

Outline Plan

Part Two

July 2010 Updated March 2012



Pt E ½ -4-53-2-W5 Parkland County

Fawn Meadows Development Ltd.

Prepared by

The Norcan Group Inc.

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2	Essential Documents -Standards -Legal Interpretation & Legislation -Authorization and Title Copy
3	Communication -Community Consultation -Developer Response -Architectural Guidelines
4	Engineering & Technical Evaluations -Condensed Servicing Design Brief -Preliminary Stormwater Mgmt. Report -Groundwater Supply Analysis -Waste Water System Analysis
5	Geotechnical Evaluations -Slope Stability/Ground Water Considerations -Slope Stability Assessment -Geotechnical Site Assessment for Bld. Fnd and Roadways -Geotechnical Site Assessmen for Prop. Facility
6	Environmental -Biophysical Assessment -Phase 1 Environmental Site Assessment
7	Transportation -Traffic Impact Assessment
8	Supportive Living Standards

September 14, 2009

VIA E-MAIL: norcan@lincsat.com

Norcan Consulting Group 2209, Hwy 16, Parkland County Box 38, Site 219, RR2 Carvel, Alberta TOE 0H0

Attention: Frank Florkewich

Dear Sir:

Re: Fawn Meadows Condominium Project - File No. 074457

You have asked me to confirm my understanding of the various phases comprising the above noted development.

understand the various components to be as follows:

SINGLE DETACHED HOMES

I understand this project is to be comprised of individual bare land Condominium Units. Each owner will be responsible for the exterior of the building including roofs, siding and all landscaping and utilities on the Unit. The Condominium Corporation will repair and maintain the common roadways and all utility services to the Unit boundaries.

VILLAS AND TOWNHOMES

I understand that this project will be individual bare land Condominium Units with the Condominium Corporation responsible for repair and maintenance of the exteriors of the buildings and all landscaping on the Units. The Condominium Corporation will be responsible to repair and maintain the common roadways and all utility services to the interior finishing of the buildings.

APARTMENT CONDOMINIUMS

I understand that this project will consist of approximately 140 apartment Condominium Units which will be a conventional condominium project whereby an owner will own the interior finishing of their Unit inwards. The structure of the building together with the exterior, all parking, the common roadways, all common utilities and all landscaping will be common property which will be the responsibility of the Corporation to repair and maintain.

Please reply to Bannister Road Office

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October 13, 2009

Fawn Meadows Development Inc. Suite 607, 4603 Varsity Drive NW Calgary, Alberta T3A 2V7

Attention: Barry Ibsen (via email)

Ambrose Comchi (via email)

Dear Sirs:

Re: Fawn Meadows - File No. 74457

Further to our letter of September 14, 2009, concerning the above noted development, we wish to clarify certain matters.

Separate Condominium Corporations

We understand that the intent of the whole development is to have an aging-in-place facility. Each phase would have different rights and responsibilities as outlined in our previous letter of September 14, 2009. To accomplish this, firstly, a subdivision plan would need to be registered to create entirely separate parcels for each phase. The common roadway and any common utility installations would also be on a separate parcel. Then, separate condominium plans would be registered for each phase, creating separate Condominium Corporations that would all share in the use of the roadway and utilities. Each phase would have separate Bylaws and rules and regulations governing it and would be drafted specifically to accommodate the physical characteristics of the phase as well as the intent as to the services to be provided to unit owners. The Condominium Property Act requires extensive disclosure to proposed purchasers so that they know exactly what they are buying at the time they enter into purchase agreements.

Enforcement of Condominium Bylaws

A Condominium Corporation has very powerful methods to enforce its Bylaws against defaulting or non-compliant owners.

If the Bylaws so provide, the corporation may levy a monetary or non-monetary sanction or may pursue an owner to change behaviour or force something to be done. The Condominium Corporation also has broad powers to enforce the payment of condominium contributions and in the event an owner does not pay, the unit may be put up for sale with the Condominium Corporation ranking in priority over a mortgage company to recover its outstanding condominium fees. Any violation of the Bylaws such as the keeping of pets, the placement of RV's, enforcement regarding extra vehicles, noise, unsightly yards, the use of snowmobiles, etc., would all be matters dealt with in the Bylaws of a Condominium Corporation and the

Please reply to Bannister Road Office



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Corporation could take legal action to make an owner comply with the Bylaws. The Criminal Law of Canada still applies to any condominium project with regard to any criminal activities that might take place on a condominium project.

We trust that the aforegoing clarifies some matters with regard to this project.

Yours very truly, McLEOD & COMPANY LLP

Heather M. Bonnycastle Q.C.

Direct: (403) 873-3703 bonnycastle@mcleod-law com Assistant: Stephanie Koole Direct: (403) 254-3834 skoole@mcleod-law com

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Western Canada Office #350-220 Cambie Street Vancouver, B.C. V6B 2M9 Tel: (604) 648-2273 Fax:(604) 648-2277

November 3, 2009

Barrie G. Ibsen Director & General Manager Fawn Meadows Development Inc. By E-mail

RE: Management Services-Seniors Housing Project

Dear Mr. Ibsen:

As you know, Chartwell owns and or operates a range of independent seniors living communities, assisted living seniors housing and long term care residences across North America. We offer our residents a safe and rewarding lifestyle in a seniors housing community that they are proud to call home.

From our conversations on several occasions, Chartwell may very well be interested in providing Management Services for your proposed building; however, it would be premature for us to offer any service to you until you have obtained County approval of your project. As we have discussed, we need to know the number of each lifestyle you would be constructing and what Levels of Services you would be offering to the residents.

Once you have all this in place and are well underway with the first two phases and have commenced building of the Independent and Supportive Living Building, we would certainly look at a Management Services Contract.

I might also suggest the considerable experience of Chartwell Seniors Housing may assist you through a consultative process which could expedite your project in many different ways. As you said before, you do not need to reinvent the wheel, just make it better if you can.

Thank you for choosing Chartwell; we look forward to working with you in the future.

Yours truly,

Chartwell Seniors Housing REIT

Donna Marasco

Senior Vice-President Operations

Tel: (905) 501-9219 Fax: (905)501-0813

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APPLICANT'S AUTHORIZATION

I/We,Fawn Mead	ows Development Inc.				
being the registered over	mer/s of lands legally desi	cribed as:			
Lot	Block	Plan		Subdivision	
NW / NE / SW / SE (please indicate) Pt E 1/2	Section 4	Township 53		Range 2	WM 5
do hereby authorize		an Consult	ing Group I	nc.	to make application
subdivision affecting the Dated this	e above noted property. day of	iary	, 2010,		
	Conchi, D.	irector	Bar	ie H. J	Com Direct
Signature of Registered	Owner		Signature of	of Registered Own	ner
The registered owner/s inspection relative to the		intry by an a	RY AUTHOR		County for the purpose of a land
In accordance with the Right of Entry Authoriza		ct of Alberta	and Parklan turned with th	d County's subdi e Subdivision App	ivision application requirements proval Application.
do [1/] / do not [] (plands for the purpose of		sent for an a	uthorized pere ding the propo	on of Parkland Cosed subdivision.	county to enter upon the subject
Lot	Block	Plan		Subdivision	And the second s
NW/NE/SW/SE	Section	Township		Range	WM
Pt E 1/2	4	53		2	5
Dated this 3rd	day of February	asy	2010		
	Conchi,	Director	Bar	ie G. D	law Director
Signature of Registered	Owner		Signature of	Registered Own	er



LAND TITLE CERTIFICATE

S

LINC 0022 814 537 5;2;53;4;NE

SHORT LEGAL

TITLE NUMBER 042 286 912

LEGAL DESCRIPTION

MERIDIAN 5 RANGE 2 TOWNSHIP 53 SECTION 4 QUARTER NORTH EAST CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS EXCEPTING THEREOUT: (A) THE NORTHERLY 693 FEET THROUGHOUT CONTAINING 17.0 HECTARES (42 ACRES) MORE OR LESS (B) 0.624 HECTARES (1.54 ACRES) MORE OR LESS AS SHOWN ON ROAD PLAN 466JY

EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: PARKLAND COUNTY

REFERENCE NUMBER: 832 050 645

REGISTERED OWNER(S)

REGISTRATION DATE(DMY) DOCUMENT TYPE VALUE

042 286 912 12/07/2004 TRANSFER OF LAND \$197,965 SEE INSTRUMENT

OWNERS

FAWN MEADOWS DEVELOPMENT INC.. OF 3215 UTAH PLACE NW CALGARY ALBERTA T2N 4A8

ENCUMBRANCES, LIENS & INTERESTS

PAGE 2 # 042 286 912

REGISTRATION

NUMBER DATE (D/M/Y)

PARTICULARS

052 267 815 05/07/2005 CAVEAT

RE: AGREEMENT CHARGING LAND CAVEATOR - AMBROSE WILLIAM COMCHI 3215 UTAH PLACE NW

CALGARY

ALBERTA T2N4A8

082 319 992 01/08/2008 MORTGAGE

MORTGAGEE - AXCESS MORTGAGE FUND LTD..

SUITE 1410, 10665 SOUTHPORT ROAD SW

CALGARY

ALBERTA T2W4Y1

AS TO 60/580

MORTGAGEE - B2B TRUST.

404, 130 ADELAIDE ST WEST

TORONTO

ONTARIO M5H3P5

MORTGAGEE - CANADIAN WESTERN TRUST COMPANY.

600 - 750 CANCIE STREET

VANCOUVER

BRITISH COLUMBIA V6B4Y7

MORTGAGEE - WILLIAM HEALEY

MORTGAGEE - CHRISTIAN STEVENSON

MORTGAGEE - MARLENE STEVENSON

MORTGAGEE - RAYMOND STEVENSON

ALL OF :

C/O AXCESS CAPITAL PARTNERS

1410, 10655 SOUTHPORT RD SW

CALGARY

ALBERTA T2W4Y1

AS TO 520/580

ORIGINAL PRINCIPAL AMOUNT: \$580,000

(DATA UPDATED BY: TRANSFER OF MORTGAGE 102107963)

082 319 993 01/08/2008 CAVEAT

RE : ASSIGNMENT OF RENTS AND LEASES

CAVEATOR - B2B TRUST.

C/O 212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - CANADIAN WESTERN TRUST COMPANY.

212 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - WILLIAM HEALEY

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3 # 042 286 912

REGISTRATION

NUMBER DATE (D/M/Y)

PARTICULARS

CAVEATOR - CHRISTIAN STEVENSON CAVEATOR - MARLENE STEVENSON CAVEATOR - RAYMOND STEVENSON ALL OF:

C/O #212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - GREENTREE MORTGAGE CORPORATION.

C/O 212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

AGENT - DOUGLAS M SEFCIK

082 360 125 21/08/2008 POSTPONEMENT

OF CAVE 052267815

TO MORT 082319992 CAVE 082319993

112 380 928 25/11/2011 WRIT

CREDITOR - CALIBRE DRILLING LTD..

431 SOUTH AVENUE SPRUCE GROVE ALBERTA T7X3B3

DEBTOR - FAWN MEADOWS DEVELOPMENT INC..

3215 UTAH PLACE NW

CALGARY

ALBERTA T2N4A8

AMOUNT: \$38,663 AND COSTS IF ANY

ACTION NUMBER: 1103 07382

TOTAL INSTRUMENTS: 005

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 5 DAY OF MARCH, 2012 AT 10:48 A.M.

ORDER NUMBER: 20739743

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.

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"A quality of Life - Country Style"

Fawn Meadows Development Inc.
Suite 607, 4603 Varsity Drive N. W., Calgary, Alberta, Canada, T3A 2V7
Tel: (877) 843-3999 Fax: (403) 210-0087 Email: fmd@fbirealty.com

COMMUNICATIONS WITH THE RESIDENTS OF PARKLAND COUNTY

- Three Public Meetings Were Held: February 18, 2005; April 18, 2009; May 26, 2009.
 - A. Issues. These similar issues arose at all of the three public meetings.
 - 1. Water Supply. What adverse effects might Fawn Meadows Estates' water wells have on the neighbouring wells?
 - 2. Traffic. What will be the effect of increased traffic from the high population density?
 - 3. Visual Effects. What will be the visual effects of the residences in the development?
 - 4. **Sewage Treatment**. How will the sewage system work, and what about odors from waste water ponds? Will the sewage contaminate the water reservoir?
 - 5. Condominiums. How tall is your condominium going to be?
 - B. Responses to the issues.
 - 1. Water Supply. Water flow tests on the two wells drilled on Fawn Meadows Estates revealed that a surplus supply of water is available for the population density being planned. Furthermore, tests proved that the new second well, the production well, had a radius of influence of water depletion that did not extend beyond the perimeter of Fawn Meadows Estates. That is, water pumped out by the new development would have practically no effect on the volume of water available to neighboring wells.
 - 2. Traffic. A Traffic Impact Assessment concluded that the roads currently servicing the proposed development were adequate and did not require any upgrading. Also, at the meetings, the presenters pointed out that the aging residents in the Senior's Lodge would probably not be driving vehicles any longer. A bus would be provided for their trips off site.

- 3. Visual Effects. In response to a query about visual effects, NORCAN Consulting assured the residents living directly across Highway 770 from Fawn Meadows that planned tree planting in addition to trees already along the highway would shield the development. Also, the location of homes and their design would have minimal impact on neighbors.
- 4. Sewage Treatment. The representative from the water and sewage consulting company explained the workings of the proposed system and assured the attendees that the water reservoir would not be contaminated. He also responded to questions about where the proposed system is currently being used.
- 5. Condominiums. The Bareland Condominium concept was defined as a form of ownership of land and building space. It would not be a high rise building. Residents would own a lot and also part interest in all of the common lands, roads, services, utilities, park areas, recreational facilities, and other improvements. When a condominium plan would get registered with the land titles office, an administrative board would be automatically created. The board's purpose would be to manage the affairs of the Condominium Corporation, which would be made up of the owners of the individual units or lots. All Condominium Corporations are governed by "The Condominium Properties Act."

II. Email Supporting the Development.

On Wed, Mar 24, 2010 at 8:24 AM, Elaine Aronyk < <u>EAronyk@psd70.ab.ca</u>> wrote:

Excellent. We are very supportive of the project and are glad to see you haven't been beaten to failure; sometime a small vocal group can change the whole face of a meeting. When we retire this is exactly the type of place we would want. Please keep us on your information updates. All the best with the project.

Terry & Elaine Aronyk

Submitted by Ambrose Comchi & Barrie Ibsen,
Directors of Fawn Meadows Development Inc.
July 13, 2010

Fawn Meadows - The Concept

Fawn Meadows is a new development that is being proposed just west of Stony Plain, near Carvel Corner. The project is in the planning stages and requires community consultation for Parkland County approval. Community consultation is under way to obtain input from area residents.

The subdivision is designed to meet the needs of aging and elderly rural residents aged 50 and over through the provision of supportive living services. It is an innovative concept that encourages seniors to stay in a rural community and remain independent for as long as possible. This concept is called "aging in place," meaning residents do not need to leave their community in order to receive higher levels of daily living support.

Quick Facts

Fawn Meadows will have four types of dwellings within the complex:

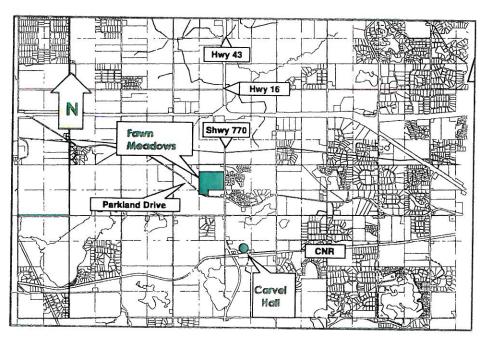
- 35 detached residences
- 20 semi-detached residences
- 56 villa-style residences
- 140 apartment-style residences

Total projected population: 450-500 residents in 251 living units, depending on singles/couples mix.

Who is best suited for Fawn Meadows?

Fawn Meadows is targeted to healthy, mobile and aging adults who may need some level of supportive living services now or in the future. Typical residents will include:

- Healthy, mobile adults (age 50 plus) who wish to live independently.
- Aging adults who want freedom from yard work and outdoor maintenance.
- Aging adults who want some meals supplied and may need scheduled health and personal care services such as home care, bathing assistance and medication support.



Supportive Living in Parkland County

Currently there are few to no support services available to rural seniors in Alberta. In many areas, home care and personal/domestic services are only offered on a *scheduled basis* – that is, by specific appointment times and for specific purposes. However, many seniors find they need services on a more frequent or unscheduled basis, or would like more support with meal preparation and social interaction.

Seniors often have to move to urban centres to access more complete support services. Many are required to leave their local community if they need supportive living services beyond basic home care. For this reason, **Fawn Meadows** is proposing to build a large, urban-standard facility just west of Stony Plain to give rural residents the same access to supportive living services as urban seniors.



Water Management Plan

Fawn Meadows will incorporate high environmental standards for potable, waste and storm water.

Potable (household) water will be drawn from a local aquifer, then treated and distributed to residences via a low-pressure trickle system.

Wastewater will be collected from each residence and piped to an on-site treatment facility. Following a three-stage treatment process, the cleaned water will be dispersed into the soil, thereby replenishing the area aquifer.

Stormwater will be collected, treated and then stored primarily for fire protection use and secondarily for irrigation.

Full environmental and engineering studies have either been completed or are under way to manage domestic water and wastewater.



Fawn Meadows Public Meeting

Tuesday, May 26 Carvel Hall

6:30 p.m. Display Viewing 7:30 p.m. Presentation, Q & A

On-Site Amenities

Fawn Meadows will be a lifestyle and recreational centre for adults aged 50 and over. More than 50% of the property will be left in its natural, undeveloped state so residents can enjoy the trees, wildlife and rolling hills on the property. There will be extensive walking and hiking trails for a truly outdoor experience.

Residents will have access to a full range of services and supports. The community consultation process will help identify the priorities of residents, which might include:

- Indoor and outdoor recreation areas for games, exercise, and social activities
- On-site retail services such as a coffee shop, convenience store, and CarMan Corner Gas
- On-site RV and mini storage
- On-site staff, such as personal care aides and licensed practical nurses
- On-site and local community mini-bus

Home Ownership Facts

Fawn Meadows will be a condominium community. This refers to the *legal* relationship between owners and <u>not</u> the style of physical structure. In the case of Fawn Meadows, there will be a mix of detached, semi-detached, villa, and apartment-style units, all under condominium governance.

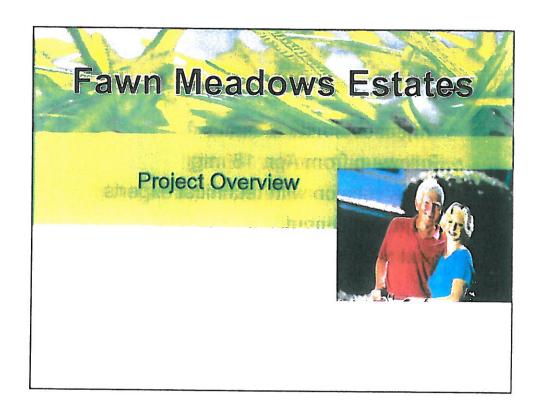
In a condominium development, residents own their dwelling and sometimes their lot, as well as a percentage interest in the common areas (roadways, grounds, recreation centre, etc.). The development is managed by a condominium corporation, which includes a board of elected memberowners. The board has the authority to collect monthly condominium fees from residents to pay for common and operational expenses, as well as the power to enforce the bylaws of the corporation. Prospective homeowners, before purchasing a lot or residence, must agree in writing to abide by the bylaws and regulations of the condominium corporation.

Detached and semi-detached units are designed for relatively independent, mobile residents who wish to maintain their own property.

Villa style units are designed for independent, mobile residents who no longer want to manage their own gardening and exterior maintenance.

Apartment-style units are designed for residents who prefer a smaller living unit and those who are less independent.

The purchase price and associated condominium fees for all units will be determined at a later date, taking into consideration market pricing, construction costs, and each resident's desired level of supportive living services.



Fawn Meadows - Who's Who

- Developers:
 - Barrie Ibsen & Ambrose Comchi
- Project Manager:
 - Norcan Consulting
 - Frank Florkewich (Project Manager)
 - Other engineering & project consultants
- Communications Consultant:
 - Lechelt Group
 - Leah Lechelt

Agenda

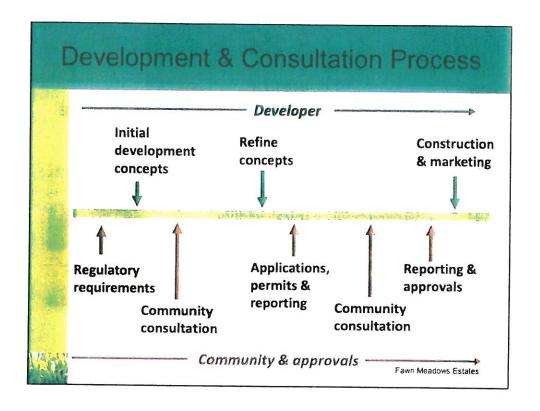
- Project overview & status
- Follow-up from Apr. 18 mtg
- Q & A session with technical experts
- Community input
- Next steps & decisions

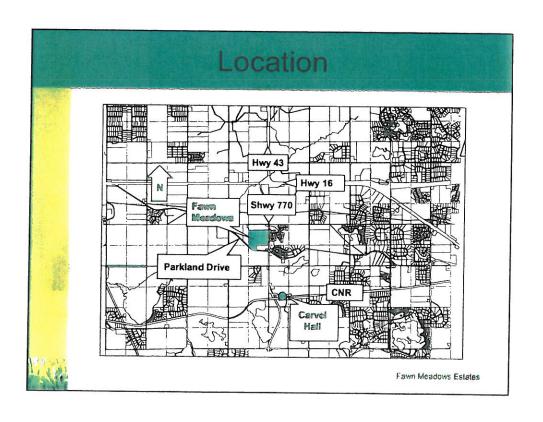
Fawn Meadows Estates

Consultation Process To-Date

- Email follow-up
- May 2009 Newsletter #1
- April 2009 Community mtg
- 2005 Community mtg







Quick Facts

- Proposed development applying for approval
- For independent adults (50+) & aging seniors
- Key features:
 - More than 50% undeveloped/natural
 - Walking trails, natural wildlife
 - Complete lifestyle, recreation social activities
 - On-site supportive living services
 - RV parking and mini-storage on site



Fawn Meadows Estates

Quick Facts

- Condominium style of ownership
 - Legal rules, not physical structure
- 4 types of dwellings:
 - Detached
 - Semi-detached
 - Villa style
 - Apartment-style



Fit City C .. See



Land Use	На	Acres	%	Livin
Residential – SF	6.8	16.9	13.4	35
Residential - Semi Detach	7.8	19.3	15.3	76
Residential – Specialized	2.6	6.3	5.0	140
Commercial seasons and seasons	2.2	5.0	4.0	N/A
Conservation Reserve	16.0	39.5 (31.2	
Roads & Utilities	7.8	19.3	15.3	
Open Space – Common	8.0	19.8	15.8)
Gross Title Area	51.18	126.46	100.0	

Population Projections

- 450 500 residents in total, depending on # singles/couples
- Proposed unit breakdown (subject to change)

– Detached: 35 units

– Semi-detached: 20 units

– Villa style: 56 units

- Apartment-style: 140 units

Total: 251 units

Fawn Meadows Estates

Demographic Profile

- Healthy, mobile, independent adults 50+
- Aging adults wanting:
 - Help with outdoor maintenance & yard work
 - Some supplied meals
 - Scheduled personal & health care services
- · Key concept: age in place

Ownership Information

- Purchased and owned as private condominium
- Purchaser owns:
 - Dwelling
 - Portion of common areas
 - May or may not own lot
- Re-sell privately if/when vacating
- Pricing TBD: fair market value for dwelling
- Supportive living services: additional fee

Fawn Meadows Estates

Fawn Meadows Estates

Current Seniors' Living Facilities

- Poor access in rural areas
- Support role of adult children
- Differing support/care needs within a couple
- Generally poor natural, recreational environment



Fawn Meadows Services

- Personal services for independence
 - Snow shoveling & lawn maintenance
 - Meals
 - Home care & nurse visits
- Social/recreational supports
 - Social activities
 - Outdoor recreational areas
- Safety and security
 - Staff and neighbours checking in
- Transportation support



Fawn Meadows Estates

Fawn Meadows Is For:

- Independent and semi-independent adults
- Lower-level support/care needs
- Scheduled support
- Normal cognitive function
- Moderate/good mobility



Why This Location?

- Family owned land
- Developers: More than 100-year family histories in this area



- Developer's vision:
 age-in-place facility in a rural setting
- Capacity for natural/unspoiled landscape

Fawn Meadows Estates

Comprehensive Water Assessment

- Water Needs: potable, fire and irrigation
- Water Sources: wells, stormwater and treated wastewater
- Assessment: balance need and source
- Goal: minimize groundwater use and maximize other sources to meet needs

Fawn Meadows will exceed current environmental standards

Water Management Approach

- High environmental standards
- Water conservation
- Stormwater capture, reclamation & re-use
- Stormwater storage for fire & irrigation
- Wastewater returned to soil for infiltration
- Open to other ideas

Fawn Meadows Estates

Potable Water

- Source: water wells
- Distributed via lowpressure trickle-system
- Goal: no impact on existing wells (volume and pressure) at peak load
- Studies ongoing



Water Well Testing

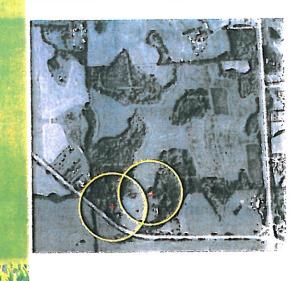
- 72-hour pump test conducted to determine effects of groundwater pumping
 - New well installed and pumped
 - Backup well used for monitoring
 - Neighboring wells more than 150 metres away will not be affected



Fawn Meadows Estates

Redius of Influence 21 Ib' Static Moter Level 20 According to AENV guidelines, well can safely pump 70 GPM 20 Ib' Pumping Moter Level 20 Ib' Static Moter Level 20 Pumping Moter Level 20 According to AENV 20 Ideal Icentify 20 Ib' Static Moter Level 20 Ib' Static Moter Level 20 According to AENV 20 Ideal Icentify 20 Ib' Static Moter Level 20 Foot test well 20 According to AENV 20 Ideal Icentify 20 Ib' Static Moter Level 20 According to AENV 20 Ideal Icentify 20 Ib' Static Moter Level 20 Ib' Static Moter Level 21 Ib' Static Moter Level 22 Ib' Static Moter Level 23 Ib' Static Moter Level 24 According to AENV 25 Ideal Icentify 25 Ib' Static Moter Level 25 Ib' Static Moter Level 26 According to AENV 26 Ib' Static Moter Level 27 Ib' Static Moter Level 27 Ib' Static Moter Level 28 Ib' Static Mot

Radius of Influence



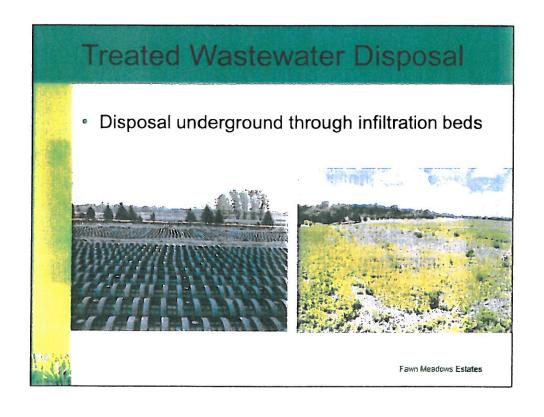
 Preliminary studies indicate the limit of influence is no greater than 150 metres.

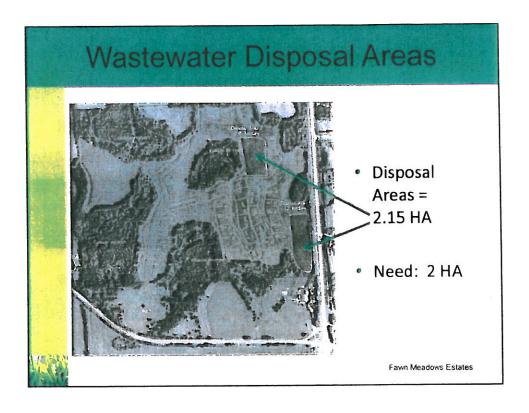
Fawn Meadows Estates

Wastewater

- · Collected from each residence
- Piped to on-site treatment facility
- 3-stage treatment process
- Cleaned water dispersed into soil
- Continuous replenishing of area aquifer

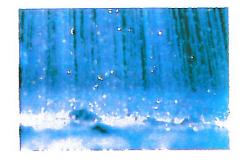






Stormwater

- Collected and treated on-site
- Stored for fire protection
- Surplus for local irrigation



Vehicle Traffic

- Traffic Impact Assessment under way
- Traffic influences:
 - Retired/non-working residents
 - Predominantly empty nesters
 - Supportive living: some no longer driving
 - On-site amenities reduce # trips off property
 - Mini bus for local transportation

Fawn Meadows Estates

Community Questions - Apr. Meeting

- Number of potential residents
- Potable water supply
- Impact on area wells
- Trucking in water
- Traffic impact
- Visual impact
- Market pricing
- Health care questions

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Fawn Meadows Estates

Next Steps

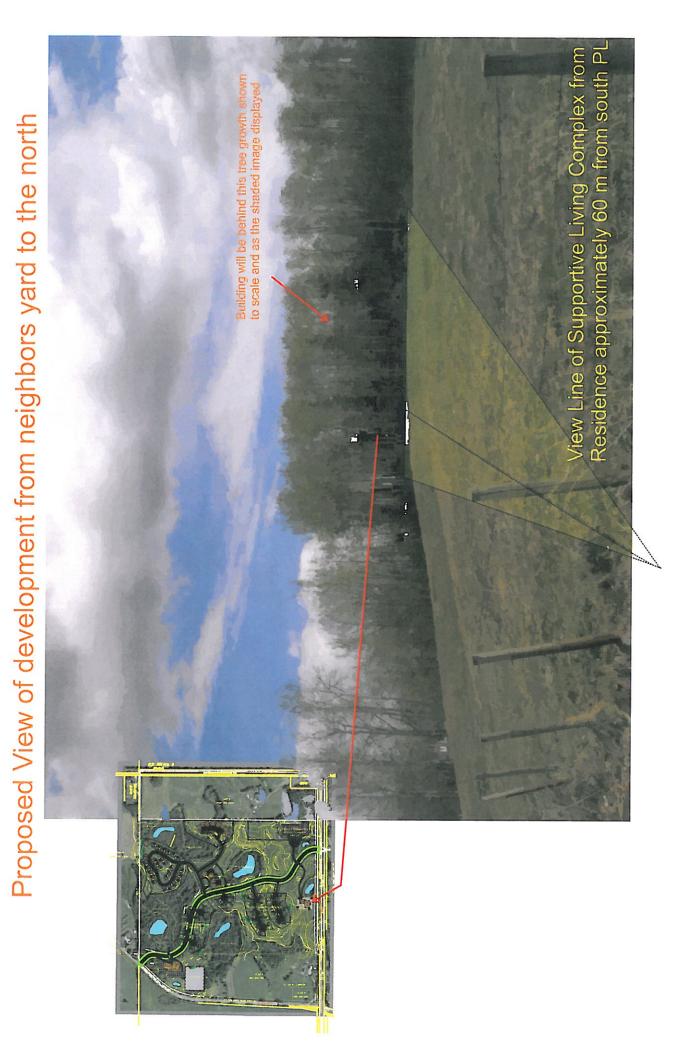
- Q & A session today
- Written summary (distribute via email)
- Sign up for updates & notices
- Continued meetings

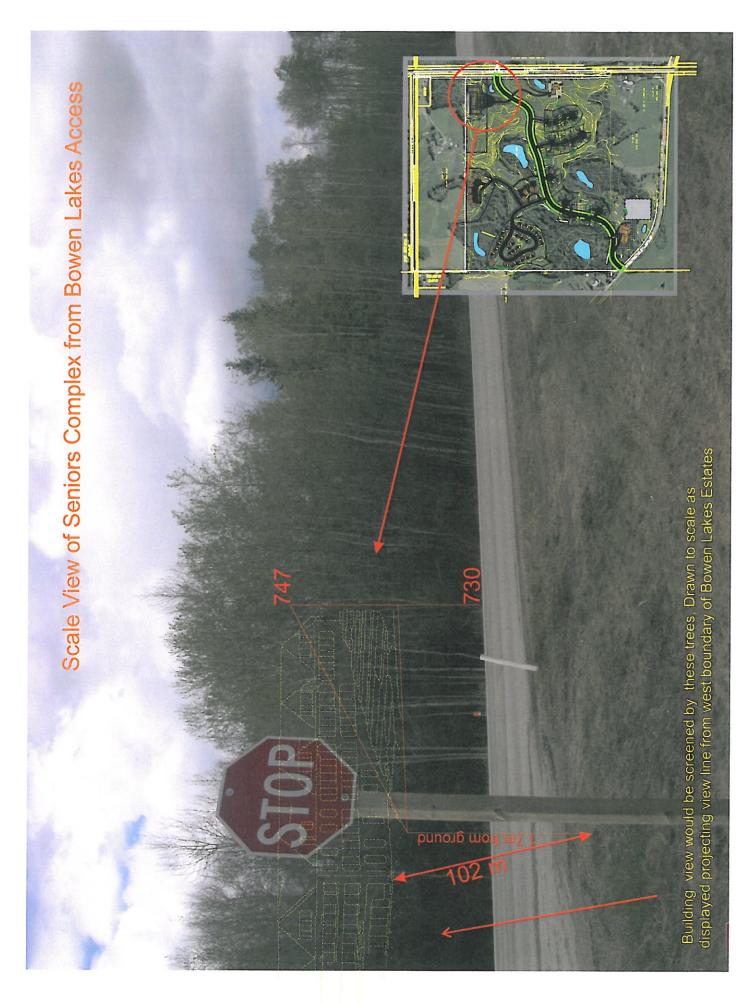
Fawn Meadows Estates



Proposed View of development from Hargreaves driveway

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Fawn Meadows Development Inc.
Suite 607, 4603 Varsity Drive N. W., Calgary, Alberta, Canada, T3A 2V7
Tel: (877) 843-3999 Fax: (403) 210-0087 Email: fmd@fbirealty.com

July 13, 2010

To Whom It May Concern:

RE: DEVELOPERS INTENT

As part of our submission for the development called Fawn Meadows Estates, please find the following:

The supportive living building which will be called the LeMar Centre will be a condominium complex in which each suite will be owned individually and which will provide independent living accommodations for each resident or each couple who might reside therein.

Below, please find a description of the suites and attributes thereof upon completion:

Suites

- Number of suites: 140
- Unfurnished Studio, One & two bedroom
- Heat, electricity & water included
- All suites pre-wired for phone, cable & internet
- Ensuite bathroom with tub or shower
- Full kitchen Amenities
- Elevators
- Emergency response system
- Fire alarm system
- Sprinkler system
- Emergency lighting
- Pets allowed
- Smoke free environment
- Wheelchair accessibility

Common Areas

- Dining room
- Lounges
- Exercise room
- Movie theatre
- Library
- Non-denominational Chapel

Outdoor Enjoyment

- Attractive Landscaped grounds
- Walking Trails
- Parks
- Gardening Plots
- Well treed natural areas with picnic tables
- Outdoor Recreational Activities
- Community Centre
- On-site cafe, convenience store and gas bar

Services Included:

- On-site Administrator
- 24 hour emergency response
- · Daily Dinner Service and refreshments all day
- Licensed Practical Nurse on Staff (8:00 AM-4:00 PM)
- Maintenance Services
- Snow removal in the winter
- Daily Safety Checks
- Monthly calendar of social, cultural and recreational activities and outings
- Smoke free environment
- Air conditioning in common area
- Parking for residents and visitors

Dining

- · Access to self serve refreshment area
- Full service dining room with 2 seatings

For Fee Services Menu:

- Laundromat Facilities
- Weekly bus service to local shopping
- Private family dining room available
- Weekly housekeeping including:

vacuuming, light dusting, cleaning of bathrooms, kitchenette surfaces floors and change and laundry of bed linens

Extra Services Available:

The following list of extra services will be made available by providing space on the lower level for independent businesses to lease:

- Hair Salon and Barber Shop
- Manicures, Pedicures and Massage
- Doctors Office including reception room and 2 examination rooms

It is our hope that several doctors may see a benefit in coming to the LeMar Centre on a weekly basis with a high concentration of clients available in the immediate area.

The extra services provided will be available for the entire community of Fawn Meadows Estates on an appointment basis only and people from the surrounding area may also book appointments on a first come first serve basis

Submitted by Ambrose Comchi & Barrie Ibsen,

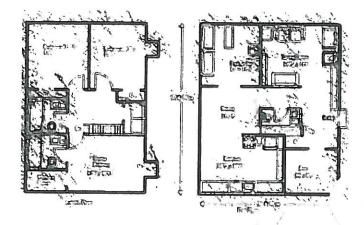
Directors of Fawn Meadows Development Inc.

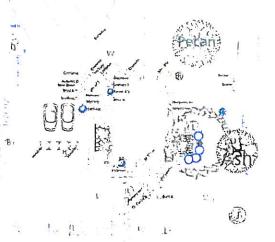
July 13, 2010

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No sale is to be represented as final to a prospective purchaser until the final approval of the plans, elevations, lot siting and color scheme has been given by Fawn Meadows The home builder shall be fully and solely responsible for such representations.

The information contained herein is intended as a guide. Neither Fawn Meadows nor its designated Consultant shall have any liability whatsoever for any defect or lack of suitability in any of the materials or products suggested by or required by these guidelines. Fawn Meadows and its designated Consultant make no representation or warranties as to the accuracy of completeness of this information. The enforcement of these guidelines and interpretation of same shall be at the sole discretion of Fawn Meadows.

Fawn Meadows reserves the right to revise these guidelines without notice.



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Favor Meadows

1.0 Introduction

Fawn Meadows Development Inc.'s vision for Fawn Meadows is the creation of a naturally beautiful haven for homeowners. A neighbourhood with extensive parks and natural reserves, professional landscaping with mature trees, indigenous plants and colorful flowers, all enhancing the natural characteristics of the land.

A handsome stone entry gate provides a dramatic sense of arrival in Fawn Meadows. Its views and peaceful setting, along with neighborhood natural areas and tree-lined walking pats, create natural beauty and special places where families can enjoy their leisure time.

Fawn Meadows Development's vision is also reflected in thoughtful architectural guidelines which enhance the visual appeal of neighborhood streets and preserve value.

The intent of these guidelines is to direct proportions, architectural elements and materials of the neighborhood to present an expression of harmony. The general architectural theme will encourage homes of traditional styling with thoughtful attention to detail. Through consistent new home quality, exterior styling and massing, these architectural guidelines perserve the overall integrity of the neighborhood; while permitting the flexibility for homes to reflect the unique preferences and dreams of their owners.



2.0 Design Guidelines

2.1 Siting

Siting should reflect careful consideration of lot characteristics, relationship and orientation. Building mass, siting and style may be adjusted on a lot to lot basis to enhance the streetscape. Setback may be increased accordingly.

2.2 Dwelling Unit Size

Houses are to have a consistency of apparent volume, As such, house widths and sizes must relate logically and proportionately to the lot and adjacent houses. The minimum house width must be within two feet of the building pocket maximum.

For the estate product the minimum house sizes calculated above grade shall be:

- *Bungalow 1400 sq. ft
- * 2 storey 2160 sq. ft
- * 1 ½ Storey 1900 sq. ft
- * Bi-level- 1400 sq. ft.



2.3 Corner Lots

Houses on corner lots require special design consideration because of their high visibility. Bungalows or 1 ½ storey models are encouraged, however all model types will be considered on the basis of their unique suitability to these locations.

Flanking side elevations must reflect appropriate wall heights, window placement and detail treatments consistent with the front elevations.





Two storey models on corners will require substantial variation in wall planes. Second floor should be set back from the vertical plane of the lower level to provide roof mass between floors.



2.4 Repetition

Similar elevations may not be repeated within two lots of each other or directly across the street.

Repetitive use of elevations will be monitored to ensure interesting streetscapes. Modification to elevation treatments may be required accordingly.

2.5 High Visibility, Special Considerations



Standard elevation

High visibility rear/side elevations require special design consideration. Elevations at these locations must avoid expanses of blank wall space and corporate attention to detailing



Modified for high visibility

These high visibility locations include homes abutting parks and backing onto public spaces as noted on the lot plan.



Standard elevation



Modified for high visibility



Standard elevation



Modified for high visibility

The rear elevations of Lots backing towards S. Hwy. 770 and Parkland Drive should avoid large expanses of blank wall space and incorporate appropriate overhangs on all roofs. Homes designated "W" on the lot plan will require the siting of a walkout basement model.



Homes with walkout basement designs must incorporate a combination of architectural measures to address three storey appearance in highly visible settings.



These measures include:

- * variation in wall planes
- * downhill sloping roofs
- * dormers
- * decks and decorative posts/columns
- * decorative windows
- * absence of blank wall space





2.6 Lot Grading

Lot grading must be in strict conformance with the approved grading plans. Grade variations should be absorbed within the building mass, to minituze steeper slopes and contrast between lots.



All lot plans and stakeouts must be done by the designated surveyor to provide consistency in establishing building elevations throughout the subdivision. The builder is responsible for meeting the required grade elevations and ensuring drainage patterns are maintained within the property lines to the satisfaction of Parkland County & Fawn Meadows. An approved final grading certificate is a prerequisite for final inspection and release of security deposit by Fawn Meadows

Retaining walls are the responsibility of the property owner and must not compromise the grading design and drainage of the lot. In the event retaining walls are required, such shall be approved by the Developer prior to construction.



Special attention is to be given the treatment of exposed concrete foundation walls. A maximum of 2°6" of parged concrete will be permitted on all elevations of the home. Variation in grade and basement design may require the cladding material be lowered or extended to within 2°6" of ground level.

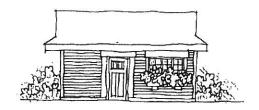


Front entry steps are to be a maximum of three risers per set in the estate and move-up product. Where the grade elevation calls for more than three risers, the run must be split. Exceptions to this requirement may be granted in consideration of unique design and/or topography. A maximum of four risers per set shall be the standard on the starter homes.



2.7 Driveways, Garages, Walkways





For designated lots, detached garages should be consistent in style, finish and color with the design of the house.

Garage pads will be a minimum 20'0" X 24'0" poured concrete, provided concurrent with the house construction.

The approach to the garage door from the laneway must be paved with paving stone, or other pervious material approved by Fawn Meadows.





The estate homes must be provided with a double attached garage, constructed concurrently with the home and located in accordance with the garage location plan. Designs with front drive garages should envelope the garage within the design of the home to integrate and minimize the garage appearance, while highlighting the architectural features and mass of the house itself. Garage overhead doors are to be sectional with raised panels. The height between garage overhead door and eave line should be kep to 2'0". Where the design exceeds 2'0", special treatment is required.

Front driveways and walkways may be constructed of the following materials:

- * concrete paving stone with sand joint, including plain, stamped or colored concrete
- * colored concrete pavers
- * paving stone





In all cases where colored pavers are used, the colors must be expressly approved by Fawn Meadows.

The walkway to a residence from the roadway, curb or driveway must be a minimum of concrete paving stone, 2'6" in width. Individual patio paving stones will be permitted, with proper joints and space fill materials.

2.8 Roofs



Roof slopes will be a minimum of 6/12. The intent of this requirement is to unify the subdivision by exposing a dominant roof element and to provide an overall composition of roofs sloping towards view, increasing the curb appeal of each individual home.

Eave overhangs are to be proportionate to the design of the home but not less than 1'4". Exception to this requirement may be granted in consideration of unique architectural design and detailing.

Facia boards for the homes are to be a minimum of 10". Soffits and fascia may be wood or aluminum in a compatible finish. Eavestrough must be the same color as the fascia.

All furnace and fireplace chimneys must be contained within a corbeled chase, finished in a style consistent with the home design. Corbeling shall, at a minimum, consist of two raised bands (2" x 10" and 2" x 4").

Direct vents for fireplaces should be located out of public view.





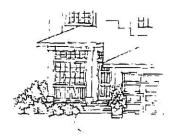
2.9 Architectural Treatments and Entries



The general architectural theme will encourage homes in traditional styling. Front elevation treatments will reflect architectural features that define entranceways and utilize building components with strong detailing.

Entrance treatments must incorporate a verandah or covered entry. Where the design does not lend itself to this concept, the use of alternate detailing and feature windows will be considered by Fawn Meadows.

















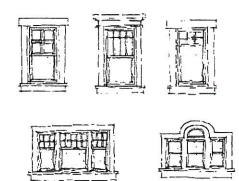




The use of window and door surrounds and/or a combination of battens, trim boards, louvers and brick or stone will be features on all homes.

Wood trim details and surrounds must be in a smooth painted, or clad finish. A minimum 6" width is encouraged, but as details and surrounds should be of appropriate scale, 4" may be permitted.





2.10 Exterior Finishes



Permitted cladding materials include:

- * brick, stone or shale in stacked application *hardboard siding, prefinished (long life)
- *machine applied or trowel finish stucco*
 *stone tile

* Stucco may be used only with detailing that reflects the traditional character of the neighborhood.

Fieldstone and River rock may be considered on an individual basis.

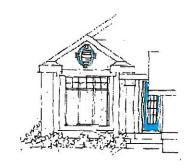




All trim and masonry details must be returned 24" around corners.



Where columns or posts are used on the front or highly visible rear elevations, they are to be of substantial form, ie. to appear load bearing and solid. The base of such columns or posts must rest entirely on the landing or step beneath. Columns and posts should include suitable step details top and bottom.





ging not to exceed 2'6" on all elevations, lower line of cladding accordingly.

The application of a minimum of 200 sq. ft. of brick or stone will be required for all est estate home. Brick or stone should be applied in a panel effect. Exceptional stucco elevations may be exempt from this requirement at the descretion of Fawn Meadows.

2.11 Colors

Color schemes with two tones or a contrast are acceptable. Use of a third accent color is required. Colors will be approved on a lot by lot basis without repetition on adjacent lots. Color combinations have been provided in the Appendix B for reference.



2.12 Accessories

A address plaque is required on every house. The plaques shall be the design and size as supplied by a approved supplier for Fawn Meadows



3.0 Fencing

Lots backing onto a common amenity where the rear property fence is split log or plank will require fencing to match. Wood screen fencing will be permitted, between buildings only on these lots.

Fencing on all other lots should be consistent in design and color with the fencing style established for the subdivision.





4.0 Accessory Buildings

Where visible from a common or public adjacency, accessory buildings must be consistent in style, finish and color with the house.

5.0 Construction Activity

Each builder must inspect the condition of curbs, ditches, cuulverts, sidewalks, street lamps perimeter fence, etc, on or in front of the lot. A written lot inspection report must accompany the application for house plan approval.

The builder is required to maintain the lot in a clean and orderly fashion during construction. The dumping or storage of materials on other lots or on common lands is prohibited.

6.0 Approval Process

All applications must include the following information:

- a) completed application form
- b) one set of working drawings at 1/4" 1" scale
- c) two copies of the plot plan prepared by Designated Surveyor, at 1:300 scale
- d) completed Start Information Form
- e) lot inspection report
- f) color or material samples as may be required
- g) signed declarations include structured wiring requirements



These submissions must be made ten days in advance of the desired construction start date. It is not the purpose of this process to check for compliance with applicable governing statutes and requirements.

Incomplete submissions may be returned without review. The application and plans will be reviewed for adherance to the guidelines. Modifications may be requested. The original plan and forms will be retained on file. A copy of the approved house exterior and approved application form will be returned to the builder. Any changes to approved plans must be approved in writing prior to implementation.

7.0 Final Inspection, Security Deposit Return

To initiate the Final Inspection, the following must be done:

- a) Construction completed, exterior completed in accordance with these guidelines and as per the house plan approval. Accessories installed.
 - b) Rough grading certificate and approved grading inspection report from Fawn Meadows.
 - c) Watervalve exposed and marked.
 - d) Sidewalks, road lanes, ditches. gutters and curbs in clean condition
 - e) Address plaque and mailbox installed
- f) Written request to Fawn Meadows to perform the final inspection, (must include grading certificate and County approval of same). A copy of the final inspection report will then be forwarded to Fawn Meadows for appropriate action.

8.0 Signage

All informational, directional and showhome signage must be in accordance with signage standards extablished by Fawn Meadows. All three types of signage shall be consistent in design, color and quality and must be designed, produced and erected by Fawn Meadows.

The Builders shall be allowed to display one (1) For Sale sign per lot provided said sign is erected on a suitable stand and not affixed to the house in any manner either during construction or upon completion of same.

All For Sale signs must display the Builder's name, corporate logo (if applicable) and telephone number as a minimum standard. The For Sale signs must be produced in the Builder's corporate colors and must be manufactured by a professional sign company to ensure consistent quality.



Each For Sale sign must not be larger than 32" x 48" prior to being affixed to the stand.

Subtrade and supplier signage will not be permitted to be displayed on the lot or the house in any manner, whatsoever. There will be no exception granted in this request.

9.0 Structured Wiring

The TIA/E1A-570-A Residential Telecommunications Cabling Standard was devised in an effort to standardize cabling infrastructure in the residential environment. A Grade 2 installation meets the requirements for advanced telecommunication and multimedia services such as high speed (broadband) Internet access, networking, closed-circuit security monitoring and multi-room video.

The home will have approved cable infrastructure to support the condominium access control and communication system as well as digital monitoring of utilities.

The purchasers inclusion of the TIA/EIA-570-A Residential Telecommunications Cabling Standard Installation Grade 2 (structured wiring), as approved by Fawn Meadows, is a condition of the purchase agreement and the house plan approval for this community. The exact requirements of this condition will be detailed by Fawn Meadows, or its consultant, at the time of house plan approval. Purchasers warrant their compliance with this condition through the signing of the Agreement for Purchase and Sale, submission of signed declaration at time of house plan application, and acknowledgement of the explicit condition when they obtain their satisfactory final inspection.

10.0 Other

Recreational vehicles and commercial vehicles in excess of 3/4 ton capacity shall not be stored in the front yard or driveway of any property between the building line and the curb, and if otherwise stored on the property for not more than 7 days. Longer term storage will be available with in Fawn Meadows at a designated location.



Appendix A

Neighborhood Context Plans

Appendix B

Colors



Suggested Color Combinations

FAWN MEADOWS PT.NE & SE4-53-2-W5

CONDENSED SERVICING DESIGN BRIEF

FILE: NC-145-1

Prepared by:

Altime Engineering Ltd.
Suite 223, 86 McKenney Avenue
St. Albert, AB T8N 2T7
Phone 780.458-0013
Fax 780.459-1316

Submitted to:

Stephen Fegyverneki, Senior Planner Planning & Development Services Parkland County 53109A Hwy 779 Parkland County, AB T7Z1R1

Revised February 24, 2012

ALTIME ENGINEERING LTD.

A PARTNER OF THE NORCAN GROUP INC.

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Appendix A - Condensed Servicing Design Brief

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CORPORATE AUTHORIZATION

This report "Fawn Meadows" Part of NE & SE4-53-2-W5: Condensed Servicing Design Brief was prepared by Altime Engineering Ltd. for Fawn Meadows Development Inc. The material in it reflects the judgment of Altime Engineering, in light of the information available at the time of preparation. Any use of the information by a third party, or any reliance on or decisions made on it, are the responsibility of such third parties. Altime Engineering accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made, or actions taken, based upon information contained in the report.

ENGINEER PROPERTY OF THE PROPE

PROFESSIONAL SEAL S.R. Andriuk, P. Eng. PERMIT TO PRACTICE
ALTIME ENGINEERING LTD.

Signature Feb 24, 2012

PERMIT NUMBER: P 3479

The Association of Professional Engineers.
Gerdogivts and Geophysiciats of Alberta

PERMIT TO PRACTICE

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this Condensed Servicing Design Brief is to articulate the servicing intent for the development of Fawn Meadows. This Brief has been prepared in support of an application to amend policies included within the Parkland County Municipal Development Plan Bylaw No. 37-2007, Jackfish-Mayatan Area Structure Plan Bylaw No. 41-80 and Land Use Bylaw No. 20-2009.

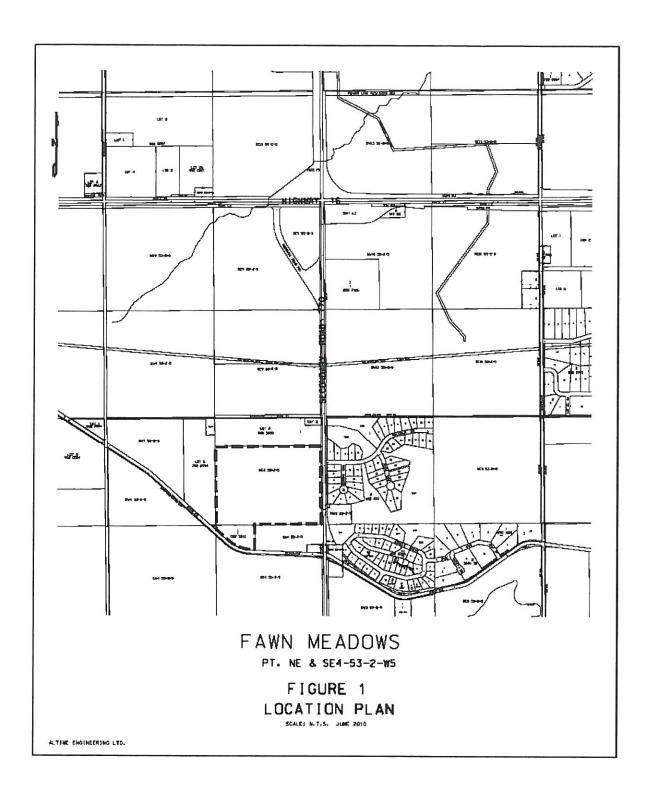
Final engineering design will be in accordance with Parkland County standards and subject to approvals from the County's Engineering Services Department, Alberta Environment and other applicable approving agencies.

1.2 SUBJECT AREA

The subject property is located in the north-central sector of Parkland County and is located on the west side of SHY 770 (Range Road 23), south of Highway 16 on land legally described as Pt. of SE and NE4-53-2-W5 (see **Figure 1 - Location Plan**). The property is comprised of approximately 51.0 hectares. The property is bound to the north, west and south by multi-acre developed parcels; to the east by Secondary Highway 770, with country residential development beyond and to the east SHWY 770.

Portions of the property have historically been utilized as farm land since the early 1950s. The current property owner is Fawn Meadows Development Ltd.

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2.0 BACKGROUND

2.1 PROPOSED DEVELOPMENT

Fawn Meadows will be an environmentally friendly residential community and will feature as the principal land uses 36 single detached residential dwelling units, 24 semi-detached residential dwelling units, 56 living villas consisting of multiplex dwellings (tri and four-plex), a 140 unit adult supported independent living complex, a community centre, recreational vehicle and mini-storage facility, and a convenience store, gas bar & restaurant.

The entire area will be developed within the context of a bare land condominium. This development will occur in 3 phases. (See Figure 2-Proposed Phase and Population Projections)

Fawn Meadows Figure 2 Proposed Phase and Population Projections

Living Units by Phase:

UNIT TOTALS							
Phase	Single Detached	Semi Detached	Villa	Complex			
1	16	0	28	56			
2	10	0	28	84			
3	10	24	0	0			
Total	36	24	56	140			

Population by Phase:

UNIT TOTALS							
Phase	Single Detached	Semi Detached	Villa	Complex	Staff		
1	32	0	56	60			
2	20	0	56	180			
3	20	48	0	0	26		
Total	72	48	112	240	26		

TOTAL POPULATION: 498 ADULTS

2.2 TOPOGRAPHY

The topography of the property is varied, with some significant slopes throughout. A Geotechnical Investigation was completed by Hagstrom Geotechnical Services Ltd and has been on going from 2004 to 2009. The geotechnical investigation consisted of a field investigation, laboratory testing, summary of conditions and recommendations relating to site preparation, grading, utilities, groundwater elevations, slopes and building construction. Further details regarding the geotechnical investigation can be found in the briefs provided by Hagstrom Geotechnical Services and Sabatini Geotechnical Services.

2.3 EXISTING INFRASTRUCTURE

In the past Fawn Meadows was pasture land and hay land and therefore had no previous existing infrastructure.

2.3.1 GROUNDWATER WELLS

A Groundwater Well and Aquifer Assessment completed for the subject property by Stantec Engineering in March 2009. Two wells were drilled; one as an observation well and one as a production well. Further details regarding these well can be found in the reports provided by SD Consulting Group.

3.0 WATER DISTRIBUTION SYSTEM

3.1 GENERAL

Water supply is proposed to be sourced from the groundwater wells. The objective for the proposed water distribution system will be to provide treated potable water to the development area in accordance with Alberta Environment guidelines and Parkland County Subdivision Development Standards.

3.2 DESIGN CRITERIA

The design criteria for the water supply includes for distribution, treatment, pumping and storage are as follows:

Domestic Water Usage based on 0.378 cubic metres per capita per day

Phase 1 Phase 2 Phase 3 Totals

Single Detached	Semi Detached	Villa	Complex	Staff	Total
12.1	0.0	21.2	15.1		48.4
7.6	0.0	21.2	75.6		104.3
7.6	18.1	0.0	0.0	9.8	204.1
27.2	18.1	42.3	90.7	9.8	188.2

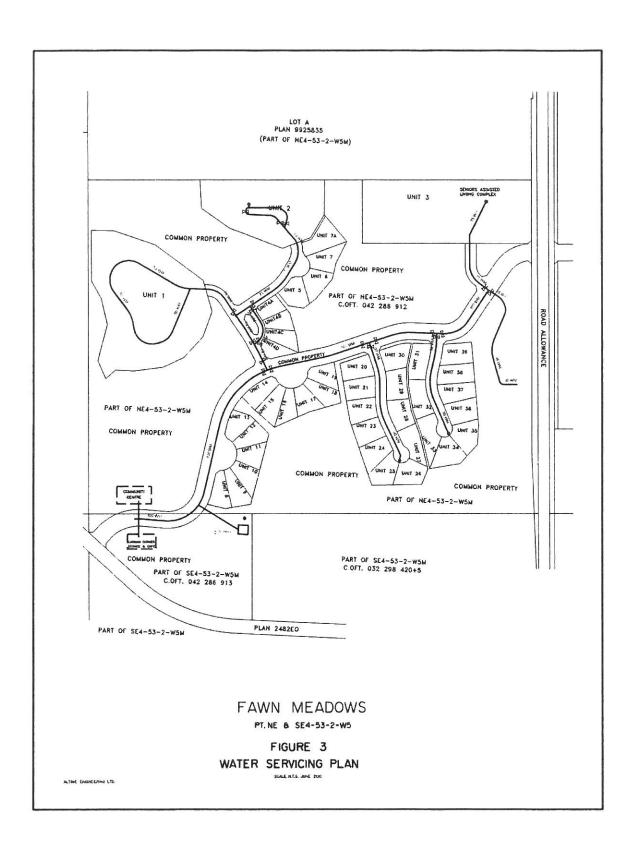
Units are cubic metres

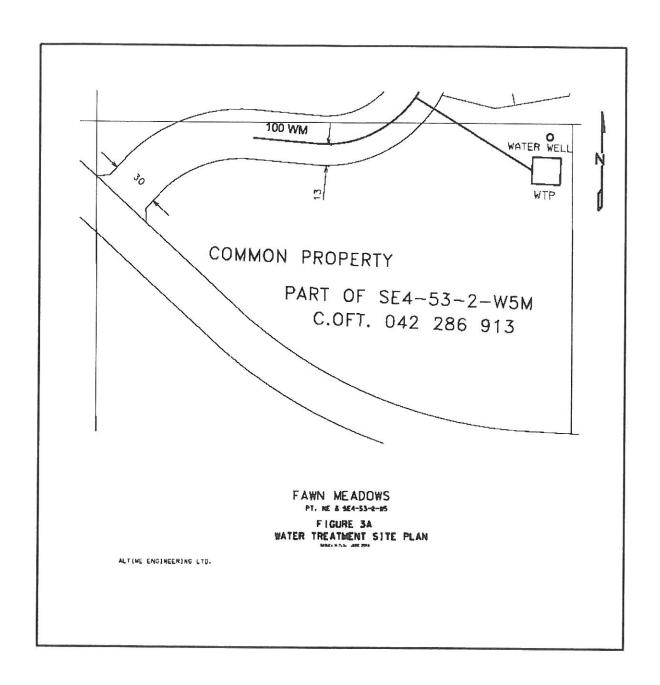
Total Cubic Metres Per day	188.2
Average Cubic Metres Per Minute	0.131
Peak Cubic Metres Per Minute	0.392

3.3 WATER SUPPLY, DISTRIBUTION, TREATMENT AND STORAGE

The water supply system will consist of components to supply, treat, pump and distribute potable water throughout the development. The water treatment plant will consist of the water treatment building, water disinfection system and water distribution pumps. There will also be a metering system and underground storage tanks.

Water service shall be provided to all dwellings via a community distribution system that is operational on a year round basis. Water distribution system will be a "Trickle System" which provides each dwelling with potable water at a rate of 2.27 liters per minute (0.5 gallons per minute) (720 Imperial gallons per day). Each dwelling will have a cistern and pressure system. A condominium association shall be incorporated to manage, operate and maintain the water supply, the water treatment facility and water distribution system. This same condominium association will also manage, operate and maintain the wastewater collection, wastewater treatment and treated effluent disposal system. The condominium association will employ a licensed water and wastewater technician/utility company to operate and maintain both the water and wastewater systems. The water system shall be designed to the standards set by Alberta Environment and the County, and constructed at the sole expense of the developer. (see Figure 3 - Water Servicing and Figure 3A-Water Treatment Site Plan)





4.0 WASTEWATER SYSTEM

4.1 GENERAL

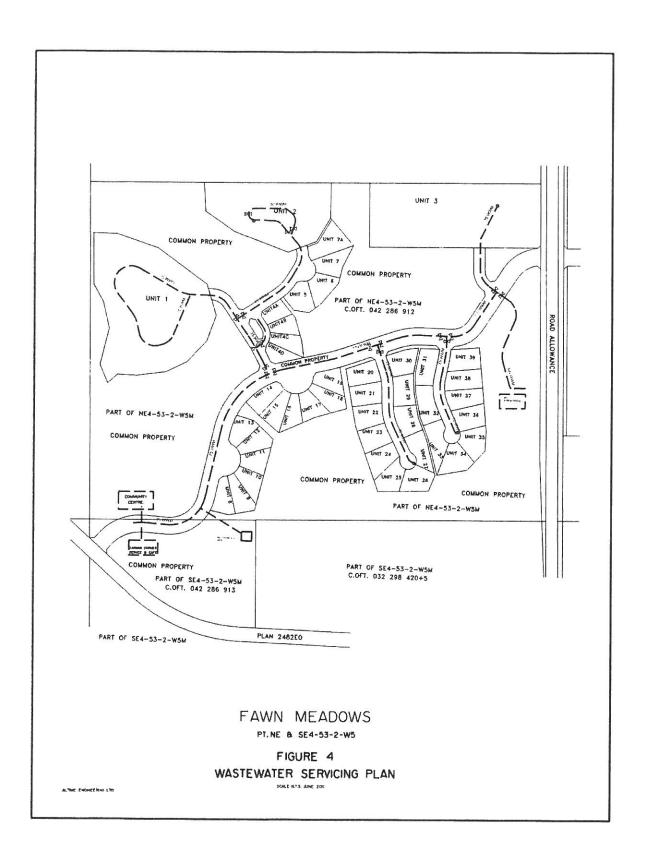
Wastewater will be accommodated by septic tanks located on each lot. The effluent from each septic tank will be pumped to a wastewater treatment facility and the treated effluent being disposed of by soil absorption methods. The wastewater collection system from the dwellings shall be provided by the developer and installed at the sole expense of the developer. The wastewater collection system will be the "STEP" system that is Septic Tank Effluent Pumping. This system comprises of a septic tank which separates the solids and greases from the effluent, a small submersible pump moves the liquid effluent via small diameter plastic pipes to the wastewater treatment facility. The wastewater collection system will be designed, located, and approved in accordance with Provincial and Municipal requirements, and are to be owned by the condominium association with exclusive use and operating costs being the responsibility of each dwelling owner.

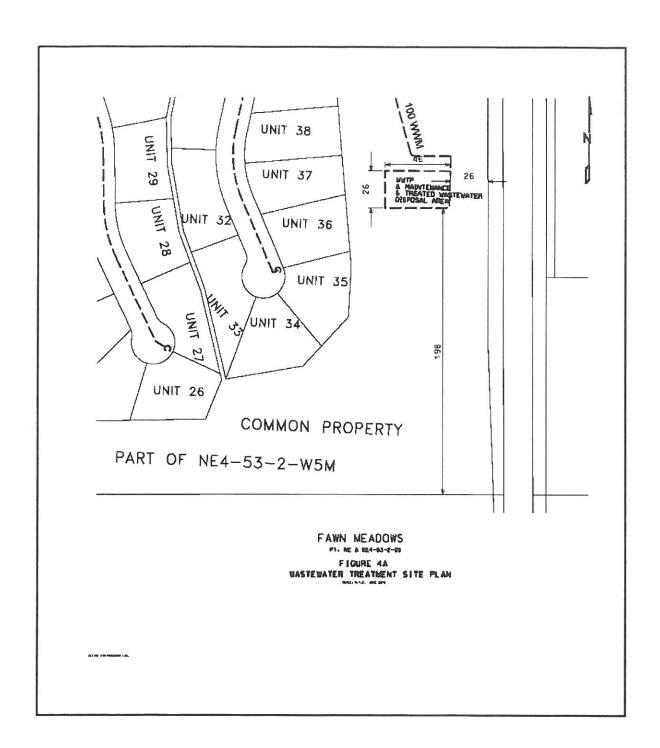
Prior to subdivision approval, the developer shall provide confirmation that effluent from the Plan Area will be received by a wastewater treatment facility acceptable to Alberta Environment and the County. This same condominium association will also manage, operate and maintain the wastewater collection, wastewater treatment and treated effluent disposal system. The condominium association will employ a licensed wastewater technician to operate and maintain the wastewater system.

4.2 DESIGN CRITERIA

The design for the wastewater system is based on the following criteria:

- · Individual septic tanks located on each lot.
- Scheduled clean out of the septic tanks as required.
- Septic tanks with a storage capacity equal to an average day of wastewater volume.
- The wastewater effluent from the septic tanks will be treated on site. (see Figure 4-Wastewater Servicing Plan and Figure 4A Wastewater Treatment Site Plan)





5.0 STORMWATER MANAGEMENT SYSTEM AND FIRE PROTECTION

5.1 GENERAL

Altime Engineering Ltd. has prepared a preliminary stormwater management report for the proposed development. The purpose of the report is to present the stormwater drainage concepts that will form the basis of the drainage plan that will service the community. Storm water management will be based upon the principle of minimizing the amount of disturbance to the natural surface drainage patterns and to maximize opportunities for infiltration of storm water into the sub-soil and near surface aquifer.

Runoff that is collected via drainage swales and roadside ditches will drain to stormwater detention facilities that will be constructed in the existing low areas of each catchment area. The development as a whole will be designed such that all runoff up to and including the 1:100 year storm event will be contained on site and discharged at predevelopment rates. However, the development detention facilities will be designed with appropriately located emergency spillways. All stormwater management within the Plan Area shall be designed and constructed to Alberta Environment and County servicing standards.

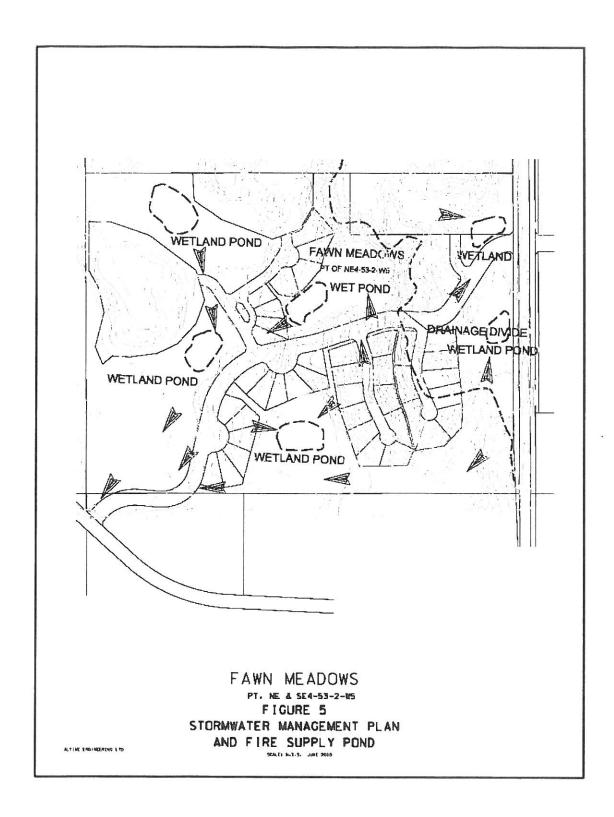
The post-development stormwater runoff rate from the Plan Area shall be no greater than the pre-development rate with a quality consistent with Alberta Environment guidelines. Stormwater management facilities shall be designed to utilize standing water. The stormwater management facilities shall be constructed at the sole expense of the developer.

5.2 DESIGN CRITERIA

The stormwater management system for Fawn Meadows will be designed in accordance with Alberta Environment Stormwater Management Guidelines and Parkland County's Subdivision Development Standards and will generally be comprised of a major (overland) system designed to convey 1 in 100 year storm runoff.

5.3 FIRE PROTECTION

Fire protection will be provided by using a stormwater wet pond as "fire pond" which is located on the center of the site and will have a permanent water depth of 2 meters. A dry hydrant and access point for a tank truck will be provided with sufficient storage to meet minimal fire standards. (See Figure 5 - Stormwater Management and Fire Supply Ponds)



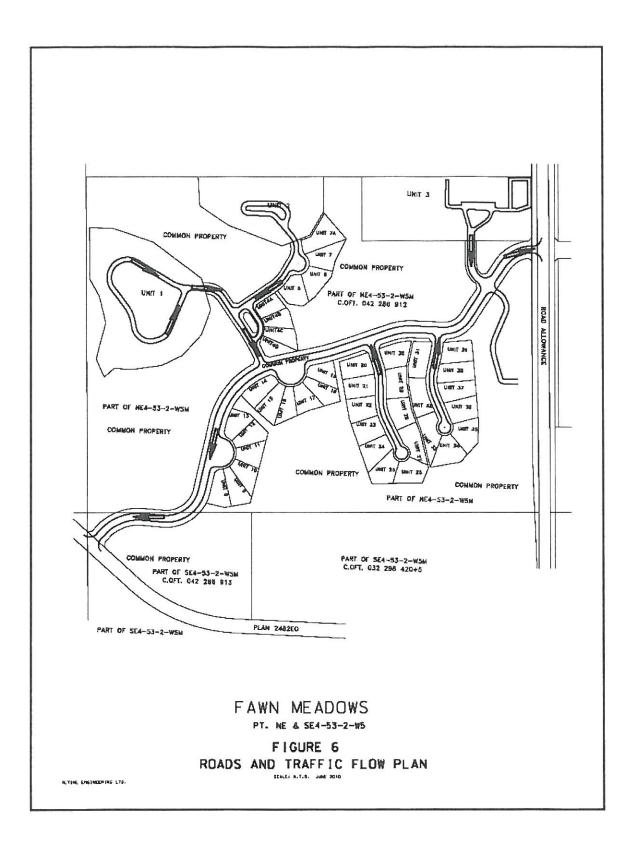
6.0 ROADWAYS AND TRAFFIC FLOW

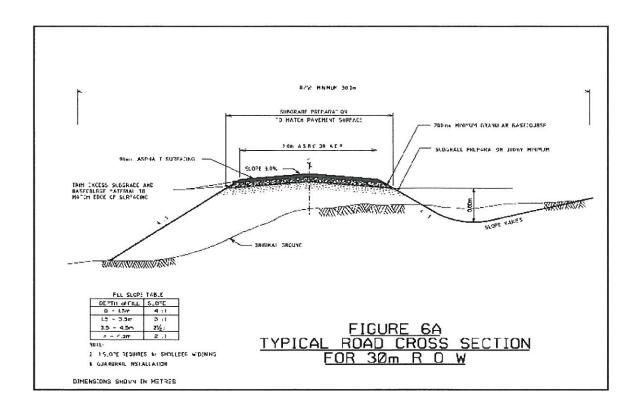
6.1 GENERAL

Fawn Meadows will be serviced by a hard surface road network. As a gated community, both entrances will have electronically controlled gates. Access codes for EMS and other service providers will be provided. The east gate located in the northeast portion of Fawn Meadows will only be accessible for EMS services or other emergency.

A stone finished metal gate on a remote control system will be constructed upon completion of the access road at each entrance.

All the internal roads within Fawn Meadows will be constructed to an engineered internal road standard which includes a 7 metre (23 ft.) hard surfaced top, within a utility and transportation width of 30 m and 20m. (See Figure 6 Roads and Traffic Flow Plan and Figure 6A-Typical Road Cross Section)





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FAWN MEADOWS

Pt. of NE & SE4-53-2-W5, Parkland County

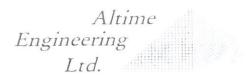
Preliminary Stormwater Management Report

Prepared By:

Altime Engineering Ltd A Partner of the Norcan Group Inc.

#223, 86 Mckenney Avenue St. Albert, AB T8N 2T7

Submitted: January 2012 AEL FILE NO. NC-145-02



January 30, 2012

Parkland County 53109A SH779 Parkland County, Alberta T7Z 1R1

Attention: Mr. Stephen Fegyverneki, RPP MCIP

Senior Planner, Planning & Development Services

Dear Sir:

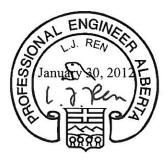
Re: Preliminary Stormwater Management Report – Fawn Meadows

Pt. of NE & SE4-53-2-W5, Parkland County

Enclosed please find a copy of the Preliminary Stormwater Management Report in support of the proposed subdivision development under Water Act.

Please contact the undersigned should you have any questions or comments pertaining to the enclosed report.

Yours truly,



PERMIT TO PRACTICE ALTIME ENGINEERING LTD.

Signature J.R. Andruk

Date January 30, 2012

PERMIT NUMBER: P 3479

The Association of Professional Engineers.

Geologists and Geophysicists of Alberta

L.J.Ren, M.Eng., P.Eng. LJR/ljr

Enclosures

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1.0 INTRODUCTION

This report is intended to outline the methodology to develop the on-site drainage and stormwater management (SWM) system for the proposed subdivision development. This report presents the design of the site plan and SWM system based on the topographical information received from Western Topographic Ltd. and visual site observations.

2.0 DESCRIPTION OF STUDY AREA

2.1 LOCATION AND SITE DESCRIPTION

The proposed development "Fawn Meadows" is located on Pt. of SE & NE4-53-2-W5 in Parkland County. The property is comprised of approximately 51.0 hectares. The subject land is bound to the north, west and south by agriculture land; to the east by Second Highway 770, with county residential development beyond and to the east of SHWY 770.

The property is currently used for agriculture and features a significant area of tree cover. The land has historically been used for forage crop and pasture.

2.2 TOPOGRAPHY AND DRAINAGE

The land at Fawn Meadows is very rolling and features an overall relief of about 20 metres. The highest point at Fawn Meadows is a ridge located in the southeast of the property. The lowest elevation in Fawn Meadows is in the southwest corner of the property.

There are five low lying areas in Fawn Meadows. The main feature of each low lying area is a small forest consisting of a mixture of black poplar, birch and black spruce trees. Surrounding each low lying area is forest cover. There is no definite drainage pattern across the site.

The soil profile of the site consists of a thin layer of topsoil that ranged from 18 to 67 cm in depth. Clay lenses of variable thickness and silt lenses are common beneath the topsoil level. Groundwater was found to be variable throughout the site with none of the sites having a high water table.

3.0 STORMWATER MANAGEMENT CRITERIA

The criteria used in the design of the proposed subdivision stormwater management follows the Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage Systems (January 2006), Storm Water Management Guidelines for the Province of Alberta (January 1999) and Subdivision Development and Engineering Standards of Parkland County.

4.0 PROPOSED STORMWATER MANAGEMENT STRATEGY

The postdevelopment subject land will increase in impervious area and as a result runoff rate will be greater than the predevelopment rate. To restrict the runoff flow rate and to maximize opportunities for infiltration of stormwater into the sub-soil and near surface aquifer, a Stormwater Management Plan has been prepared. (Please refer to attached Stormwater

Management Plan). The drainage of the subject site in general is divided into two basins by a ridge, an east drainage basin and a west drainage basin. The east drainage basin contains approximately 9.6 hectare of land and drains to an existing wetland in the northeast corner. The west drainage basin is comprised of 37.4 hectare of land and drains to the southwest. Constructed wetland ponds and a wet pond with 2m permanent water depth are proposed to receive the runoff of 1 in 100 year storm event and provide sediment removal treatment to the stormwater before it is released. The location, size, storage, outlet structure and other details of the ponds will be determined later in the detailed design.

5.0 EROSION AND SEDIMENT CONTROL

The potential of erosion and sedimentation is high during site preparation and/or construction of roads and buildings. The storm runoff from the development area will flow overland and in the road ditches. Erosion and sedimentation control measures need to be put in place to contain the transport of sediment within the site boundaries during construction activities.

The following measures should be addressed at the time of construction.

- 1. Silt fences shall be placed as required to contain sediment transport and should be inspected regularly and any damages repaired.
- 2. Any disturbed soil surfaces shall be regularly watered to provide dust control. Watering shall be done daily, if required, by having water trucks on site and carrying out frequent checks.
- 3. Construction of a mud mat shall be placed at the site entrance in order to promote self-cleaning of truck tires when leaving the site.
- 4. Any piles of dirt or soil stock piled on site during construction for more than 14 days will be seeded to prevent erosion.

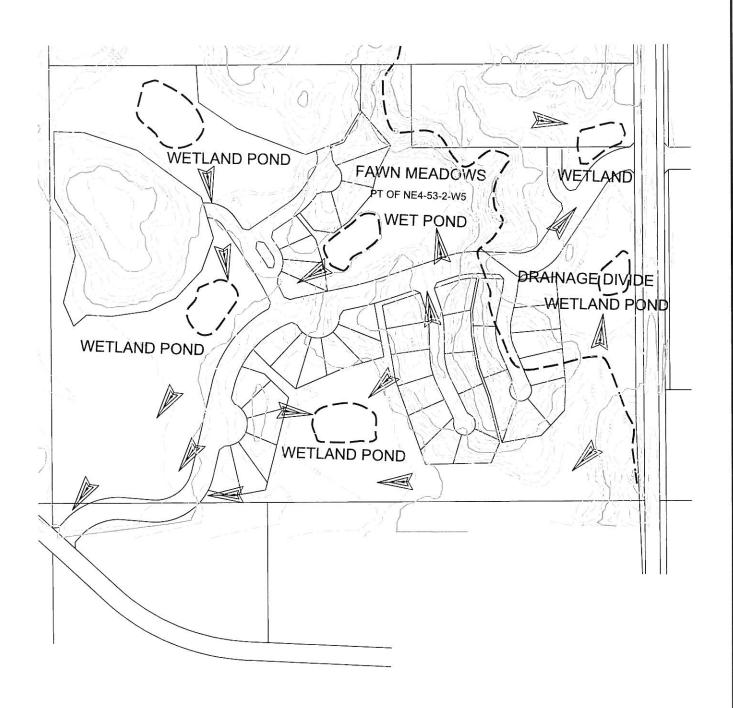
6.0 CONCLUSION AND RECOMMANDATION

It is noted that there is no definite drainage pattern in the subject land. In general two drainage basins are identified. The east drainage basin drains to an existing wetland, and the west drainage basin drains to proposed stromwater management ponds for quality and quantity control before water leaves the site. It is suggested the erosion and sediment control measures as outlined above be applied during construction period to contain sediments onsite and minimize adverse effect on the downstream and receiving water bodies.

7.0 DISCLOSURE

This report was prepared for Fawn Meadows subdivision development to provide a storm water management Plan in Pt. of NE & SE4-53-2-W5.

The services provided by Altime Engineering Ltd. in the preparation of this report were conducted in a manner consistent with the level of skill ordinarily exercised by members of the profession currently practicing under similar conditions. No warranty expressed or implied is made.



FAWN MEADOWS PT. NE & SE4-53-2-W5

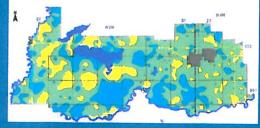
STORMWATER MANAGEMENT PLAN

ALTIME ENGINEERING LTD.

SCALE: N.T.S. JUNE 2010







Groundwater Supply Analysis

Fawn Meadows

August 2009 REVISED February 2012

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REPORT TO

NorCan Consulting

FOR

Groundwater Supply Analysis

ON

Fawn Meadows Development (NC-145)

PRINCIPAL CONTACT

Frank Florkewich

NorCan Consulting Group

August 2009, REVISED January 2012

SD Consulting Group 796 Cherokee Ave Saint Paul, MN 55107

Stantec White Bear Lake, MN 55015

I hereby certify that this report was prepared by me or under my direct supervision and that I am duly Registered Professional Engineer under the laws of the Province of Alberta.





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APPENDICIES

A: WATER WELL MAP AND DRILLING REPORTS

B: PRODUCTION AND OBSERVATION WELL DRILING LOGS

C: PUMPING TEST FIELD REPORTS

D: WATER QUALITY LAB REPORTS

1.0 Introduction

Stantec NAWE was retained by Fawn Meadows Development Corporation through NorCan Consulting as water supply and wastewater consultants. The scope of these services includes the completion of a groundwater supply analysis in support of an application under the *Water Act* for a groundwater diversion license. All revisions to this report were completed by SD Consulting Group.

The purpose of this analysis is to provide information on the capacity of the groundwater aquifer and its ability to meet the potable water demands of the proposed Fawn Meadows Development. This report provides information on site characteristics, locations and ownership of local wells, as well as pump test, water quality and well impact information. Reference materials include the Alberta Environment Water Well Database, The Parkland County Regional Groundwater Assessment other published geology and hydrogeology texts and figures.

The proposed development is located south of Highway 16 and west of Highway 43 in Parkland County. Location maps and property boundaries are provided in **Figure 1.1**.

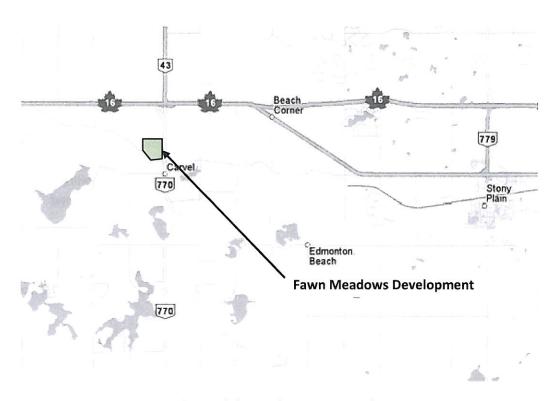


FIGURE 1.1 FAWN MEADOWS LOCATION

1.1 PROPOSED WATER SUPPLY

1.1.1 Water Demands

Current development plans include 35 single family detached dwellings, 20 semi-detached dwellings, 56 villa style dwellings, and 140 apartments. As shown in **Table 1.1**, **this equates to an average daily flow of 177 m³/day and an average flow of 0.123 m³/min.** As discussed later in this report, the production well can produce a sustainable yield of 0.46 m³/min, which is more than enough to meet the demands of the development and not cause negative impacts to neighboring wells.

of Units Residents Total Water **Total Water Unit Type** Residents Demand Demand /Dwelling Per Capita (m³/day) (m³/day) **Detached Dwellings** 2 70 0.378 26.5 35 Semi-Detached Dwellings 2 0.378 24 48 18.1 Villa-Style Dwellings 56 2 112 0.378 42.4 Apartment-Style 100 2 200 0.378 75.6 40 1 40 0.378 Dwellings 15.1 255 470 177.7 **Totals**

Table 1.1: Water Demands

1.1.2 Groundwater Sources

As shown in Figure 1.2, two groundwater wells have been installed on the property:

- Observation Well (AENV ID #1165411) Installed on June 12, 2008 to a depth of 73.1 feet, the well has a casing diameter of 18 centimeters. This well installation was exploratory for preliminary water supply determination. The observation well was used as an observation well during the 2009 pump testing and will be used as a backup domestic supply well in the development.
- Production Well 2 (AENV ID# TBD) Installed on May 13, 2009 to a depth of 84.4 feet, this well is intended for use as the primary water supply well. This well was installed with a 26 centimeter casing diameter and was test pumped for 72 hours with a 24 hour recovery period.

Both wells are installed into the interlayered sandstone and shales of the Horseshoe Formation. Five separate sandstone units are discharging into the production well casing. The two wells are 244 meters apart.

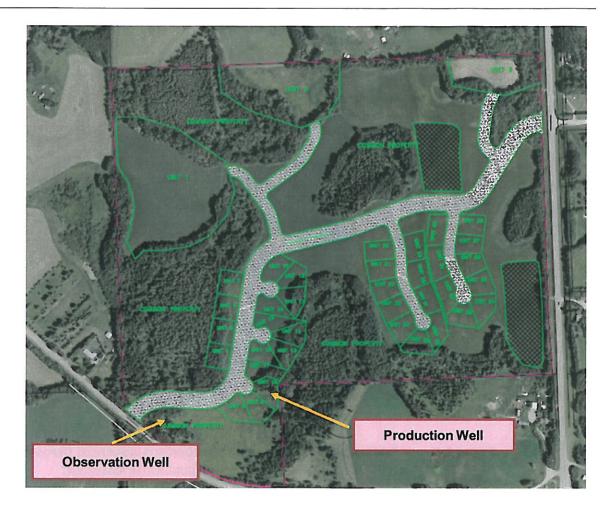


FIGURE 1.2 FAWN MEADOWS WELL LOCATIONS

2.0 Site Geology and Hydrogeology

2.1 SITE GEOLOGY

2.1.1 Local Surficial Geology

Fawn Meadows is located on the western edge of the Alberta Plains in a landscape characterized by rolling hills, river terraces, hummocky moraines, and numerous lakes/wetlands. Surficial geology is dominated by glacial till, lacustrine and outwash deposits from the Wisconsin Glaciation. Locally, the Fawn Meadows site is on the western edge of a large outwash deposit. Therefore, surficial materials consist of silt, sand and gravel. Approximately 10-50% of the surficial deposits consist of sand and gravel. Surficial deposits at Fawn Meadows have an average thickness of 20 meters over bedrock. Figure 2.1 shows the amount of sand and gravel

in surficial deposits throughout the county; the location of the proposed Fawn Meadows development is noted.

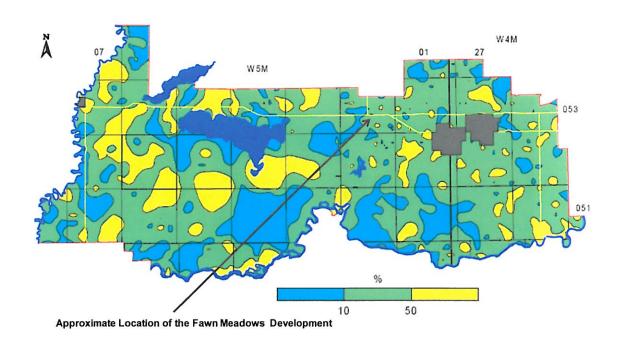


FIGURE 2.1 PARKLAND COUNTY SAND AND GRAVEL DEPOSITS IN SURFICIAL DEPOSITS
FIGURE SOURCE: PARKLAND COUNTY REGIONAL GROUNDWATER ASSESSMENT

2.1.2 Local Bedrock Geology

According to the Parkland County Regional Groundwater Assessment and the Research Council of Alberta's "Hydrogeology of the Wabamun Lake Area", Fawn Meadows is underlain by the Edmonton Group, a series of bedrock units consisting of alternating sandstone, siltstone and shale layers. The first bedrock unit, the Upper Horseshoe Formation is encountered at a depth of 20 meters and is approximately 80 meters at its thickest point. Below the Upper Horseshoe Formation, the Middle and Lower Horseshoe formations are encountered to a depth of approximately 300-500 meters below ground surface. The Bearspaw Formation is encountered below the Horseshoe and is the lowest bedrock unit typically studied in the area. A Parkland County bedrock map is provided in **Figure 2.2**.

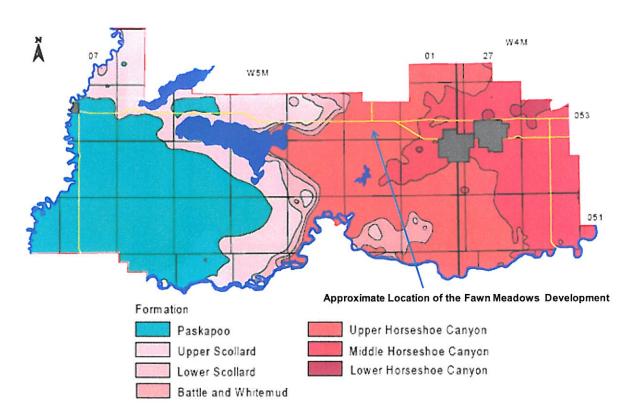


FIGURE 2.2 PARKLAND COUNTY BEDROCK GEOLOGY

FIGURE SOURCE: PARKLAND COUNTY REGIONAL GROUNDWATER ASSESSMENT

2.2 SITE HYDROGEOLOGY

Drinking water at Fawn Meadows will be provided by the Horseshoe Canyon Aquifer, which consists of three distinct bedrock formations. The upper, middle and lower Horseshoe Canyon Aquifers are the porous and permeable parts of the formation. The source aquifer consists of alternating layers of porous sandstone and impermeably shale/siltstone. Well casings typically intersect several sandstone layers that provide potable water and the entire system functions as a leaky confined aquifer. These aquifers are encountered at depths between 20-300 meters below ground surface and this aquifer is the most common bedrock aquifer in this region of Parkland County.

According to the Parkland County Regional Groundwater Assessment, the aquifer recharge/discharge for the Horseshoe Canyon formations, and the surficial deposits, discharge from the bedrock occurs over and area smaller than 10% of the County. **Figure 2.3** shows the recharge and discharge areas for the Upper Horseshoe Canyon Aquifer.

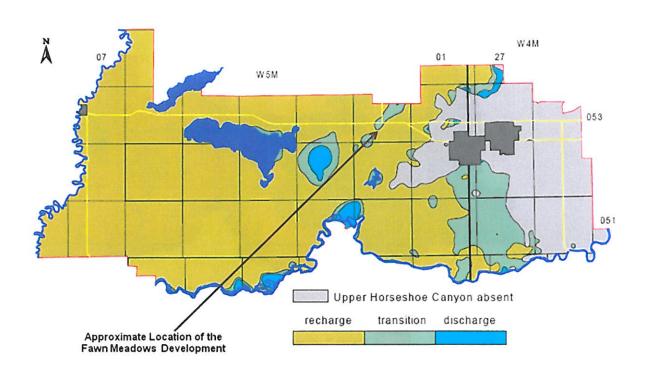


FIGURE 2.3 RECHARGE/DISCHARGE AREAS BETWEEN SURFICIAL DEPOSITS AND UPPER HORSESHOE CANYON AQUIFER

FIGURE SOURCE: PARKLAND COUNTY REGIONAL GROUNDWATER ASSESSMENT

3.0 Well Survey

According to the Parkland County Regional Groundwater Assessment, of the 3,107 recorded water wells in the county, 1,617 were defined as being constructed in the bedrock aquifer. Of these bedrock wells, 640 are located in the Upper Horseshoe Canyon Aquifer, 485 in the Middle Horseshoe Canyon Aquifer and 79 in the Lower Horseshoe Canyon Aquifer.

The Alberta Environment Well Database has been utilized to identify wells drilled within a 1 km radius of the well for the proposed Fawn Meadows Development. Field verification has not been completed so it is likely that not all of these wells are in use. **Figure 3.1** shows the general location of wells within this radius. **Table 3.1** summarizes the data on the known wells within this area. Individual water well drilling reports and maps are located in **Appendix A** of this report. Exact well locations will not be known until field verification. However, approximate well locations are provided for reference to the production well.

TABLE 3.1 NEIGHBORING WELL LOCATION DATA

Owner's Name	WellID	Legal Land Location	Date (DD MM YY)	Well Depth	Original Non- Pumping Water Level
Onyschuk, Andy	0351132	NW-04-53-02-W5	18 05 1990	210	36
Enders, Dave	0352280	SW-03-53-02-W5	02 08 1990	280	60
Franks, Gary	0353715	SW-03-53-02-W5	12 09 1990	260	65
Enders, Dave	0363257	SW-03-53-02-W5	15 05 1989	215	60
Chaput, Ralph	0365507	SW-03-53-02-W5	11 06 1992	260	59
Taylor, Robert	0365688	NW-03-53-02-W5	17 07 1992	205	48
Hawkins, Doug	0366255	SW-03-53-02-W5	18 08 1992	242	43
Chubaty, Mike	0368748	SW-03-53-02-W5	13 11 1992	240	63
Enders, Dave	0380523	SW-03-53-02-W5	14 03 1994	240	70
Bleker, Ernie, Jr.	0418277	SW-03-53-02-W5	04 10 1995	319	99
Carvel Dev	0459689	04-03-53-02-W5	25 06 1979	220	65.4
Stecyck, Fred	0459702	SW-03-53-02-W5	30 03 1971	190	54
Bleker, Ernie	0459710	SW-03-53-02-W5	11 06 1980	256	75
Enders, Dave	0459713	SW-03-53-02-W5	28 11 1989	285	55
Scott, Bertha	0459723	13-03-53-02-W5	07 12 1983	120	15
McDonald, Evan	0459734	12-03-53-02-W5	18 08 1983	220	40
Adams, Jack	0459744	SW-04-53-02-W5	23 08 1985	198	75
Bell, Jack	0459745	12-04-53-02-W5	17 08 1981	240	147
Turlock, S.	0459747	NW-04-53-02-W5	26 05 1967	170	18
Solar, Const	0459748	14-04-53-02-W5	26 09 1976	120	19
Wasylyshyn, Steve	0459749	NW-04-53-02-W5	17 08 1963	124	32
Enders, Dave/CDK Const	0466661	SW-03-53-02-W5	10 08 1994	260	65
Enders, Dave	0467926	SW-03-53-02-W5	26 09 1995	240	40
Shenfield, Tim	0494989	SW-03-53-02-W5	06 05 1999	220	85
Bates, Gerlad	0495847	SW-03-53-02-W5	13 10 1999	220	42.1
Willow Peak Homes	0496508	SW-03-53-02-W5	14 07 2000	265	42.2
Mercier, Ron	1165150	03-03-53-02-W5	21 02 2002	240	77.7
Ostermayer, Craig & Pat	1165151	NW-04-53-02-W5	18 05 2003	140	32.48
Phillps, Ross and Sarah	1495171	05-03-053-02-W5	21 06 2005	320	72.08
Taylor, Trudy	1715041	12-03-53-02-W5	26 02 2003	195	20.013

^{1.} Standard units are used as they are specified on all well logs

4.0 Pumping Test and Water Level Monitoring

4.1 TESTING PROCEDURES

Two pump tests have been completed at the Fawn Meadows Development. The first test occurred in the Observation Well on June 24th, 2008 and the well was pumped for 26 hours until steady state

conditions were reached. Recovery in the well was monitored over an 18 hour period before monitoring equipment was removed from the well. Only one well had been installed at this time, so this test was completed as a single well aquifer test.

Following the installation of the Production Well in May of 2009, a second pump test was completed on May 21, 2009. The production well was pumped for 72 hours and the first well was monitored as an observation well. Recovery was monitored in both wells over a 24 hour period. The water well drilling report for both wells is provided in **Appendix B**, and the pump testing field reports are located in **Appendix C** of this report. All test monitoring was completed at intervals specified in the *Alberta Groundwater Evaluation Guidelines*.

4.2 AQUIFER PARAMETERS

Table 4.1 summarizes the results of the tests performed. All hydraulic parameters have been calculated utilizing the computer software AQTESOLV v4.5.

Well	Rate		Analytical Procedure	Transmissivity(m ² /d)	Storativity	Observation Well?	
Observation	26	0.113	Hantush	14.67	NA ¹	No	
Production	72	0.227	Hantush	26.05	.0008714	Yes	
	1		Theis	26.05	.0008712	Yes	

TABLE 4.1 AQUIFER PARAMETERS

Using the equation T = KB, the hydraulic conductivity of the groundwater aquifer was calculated. Using a T value of 26.05 and a saturated thickness of 72 meters, the hydraulic conductivity is calculated to be 0.361 m/day, or 0.000004183 m/sec. This is consistent with textbook values for sandstone aquifers (3 \times 10-10 – 6 \times 10-10), so it appears to be appropriate for this analysis.

4.2.1 Sustainable Yield

The theoretical long-term safe yield (Q_{20}) of the production well has been calculated using the Farvolden Method and the results of the aquifer testing. The equations and calculations using this method are shown below.

Equation 4.1 Farvolden Method

$$Q_{20} = (0.68) \times T \times H \times (0.7)$$

T = Transmissivity

H = Distance from top of aquifer to the pre pumping water level

Using the Farvolden Method, a Q_{20} of 0.460 m³/min is calculated as the safe yield. As mentioned previously, the new development will require a peak flow of approximately 0.30 m³/min. Based upon the results of this analysis, the production well has the ability (with

^{1 -} Unable to calculate storativity without observation wells

FAWN MEADOWS GROUNDWATER SUPPLY ANALYSIS

Pumping Test and Water Level Monitoring July 20, 2009 REVISED JUNE 2011

adequate pump capacity) to support a flow of 0.460 m³/min and meet the demands of the new development. If additional water supply is needed, the observation well will serve as the backup production well.

4.2.2 Radius of Influence Modeling (Well Impact Assessment)

The radius of influence of the production well was modeled using the Theis Distance Drawdown Method. Pumping rate, transmissivity, and storativity were all utilized in the software to estimate the extent of the affected area. Using this data, the predicted radius of influence is 1038 meters from the Production well. However, past a distance of 234 meters, drawdown is minimal (<1.5 meters) and will not unreasonably interfere with neighboring groundwater supplies.

On Figure 4.1, the radius of influence has been broken down into three zones: major, minor and minimal impact areas. The major impact area consist of drawdown greater than 1.5 meters is contained within the property boundaries to a distance of 234 meters from the production well. The minor impact area shows an estimated drawdown of 1.5 meters or less and the minimal impact area consists of impact less than 0.2 meters and extends to a distance of 1038.15 meters, and which aquifer impact is predicted. Graphically, this is shown as a circle in Figure 4.1. Realistically, the radius of impact is an elongated circle in the direction of groundwater flow, which is generally northwest to southeast in the Horseshoe Aquifer.

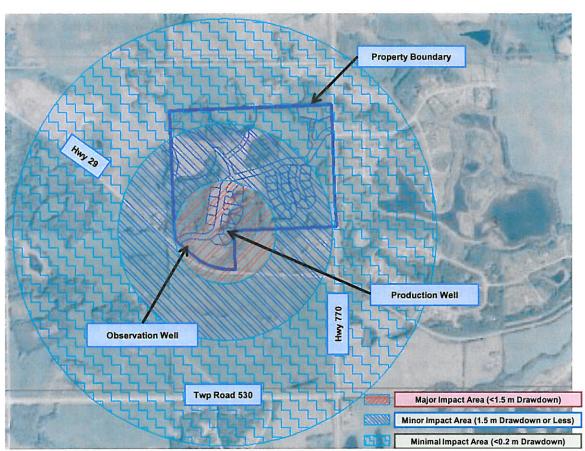


FIGURE 4.1 FAWN MEADOWS MAJOR AND MINOR WELL IMPACT AREAS

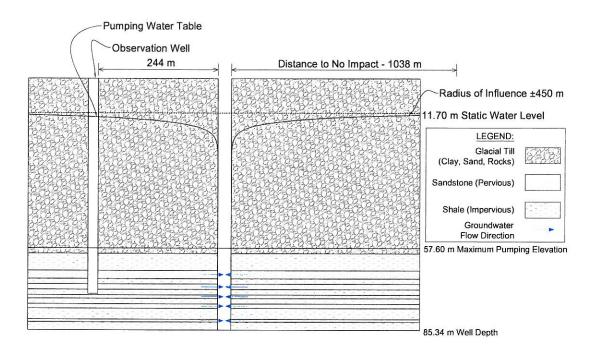


FIGURE 4.2 FAWN MEADOWS WELL CROSS SECTION

5.0 Water Quality Assessment

Water samples were taken from the production wells immediately before completion of the pump test at 72 hours. These samples were analyzed by Kaizen Labs for routine heavy metals and bacterial content. Lab reports are provided in **Appendix D** of this report. Groundwater quality from the production well is consistent with the Horseshoe Formation.

Water quality results indicate levels of sodium and total dissolved soils (TDS) that exceed Canadian Drinking Water Quality Standards. Groundwater is classified as sodium- bicarbonate water with high levels of sodium, TDS, and in some cases (not for this project), sulfate. Water treatment will likely be necessary to bring TDS levels down to potable standards.

6.0 Conclusions

Two wells have been installed and pump tested at the proposed Fawn Meadows Development. The following conclusions summarize the results of the well installation and pump testing:

- The new development will require a peak flow of approximately 0.123 m³/min According to this study, well #2 has the ability to support a flow of 0.46 m³/min and meet the demands of the development.
- The predicted radius of influence is 1038 meters from the production well. However, past a distance of 244 meters, drawdown is minimal (<1.5 m). For example, the maximum impact predicted for the nearest wells east of Highway 770 is less than 0.2 meters of drawdown.
- The average flow from the development will be approximately 0.123 m³/min(27 igpm). Considering that the pump test was completed at a rate of 0.22 m³/min (49 ipgm), the average pumping rate will have considerably less impact than observed in **Figure 4.1**. It is likely that at low pumping rates, the impact will be limited to the boundaries of the project. In addition, all modeling assumed consistent pumping conditions. In reality, the well will be pumped intermittently to feed water storage and treatment facilities. The pumps will not consistently run as they did during the pump testing.
- Groundwater usage will be further limited by the reuse of stormwater for domestic irrigation and fire protection. Groundwater will not be used for domestic irrigation. Stormwater will be harvested from roofs and collected in storage tanks to feed domestic irrigation in the summer and maintain a dead storage for fire protection via a sprinkler system. Refer to the Fawn Meadows Integrated Water Management Plan for further information on the water savings.
- Aquifer testing and analysis indicate that a diversion of 190 m³/day (0.13 m³/min) is sustainable and will not unreasonably interfere with neighboring groundwater supplies.
- Water quality results indicate values of sodium and total dissolved solids in exceedance of Canadian Drinking Water Quality Standards. Water treatment will be necessary before use as potable water.

7.0 Closure

This report presents results of the Hydrogeologic Investigation at the Fawn Meadows Development and is intended for presentation to Parkland County and Alberta Environment for a groundwater diversion license pursuant to the Alberta *Water Act*.

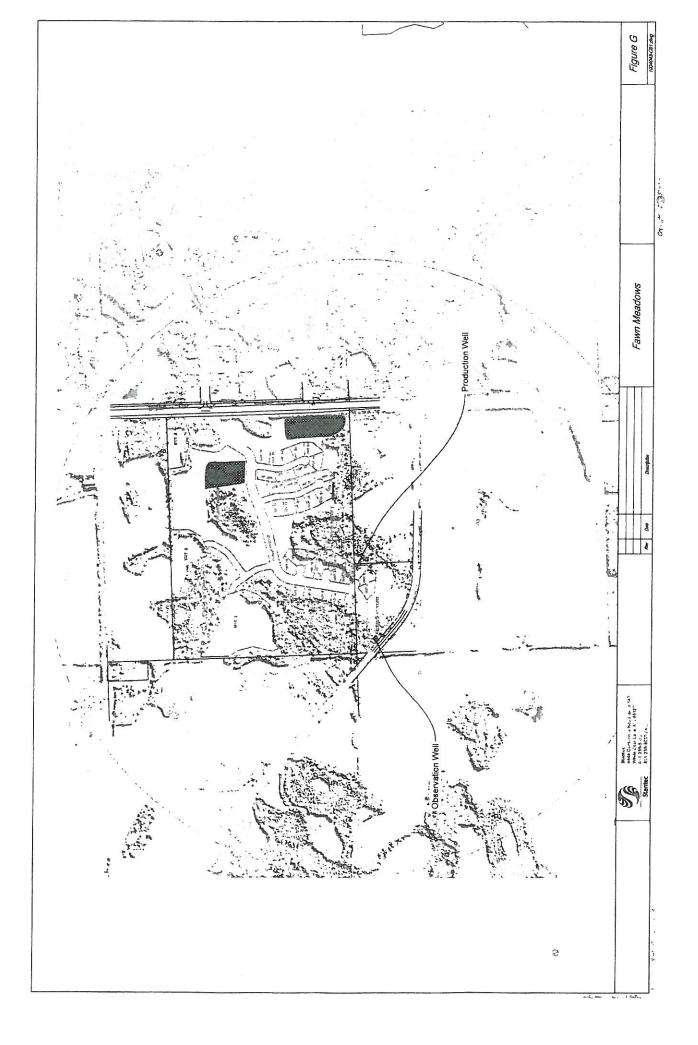
FAWN MEADOWS GROUNDWATER SUPPLY ANALYSIS

Closure

July 20, 2009 REVISED JUNE 2011

This report also incorporates field data collected by others and this information is assumed to be accurate for the purposes of this report. This work was carried out using commonly accepted hydrogeologic practices and no other warranty is made as to these professional services. Any third party use of this report, or decisions made based upon it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by third parties as a result of decisions made based on this report.

Appendix A Water Well Map and Drilling Reports



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The data contained in this	Well Drilling report is supplied by the Dril responsibility for its accuracy	ller. The province disclaims	Well I.D.: 1165150 Map Verified. Map Date Report Received: 2006/10/25
Environment	,	·	Measurements: Imperial
1. Contractor & Well Owner Informa Company Name:			2. Well Location
CALIBRE DRILLING LTD.		rilling Company Approval No.:	1/4 or Sec Twp Rge Westol LSD M
Mailing Address: City or Tov	vn: Po	ostal Code:	03 03 053 02 5
BOX 4083 SPRUCE CANADA	GROVE ALBERTA T7	7X 3B3	Location in Quarter FT from N Boundary
WellOwner's Name: Well Locat	on Identifier:		FT from N Boundary FT from E Boundary
MERCIER, RON LAKE COL P.O. Box Number: Mailing Ad	INTRY PROPERTIES		Lot Block Plan
SITE 218 F		ostal Code: DE 0H0	10 3 8020386 Well Elev: How Obtain:
City: Province:	Co	ountry:	FT Not Obtain
3. Drilling Information	CA	4	6. Well Yield
Type of Work: New Well		Proposed well use:	Test Date Start Time: (yyyy/mm/dd):
Reclaimed Well	asi ser sociate da sombo se	Domestic	2002/02/21 11:00 AM
Date Reclaimed: Mater Method of Drilling: Rotary	ials Used: Unknown	Anticipated Water Requirements/day	Test Method: Air Non pumping 77.789 FT
Flowing Well: No Rate:	Gallons	500 Gallons	static level:
	esent: No		Rate of water 10
4. Formation Log Depth	5. Well Completion	Data Carrelated	removal: Gallons/Min Depth of 140.092 FT
from	Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):	pump intake:
ground Lithology Description level	2002/02/20	2002/02/21	Water level at 131.1 FT end of
(feet)	Well Depth: 240 FT	Inches	pumping:
62 Brownish Yellow Till	Casing Type: Plastic	Liner Type: Plastic	Distance from top of 19.685 casing to ground Inches
71 Brown Fine Grained Sand 92 Brownish Yellow Till	Size OD: 6 Inches Wall Thickness: 0.39	Size OD: 4.5 Inches	level:
102 Blue Gray Till	Inches	Wall Thickness: 0.237 Inches	Depth To water level (feet)
151 Gray Medium Grained Sand 159 Dark Gray Clay	Bottom at: 190 FT	Top: 185 FT Bottom:	Elapsed Time Drawdown Minutes:Sec Recovery
159 Dark Gray Clay 166 Dark Gray Shale	Perforations	Perforations Size:	0:00 131.168
177 Medium Grained Sandstone	from: 194 FT to: 233 FT	0.062 Inches x 12 Inches	1:00 125.689 2:00 116.831
184 Light Gray Shale 188 Medium Grained Sandstone	from: FT to: FT from: FT to: FT	Inches x Inches Inches x Inches	3:00 108.858
194 Green Shale	Perforated by: Saw		4:00 104.364
207 Light Gray Shale	Seal: Bentonite Chips/Table from: 0 FT	ets to: 190 FT	5:00 99.77 6:00 95.407
216 Medium Grained Sandstone 224 Green Shale	Seal: Unknown	10. 190 F1	7:00 92.159
233 Medium Grained Sandstone	from: FT Seal: Unknown	to: FT	8:00 90.453 9:00 88.615
240 Green Shale	from: FT	to: FT	10:00 87.041
	Screen Type: Unknown	Screen ID: Inches	12:00 84.35
	from: FT to: FT Screen Type: Unknown	Slot Size: Inches Screen ID: Inches	14:00 82.808 16:00 81.496
	from: FT to: FT	Slot Size: Inches	20:00 80.479
	Screen Installation Method: Fittings	Unknown	25:00 79.626
	Top: Unknown	Bottom: Unknown	30:00 78.707 35:00 78.248
	Pack: Unknown	A	40:00 78.051
	Grain Size: Geophysical Log Taken:	Amount: Unknown	50:00 77.822
	Retained on Files:		60:00 77.789 75:00 77.789
	Additional Test and/or Pum Chemistries taken By Driller		90:00 77.789
	Held:	Documents Held:	105:00 77.789
	Pitless Adapter Type:		120:00 77.789 Total Drawdown: 53.379 FT
	Drop Pipe Type: Length: FT	Diameter: Inches	f water removal was less than 2 hr
	Comments:		duration, reason why:
	AIR TEST 10 GPM @ 39.98 BENTONITE PRODUCT &	B METERS, SEAL -	
Ę	DIAMETER - 8.75" & 4.875'	" ANTICIPATED	700000000000000000000000000000000000000
	REQUIREMENT PER DAY	SOUTH OUT ONLE ON	Recommended pumping rate: 7 Gallons/Min Recommended pump intake:
	7. Contractor Certific	ation	137.795 FT
ı	Drillaria Nama:	DANIDA DEIDI INICED	Type Pump Installed

	The data contained in this	Well Drilling report is supplied by the I responsibility for its accura	Driller. The	ort province disclaims	Well I.D.: Map Verified: Date Report Received:	1165151 Not Verified 2006/10/25
	ironment	,			Measurements:	Imperial
Company	ractor & Well Owner Informat	lion	Drilling Co	mpany Approval No.:	2. Well Locati	
,	DRILLING LTD.		128944	impany Approvaria.	LSD	M M
Mailing Ad	ddress: City or Tow		Postal Co	de:	NW 04 05	
BOX 4083	4	SROVE ALBERTA	T7X 3B3		Location in Quarte	er V Boundary
WellOwne	CANADA Well Locati	on Identifier:				E Boundary
	AYER, CRAIG & PAT	orr racritimer.			Lot Block	
P.O. Box			Postal Co	de:		
		RR 2 BOX 25	T7Z 1X2			How Obtain:
City: STONY P	PLAIN AB		Country: CA		Name and Address of the Owner, where the Party of the Owner, where the Owner, which is the Owner	Not Obtain
NAME AND ADDRESS OF THE OWNER, OF TAXABLE PARTY.	ng Information		UN .		6. Well Yield Test Date	Start Time:
Type of M	Vork: New Well			Proposed well use:	(yyyy/mm/dd):	Start Time.
Reclaimed	d Well			Domestic	2003/05/18	7:55 PM
Date Reci		ials Used: Unknown		Anticipated Water	Test Method: Air	
	f Drilling: Rotary			Requirements/day	Non pumping	32.48 FT
Flowing V		Gallons		Gallons	static level: Rate of water	12
Gas Prese		esent: No		1	removal:	12 Gallons/Min
	nation Log	5. Well Completio			Depth of	59.055 FT
Depth		Date Started(yyyy/mm/d		Completed mm/dd):	pump intake:	
from ground	Lithology Description	2003/05/18	2003/0		Water level at	48.32 FT
level	Littlology Description			ole Diameter: 8.75	end of	
(feet)		Well Depth: 140 FT	Inches		pumping: Distance from top	of 27 550
	Brownish Yellow Clay	Casing Type: Plastic		Type: Plastic	casing to ground	Inches
	Blue Gray Clay	Size OD: 6 Inches		D: 4.5 Inches	level:	
	Blue Gray Till	Wall Thickness: 0.39		hickness: 0.237	Depth To wat	ter level (feet)
108 111	Green Shale Fine Grained Sandstone	Inches	Inches Top: 1			d Time
	Green Shale	Bottom at: 105 FT	140 F			es:Sec Recovery
115	Fine Grained Sandstone	Perforations		ations Size:		:00 48.327 :00 42.028
121	See Comments Sandstone	from: 111 FT to: 140 FT		Inches x 12 Inches		:00 39.862
124	Coarse Grained Sandstone	from: FT to: FT		x Inches		:00 39.14
	Greenish Gray Shale	from: FT to: FT Perforated by: Saw	inches	x Inches	4	:00 37.959
	Light Gray Shale	Seal: Bentonite Chips/T	ablets			:00 37.27
140	Coarse Grained Sandstone	from: 0 FT	to: 105	5 FT		:00 36.745
		Seal: Unknown				:00 36.45
		from: FT	to: FT			:00 36.122 :00 35.827
		Seal: Unknown from: FT	to: FT			0:00 35.663
		Screen Type: Unknown		n ID: Inches		2:00 35.4
1		from: FT to: FT		ize: Inches		1:00 35.105
		Screen Type: Unknown	Scree	n ID: Inches	16	34.875
		from: FT to: FT		ize: Inches		0:00 34.613
		Screen Installation Meth	nod: Unkno	wn		5:00 34.35
l		Fittings Top: Unknown	Botton	n; Unknown		0:00 34.121
		Pack: Unknown	50((0)	ii, onanomi		5:00 33.957 0:00 33.825
		Grain Size:	Amou	nt: Unknown		0:00 33.629
		Geophysical Log Taken				0:00 32.48
		Retained on Files:				5:00 32.48
		Additional Test and/or F				0:00 32.48
		Chemistries taken By D Held:		nents Held:		5:00 32.48
		Pitless Adapter Type:	Docui	norma riald.		0:00 32.48
		Drop Pipe Type:			Total Drawdown:	
		Length: FT	Diame	eter: Inches	If water removal of duration, reason	was less than 2 h
		Comments:			duration, reason	writy.
		AIR TEST 12 GPM @ 1			1	
		METERS. 115' - 121' H DIAMETER - 8.75" & 4.				
1		PRODUCT & CUTTING		- DERTORITE	Recommended p	umping rate: 10
		[51 -		Gallons/Min	
1		1			Danet	
		7. Contractor Cer			Recommended p 82.021 FT	ump intake:

C1C1 7/1/2000

The data contained in this	Well Drilling report is supplied by the Dr esponsibility for its accurace	riller. The province disclaims	Well I.D.: 0351132 Map Verified: Not Verified Date Report 1990/06/19
Contractor & Well Owner Informat	ion		Measurements: Imperial
Company Name:		Orilling Company Approval No.	2. Well Location 1/4 or Sec Twp Rge Westof
MAR-WAYNE WATER WELL DRILLING SERVI	CES LTD. 1	118900	LSD M
Mailing Address: City or Tow		Postal Code:	NW 04 053 02 5
BOX 4, SITE 5, RR 1 CALAHOO WellOwner's Name: Well Location	on Identifier:	TOG 0J0	Location in Quarter 0 FT from Boundary
ONYSCHUK, ANDY	on identifier		0 FT from Boundary
P.O. Box Number: Mailing Add		Postal Code:	Lot Block Plan
City: RR1 CARV Province:		FOE 0H0 Country:	Well Elev: How Obtain: FT Not Obtain
3. Drilling Information			6. Well Yield
Type of Work: New Well		Proposed well use:	Test Date Start Time:
Reclaimed Well Date Reclaimed: Materi	olo I lood:	Domestic	(yyyy/mm/dd):
Method of Drilling: Rotary	als Used:	Anticipated Water Requirements/day	1990/05/18 11:00 AM Test Method: Air
Flowing Well: No Rate:	Gallons	0 Gallons	Non pumping 36 FT
Gas Present: Oil Pre			static level:
4. Formation Log	5. Well Completion		Rate of water 8 removal: Gallons/Min
Depth from	Date Started(yyyy/mm/dd): Date Completed (vyyy/mm/dd):	Depth of 0 FT
ground Lithology Description	1990/05/16	1990/05/18	pump intake:
level (feel)	Well Depth: 210 FT	Borehole Diameter: 0	Water level at 140 FT end of
17 Brown Silt	Casing Type: Plastic	Inches Liner Type: Plastic	-pumping:
28 Gray Clay	Size OD: 6 Inches	Size OD: 4.5 Inches	Distance from top of Inches
137 Shale	Wall Thickness: 0 Inches	Wall Thickness: 0.25	casing to ground level:
142 Green Shale 145 Gray Shale	VVali Triickiicss. 6 menes	Inches	Depth To water level (feet)
155 Gray Sandstone	Bottom at: 160 FT	Top: 156 FT Bottom: 210 FT	Elapsed Time
168 Green Shale	Perforations	Perforations Size:	Drawdown Minutes:Sec Recovery Total Drawdown: 104 FT
190 Fractured Shale	from: 168 FT to: 210 FT	0 Inches x 0 Inches	If water removal was less than 2 hr
201 Gray Sandstone 210 Shale	from: 0 FT to: 0 FT from: 0 FT to: 0 FT	0 Inches x 0 Inches 0 Inches x 0 Inches	duration, reason why:
210 Office	Perforated by: Other	T MONOCK T MONOC	1 1
	Seal: Shale Trap	100 57	
	from: 0 FT Seal:	to: 160 FT	Recommended pumping rate: 8
	from: 0 FT	to: 0 FT	Gallons/Min Recommended pump intake: 0 FT
	Seal: from: 0 FT	to: O FT	Type Pump Installed
	Screen Type:	to: 0 FT Screen ID: 0 Inches	Pump Type:
	from: 0 FT to: 0 FT	Slot Size: 0 Inches	Pump Model: H.P.:
	Screen Type:	Screen ID: 0 Inches	Any further pumptest information?
	from: 0 FT to: 0 FT Screen Installation Method	Slot Size: 0 Inches	
	Fittings		1 I
	Top:	Bottom:	1
	Pack: Grain Size:	Amount: 0	
	Geophysical Log Taken:	/ Milount. O	1 1
	Retained on Files:]
	Additional Test and/or Pur Chemistries taken By Drille	np Data	1
	Held: 1	er: No Documents Held: 2	
	Pitless Adapter Type:		1
	Drop Pipe Type: Length: FT	Diamotor: Inches	
	Comments:	Diameter: Inches	
	Security Security		
	7 Contractor Contis	cation	
· ·	7. Contractor Certifi Driller's Name:	UNKNOWN DRILLER	
	Codification No.	257	l l

mater mentacport

Water Well Drilling Report

The data contained in this report is supplied by the Driller. The province disclaims responsibility for its accuracy.

Well I.D.: Map Verified: Date Report 0352280 Мар 1990/10/16 Received:

Environment responsibility for its accuracy.					Imperial
1. Contractor & Well Owner Information	tion			2. Well Loca	ition
Company Name: D&D WATER WELL DRILLING & SERVICING L		Drilling Compa 96030	ny Approval No.:	LSD	Twp Rge Westof M
Mailing Address: City or Tow		Postal Code:			053 02 5
	AIN AB CA on Identifier:	T7Z 1X5		Location in Qua 0 FT from	rter Boundary
ENDERS, DAVE	on identifier.			0 FT from	Boundary
P.O. Box Number: Mailing Adv RR2, CAR		Postal Code:		Lot Bloc 6 6	k Plan
City: Province:		Country:		Well Elev:	How Obtain:
				FT	Not Obtain
3. Drilling Information				6. Well Yield	
Type of Work: New Well Reclaimed Well			oosed well use: nestic	Test Date (yyyy/mm/dd):	Start Time:
10 (A 10 (B 10 (B))))))))))))))))))))))))))))))))))))	ials Used:	Anti	cipated Water	1990/08/02	11:00 AM
Method of Drilling: Rotary			uirements/day	Test Method: Ai	
	Gallons	lo G	allons	Non pumping static level:	60 FT
Gas Present: Oil Pr 4. Formation Log	esent: 5. Well Completion	, '		Rate of water	15
Depth		Data Comp	leled	removal:	Gallons/Min
from	Date Started(yyyy/mm/do	a): (yyyy/mm/d	ld):	Depth of pump intake:	0 FT
ground Lithology Description	1990/08/01	1990/08/02		Water level at	160 FT
level (feet)	Well Depth: 280 FT	Borehole D Inches	iameter: 0	end of	10011
38 Yellow Clay	Casing Type: Plastic	Liner Type:	Plastic	pumping:	
128 Blue Silty Clay	Size OD: 6 Inches	Size OD: 4		Distance from to casing to ground	
133 Green Sandy Shale	Wall Thickness: 0.37		ness: 0.248	level:	1
139 Gray Sandy Shale 141 Green Sandy Shale	Inches	Inches Top: 154 F	T Bottom:		ater level (feet)
164 Green Shale	Bottom at: 156 FT	280 FT	i Bollom.		ed Time
169 Sandstone	Perforations	Perforation	s Size:	Total Drawdown	utes:Sec Recovery
178 Green Shale	from: 150 FT to: 275 FT		s x 10 Inches		was less than 2 hr
180 Sandstone	from: 0 FT to: 0 FT from: 0 FT to: 0 FT	0 Inches x		duration, reasor	why:
209 Green Shale 215 Sandstone	Perforated by: Other	O INDITION X	0 11101100	1	
219 Gray Shale	Seal: Shale Trap				
229 Sandstone	from: 0 FT Seal:	to: 156 FT		Recommended	pumping rate: 0
235 Gray Shale	from: 0 FT	to: 0 FT		Gallons/Min	pump intake: 0 FT
243 Sandstone 247 Gray Shale	Seal:			Type Pump Inst	
253 Sandstone	from: 0 FT Screen Type:	to: 0 FT Screen ID:	O Inches	Pump Type:	
267 Green Shale	from: 0 FT to: 0 FT	Slot Size: 0		Pump Model: H.P.:	
274 Sandstone	Screen Type:	Screen ID:	0 Inches		ptest information?
280 Green Shale	from: 0 FT to: 0 FT Screen Installation Metho	Slot Size: 0	Inches		
	Fittings	00:			
	Top:	Bottom:			
ļ	Pack:			1	
	Grain Size: Geophysical Log Taken:	Amount: 0			
	Retained on Files:				
	Additional Test and/or Po			1	
	Chemistries taken By Dr		Malaka	1	
	Held: 0 Pitless Adapter Type:	Documents	Heid: 1	ł	
	Drop Pipe Type:			1	
	Length: FT	Diameter: I	nches	Į	
	Comments: Well located in Lake Cou	intry Estates		1	
	vveii located ili Lake Cot	antry ⊏states.			
				Į	
	7. Contractor Certi				
l	Driller's Name:	UNKNOWN	DRILLER	I	8.

Matar	Wall Drilling	Dan	ort	Well I.D.:	0365507
Water	Well Drilling	veh	ort	Map Verified:	Мар
Alberta Environment	report is supplied by the D responsibility for its accura	riller. The cy.	province disclaims	Date Report Received:	1992/08/06
1. Contractor & Well Owner Informa	tion.			Measurements:	Imperial
Company Name:		Drilling Co	ompany Approval No.	2. Well Location	
MAR-WÁYNE WATER WELL DRILLING SERV	ICES LTD.	118900	imparty Approval No.	1/4 or Sec Tw	p Rge Westof M
Mailing Address: City or To		Postal Co	de:	SW 03 053	3 02 5
BOX 4, SITE 5, RR 1 CALAHOO WellOwner's Name: Well Local	O AB CA tion Identifier:	TOG 0J0		Location in Quarter 0 FT from	
CHAPUT, RALPH	ion identiner.			0 FT from	Boundary Boundary
P.O. Box Number: Mailing Ad	dress:	Postal Co	de:	Lot Block	Plan
	JNTRY ESTATES,			4 4	
CARVEL City: Province:		Country:			low Obtain: lot Obtain
		oodiniy.		6. Well Yield	ot Obtain
3. Drilling Information				Test Date	Start Time:
Type of Work: New Well			Proposed well use:	(yyyy/mm/dd):	McWallandon market
Reclaimed Well Date Reclaimed: Mate	rials Used:		Domestic Anticipated Water	1992/06/11	11:00 AM
Method of Drilling: Rotary	idio Oocu,		Requirements/day	Test Method: Air Non pumping	59 FT
Flowing Well: No Rate:	Gallons		0 Gallons	static level:	
	esent: No			Rate of water	9
4. Formation Log	5. Well Completion			removal: Depth of	Gallons/Min 190 FT
Depth from	Date Started(yyyy/mm/dd		ompleted nm/dd):	pump intake:	190 - 1
ground Lithology Description	1992/06/10	1992/0		Water level at	126 FT
level	Well Depth: 260 FT		ole Diameter: 0	end of	
(feet) 23 Brown Silty Clay	Casing Type: Plastic	Inches		pumping: Distance from top o	of Inches
25 Gray Silty Clay	Size OD: 6 Inches		ype: Plastic D: 4.5 Inches	casing to ground	
45 Brown Silty Clay	Wall Thickness: 0.5 Inche	Wall T	nickness: 0.25	level:	Level (foot)
125 Gray Silty Clay 128 Gravel	Trail Thickness, U.S HICHE	inches		Depth To water Elapsed	Time
128 Gravel 136 Clay	Bottom at: 197 FT	Top: 1: 260 FT		Drawdown Minutes	:Sec Recovery
148 Green Shale	Perforations		tions Circi	Total Drawdown: 67 If water removal wa	
156 Gray Shale	from: 200 FT to: 260 FT	0.062	nches x 1 Inches	ii water removai wa duration, reason wh	
162 Gray Sandstone 170 Green Shale	from: 0 FT to: 0 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches		
193 Fractured Shale	Perforated by: Saw	o mone	O A O ITIGINGS		1
197 Green Shale	Seal: Shale Trap & Bento			Recommended pun	nping rate: 9
208 Greenish Gray Shale	from: 0 FT Seal:	to: 194	FI	Gallons/Min	
213 Gray Sandstone 224 Green Shale	from: 0 FT	to: 0 F		Recommended pun FT	np intake: 160
239 Gray Sandstone	Seal:	4- 0.55		Type Pump Installe	d
253 Shale	from: 0 FT Screen Type:	to: 0 F	15 01 1	Pump Type:	
257 Gray Sandstone	from: 0 FT to: 0 FT		0.1	Pump Model: H.P.:	1
260 Shale	Screen Type:	Screen	ID: 0 Inches	n.e Any further pumptes	st information?
	from: 0 FT to: 0 FT Screen Installation Metho		e: 0 Inches		
	Fittings	u			- 1
	Тор:	Bottom	:		1
	Pack:	Δ			ı
	Grain Size: Geophysical Log Taken:	Amoun	C.		
	Retained on Files:				
	Additional Test and/or Pur				- 1
	Chemistries taken By Dritl Held: 0		ents Held: 1		
	Pitless Adapter Type:	DOCUIT	onto FICIU. I		1
	Drop Pipe Type:				
	Length: FT Comments:	Diamet	er: Inches		
	Comments.				
	l		ı		
					1
					- 1
					- 1
	7. Contractor Certif				
	Dellada Nemai	LIAINAI	NAMI DOUTED		J

Alberta Environment The data contained in this	Well Drilling report is supplied by the Dri responsibility for its accuracy	iller. The province disclair	Measurements: Imperial
1. Contractor & Well Owner Informa		cilling Company Approve	2. Well Location I No.: 1/4 or Sec Twp Rge Westo
Company Name: RODCO DRILLING		rilling Company Approva 21074	LSD M
Mailing Address: City or Tov		ostal Code:	NW 03 053 02 5
	GROVE AB CA T ion Identifier:	7X 3A3	Location in Quarter 0 FT from Boundar
TAYLOR, ROBERT			0 FT from Boundar
P.O. Box Number: Mailing Ad		ostal Code: 0E 0H0	Lot Block Plan 17 2 8120011
32 SITE 118 I City: Province:		ountry:	Well Elev: How Obtain:
			FT Not Obtain
3. Drilling Information Type of Work: New Well		Proposed well u	6. Well Yield Ise: Test Date Start Time:
Reclaimed Well		Domestic Domestic	(yyyy/mm/dd):
	rials Used:	Anticipated Wat	
Method of Drilling: Rotary Flowing Well: No Rate:	Gallons	Requirements/o 200 Gallons	Non pumping 48 FT
	esent: No		static level:
4. Formation Log	5. Well Completion		Rate of water 5 removal: Gallons/Min
Depth	Date Started(yyyy/mm/dd)	Date Completed	Depth of 195 FT
from ground Lithology Description	1992/07/17	, (yyyy/mm/dd): 1992/07/17	pump intake.
level	Well Depth: 205 FT	Borehole Diameter: 0	Water level at 195 FT end of
(feet) 18 Sandy Clay	Casing Type: Plastic	Inches Liner Type: Plastic	——pumping:
105 Blue Clay	Size OD: 6 Inches	Size OD: 4.5 Inches	Distance from top of Inches
135 Gravel	Wall Thickness: 0.375	Wall Thickness: 0.25	casing to ground level:
203 Shale 205 Sandstone	Inches	Inches Top: 145 FT Botto	Depth To water level (feet)
205 Sandstone	Bottom at: 150 FT	205 FT	om: Elapsed Time Drawdown Minutes:Sec Recovery
	Perforations from: 185 FT to: 205 FT from: 0 FT to: 0 FT from: 0 FT to: 0 FT Perforated by: Machine	Perforations Size: 0.02 Inches x 2.5 Inche 0 Inches x 0 Inches 0 Inches x 0 Inches	Total Drawdown: 147 FT
	Seal: Driven & Shale Trap from: 0 FT Seal:	to: 150 FT	Recommended pumping rate: 5 Gallons/Min
	from: 0 FT Seal:	to: 0 FT	Recommended pump intake: 180
1	from: 0 FT	to: 0 FT	FT Type Pump Installed
	Screen Type: from: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches	Pump Type:
	Screen Type:	Screen ID: 0 Inches	Pump Model: H.P.:
	from: 0 FT to: 0 FT	Slot Size: 0 Inches	Any further pumptest information?
	Screen Installation Methor Fittings	d:	
	Top:	Bottom:	
	Pack: Grain Size:	Amount:	
	Geophysical Log Taken:	7 anount.	
	Retained on Files: Additional Test and/or Pur	mn Data	
	Chemistries taken By Drill		
	Held: 1	Documents Held: 2	
	Pitless Adapter Type: Drop Pipe Type:		
	Length: FT Comments:	Diameter: Inches	
	7. Contractor Certif		
•	Driller's Name:	UNKNOWN DRILLER	

The data contained in this	Well Drilling report is supplied by the responsibility for its accura-	Driller. The province disclai	Well I.D.: 0366255 Map Verified: Map Date Report 1992/10/09 Received: Imperial
1. Contractor & Well Owner Informa	tion		2. Well Location
Company Name:		Drilling Company Approva	No.: 1/4 or Sec Twp Rge Westo
D&D WATER WELL DRILLING & SERVICING		96030	LSD M
Mailing Address: City or Tov BOX 12, SITE 502, RR 5 STONY PL	vn: _AIN AB CA	Postal Code: T7Z 1X5	SW 03 053 02 5 Location in Quarter
	ion Identifier:	172 183	0 FT from Boundary
HAWKINS, DOUG			0 FT from Boundary
P.O. Box Number: Mailing Ad		Postal Code:	Lot Block Plan
703 LAKE COU	JNTRY EST, STONY	T0E 2G0	7 5 8020386 Well Elev: How Obtain:
City: Province:		Country:	Well Elev: How Obtain: FT Not Obtain
			6. Well Yield
3. Drilling Information			Test Date Start Time:
Type of Work: New Well		Proposed well t	use: (yyyy/mm/dd):
Reclaimed Well Date Reclaimed: Mater	rials Used:	Domestic	1992/08/18 11:00 AM
Method of Drilling: Rotary	iais USCU.	Anticipated War	
Flowing Well: No Rate:	Gallons	0 Gallons	static level:
Gas Present: No Oil Pr	esent: No		Rate of water 20
4. Formation Log	5. Well Completion		removal: Gallons/Min
Depth from	Date Started(yyyy/mm/	dd): Date Completed	Depth of 150 FT pump intake:
ground Lithology Description	1992/08/18	^{uu}). (yyyy/mm/dd): 1992/08/18	Water level at 95 FT
level		Borehole Diameter: 0	end of
(feet)	Well Depth: 242 FT	Inches	pumping:
78 Yellow Clay	Casing Type: Plastic	Liner Type: Plastic	Distance from top of Inches casing to ground
87 Sand 134 Blue Clay	Size OD: 6 Inches	Size OD: 4.5 Inches	level:
134 Blue Clay 153 Green Shale	Wall Thickness: 0.375 Inches	Wall Thickness: 0.248 Inches	Depth To water level (feet)
159 Sandstone		Top: 148 FT Botto	Elapsed Time
166 Gray Shale	Bottom at: 150 FT	242 FT	Drawdown Minutes:Sec Recovery Total Drawdown: 52 FT
171 Sandstone	Perforations	Perforations Size:	If water removal was less than 2 hr
184 Gray Shale	from: 165 FT to: 230 F		es duration, reason why:
207 Green Shale	from: 0 FT to: 0 FT from: 0 FT to: 0 FT	0 Inches x 0 Inches 0 Inches x 0 Inches	
231 Sandstone 242 Green Shale	Perforated by: Saw	o menes x o menes	
212 Green Ghaic	Seal: Shale Trap & Ber		Recommended pumping rate: 0
	from: 0 FT	to: 150 FT	Gallons/Min
	Seal: from: 0 FT	to: 0 FT	Recommended pump intake: 100
	Seal:	10. 011	FT
	from: 0 FT	to: 0 FT	Type Pump Installed Pump Type:
	Screen Type:	Screen ID: 0 Inches	Pump Model:
	from: 0 FT to: 0 FT Screen Type:	Slot Size: 0 Inches Screen ID: 0 Inches	H.P.:
	from: 0 FT to: 0 FT	Slot Size: 0 Inches	Any further pumptest information?
	Screen Installation Met		
	Fittings		
	Top:	Bottom:	
	Pack: Grain Size:	Amount:	1
	Geophysical Log Taker		
	Retained on Files:		
	Additional Test and/or F		
	Chemistries taken By D Held: 1	riller: No Documents Held: 2	
	Pitless Adapter Type:	Documents neiti. Z	 1
	Drop Pipe Type:		
	Length: FT	Diameter: Inches	
	Comments:		
	1		
	7. Contractor Cert	rification	
	Dellaria Nama	INICATION	⊣

The data contained i	er Well Drillin	ne Driller. The province discla	Well I.D.: 0368748 Map Verified: Map Date Report 1993/03/11 Received: 1993/03/11
Alberta Environment	responsibility for its acc	curacy.	Measurements: Imperial
1. Contractor & Well Owner Info	rmation		2. Well Location
Company Name:		Drilling Company Approv	
MAR-WAYNE WATER WELL DRILLING S Mailing Address: City o	SERVICES LTD. or Town:	118900 Postal Code:	LSD M SW 03 053 02 5
	AHOO AB CA	TOG 0J0	Location in Quarter
WellOwner's Name: Well	Location Identifier:	·	0 FT from Boundary
CHUBATY, MIKE P.O. Box Number: Mailir	ng Address:	Postal Code:	0 FT from Boundary
	COUNTRY EST, STONY	rostar code.	8 4 Well Elev: How Obtain:
City: Provi	nce:	Country:	FT Not Obtain
3. Drilling Information			6. Well Yield Test Date Start Time:
Type of Work: New Well		Proposed well	
Reclaimed Well		Domestic	1992/11/13 11:00 AM
Date Reclaimed: Method of Drilling: Rotary	Materials Used:	Anticipated War	
Flowing Well: No	Rate: Gallons	0 Gallons	static level:
	Oil Present: No		Rate of water 8
4. Formation Log	5. Well Complet	ion	removal: Gallons/Min
Depth	Date Started(yyyy/mr	Date Completed	Depth of 175 FT pump intake:
from around Lithology Description		(yyyy/mm/dd): 1992/11/13	Water level at 131 FT
ground Lithology Description	••	Borehole Diameter: 0	end of
(feet)	Well Depth: 240 FT	Inches	pumping: Distance from top of Inches
18 Brown Clay	Casing Type: Plastic		casing to ground
119 Gray Clay & Silt 122 Sand	Size OD: 6 Inches	Size OD: 4.5 Inches Wall Thickness: 0.25	——level:
137 Green Shale	Wall Thickness: 0.5 li	nches Inches	Depth To water level (leet)
146 Gray Sandstone	Bottom at: 180 FT		ttom: Drawdown Minutes:Sec Recovery
149 Gray Shale	100	1240 FT	Total Drawdown: 68 FT
156 Gray Sandstone 164 Green Shale	Perforations from: 185 FT to: 240	Perforations Size: FT 0.062 Inches x 1 Inch	If water removal was less than 2 hr
175 Gray Shale	from: 0 FT to: 0 FT	0 Inches x 0 Inches	duration, reason why:
185 Green Shale	from: 0 FT to: 0 FT	0 Inches x 0 Inches	
196 Gray Sandstone	Perforated by: Saw	lantasita	
205 Green Shale	Seal: Shale Trap & B	to: 180 FT	Recommended pumping rate: 8 Gallons/Min
208 Gray Sandstone 210 Gray Shale	Seal:		Recommended pump intake: 175
213 Gray Sandstone	from: 0 FT Seal:	to: 0 FT	FT
221 Shale	from: 0 FT	to: 0 FT	Type Pump Installed
230 Gray Sandstone	Screen Type:	Screen ID: 0 Inches	Pump Type: Pump Model
240 Shale	from: 0 FT to: 0 FT		———H.Р.:
	Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches	Any further pumptest information?
	Screen Installation M		
	Fittings		
	Top:	Bottom:	
	Pack: Grain Size:	Amount:	
	Geophysical Log Tak		
	Retained on Files:		
	Additional Test and/o Chemistries taken By	or Pump Data	
	Held: 0	Documents Held: 1	
	Pitless Adapter Type		
	Drop Pipe Type:	Diameter Inches	
l	Length: FT Comments:	Diameter: Inches	
	Comments:		
l .	7. Contractor Co		
1	Dellara Namai	TIMINATOTAMI DON I CI	2 1

The data contained in this	Well Drilling report is supplied by the Dresponsibility for its accura	riller. The		Well I.D.: Map Verified: Dale Report Received:	0380523 Map 1994/06/20
1. Contractor & Well Owner Informa	tion			Measurements: 2. Well Location	Imperial
Company Name:		Drilling Co	ompany Approval No.		
KAP'S DRILLING LTD. Mailing Address: City or Tow				LSD	M
Mailing Address: City or Tow	/n:	Postal Co	de:	SW 03 053 Location in Quarter	02 5
	on Identifier:			0 FT from	Boundary
ENDERS, DAVE P.O. Box Number: Mailing Ado	draga	Deetel C-	J	0 FT from	Boundary
RR2, CAR		Postal Co T0E 0H0	ae:	Lot Block 2 4	Plan
City; Province:		Country:			ow Obtain:
3. Drilling Information				6. Well Yield	ot Obtain
Type of Work: New Well			Proposed well use:	Test Date	Start Time:
Reclaimed Well			Domestic	(yyyy/mm/dd):	Otali Time.
Date Reclaimed: Mater Method of Drilling: Rotary	ials Used:		Anticipated Water	1994/03/14	11:00 AM
	Gallons		Requirements/day 500 Gallons	Test Method: Bailer Non pumping	70 FT
Gas Present: No Oil Pro	esent: No			static level:	
4. Formation Log	5. Well Completion			Rate of water removal:	7 Gallons/Min
Depth from	Date Started(yyyy/mm/do		completed nm/dd):	Depth of	160 FT
ground Lithology Description	1994/03/14	1994/0		pump intake:	
level (feet)	Well Depth: 240 FT		ole Diameter: 0	Water level at end of	160 FT
50 Brown Sandy Clay	Casing Type: Steel	Inches	ype: Plastic	pumping:	
127 Coarse Grained Sand	Size OD: 4.5 Inches		D: 3.5 Inches	Distance from top o	f Inches
153 Blue Clay	Wall Thickness: 0.156	Wall T	hickness: 0.25	casing to ground level:	
166 Shale 173 Sandstone	Inches	Inches Top: 2		Depth To water	
189 Shale	Bottom at: 201 FT	240 FT		Elapsed Drawdown Minutes	
196 Sandstone	Perforations		ations Size:	1:00	
208 Shale 238 Sandstone	from: 201 FT to: 239 FT from: 0 FT to: 0 FT		nches x 3 Inches	2:00	151.244
240 Shale	from: 0 FT to: 0 FT		es x 0 Inches	3:00	
	Perforated by: Saw			5:00	
	Seal: Driven from: 0 FT	to: 200	FT	6:00	
	Seal:	E 102/00/200		7:00	
	from: 0 FT Seal:	to: 0 F	Г	8:00 9:00	
	from: 0 FT	to: 0 F	Г	10:00	95.144
	Screen Type:		ID: 0 Inches	12:00	
	from: 0 FT to: 0 FT Screen Type:		ze: 0 Inches ID: 0 Inches	14:00 16:00	
	from: 0 FT to: 0 FT	Slot Siz	ze: 0 Inches	20:00	
	Screen Installation Metho	d:		25:00	75.459
	Fittings Top:	Bottom		30:00 35:00	
	Pack:			40:00	
	Grain Size:	Amoun	t:	50:00	73.359
	Geophysical Log Taken: Retained on Files:			Total Drawdown: 90	
	Additional Test and/or Pu	mp Data		If water removal was duration, reason who	
	Chemistries taken By Dril Held: 0	ler: No	ents Held: 1		128
	Pitless Adapter Type:	Docum	ents neid. I		
	Drop Pipe Type:			Recommended pum	ping rate: 7
	Length: FT Comments:	Diamet		Gallons/Min	
	commond.			Recommended pum FT	p intake: 160
				Type Pump Installed	
				Pump Type:	
				Pump Model: H.P.:	
	7. Contractor Certif	ication		Any further pumptes	information?
	Driller's Name:		OWN DRILLER	379%	
	Codification No.	1/47500			

The data contained in this	Well Drilling report is supplied by the Dr	iller. The	ort province disclaims	Well I.D.: Map Verified: Date Report Received:	0418277 Not Verified 1995/11/22
Environment	esponsibility for its accurac	y.		Measurements:	Imperial
1. Contractor & Well Owner Information	tion			2. Well Locat	
Company Name:			ompany Approval No.		wp Rge Westof
GERALD MCGINN DRILLING LTD. Mailing Address: City or Tow		20047 ostal Co	de:	LSD SW 03 0	53 02 5
	AIN ALBERTA CANADA T		ue.	Location in Quart	
	on Identifier:			0 FT from	Boundary
BLEKER, ERNIE JR				0 FT from	Boundary
P.O. Box Number: Mailing Add 12 RR1, CAR		ostal Co OE 0H0	de:	Lot Block	Plan
City: Province:		Country:		Well Elev:	How Obtain:
		,		FT	Not Obtain
3. Drilling Information				6. Well Yield	
Type of Work: New Well			Proposed well use:	Test Date	Start Time:
Reclaimed Well	iala I laadi		Domestic	(yyyy/mm/dd): 1995/10/04	11:00 AM
Date Reclaimed: Mater Method of Drilling: Rotary	ials Used:		Anticipated Water Requirements/day	Test Method: Bai	
	Gallons		300 Gallons	Non pumping	99 FT
	esent: No			static level:	
4. Formation Log	5. Well Completion			Rate of water	3.5
Depth	Date Started(yyyy/mm/dd	, Date (Completed	removal: Depth of	Gallons/Min 260 FT
from	The second secon	(yyyy	mm/dd):	pump intake:	200 1:1
ground Lithology Description level	1995/09/26	1995/0	09/28 ole Diameter: 0	Water level at	225 FT
(feet)	Well Depth: 319 FT	Inches		end of	
50 Yellow Clay	Casing Type: Plastic		Type: Plastic	pumping: Distance from to	
95 Blue Clay	Size OD: 6 Inches		DD: 5 Inches	casing to ground	of inches
190 Sand	Wall Thickness: 0.36		hickness: 0,26	level:	
197 Blue Clay & Rocks 205 Green Shale	Inches	Inches	371 FT Bottom:		ter level (feet)
222 Gray Sandy Shale	Bottom at: 278 FT	316 F			ed Time
253 Green Shale	Perforations		ations Size:		les:Sec Recovery :00 225
256 Gray Sandy Shale	from: 278 FT to: 316 FT		Inches x 12 Inches		:00 205
265 Green Shale	from: 0 FT to: 0 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches		:00 193
270 Gray Sandy Shale	Perforated by: Saw	O IIICII	es x o mones		:00 180
285 Greenish Gray Shale 305 Gray Sandy Shale	Seal: Formation Seal				:00 162
310 Green Shale	from: 0 FT	to: 278	3 FT		:00 154 :00 146
312 Sandstone	Seal:	10: 0 F	· T		:00 141
319 Green Shale	–from: 0 FT –Seal:	to: 0 F	1		:00 135
	from: 0 FT	to: 0 F	Т		0:00 130
	Screen Type:		n ID: 0 Inches		2:00 125
	from: 0 FT to: 0 FT		ize: 0 Inches		1:00 122
	Screen Type: from: 0 FT to: 0 FT		n ID: 0 Inches ize: 0 Inches		6:00 117 0:00 115
	Screen Installation Metho				5:00 113
	Fittings				0:00 110
	Тор:	Bottor	n:		5:00 107
	Pack:	Amou	nt:		0:00 105
1	Grain Size: Geophysical Log Taken:	Amou	111.		0:00 104
	Retained on Files:				0:00 103 5:00 101
	Additional Test and/or Pu				0:00 99
	Chemistries taken By Dril		nanta I I al di d		0:00 99
	Held: 0 Pitless Adapter Type:	Docur	nents Held: 1	Total Drawdown:	126 FT
	Drop Pipe Type:				was less than 2 hr
	Length: FT	Diame	eter: Inches	duration, reason	wny.
	Comments:				
	DRILLER REPORTS DIS CASING TO GROUND L			Recommended p	umping rate: 3
				Gallons/Min	
				Recommended p	ump intake: 225
	7. Contractor Certif	fication	1	Type Pump Insta	lled
	Driller's Name:		IOWN DRILLER	Pump Type:	
I.	Cadification No.	2024		Pump Model:	

		Matau	Mall Duilling			Well I.D.:	-	0459689
a)	vvater	Well Drilling	ГКер	ort	Map Verifi		Not Verified
	Alberta The	data contained in this	report is supplied by the E responsibility for its accura	Oriller. The	province disclaims	Date Repo	ırı	1979/09/03
	vironment			acy.		Measurem	ents:	Imperial
1. Cont	tractor & Wel	l Owner Informa	tion			2. Well L		Andrew Commission of the Commi
Company	y Name:			Drilling Co	ompany Approval No.	1/4 or Se		Rge West
MAR-WA	YNE WATER WE	ELL DRILLING SERVI	ICES LTD.	118900		LSD	2000 - 2000 - 3 00	M
Mailing A	Address: SITE 5, RR 1	City or Tow		Postal Co	de:	04 03		02 5
	er's Name:	CALAHOO Well Locati	on Identifier:	TOG 0J0		Location in 0 FT fro		D
CARVEL		Well Locali	on identifier.			OFT fro		Boundar Boundar
P.O. Box	Number:	Mailing Add		Postal Co	de:	Lot	Block	Plan
City		RR1, CAR						
City:		Province:		Country:		Well Elev:		w Obtain:
3 Drilli	ing Information	20			· ·	2450 FT		imated
	Vork: New Well	אונ			Dropped well was	6. Well Y	ield	Ct Ti
Reclaime					Proposed well use: Domestic	Test Date (yyyy/mm/d	q).	Start Time:
Date Rec		Mater	ials Used:		Anticipated Water	1979/06/25	a).	11:00 AM
	f Drilling: Rotary				Requirements/day	Test Metho		
Flowing V			Gallons		0 Gallons	Non pumpir	ng	65.4 FT
Gas Pres	The second secon	Oil Pro	esent: No		l	static level:	or .	10
	nation Log		5. Well Completion			Rate of wat removal:		10 Gallons/Min
Depth from			Date Started(yyyy/mm/do		completed	Depth of		0 FT
ground	Lithology	Description	1979/06/25	/ (yyyy/r 1979/0	nm/dd): 16/25	pump intake	9:	5 \$ 5
level		, =, , , , , , , , , , , , , , , , , ,	Well Depth: 220 FT		ole Diameter: 0	Water level		75 FT
(feel)				Inches		end of		
	Brown Silty Clay		Casing Type: Galvanized	liner T	ype: Steel	pumping: Distance fro	m lon of	Inches
129	Gray Silty Clay Fine Grained Sa	nd	Steel Size OD: 4.5 Inches		••	casing to gr		inches
	Gray Clay & Roc		Wall Thickness: 0 Inches		D: 3.56 Inches hickness: 0 Inches	level:		
	Green Shale			Top: 0				evel (feet)
	Light Gray Sand:	stone	Bottom at: 180 FT	FT	Dollonii. EEO		lapsed Ti	ime Sec Recovery
220	Green Shale		Perforations		itions Size:	69.81	1:00	sec Recovery
			from: 190 FT to: 220 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches	70.58	2:00	
			from: 0 FT to: 0 FT		es x 0 inches	70.99	3:00	
			Perforated by: Torch		A V V III ON CO	71.29	4:00	
			Seal: Driven			71.49 71.59	5:00 6:00	
			from: 0 FT Seal:	to: 180	FT	71.79	7:00	
			from: 0 FT	to: 0 F	-	71.9	8:00	
			Seal:	10.01		72.01	9:00	
			from: 0 FT	to: 0 F1		72.09	10:00	
			Screen Type:		ID: 0 Inches	72.44	15:00	
			from: 0 FT to: 0 FT Screen Type:		te: 0 Inches ID: 0 Inches	72.69	20:00	
			from: 0 FT to: 0 FT		te: 0 Inches	72.86 73	25:00 30:00	
			Screen Installation Metho			73.24	40:00	
			Fittings			73.4	50:00	
			Top:	Bottom	;	73.54	60:00	
			Pack: Grain Size:	Amoun		73.73	75:00	
			Geophysical Log Taken:	Amoun		73.83	90:00	
			Retained on Files:			74 74.09	105:00	
			Additional Test and/or Pu			74.03	140:00	
			Chemistries taken By Drill			74.42	180:00	
			Held: 1 Pitless Adapter Type:	Docum	ents Held: 3	74.54	240:00	
			Drop Pipe Type:			74.8	300:00	
			Length: FT	Diamete	er, inches	Total Drawd		
			Comments: DRILLER REPORTS WA	TER IS HA	I I	duration, rea		ess than 2 hr
						Recommend	ed pumpi	ing rate: 0
						Gallons/Min		
			7. Contractor Certif	ication		Recommend	ed pump	intake: 0 FT
			Driller's Name:		WN DRILLER	Type Pump I	netalle -	

Alberta Environment	Well Drilling I report is supplied by the Drill responsibility for its accuracy	er. The province disclaims	Weil I.D.: 0459702 Map Verified: Not Verified Date Report 1971/06/08 Received: Imperial
1. Contractor & Well Owner Information			2. Well Location
Company Name: MCGINNIS ROBERT	Dr	Illing Company Approval No.	: 1/4 or Sec Twp Rge Westo LSD M
Mailing Address: City or Tow	m: Po	stal Code:	SW 03 053 02 5 Location in Quarter
	on Identifier:		0 FT from Boundary
STECYCK, FRED P.O. Box Number: Mailing Add STONY PL		stal Code:	Lot Block Plan
City: Province:		ountry:	Well Elev: How Obtain: FT Not Obtain
3. Drilling Information			6. Well Yield
Type of Work: New Well		Proposed well use:	Test Date Start Time:
Reclaimed Well		Domestic	(yyyy/mm/dd):
	ials Used:	Anticipated Water	1971/03/30 11:00 AM Test Method: Unknown
Method of Drilling: Rotary	Gallons	Requirements/day 0 Gallons	Non pumping 54 FT
	esent: No	O GENONS	static level:
4. Formation Log	5. Well Completion		Rate of water 5.5
Depth		Date Completed	removal: Gallons/Min
from	Date Started(yyyy/mm/dd):	(yyyy/mm/dd):	Depth of 0 FT pump intake:
ground Lithology Description		1971/03/30	Water level at 158 FT
level	Well Depth: 190 FT	Borehole Diameter: 0	end of
(feet) 30 Brown Clay & Rocks		Inches	pumping:
70 Gray Silty Clay	Casing Type: Steel Size OD: 4.56 Inches	Liner Type: Size OD: 0 Inches	Distance from top of Inches
128 Sand	Wall Thickness: 0 Inches	Wall Thickness: 0 Inches	casing to ground
130 Gravel	Trail Trickiness: 6 inches	Top: 0 FT Bottom: 0	level: Depth To water level (feet)
147 Gray Sandy Clay & Rocks	Bottom at: 157 FT	FT Bottom. C	Elapsed Time
157 Blue Shale	Perforations	Perforations Size:	Drawdown Minutes:Sec Recovery
159 Blue Sandy Shale	from: 0 FT to: 0 FT	0 Inches x 0 Inches	Total Drawdown: 104 FT
161 Gray Rocks 166 Gray Sandy Shale	from: 0 FT to: 0 FT	0 Inches x 0 Inches	If water removal was less than 2 h
166 Gray Sandy Shale 172 Blue Shale	from: 0 FT to: 0 FT	0 Inches x 0 Inches	duration, reason why:
176 Gray Sandy Shale	Perforated by: Seal: Driven		-
190 Blue Shale & Rocks	from: 0 FT	to: 0 FT	
	Seal:	10. 0. 1	Recommended pumping rate: 0
	from: 0 FT	to: 0 FT	Gallons/Min Recommended pump intake: 120
2	Seal:	to: 0 FT	FT
	from: 0 FT Screen Type:	to: 0 FT Screen ID: 0 Inches	Type Pump Installed
l .	from: 0 FT to: 0 FT	Slot Size: 0 Inches	Pump Type: SUB
	Screen Type:	Screen ID: 0 Inches	Pump Model:
	from: 0 FT to: 0 FT	Slot Size: 0 Inches	H.P.: 1/4 Any further pumptest information?
	Screen Installation Method	:	- Surpress information:
	Fittings Top:	Bottom:	1
	Pack:	DOLLOTT.	-
	Grain Size:	Amount:	
	Geophysical Log Taken:		1
	Retained on Files:		4
	Additional Test and/or Purn Chemistries taken By Drille	np Data	1
	Held: 0	Documents Held: 1	
1	Pitless Adapter Type:	_ 500.110.110 F 1010, 1	1
	Drop Pipe Type:		
	Length: FT	Diameter: 1 Inches	_
	Comments: DRILLER REPORTS WAT	ER IS MEDIUM SOFT	
	7. Contractor Certifi	cation	-
	Driller's Name:		⊣
i e	Marillor e Namo	UNKNOWN DRILLER	

The data contained in this	Well Drilling report is supplied by the Dri responsibility for its accuracy	iller. The pr	rt ovince disclaíms	Well I.D.: Map Verified: Date Report Received:	0459710 Map 1980/06/30
1. Contractor & Well Owner Informa	tion			Measurements:	Imperial
Company Name:		rilling Com	pany Approval No.:	2. Well Location 1/4 or Sec Two	
GERALD MCGINN DRILLING LTD.	1	20047		LSD	M
Mailing Address: City or Tov 4910 50 AVENUE STONY PL	/n: AIN ALBERTA CANADA Т	ostal Code:		SW 03 053 Location in Quarter	
WellOwner's Name: Well Locati	on Identifier:	12 103		0 FT from	Boundary
BLEKER, ERNIE				0 FT from	Boundary
P.O. Box Number: Mailing Add RR1, CAR		ostal Code: 0E 0H0		Lot Block	Plan
City: Province:		ountry:			low Obtain:
2 Deillian Information				The same of the sa	ot Obtain
3. Drilling Information Type of Work: New Well		ID.		6. Well Yield Test Date	Start Time:
Reclaimed Well			oposed well use:	(yyyy/mm/dd):	Start Time:
	ials Used:	Ar	nticipated Water	1980/06/11	11:00 AM
Method of Drilling: Rotary Flowing Well: No Rate:	Gallons			Test Method: Unkn Non pumping	own 75 FT
	esent: No	۲		static level:	7311
4. Formation Log	5. Well Completion			Rate of water	5
Depth	Date Started(yyyy/mm/dd)	Date Con		removal: Depth of	Gallons/Min 125 FT
from ground Lithology Description	1980/06/10	(yyyy/mm 1980/06/	vaa).	pump intake:	72011
level	Well Depth: 256 FT		Diameter: 0	Water level at end of	125 FT
(feet) 20 Yellow Clay	VVeil Deptil. 250 F1	Inches		ena or pumping:	
133 Blue Clay	Casing Type: Steel	Steel	e: Galvanized	Distance from top of	of Inches
150 Sand	Size OD: 5.56 Inches	Size OD:	4.5 mones	casing to ground level:	
194 Sandy Clay 196 Hard Formation	Wall Thickness: 0 Inches		kness: 0 Inches	Depth To water	level (feet)
207 Greenish Gray Shale	Bottom at: 228 FT	Top: 0 F1	Bottom: 256	Elapsed	Time
221 Gray Sandy Shale	Perforations	Perforation	ns Size:	Drawdown Minutes Total Drawdown: 50	
230 Green Shale 250 Gray Sandy Shale & Sandstone	from: 228 FT to: 256 FT from: 0 FT to: 0 FT		hes x 12 Inches	If water removal wa	s less than 2 hr
250 Gray Sandy Shale & Sandstone 256 Gray Hard Shale	from: 0 FT to: 0 FT		x 0 Inches	duration, reason wh	ıy:
Site) Traine Situate	Perforated by: Torch				
	Seal: Formation Seal from: 0 FT	to: 228 F	r	D	
	Seal:	to. LLO	22	Recommended pun Gallons/Min	nping rate: 0
	from: 0 FT Seal:	to: 0 FT		Recommended pun	np intake: 0 FT
	from: 0 FT	to: 0 FT		Type Pump Installe	d
	Screen Type:		: 0 Inches	Pump Type: Pump Model:	1
	from: 0 FT to: 0 FT Screen Type:	Slot Size:	0 Inches	H.P.	
	from: 0 FT to: 0 FT	Slot Size:		Any further pumptes	st information?
	Screen Installation Method	:			
	Fittings Top:	Bottom:	1		- 1
	Pack:				- 1
	Grain Size: Geophysical Log Taken:	Amount:			- 1
	Retained on Files:		I		1
	Additional Test and/or Pum				
	Chemistries taken By Drille Held: 0	er: No Documen	ts Held: 1		
	Pitless Adapter Type:	Doddinell	10 1 10 Id. 1		
	Drop Pipe Type:	Diameter	Inches		
	Length: FT Comments:	Diameter:	IIICHES		- 1
	7 Contractor Contis	ontion			
	7. Contractor Certific Driller's Name:		N DRILLER		
	Codification No.	J.41(10)V	., DINELLIN		1

The data contained in this r	Well Drilling I	ler. The		Well I.D.: Map Verified: Date Report Received:	0459713 Not Verified 1989/12/07
Environment	esponsibility for its accuracy			Measurements:	Imperial
1. Contractor & Well Owner Informat				2. Well Locatio	
Company Name: D&D WATER WELL DRILLING & SERVICING L		illing Co 030	mpany Approval No.:	1/4 or Sec Twp LSD	Rge Westof M
Mailing Address: City or Town		stal Cod	le:	SW 03 053	02 5
BOX 12, SITE 502, RR 5 STONY PLA	AIN AB CA T7	Z 1X5		Location in Quarter	
WellOwner's Name: Well Location ENDERS, DAVE	on Identifier:			0 FT from 0 FT from	Boundary Boundary
P.O. Box Number: Mailing Add		stal Cod	le:	Lot Block	Plan
City: Province:		ountry:			ow Obtain: ot Obtain
3. Drilling Information				6. Well Yield	ot Obtain
Type of Work; New Well			Proposed well use:	Test Date	Start Time:
Reclaimed Well	2 22 2		Domestic	(yyyy/mm/dd):	
	als Used:		Anticipated Water Requirements/day	1989/11/28 Test Method: Air	11:00 AM
Method of Drilling: Rotary Flowing Well: No Rate: 0	Gallons		0 Gallons	Non pumping	55 FT
	esent: No			static level:	
4. Formation Log	5. Well Completion			Rate of water removal:	6 Gallons/Min
Depth	Date Started(yyyy/mm/dd):		ompleted	Depth of	140 FT
from ground Lithology Description	1989/11/28	(yyyy/n 1989/1		pump intake:	
level			le Diameter: 0	Water level at	140 FT
(feet)	Well Depth: 285 FT	Inches		end of pumping:	1
48 Yellow Sandy Clay 97 Blue Clay	Casing Type: Galvanized	Liner T	ype: Plastic	Distance from top or	f Inches
105 Unknown	Steel Size OD: 4.5 Inches		D: 3.5 Inches	casing to ground	
148 Blue Clay	Wall Thickness: 0.156		nickness: 0.216	level: Depth To water	lovel (feet)
174 Green Shale	Inches	Inches		Elapsed	
193 Sandstone	Bottom at: 163 FT	Top: 16 285 FT		Drawdown Minutes	:Sec Recovery
224 Gray Shale 248 Sandstone	Perforations		itions Size:	Total Drawdown: 95 If water removal wa	
267 Gray Shale	from: 170 FT to: 280 FT		nches x 10 Inches	duration, reason wh	
274 Sandstone	from: 0 FT to: 0 FT		es x 0 Inches		·
285 Green Shale	from: 0 FT to: 0 FT Perforated by: Machine	Uniche	es x 0 Inches	1	1
	Seal: Welded Collar			Recommended pur	nping rate: 0
	from: 0 FT	to: 163	FT	Gallons/Min	
	Seal: from: 0 FT	to: 0 F	ŕ	Recommended pur	
	Seal:			Type Pump Installed Pump Type:	'
1	from: 0 FT	to: 0 F		Pump Model:	
	Screen Type: from: 0 FT to: 0 FT		ID: 0 Inches ze: 0 Inches	H.P.:	
	Screen Type:		ID: 0 Inches	Any further pumptes	st information?
	from: 0 FT to: 0 FT		ze: 0 Inches	1	
	Screen Installation Method Fittings	;		1	ł
	Top:	Bottom		1	
	Pack:			1	l
	Grain Size:	Amoun	t:	1	1
	Geophysical Log Taken: Retained on Files:				Į.
	Additional Test and/or Purn			1	
	Chemistries taken By Drille		- - . d		1
I.	Held: 0 Pitless Adapter Type:	Docum	ents Held: 1	1	
}	Drop Pipe Type:			1	
	Length: FT	Diamet	er: Inches	4	
	Comments:				1
				1	
	İ			1	
					- 1
	7. Contractor Certific	cation]	I
ı	Drillaria Nama:	LINIUNI	NAME DOLL I ED	1	

A .			
Water	Well Drilling	Panort	Well I.D.: 0459723
The data contained in this	report is supplied by the Dri	Nepull	Map Verified: Not Verified Date Report
Alberta	responsibility for its accuracy		Received: 1984/06/04
Environment	100 (CO 100 (C		Measurements: Imperial
1. Contractor & Well Owner Informa			2. Well Location
Company Name: GROVE DRILLING ENTERPRISES (1980) LTD	Di	rilling Company Approval No.	
Mailing Address: City or Tov		ostal Code:	LSD M 13 03 053 02 5
			Location in Quarter
WellOwner's Name: Well Locat SCOTT, BERTHA	on Identifier:		0 FT from Boundary 0 FT from Boundary
P.O. Box Number: Mailing Ad	dress: Po	ostal Code:	Lot Block Plan
CARVEL			
City: Province:	Co	ountry:	Well Elev: How Obtain: FT Not Obtain
3. Drilling Information			6. Well Yield
Type of Work: New Well		Proposed well use:	Test Date Start Time:
Reclaimed Well Date Reclaimed: Mater	f_1_ 11 d	Domestic	(yyyy/mm/dd):
Method of Drilling: Rotary	ials Used:	Anticipated Water Requirements/day	1983/12/07 11:00 AM Test Method: Bailer
Flowing Well: No Rate:	Gallons	0 Gallons	Non pumping 15 FT
	esent: No		static level:
4. Formation Log	5. Well Completion		Rate of water 7 removal: Gallons/Min
Depth from	Date Started(yyyy/mm/dd):	Date Completed (yyyy/mm/dd):	Depth of 100 FT
ground Lithology Description	1983/12/07	1983/12/07	pump intake:
level (feet)	Well Depth: 120 FT	Borehole Diameter: 0	Water level at FT end of
94 Clay	Casing Type: Steel	Inches Liner Type:	pumping:
105 Sand	Size OD: 4.56 Inches	Size OD: 0 Inches	Distance from top of Inches
120 Clay	Wall Thickness: 0.141	Wall Thickness: 0 Inches	casing to ground level:
	Inches	Top: 0 FT Bottom: 0	Depth To water level (feet)
	Bottom at: 101 FT	FT Bottom: 0	Elapsed Time Drawdown Minutes:Sec Recovery
	Perforations	Perforations Size:	Total Drawdown: 0 FT
	from: 0 FT to: 0 FT from: 0 FT to: 0 FT	0 Inches x 0 Inches 0 Inches x 0 Inches	If water removal was less than 2 hr
	from: 0 FT to: 0 FT	0 Inches x 0 Inches	duration, reason why:
	Perforated by:]
	Seal; from: 0 FT	to: 0 FT	
	Seal:	10.011	Recommended pumping rate: 7 Gallons/Min
	from: 0 FT Seal:	to: 0 FT	Recommended pump intake: 100
	from: 0 FT	to: 0 FT	FT
	Screen Type: Stainless	Screen ID: 4 Inches	Type Pump Installed Pump Type:
	Steel from: 101 FT to: 105 FT		Pump Model:
	Screen Type:	Carrage ID: O lanks	H.P.: Any further pumptest information?
	from: 0 FT to: 0 FT	Slot Size: U Inches	any learner pumpted information?
	Screen Installation Method: Fittings		{
	Top: Welded	Bottom: Plug	
	Pack: Sand		
	Grain Size: Geophysical Log Taken:	Amount: 0.25 Yards	1
	Retained on Files:		
	Additional Test and/or Pum		
	Chemistries taken By Drille Held: 0	r: Yes Documents Held: 1	
	Pitless Adapter Type:	Documents Field. 1	
	Drop Pipe Type:	Diameter Inshire	
	Length: FT Comments:	Diameter: Inches	
	DRILLER REPORTS WATE	ER IS MEDIUM HARD	
			1
			1
			, ,
	7 Contractor Cortific	ation	
	7. Contractor Certific	INICALONAL DOLL I ED	

	Alberta The data contained in this in right in the data contained in this in the data contained in the data contained in this in the data contained in the	esponsibility for its accurac	riller. The	ort province disclaims	Well I.D.: Map Verified: Date Report Received: Measurements:	0459734 Map 1983/10/05 Imperial
	tractor & Well Owner Informat				2. Well Locat	
Company MAR-WA	/ Name: YNE WATER WELL DRILLING SERVIO		Orilling Co I 18900	ompany Approval No	.: 1/4 or Sec TV LSD	vp Rge Westof M
Mailing A	ddress: City or Tow	n: F	Postal Co	de:	12 03 05 Location in Quart	53 02 5
	ITE 5, RR 1 CALAHOO er's Name: Well Location	on Identifier:	100 000		0 FT from	Boundary
	ALD, EVAN Number: Mailing Add	race.	Postal Co	de:	0 FT from Lot Block	Boundary Plan
18	BOWĔN LA	KE ESTATES, CARVEL	TOE 0H0		13 2	8120011
City:	Province:	(Country:			How Obtain: Not Obtain
	ing Information				6. Well Yield	
Reclaime Date Rec	claimed: Materi	als Used:		Proposed well use: Domestic Anticipated Water	Test Date (yyyy/mm/dd): 1983/08/18 Test Method: Air	Start Time: 11:00 AM
Flowing \	of Drilling: Rotary Well: No Rate:	Gallons		Requirements/day 100 Gallons	Non pumping	40 FT
Gas Pres	sent; No Oil Pre	esent: No			static level: Rate of water	10
4. Forn Depth	nation Log	5. Well Completion	Date (Completed	removal:	Gallons/Min
from	Liabala Basa C	Date Started(yyyy/mm/dd	^{1):} (yyyy/	mm/dd):	Depth of pump intake:	150 FT
ground level	Lithology Description	1983/08/17 Well Depth: 220 FT	1983/ Boreh	08/18 ole Diameter: 0	Water level at end of	150 FT
(feet) 18	Brown Clay	Casing Type: Galvanized	Inches		pumping:	
41	Blue Clay	Steel	Linei	Type: Plastic	Distance from top casing to ground	of Inches
133 136	Blue Sandy Clay Green Shale	Size OD: 4.5 Inches Wall Thickness: 0 Inches		DD: 3.5 Inches hickness: 0 Inches	level:	
148	Light Gray Sandstone	Bottom at: 180 FT	Top: 1	78 FT Bottom:		ler level (feet) d Time
163 175	Gray Shale Light Gray Sandstone	Perforations	220 F	rations Size:	Drawdown Minut Total Drawdown:	es:Sec Recovery
188	Greenish Gray Shale	from: 180 FT to: 220 FT	0 Inch	es x 0 Inches	If water removal	
196 204	Light Gray Sandstone Gray Shale	from: 0 FT to: 0 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches	duration, reason	why:
214	Light Gray Sandstone	Perforated by: Machine Seal: Driven		***	7	
220	Gray Shale	from: 0 FT Seal:	to: 18	D FT	Recommended p Gallons/Min	umping rate: 50
		from: 0 FT Seal:	to: 0 F	T	Recommended p	ump intake: 110
		from: 0 FT	to: 0 F		FT Type Pump Insta	lled
		Screen Type: from: 0 FT to: 0 FT	TO / TO S. T. (17)	n ID: 0 Inches ize: 0 Inches	Pump Type: Pump Model:	
1		Screen Type:	Scree	n ID: 0 Inches	H.P.:	
		from: 0 FT to: 0 FT Screen Installation Metho		ize: 0 Inches	Any further pump	test information?
		Fittings Top:	Bottor	n:	7	
		Pack:	BULLUI	11.	1	
		Grain Size: Geophysical Log Taken:	Amou	nt:	4	
		Retained on Files:				
		Additional Test and/or Pu Chemistries taken By Dri				
		Held: 1		nents Held: 2		
		Pitless Adapter Type: Drop Pipe Type:				
		Length: FT Comments:	Diame	eter: Inches	-	
		DRILLER REPORTS WA	ATER IS I	MEDIUM HARD		
		7. Contractor Certi	fication	1	-	
1		Driller's Name:		IOWN DRILLER	-	

A			Well I.D.: 0459744
Water	Well Drilling	Report	Map Verified: Not Verified
The data contained in this	report is supplied by the I	Oriller. The province disclaims	Date Report
Alberta Environment	esponsibility for its accura	асу.	Received.
			Measurements: Imperial
1. Contractor & Well Owner Informat		D-IIII O	2. Well Location
KAP'S DRILLING LTD.		Drilling Company Approval No.	
Mailing Address: City or Tow	n:	Postal Code:	LSD M SW 04 053 02 5 Location in Quarter
WellOwner's Name: Well Location ADAMS, JACK	on Identifier:		0 FT from Boundary 0 FT from Boundary
P.O. Box Number: Mailing Add	ress:	Postal Code:	Lot Block Plan
City: Province:		Country:	Well Elev: How Obtain: FT Not Obtain
3. Drilling Information			6. Well Yield
Type of Work: New Well		Proposed well use:	Test Date Start Time:
Reclaimed Well Date Reclaimed: Materi	ala I land:	Domestic	(yyyy/mm/dd):
Method of Drilling: Rotary	als Used:	Anticipated Water Requirements/day	1985/08/23 11:00 AM Test Method: Bailer
	Gallons	0 Gallons	Non pumping 75 FT
Gas Present: No Oil Pre	sent: No		static level:
4. Formation Log	5. Well Completion	1	Rate of water 7
Depth	Date Started(yyyy/mm/d	d). Date Completed	removal: Gallons/Min Depth of 140 FT
from	1985/08/22	(yyyy/min/dd).	pump intake:
ground Lithology Description		1985/08/23 Borehole Diameter: 0	Water level at 140 FT
ground Lithology Description level (feet)	Well Depth: 198 FT	Inches	end of
28 Clay	Casing Type: Plastic	Liner Type: Plastic	pumping: Distance from top of Inches
37 Sand & Gravel	Size OD: 5.5 Inches	Size OD: 4.5 Inches	casing to ground
45 Clay 47 Sand	Wall Thickness: 0.38 Inches	Wall Thickness: 0.25	level:
55 Clay		Inches Top: 150 FT Bottom:	Depth To water level (feet)
63 Sand & Gravel	Bottom at: 153 FT	198 FT	Elapsed Time Drawdown Minutes:Sec Recovery
96 Clay & Sand	Perforations	Perforations Size:	Total Drawdown: 65 FT
100 Shale	from: 153 FT to: 198 FT	0.09 Inches x 3 Inches	If water removal was less than 2 hr
115 Clay & Rocks 132 Sand & Gravel	from: 0 FT to: 0 FT from: 0 FT to: 0 FT	0 Inches x 0 Inches 0 Inches x 0 Inches	duration, reason why:
132 Sand & Gravel 143 Shale	Perforated by: Machine	5 HIGHGS & O HIGHGS	1
145 Sandstone	Seal: Formation Seal		1 1
168 Shale	from: 0 FT	to: 153 FT	Recommended pumping rate: 7
175 Sandstone	Seal: from: 0 FT	to: 0 FT	Gallons/Min
178 Shale	Seal:	IU. U F I	Recommended pump intake: 160
180 Sandstone	from: 0 FT	to: 0 FT	FT Type Pump Installed
184 Shale 193 Sandstone	Screen Type:	Screen ID: 0 Inches	Pump Type:
198 Shale	from: 0 FT to: 0 FT	Slot Size: 0 Inches	Pump Model:
	Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches	H.P.:
	Screen Installation Metho		Any further pumptest information?
	Fittings		
	Тор:	Bottom:	
	Pack:		1
	Grain Size: Geophysical Log Taken:	Amount:	
	Retained on Files:		
	Additional Test and/or Pu		
	Chemistries taken By Dril		
	Held: 0 Pitless Adapter Type:	Documents Held: 1	1
	Drop Pipe Type:		1
	Length: FT	Diameter: Inches	
	Comments:		
			i
	7. Contractor Certif		
	Driller's Name:	UNKNOWN DRILLER	

The data contained in this	Well Drilling I report is supplied by the Drill responsibility for its accuracy	er. The	ort province disclaims	Well I.D.: Map Verified: Date Report Received: Measurements:	0459745 Not Verified 1981/11/30 Imperial
1. Contractor & Well Owner Information				2. Well Locat	ion
Company Name: BLAKEMAN'S, NORM DRILLING LTD.	Dri	illing Co	empany Approval No.	: 1/4 or Sec Tv LSD	vp Rge Westo M
Mailing Address: City or Tow	vn: Po	stal Co	de:		53 02 5
WellOwner's Name: Well Locati	on Identifier:			Location in Quart 0 FT from	er Boundan
BELL, JACK				0 FT from	Boundar
P.O. Box Number: Mailing Add CARVEL	dress: Po	stal Co	de:	Lot Block	Plan
City: Province:	Co	ountry:		Well Elev:	How Obtain:
				2418 FT 6. Well Yield	Estimated
3. Drilling Information Type of Work: New Well			Proposed well use:	Test Date	Start Time:
Reclaimed Well			Domestic	(yyyy/mm/dd):	44.00.414
	rials Used:		Anticipated Water Requirements/day	1981/08/17 Test Method: Bai	11:00 AM ler
Method of Drilling: Rotary Flowing Well: No Rate:	Gallons		0 Gallons	Non pumping	147 FT
Gas Present: No Oil Pr	resent: No	W		static level: Rate of water	5
4. Formation Log	5. Well Completion	Data (Completed	removal:	Gallons/Min
Depth from	Date Started(yyyy/mm/dd):		mm/dd):	Depth of pump intake:	195 FT
ground Lithology Description	1981/08/16	1981/		Water level at	195 FT
evel (feet)	Well Depth: 240 FT	Inches	ole Diameter: 0	end of	
22 Brown Clay	Casing Type: Galvanized	Liner	Type:	pumping: Distance from to	o of Inches
85 Blue Clay 115 Silty Clay	Steel Size OD: 4.5 Inches		DD: 0 Inches	casing to ground	
184 Sand	Wall Thickness: 0.141	_	hickness: 0 Inches	level: Depth To wa	ter level (feet)
205 Gray Shale 218 Brittle Shale	Inches	Top: (Elapse	ed Time
218 Brittle Shale 225 Gray Shale	Bottom at: 200 FT	FT		Drawdown Minu Total Drawdown:	
234 Blue Sandstone	Perforations from: 0 FT to: 0 FT		ations Size: les x 0 Inches	If water removal	was less than 2 l
235 Coal 240 Blue Sandstone	from: 0 FT to: 0 FT	3733100 mm 11	es x 0 Inches	duration, reason	why:
Dide Sandstone	from: 0 FT to: 0 FT	0 Inch	es x 0 Inches	4	
	Perforated by: Seal: Driven			Recommended p	umping rate: 5
	from: 198 FT	to: 20	0 FT	Gallons/Min	
	Seal: from: 0 FT	to: 0 F	T	Recommended p	ump intake: 198
	Seal:	4 0.5	-T	Type Pump Insta	lled
	from: 0 FT Screen Type:	to: 0 F	n ID: 0 Inches	Pump Type: Pump Model:	
	from: 0 FT to: 0 FT	Slot S	ize: 0 Inches	- H.P.:	
	Screen Type: from: 0 FT to: 0 FT		n ID: 0 Inches lize: 0 Inches	Any further pump	test information
	Screen Installation Method			1	
	Fittings Top:	Botto	m'		
	Pack:	DOTTO	11.	1	
	Grain Size: Geophysical Log Taken:	Amou	int:	-	
	Retained on Files:				
	Additional Test and/or Pun			1	
	Chemistries taken By Drille Held: 0		ments Held: 1		
	Pitless Adapter Type:			1	
	Drop Pipe Type: Length: FT	Diam	eter: Inches	1	
	Comments: DRILLER REPORTS WAT				
	7. Contractor Certifi	icatio	n NOVAK DOULED		

	The data contained in the	r Well Drilling is report is supplied by the responsibility for its accur	Driller. The	ort province disclaims	Well I.D.: Map Verified Date Report Received:	0459747 Not Verified
	onment				Measurements:	Imperial
Company N	actor & Well Owner Inform	nation	Dailling Co		2. Well Locat	
MCGINNIS			Drilling Co	mpany Approval No.	1/4 or Sec Tv LSD	vp Rge Westo M
Mailing Add		own:	Postal Co	de:	NW 04 05	53 02 5
WellOwner' TURLOCK,	S.	ation Identifier:	7, ,		0 FT from 0 FT from	Boundar Boundar
P.O. Box N	RR1, ČA	RVEL	Postal Co	de:	Lot Block	Plan
City:	Province	1	Country:			How Obtain: Estimated
	g Information				6. Well Yield	
	rk; New Well			Proposed well use:	Test Date	Start Time:
Reclaimed \		laniala I la adi		Domestic & Stock	(yyyy/mm/dd):	44.00.444
Date Reclai	med: Mai Drilling: Rotary	terials Used:		Anticipated Water	1967/05/26	11:00 AM
Flowing We		e: Gallons		Requirements/day 0 Gallons	Test Method: Unk Non pumping	nown 18 FT
Gas Presen		e: Gallons Present: No		Janona	static level:	10 11
4. Forma		5. Well Completio	n		Rate of water	3
Depth	uon Log		Data	ompleted	removal:	Gallons/Min
from		Date Started(yyyy/mm/d	dd): Date C	ompietea nm/dd):	Depth of	0 FT
ground	Lithology Description	Wordshelle	1967/0		pump intake:	***
level	3) = -30p311	Mail Dooth: 170 FT		ole Diameter: 0	Water level at	FT
(feet)		Well Depth: 170 FT	Inches		end of pumping:	
	own Sandy Clay	Casing Type: Steel	Liner T	уре:	Distance from top	of Inches
	ue Silty Clay	Size OD: 4.56 Inches		D: 0 Inches	casing to ground	or inches
	own Sandy Clay	Wall Thickness: 0 Inche	es Wall Ti	nickness: 0 Inches	level:	
	own Sandy Clay & Rocks ray Sandy Clay	Bottom at: 154 FT	Top: 0	FT Bottom: 0	Depth To water	er level (feet)
	askatchewan Sand & Gravel	— Bottom at: 13411	FT		Elapsed	
	ue Shale	Perforations	Perfora	itions Size:	Drawdown Minute	
	ay Shale	from: 0 FT to: 0 FT		s x 0 Inches	Total Drawdown:	
	ue Water Bearing Sand & Shale	from: 0 FT to: 0 FT		s x 0 Inches	lf water removal w duration, reason w	
		— from: 0 FT to: 0 FT Perforated by:	U Inche	s x 0 Inches	duration, reason w	niy.
		Seal:		~		
		from: 0 FT	to: 0 F	r		
		Seal:	10.01		Recommended pu	imping rate: 0
		from: 0 FT	to: 0 F		Gallons/Min	
		Seal:			Recommended pu	mp intake: 66
		from: 0 FT	to: 0 F		FT Type Pump Install	2.21
		Screen Type:		ID: 0 Inches	Pump Type:	ea
		from: 0 FT to: 0 FT Screen Type:		te: 0 inches ID: 0 inches	Pump Model:	
		from: 0 FT to: 0 FT		e. O Inches	H.P.:	
		Screen Installation Meth			Any further pumpt	est information?
		Fittings				
		Тор:	Bottom			
		Pack:	20-11-11-11			
		Grain Size:	Amoun	t:		
		Geophysical Log Taken	:			
		Retained on Files: Additional Test and/or P	Pump Date		ľ	
		Chemistries taken By Di				
		Held: 0		ents Held: 1		
		Pitless Adapter Type:				
		Drop Pipe Type:				
		Length: FT	Diamet	er: Inches		
		Comments:	MTED IO O	OCT.		
		DRILLER REPORTS W.	AIERIS SC	JF I		
				-		
		7 0				
		7. Contractor Cert Driller's Name:		OWN DRILLER		

The data contained in this	Well Drilling F report is supplied by the Drilling responsibility for its accuracy.	er. The			erified: Report		0459748 Not Veri	
Environment	esponsibility for its accuracy.				urements		mperial	
1. Contractor & Well Owner Information					ell Loc	ation		
Company Name: GROVE DRILLING ENTERPRISES (1980) LTD		lling Co	mpany Approval No.:	1/4 or LSD	Sec	Twp	Rge V	Vestot M
Mailing Address: City or Tow		stal Coc	le:	14	04	053	02	5
WellOwner's Name: Well Locati	on Identifier:				on in Qua from	arter	Воц	ındary
SOLAR, CONST P.O. Box Number: Mailing Add	droop: Po	stal Cod	lo:	0 FT Lot	from Blo	ck	Bou Plan	ındary
EDMONTO	N .							
City: Province:	Со	untry:		Well E 2425 F		200	Obtair nated	<i>I</i> :
3. Drilling Information				_	ell Yiel			
Type of Work: New Well Reclaimed Well			Proposed well use: Domestic	Test D	ate nm/dd).	5	Start Tir	ne:
	ials Used:		Anticipated Water	1976/0	9/26		1:00 A	М
Method of Drilling: Rotary			Requirements/day	-	lethod: F		9 FT	
	Gallons esent: No		0 Gallons	Non pi	umping evel:	3	1911	
4. Formation Log	5. Well Completion			Rale o	f water		.5	
Depth		Date C	ompleted	remov Depth			Sallons	/Min
from ground Lithology Description	Date Started(yyyy/mm/dd):		nm/dd):		or intake:	1	100 F I	
level	M-11 D11- 400 FT		ole Diameter: 0		level at	1	00 FT	
(feet)	Well Depth: 120 FT	Inches		end of pumpi				
80 Clay 88 Sand	Casing Type: Steel Size OD: 4.56 Inches	Liner T	ype: D: 0 Inches	Distan	ce from		nches	
94 Clay	Wall Thickness: 0.141			casing level:	to grour	nd		
100 Sand	Inches		hickness: 0 Inches		epth To v	valer le	vel (fee	et)
108 Clay 118 Sand	Bottom at: 114 FT	Top: 0	FT Bottom: 0		Elap	sed Tir	me `	
118 Sand 120 Clay	Perforations		ations Size:	Drawo 24.	down Mir	nutes:S 1:00	ec Rec	overy
	from: 0 FT to: 0 FT		es x 0 Inches	30.		2:00		
	from: 0 FT to: 0 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches	35.		3:00		
	Perforated by:	0 1110111	SO A O MIGNES	39. 43.		4:00 5:00		
	Seal:		•	47.		6:00		
	from: 0 FT Seal:	to: 0 F		50.		7:00		
	from: 0 FT	to: 0 F	Т	53		8:00		
	Seal: from: 0 FT	to: 0 F	т	55. 58.		9:00		
	Screen Type: Stainless			68.		15:00		
	Steel		ID: 3 Inches	74.		20:00		
	from: 114 FT to: 118 FT Screen Type:		ze: 0.01 Inches	78. 81.		25:00 30:00		
	from: 0 FT to: 0 FT		ze: 0 Inches	84.		40:00		
	Screen Installation Method:			86.		50:00		
	Fittings Top: Welded	Bottom	r Plua	88. 89.		60:00 75:00		
	Pack: Jet Sand		in the second of	90.		90:00		
	Grain Size:	Amour	nt: 0.25 Yards	90.	92	105:00		
	Geophysical Log Taken: Retained on Files:			90.		120:00	-	
	Additional Test and/or Pum	p Data	X	91. 91.		150:00 180:00		
	Chemistries taken By Drille		onte Held: E	93.	29	210:00		
	Held: 1 Pitless Adapter Type:	Docum	nents Held: 5	92.		240:00		
	Drop Pipe Type:		Application of Applications		Drawdow er remova			ın 2 h
	Length: 110 FT Comments:	Diame	ter: 1 Inches		on, reasc			
	driller reports water is hard							
				Recor Gallor	nmended	d pump	ing rate	: 0
					nmended	l pump	intake	108
	7. Contractor Certific	cation		FT	20 mg = 10	ا داده		
E	Drillar's Name:	LINIUNI	ONANI DDII I ED	Type	oump Ins	stalled		

The data contained in this	Well Drilling report is supplied by the Desponsibility for its accura	riller. The	ort province disclaims	Well I.D.: Map Verified: Date Report Received: Measurements:	0459749 Not Verified
1. Contractor & Well Owner Informat	ion			2. Well Locatio	THE RESIDENCE OF THE PARTY OF T
Company Name:		Drilling Co	mpany Approval No.:		
SCHELLENBERGER M Mailing Address: City or Tow		Postal Co	100 F 50	LSD NW 04 053	M 02 5
WellOwner's Name: Well Location				Location in Quarter 0 FT from	Boundary
WASYLYSHYN, STEVE		D1-1 O-	-	0 FT from	Boundary
CARVĚL		Postal Co	de: 	Lot Block	Plan
City: Province:		Country:			ow Obtain: stimated
3. Drilling Information Type of Work: New Well				6. Well Yield	
Type of Work: New Well Reclaimed Well			Proposed well use:	Test Date	Start Time:
	als Used:		Domestic Anticipated Water	(yyyy/mm/dd): 1963/08/17	11:00 AM
Method of Drilling; Rotary	als Oscu.		Requirements/day	Test Method: Unkno	
Flowing Well: No Rate: 0	Gallons sent: No		0 Gallons	Non pumping static level:	32 FT
4. Formation Log	5. Well Completion			Rate of water	4
Depth		Data C	ompleted	removal:	Gallons/Min
from	Date Started(yyyy/mm/do	^{ב):} (yyyy/r	nm/dd):	Depth of	0 FT
ground Lithology Description		1963/0		pump intake: Water level at	40 FT
level (feet)	Well Depth: 124 FT	Boreho	ole Diameter: 0	end of	7011
92 Clay	Casing Type: Steel	Liner T		pumping:	
98 Sand	Size OD: 3.56 Inches	Size O	D: 0 Inches	Distance from top of casing to ground	Inches
105 Clay 110 Sand	Wall Thickness: 0 Inches		hickness: 0 Inches	level:	
110 Sand 115 Clay	Bottom at: 122 FT	Top: 0	FT Bottom: 0	Depth To water	
121 Shale		FT		Elapsed 1	
124 Sandstone	Perforations		ations Size:	Drawdown Minutes: Total Drawdown: 8 F	Sec Recovery
	from: 0 FT to: 0 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches	If water removal was	
	from: 0 FT to: 0 FT		es x 0 Inches	duration, reason why	
	Perforated by:				
	Seal: Driven			1	1
	from: 0 FT	to: 122	FT	Recommended pum	ning rate: 0
	Seal: from: 0 FT	to: 0 F		Gallons/Min	ping rate. 0
	Seal:	10.01		Recommended pum	p intake: 0 FT
	from: 0 FT	to: 0 F	Γ	Type Pump installed	
	Screen Type:		ID: 0 Inches	Pump Type: JET Pump Model:	- 1
	from: 0 FT to: 0 FT		ze: 0 Inches	H.P.	
	Screen Type: from: 0 FT to: 0 FT		ID: 0 Inches ze: 0 Inches	Any further pumptes	t information?
	Screen Installation Metho		LO. O MIGNES		
	Fittings				ı
	Тор:	Bottom	:		
	Pack: Grain Size:	Amoun			1
	Geophysical Log Taken:	Amoun			1
	Retained on Files:				
	Additional Test and/or Pu Chemistries taken By Dril	mp Data			1
	Held: 1		ents Held: 4		1
	Pitless Adapter Type:	Boodin	onto ricia. 4		1
	Drop Pipe Type:				
	Length: FT Comments:	Diamet	er: Inches		
	DRILLER REPORTS WA	TER IS SO	OFT		
	7. Contractor Certif	fication			
	Driller's Name: Certification No.:	UNKNO	OWN DRILLER		

The data contained in this	Well Drilling report is supplied by the Dresponsibility for its accura	oriller. The	ort province disclaims	Well I.D.: 0466661 Map Verified: Map Date Report 1996/09/23 Received: 1996/09/23		
1. Contractor & Well Owner Informa	tion			Measurements: Imperial 2. Well Location		
Company Name:		Drilling Cor	mpany Approval No.:			
KAP'S DRILLING LTD. Mailing Address: City or Tov	vn:	Postal Cod	le:	LSD M SW 03 053 02 5		
WellOwner's Name: Well Location Identifier:				Location in Quarter 0 FT from Bounda		
ENDERS, DAVE/CDK CONSTR P.O. Box Number: Mailing Ad		Postal Cod	le:	0 FT from Bounda Lot Block Plan		
RR2, CAR City: Province:		Country:		Well Elev: How Obtain: FT Not Obtain		
3. Drilling Information				6. Well Yield		
Type of Work: New Well			Proposed well use:	Test Date Start Time:		
Reclaimed Well Date Reclaimed: Mate	rials Used:		Domestic & Stock	(yyyy/mm/dd): 1994/08/10 11:00 AM		
Method of Drilling: Rotary	iais useu.	Anticipated Water Requirements/day		Test Method: Bailer & Air		
Flowing Well: No Rate:	Gallons		150 Gallons	Non pumping 65 FT		
	esent: No			static level: Rate of water 5		
4. Formation Log	5. Well Completion			removal: 5 Gallons/Min		
Depth from	Date Started(yyyy/mm/d	a): (yyyy/n	ompleted nm/dd):	Depth of 150 FT pump intake:		
ground Lithology Description level (feet)	1994/08/09 Well Depth: 260 FT		le Diameter: 0	Water level at 150 FT end of		
30 Brown Sandy Clay	Casing Type: Plastic	Inches Liner T	ype: Plastic	pumping:		
85 Gray Fine Grained Sand	Size OD: 6 Inches		D: 4.5 Inches	Distance from top of Inches casing to ground		
105 Blue Clay	Wall Thickness: 0.39		nickness: 0.25	level:		
135 Gravel 150 Blue Clay	Inches	Inches Top: 1	58 FT Bottom:	Depth To water level (feet)		
188 Shale	Bottom at: 161 FT	260 FT		Elapsed Time Drawdown Minutes:Sec Recover		
191 Sandstone	Perforations	Perfora	itions Size:	1:00 104.984		
224 Shale	from: 162 FT to: 260 FT		nches x 3 Inches	2:00 97.768		
228 Sandstone 238 Shale	from: 0 FT to: 0 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches	3:00 92.519		
238 Shale 246 Sandstone	Perforated by: Saw	0 11101110	O N O MIONIGO	4:00 87.926 6:00 81.364		
260 Sandy Shale	Seal: Driven	22/27/27/20/20/20/20/20/20/20/20/20/20/20/20/20/		7:00 78.74		
	from: 0 FT Seal:	to: 161	FI	8:00 76.935		
	from: 0 FT	to: 0 F	Г	10:00 74.146		
	Seal:	200000000000000000000000000000000000000	500	12:00 72.047		
	from: 0 FT	to: 0 F		16:00 69.881 20:00 68.733		
	Screen Type: from: 0 FT to: 0 FT		ID: 0 Inches ze: 0 Inches	Total Drawdown: 85 FT		
	Screen Type:			If water removal was less than 2 h		
	from: 0 FT to: 0 FT		ze: 0 Inches	duration, reason why:		
	Screen Installation Meth Fittings	od:		4		
	Top:	Bottom	1			
*	Pack: Grain Size:	Amoun	ŀ·	Recommended pumping rate: 5 Gallons/Min		
	Geophysical Log Taken:			Recommended pump intake: 160		
	Retained on Files:	r :		FT Type Pump Installed		
		Additional Test and/or Pump Data Chemistries taken By Driller: No		Pump Type:		
	Held: 0		ents Held: 1	Pump Model:		
	Pitless Adapter Type: Drop Pipe Type:			H.P.: Any further pumptest information		
	Length: FT	Diamet	er: Inches			
	Comments:					
	7 Contractor Cont	ification		1		
	7. Contractor Cert Driller's Name:		OWN DRILLER	-		
1	Codification No.	1/4570		1		

The data contained in this	Well Drilling report is supplied by the D responsibility for its accura	Oriller. The	ort province disclaims	Well I.D.: Map Verified: Date Report Received: Measurements:	0467926 Not Verified 1997/09/05
1. Contractor & Well Owner Informa	tion			2. Well Locatio	Imperial
Company Name:		Drilling Co	mpany Approval No.:	1/4 or Sec Twp	
KAP'S DRILLING LTD. Mailing Address: City or Tow		Postal Cod		LSD SW 03 053	M 02 5
WellOwner's Name: Well Location Identifier:				Location in Quarter 0 FT from	Poundon
ENDERS, DAVE	0745/24/03/03/02/04			0 FT from	Boundary Boundary
P.O. Box Number: Mailing Add STONY PL		Postal Cod	le:	Lot Block	Plan
City: Province:	,	Country:			ow Obtain: ot Obtain
3. Drilling Information				6. Well Yield	
Type of Work: New Well Reclaimed Well			Proposed well use:	Test Date	Start Time:
	ials Used:	Domestic Anticipated Water		(yyyy/mm/dd): 1995/09/26	11:00 AM
Method of Drilling: Rotary	Req		Requirements/day	Test Method: Air	3. V23530192250000000
	Gallons 300 Gallons sent; No			Non pumping static level:	40 FT
4. Formation Log	5. Well Completion	1		Rate of water	10
Depth	Date Started(yyyy/mm/do	Date C	ompleted	removal: Depth of	Gallons/Min 220 FT
from ground Lithology Description	1995/09/25	1995/09		pump intake:	220 F1
level (feet)	Well Depth: 240 FT	Boreho	le Diameter: 0	Water level at end of	215 FT
18 Brown Till	Casing Type: Plastic	Inches Liner T	ype: Plastic	pumping:	
136 Gray Sandy Till	Size OD: 6 Inches		D: 4.5 Inches	Distance from top of casing to ground	Inches
141 Shale 149 Sandstone	Wall Thickness: 0.39 Inches	Wall Th	ickness: 0.25	level:	
165 Shale		Top: 15	4 FT Bottom:	Depth To water	level (feel)
174 Sandstone	Bottom at: 156 FT	240 FT		Elapsed T Drawdown Minutes:	ime Sec Recovery
190 Shale	Perforations		tions Size:	1:00	
194 Sandstone 228 Shale	from: 220 FT to: 237 FT from: 0 FT to: 0 FT		nches x 3 Inches s x 0 Inches	2:00	
237 Sandstone	from: 0 FT to: 0 FT		s x 0 Inches	3:00 4:00	
240 Shale	Perforated by: Saw Seal: Driven & Bentonite			5:00	
	from: 0 FT	to: 156	FT	6:00	100.391
	Seal:		65 19	7:00	
	from: 0 FT Seal:	to: 0 FT		8:00 9:00	90.879 86.942
	from: 0 FT	to: 0 FT		10:00	
	Screen Type:		ID: 0 Inches	12:00	
	from: 0 FT to: 0 FT Screen Type:		e: 0 Inches ID: 0 Inches	14:00 16:00	
	from: 0 FT to: 0 FT		e: 0 Inches	20:00	
	Screen Installation Metho	od:		25:00	58.726
	Fittings	Bottom:		30:00	
	Top: Pack:	DOTTOIN.		35:00 40:00	
	Grain Size:	Amount	:	50:00	
	Geophysical Log Taken: Retained on Files:			60:00	
	Additional Test and/or Pu	mp Data		120:00	
	Chemistries taken By Dril	ler: No		Total Drawdown: 175 If water removal was	
	Held: 0 Pitless Adapter Type:	Docume	ante Hald: 1	duration, reason why	
	Drop Pipe Type:				
	Length: FT Comments:	Diamete	er: Inches		
	DRILLER REPORTS DIS			Recommended pum Gallons/Min	oing rate: 7
	CASING TO GROUND LE	CVEL: 18".		Recommended pump FT	o intake: 200
				Type Pump Installed Pump Type:	
	7. Contractor Certif	fication		Pump Model:	
	Driller's Name:			H.P.: Any further pumptest	information?
	Codification No.			my further pumptest	inormation?

Water The data contained in this	Well I.D.: Map Verified: Date Report Received:	0494989 Not Verified 1999/09/07			
Environment	Measurements:	Imperial			
1. Contractor & Well Owner Informa		0 :::: 0		2. Well Locati	
Company Name: COBOB PUMPS & SERVICES LTD.		Drilling Co 118857	mpany Approval No.:	: 1/4 or Sec Tw LSD	p Rge Westof M
Mailing Address: City or To		Postal Cod	de:	SW 03 05	
51517 RANGE ROAD 275 STONY P	AIN AB CA	T7Z 1Z5		Location in Quarte	SECT.
	ion Identifier:			0 FT from	Boundary Boundary
SHENFIELD, TIM P.O. Box Number: Mailing Ad	drage:	Postal Cod	4o.	0 FT from Lot Block	Plan
		TOE OHO	16.	1 4	8020386
City: Province:		Country:			How Obtain:
					Not Obtain
3. Drilling Information				6. Well Yield	- ar (+)
Type of Work: New Well Reclaimed Well			Proposed well use:	Test Date (yyyy/mm/dd):	Start Time:
	rials Used:	Domestic s Used: Anticipated W.		1999/05/06	11:00 AM
Method of Drilling: Rotary			Requirements/day	Test Method: Baile	er
Flowing Well: No Rate	Gallons		400 Gallons	Non pumping	85 FT
	resent: No		l .	static level: Rate of water	30
4. Formation Log	5. Well Completion			removal:	Gallons/Min
Depth from	Date Started(yyyy/mm/d	d): Date C	completed nm/dd):	Depth of	180 FT
ground Lithology Description	1999/05/05	1999/0		pump intake:	100 ==
level	Well Depth: 220 FT	Boreho	ole Diameter: 0	Water level at end of	180 FT
(feet)		Inches		pumping:	
55 Brown Clay 75 Gray Clay & Sand	Casing Type: Plastic		Type: Plastic	Distance from top	of Inches
75 Gray Clay & Sand 101 Gray Sand	Size OD: 6 Inches Wall Thickness: 0.394		D: 4.5 Inches hickness: 0.27	casing to ground	45
125 Gray Sandstone	Inches	Inches		level:	as level (feet)
127 Coal	Bottom at: 178 FT	Top: 1		Depth To wate Elapsed	er level (leet)
131 Dark Gray Shale		220 FT		Drawdown Minute	
150 Dark Gray Clay	Perforations		ations Size:	85 0:0	
154 Clay & Gravel 162 Gray Shale	from: 180 FT to: 200 FT from: 200 FT to: 220 FT		iches x 2.5 Inches es x 0 Inches	180 1:0	
162 Gray Shale 165 Green Shale	from: 0 FT to: 0 FT		es x 0 Inches	180 2:0 180 3:0	
167 Gray Shale	Perforated by: Machine			180 4:0	
170 Green Shale	Seal: Driven & Bentonite		. ==	180 5:0	
172 Gray Shale	from: 160 FT Seal:	to: 178	5 F I	180 6:0	00 85.5
175 Gray Sandstone	from: 0 FT	to: 0 F	Т	180 7:0	
178 Green Shale 186 Gray Shale	Seal:			180 120	
186 Gray Shale 196 Sandstone	from: 0 FT	to: 0 F		Total Drawdown: 9	
199 Gray Shale	Screen Type: from: 0 FT lo: 0 FT		n ID: 0 Inches ze: 0 Inches	duration, reason w	
206 Green Shale	Screen Type:		D: 0 Inches	1	
209 Sandstone	from: 0 FT to: 0 FT		ze: 0 Inches	_	
211 Gray Shale	Screen Installation Meth	od:		Recommended pu	imping rate: 20
215 Sandstone 220 Gray Shale	Fittings	Dotto-	٠,	Gallons/Min	imping rate. 20
220 Glay Ghale	Top: Pack:	Botton	IV.	Recommended pu	ımp intake: 170
	Grain Size:	Amour	nt:	FT	
	Geophysical Log Taken:			Type Pump Install	ed
	Retained on Files:			Pump Type: SUB Pump Model: GOL	JLD 7GS07422
	Additional Test and/or Proceedings of the Chemistries taken By Dr			H.P.:	
	Held: 0		nents Held: 1	Any further pumpt	est information?
	Pitless Adapter Type:	2 30011		1	
	Drop Pipe Type:	_			
	Length: FT	Diame	ter: Inches	4	
	Comments: DRILLER REPORTS DISTANCE FROM TOP OF CASING TO GROUND LEVEL: 2'.				
	7. Contractor Certi	UNKN	OWN DRILLER		
I .	Continuation No.	10501	0	I.	

A				Well I.D.:	0495847
Water	Well Drilling	Report		Map Verified:	Not Verified
The data contained in this	report is supplied by the Dri	ller. The province of	disclaims	Date Report Received:	2000/01/20
Environment	esponsibility for its accuracy	y.		Measurements:	Imperial
1. Contractor & Well Owner Informat	ion			2. Well Locatio	n
Company Name: RODCO DRILLING		rilling Company Ap	proval No.:	1/4 or Sec Twp	Rge Westor
Mailing Address: City or Tow		21074 ostal Code:		LSD SW 03 053	02 5
BOX 5168 SPRUCE G	ROVE AB CA T	7X 3A3		Location in Quarter	<u> </u>
WellOwner's Name: Well Location BATES, GERALD	on Identifier:			0 FT from 0 FT from	Boundary
P.O. Box Number: Mailing Add	Iress: P	ostal Code:		Lot Block	Boundary Plan
STONY PL	AIN			17 4	
City: Province:	С	ountry:			ow Obtain: ot Obtain
3. Drilling Information				6. Well Yield	or Obtain
Type of Work: New Well		Proposed	well use:	Test Date	Start Time:
Reclaimed Well Date Reclaimed: Materi	ala l laod:	Domestic		(yyyy/mm/dd):	11:00 414
Method of Drilling: Rotary	als Used:	Anticipate Requirem		1999/10/13 Test Method: Air	11:00 AM
Flowing Well: No Rate:	Gallons	250 Gallo		Non pumping	42.1 FT
THE RESERVE OF THE PARTY OF THE	esent: No			static level: Rate of water	5
4. Formation Log Depth	5. Well Completion	Data Committee		removal:	5 Gallons/Min
from	Date Started(yyyy/mm/dd)	Date Completed (yyyy/mm/dd):		Depth of	210 FT
ground Lithology Description	1999/10/11	1999/10/13		pump intake: Water level at	210 FT
(level (feet)	Well Depth: 220 FT	Borehole Diamet Inches	er: 0	end of	21011
30 Sandy Clay	Casing Type: Plastic	Liner Type: Plast	lic	pumping:	
37 Blue Clay	Size OD: 6 Inches	Size OD: 4.5 Incl	hes	Distance from top of casing to ground	Inches
75 Silty Clay 147 Blue Clay	Wall Thickness: 0.375 Inches	Wall Thickness:	0.25	level:	
155 Dirty Sand		Top: 151 FT	Bottom:	Depth To water Elapsed	
160 Gray Shale	Bottom at: 161 FT	220 FT		Drawdown Minutes:	Sec Recovery
162 Green Shale 179 Gray Shale	Perforations from: 180 FT to: 220 FT	Perforations Size 0 Inches x 0.125	YY	0:00	210
180 Hard Sandstone	from: 0 FT to: 0 FT	0 Inches x 0 Inch		3:00 4:00	
184 Gray Shale	from: 0 FT to: 0 FT	0 Inches x 0 Inch	es	5:00	
194 Green Shale 196 Sandstone	Perforated by: Hand Drill Seal: Drive Shoe			6:00	153
196 Sandstone 198 Brown Shale	from: 160 FT	to: 161 FT		7:00	
205 Green Shale	Seal: from: 0 FT	to: 0 FT		8:00 9:00	
208 Sandy Shale	Seal:	to. 0 F 1		10:00	
212 Green Shale 220 Sandstone	from: 0 FT	to: 0 FT		12:00	
Canada Ca	Screen Type: from: 0 FT to: 0 FT	Screen ID: 0 Inches Slot Size: 0 Inches		14:00 16:00	
	Screen Type:	Screen ID: 0 Inch		20:00	
	from: 0 FT to: 0 FT	Slot Size: 0 Inche	es	25:00	77.17
	Screen Installation Method Fittings	:		30:00 35:00	
	Top:	Bottom:		40:00	
	Pack: Grain Size:	A		50:00	
	Geophysical Log Taken:	Amount:		60:00	
	Retained on Files:			75:00 210 120:0	
	Additional Test and/or Pur			Total Drawdown: 16	8 FT
	Chemistries taken By Drille Held: 0	Documents Held:	4	If water removal was	
	Pitless Adapter Type:			duration, reason why	/·
	Drop Pipe Type: Length: FT	Diameter: Inches			
	Comments:	Diameter: Inches		Recommended pum	ning rate: F
	DRILLER REPORTS DIST		OF	Gallons/Min	ping rate. 5
	CASING TO GROUND LET	VEL: 2'.		Recommended pum	p intake: 190
				FT Type Pump Installed	
				Pump Type: SUB	
1	7. Contractor Certific	cation		Pump Model:	
	Driller's Name:	UNKNOWN DRIL		H.P.; Any further pumptest	t information?
	Cartification his :	E0770	ı		

	The data contained in this	Well Drilling	Driller. The	ort province disclaims	Well I.D.: Map Verified Date Report Received:	: N	496508 ot Verified 000/07/25
En	vironment r	esponsibility for its accura	acy.		Measuremer	nts: In	nperial
1. Cont	tractor & Well Owner Informat	tion			2. Well Lo		
Company				mpany Approval No.:	1/4 or Sec LSD	Twp 1	Rge Westof M
Mailing A	DRILLING Address: City or Tow	ın.	Postal Co	de:	SW 03	053	02 5
BOX 516		ROVE AB CA	T7X 3A3		Location in Q		
		on Identifier:			0 FT from		Boundary
	/ PEAK HOMES Number: Mailing Add	trace:	Postal Co	do:	0 FT from Lot B	lock	Boundary Plan
.O. DOX	STONY PL		i ostai cot	Je.		100K	
City:	Province:		Country:		Well Elev: FT		Obtain: Obtain
3. Drilli	ing Information				6. Well Yie	∍ld	
Type of V	Nork: New Well			Proposed well use:	Test Date		tart Time:
Reclaime Date Rec		ials Used:		Domestic Anticipated Water	(yyyy/mm/dd) 2000/07/14		1:00 AM
	of Drilling: Rotary	iais Oseu.		Requirements/day	Test Method:	Pump	
Flowing \	Well: No Rate:	Gallons		300 Gallons	Non pumping	4:	2.2 FT
Gas Pres		esent: No	W. C.	l	static level: Rate of water	r 3.	5
	nation Log	5. Well Completion		ampleted	removal:	G	allons/Min
Depth from		Date Started(yyyy/mm/d		Completed nm/dd):	Depth of		35 FT
ground	Lithology Description	2000/06/26	2000/0	06/28	pump intake: Water level a		35,7 FT
level (feet)	And the state of t	Well Depth: 265 FT	Boreho	ole Diameter: 0	end of	. 1.	30.7 1 1
65	Silty Clay	Casing Type: Plastic		Гуре: Plastic	pumping:		
65	Silty Clay	Size OD: 6 Inches		D: 4.5 Inches	Distance fron casing to gro		ches
95	Blue Clay	Wall Thickness: 0.375		hickness: 0.25	level:	unu	
95	Blue Clay Gravel	Inches	Inches Top: 1			water lev	
97 97	Gravel	Bottom at: 195 FT	265 F		Ela Drawdown M	apsed Tim	
145	Blue Clay	Perforations		ations Size:	42.67	0:00	135.75
145	Blue Clay	from: 245 FT to: 265 FT		es x 0.125 Inches	46.17	1:00	132.33
155	Gray Shale	from: 0 FT to: 0 FT from: 0 FT to: 0 FT		es x 0 Inches es x 0 Inches	49.42	2:00	129.83
155 161	Gray Shale Silty Shale	Perforated by: Hand Dri			52.17 55	3:00 4:00	127.08 124.5
161	Silty Shale	Seal: Driven			57.25	5:00	122.17
163	Green Shale	from: 194 FT Seal:	to: 195) F I	60	6:00	119.75
163	Green Shale	from: 0 FT	to: 0 F	Т	62.08	7:00	117.42
168 168	Silty Shale Silty Shale	Seal:		<u>.</u>	64.25 66.25	8:00 9:00	115 113.17
172	Sandstone	from: 0 FT Screen Type:	to: 0 F	n ID: 0 Inches	68.33	10:00	111.08
172	Sandstone	from: 0 FT to: 0 FT	75.0	ze: 0 Inches	72.17	12:00	107.25
175	Hard Sandstone	Screen Type:		n ID: 0 Inches	75.5	14:00	103.67
175 181	Hard Sandstone Shale	from: 0 FT to: 0 FT Screen Installation Meth		ze: 0 Inches	78.75 84.75	16:00 20:00	100.25 94.25
181	Shale	Fittings	iou.		90.67	25:00	88
182	Green Shale	Тор:	Botton	n:	96.08	30:00	82.5
182	Green Shale	Pack:			101.33	35:00	77.83
190 190	Silty Shale Silty Shale	Grain Size: Geophysical Log Taken	Amour	າເ:	104.92	40:00	73.83 67.83
191	Hard Sandstone	Retained on Files:			111.83 117.42	50:00 60:00	63.33
191	Hard Sandstone	Additional Test and/or P			124	75:00	58.5
194	Silty Shale	Chemistries taken By Di Held: 0		nents Held: 1	129.08	90:00	55.25
194 205	Silty Shale Green Shale	Pitless Adapter Type:	Docum	ici ilo i iciu. I	132.83	105:00	
205	Green Shale	Drop Pipe Type:	4,00		135.75 Total Drawdo	120:00	Т
207	Brown Shale	Length: FT	Diame	ter: Inches	If water remo		
207	Brown Shale	Comments: DRILLER REPORTS DI	ISTANCE F	FROM TOP OF	duration, rea		93
209	Green Shale	CASING TO GROUND					
209 220	Green Shale Gray Shale	+					
220	Gray Shale	1			Recommend	ed pumpir	ng rate: 3
231	Sandstone				Gallons/Min	- 4	-1-1 005
231	Sandstone	7. Contractor Cert			Recommend FT	ea pump i	птаке: 235
1		Driller's Name:	UNKN	OWN DRILLER	Type Pump I	nstalled	

Water Alberta Environment	Well Drilling report is supplied by the responsibility for its accur	Driller. The	ort province disclaims	Well I.D.: Map Verified: Date Report Received:	1165150 Map 2006/10/25
1. Contractor & Well Owner Informa	tion			Measurements:	Imperial
Company Name:	ition	Drilling Co	ompany Approval No.	2. Well Locatio	
CALÍBRÉ DRILLING LTD. Mailing Address: City or To	wo.	128944		LSD	М
	GROVE ALBERTA	Postal Co	de:	03 03 053 Location in Quarter	02 5
CANADA		T7X 3B3		FT from N	Boundary
	ion Identifier: UNTRY PROPERTIES			FT from E Lot Block	Boundary Plan
P.O. Box Number: Mailing Ad	dress:	Postal Co	de:	10 3	8020386
City: SITE 218	RR 1 BOX 27	T0E 0H0 Country:			ow Obtain: ot Obtain
CARVEL AB		CA CA		6. Well Yield	it Obtain
3. Drilling Information				Test Date	Start Time:
Type of Work: New Well Reclaimed Well			Proposed well use: Domestic	(yyyy/mm/dd): 2002/02/21	11:00 AM
Date Reclaimed: Mate	rials Used: Unknown		Anticipated Water	Test Method: Air	11.00 AW
Method of Drilling: Rotary	0-11-		Requirements/day 500 Gallons	Non pumping	77.789 FT
	Gallons resent: No		Sou Gallons	static level: Rate of water	10
4. Formation Log	5. Well Completion	n		removal:	Gallons/Min
Depth	Date Started(yyyy/mm/	Date C	ompleted	Depth of pump intake:	140.092 FT
from ground Lithology Description	2002/02/20	2002/0	nm/dd): 12/21	Water level at	131.1 FT
level	Well Depth: 240 FT	Boreho	ole Diameter: 8.75	end of pumping:	
(feet) 62 Brownish Yellow Till	Casing Type: Plastic	Inches	ype: Plastic	Distance from top of	19.685
71 Brown Fine Grained Sand	Size OD: 6 Inches		D: 4.5 Inches	casing to ground	Inches
92 Brownish Yellow Till	Wall Thickness: 0.39	Wall T	hickness: 0.237	level: Depth To water	level (feet)
102 Blue Gray Till 151 Gray Medium Grained Sand	Inches	Inches Top: 1		Elapsed T	ime
159 Dark Gray Clay	Bottom at: 190 FT	240 FT		Drawdown Minutes: 0:00	
166 Dark Gray Shale 177 Medium Grained Sandstone	Perforations from: 194 FT to: 233 FT		ations Size: nches x 12 Inches	1:00	
184 Light Gray Shale	from: FT to: FT		x inches	2:00	
188 Medium Grained Sandstone	from: FT to: FT	Inches	x Inches	3:00 4:00	
194 Green Shale 207 Light Gray Shale	Perforated by: Saw Seal: Bentonite Chips/T	ablets		5:00	99.77
216 Medium Grained Sandstone	from: 0 FT	to: 190	FT	6:00 7:00	95.407 92.159
224 Green Shale	Seal: Unknown from: FT	to: FT		8:00	90.453
233 Medium Grained Sandstone 240 Green Shale	Seal: Unknown		4	9:00	88.615
	from: FT Screen Type: Unknown	to: FT	ID: Inches	10:00 12:00	
	from: FT to: FT	Slot Siz	ze: Inches	14:00	
	Screen Type: Unknown from: FT to: FT	Screen	ID: Inches ze: Inches	16:00	
	Screen Installation Meth	nod: Unknov	vn	20:00 25:00	
	Fittings	D-41-		30:00	78.707
	Top: Unknown Pack: Unknown	Bottom	: Unknown	35:00 40:00	
	Grain Size:		t: Unknown	50:00	
	Geophysical Log Taken Retained on Files:	•		60:00	77.789
	Additional Test and/or P	ump Data		75:00 90:00	
	Chemistries taken By Di Held:		anta (Inidi	105:00	
	Pitless Adapter Type:	Docum	ents Held:	120:00	
	Drop Pipe Type:			Total Drawdown: 53. If water removal was	
	Length: FT Comments:	Diamet		duration, reason why	
	AIR TEST 10 GPM @ 3	9.98 METE	RS. SEAL -		
	BENTONITE PRODUCT DIAMETER - 8.75" & 4.1				
	REQUIREMENT PER D		O 500 GALLONS	Recommended pump Gallons/Min	
	7. Contractor Cert	ification		Recommended pump 137.795 FT	intake:
I	Drillaria Mama:	DANDY		Type Pump Installed	

Captorners Cap	The data contained in this	Well Drilling	riller. The province disclaims	Map Verified: Not	5151 Verified 6/10/25
Company Name	Alberta Environment	responsibility for its accura	cy.		erial
CALIERE DRILLING LTD	1. Contractor & Well Owner Informa				
Mailing Address:					
SPRUCE GROVE ALBERTA COAHADA C					
Well Covered Share Well Cocation Identifier Well Location Identifier	BOX 4083 SPRUCE	CDOVE ALBERTA	T7X 3B3		
CostTerMAYER_CRAIG & PAT	CANADA				
SITE 270 RR 2 BOX 25		tion identifier.			
Country	P.O. Box Number: Mailing Ac				
STONY PLAIN AB					
3. Drilling Information Type of Work. New Well Requirements Requirements Malerials Used: Unknown Method of Drilling: Rotary Flowing Well: No Gas Present: No Oil Present: No O	STONY PLAIN AB			The same of the sa	, unit
Type of Work: New Well Materials Used: Unknown					t Time:
Date Rectaimed: Materials Used: Unknown Anticipated Water Method of Drilling, Rotary	Type of Work: New Well				. 514
Method of Drilling, Rotary Requirements/day Salions Gallons Gallons Gallons Salions Salion		siala Haadi Hakaaya			PM
State Companies Callons Call		nais used. Unknown			8 FT
A. Formation Log S. Well Completion	Flowing Well: No Rate		Gallons		- 100
Depth of compound Date Started(yyyy/mm/dd): Date Completed					ons/Min
Date Started(yyyymr/dd); Continue Cont		5. Well Completion			
Second Continue	from	Date Started(yyyy/mm/d)2 FT
Well Depth: 140 FT	ground Lithology Description	2003/05/18	2003/05/18		52 F I
19 Brownish Yellow Clay Casing Type: Plastic Liner Type: Plastic Casing to ground Inches		Well Depth: 140 FT		pumping:	
Blue Gray Clay Size OD: 6 Inches Size OD: 4.5 Inches Inche		Casing Type: Plastic			
Mail Thickness: 0.39 Mail Thickness: 0.237 Inches	83 Blue Gray Clay	Size OD: 6 Inches	Size OD: 4.5 Inches		es
Fine Grained Sandstone Bottom at: 105 FT Top: 100 FT Bottom Drawdown Minutes: Sec Recovery				Depth To water level	(feet)
113 Green Shale Shale Shale Shale Shale Shale Perforations Perforations Perforations Perforations Perforations Size: 1:00 42.028 1:00 39.862 1:00 39.862 1:00 39.862 1:00 39.862 1:00 39.862 1:00 39.94 1:00 37.97 1:00 37.27 1:00		2.24.20			Pacavani
121 See Comments Sandstone From: 11 FT to: 140 FT 0.125 Inches x 12 Inch		Bottom at: 105 F I	1140 FT		
124				1:00	
127 Greenish Gray Shale					
131		from: FT to: FT	Inches x Inches		
From: OFT 10: 105 FT 5:00 36.45	131 Light Gray Shale		phloto		
Seal: Unknown Screen ID: Inches 12:00 35.827	140 Coarse Grained Sandstone				
Seal: Unknown from: FT to: FT 10:00 35.827			and a stranger of		
Screen Type: Unknown Screen ID: Inches 12:00 35.46			to: FT		
From: FT to: FT Slot Size: Inches		1 T (1 T) T		10:00	35.663
Screen Type: Unknown Screen ID: Inches 16:00 34.875					
Screen Installation Method: Unknown 25:00 34:613					
Fittings		from: FT to: FT			
Top: Unknown Bottom: Unknown 35:00 33.957 Pack: Unknown 40:00 33.825 Grain Size: Amount: Unknown 50:00 33.629 Geophysical Log Taken: 60:00 32.48 Retained on Files: 75:00 32.48 Additional Test and/or Pump Data 90:00 32.48 Chemistries taken By Driller: No 90:00 32.48 Pilless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches Comments: AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Top: Unknown 35:00 33.957 40:00 33.825 60:00 32.48 75:00 32.48 75:00 32.48 75:00 32.48 75:00 32.48 75:01 32.48 75:02 32.48 75:03 33.957 Recomments 90:00 32.48 75:00			od: Unknown		
Pack: Unknown Grain Size: Amount: Unknown Geophysical Log Taken: Retained on Files: Additional Test and/or Pump Data Chemistries taken By Driller: No Held: Documents Held: Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Amount: Unknown 50:00 33.825 60:00 32.48 90:00 32.48 105:00 32.48 105:00 32.48 105:00 32.48 105:00 32.48 105:00 32.48 106:00 32.48 107:00 32.48 108:00 108:00 32.48 109:			Bottom: Unknown		
Geophysical Log Taken: Retained on Files: Additional Test and/or Pump Data Chemistries taken By Driller: No Held: Documents Held: Documents Held: Drop Pipe Type: Length: FT Diameter: Inches Comments: AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Total Drawdown: 15.846 FT If water removal was less than 2 hr duration, reason why: Recommended pumping rate: 10 Gallons/Min Recommended pumping rate: 10 Gallons/Min Recommended pump intake: 82.021 FT					
Retained on Files: Additional Test and/or Pump Data Chemistries taken By Driller: No Held: Documents Held: Documents Held: Drop Pipe Type: Length: FT Diameter: Inches Comments: AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Total Drawdown: 15.846 FT If water removal was less than 2 hr duration, reason why: Recommended pumping rate: 10 Gallons/Min Recommended pumping rate: 10 Gallons/Min Recommended pumping rate: 10 Gallons/Min Recommended pumping rate: 10				50:00	
Additional Test and/or Pump Data Chemistries taken By Driller: No Held: Documents Held: Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches Comments: AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Total Drawdown: 15.846 FT If water removal was less than 2 hr duration, reason why: Recommended pumping rate: 10 Gallons/Min Recommended pump intake: 82.021 FT					
Chemistries taken By Driller: No Held: Documents Held: 105:00 32.48 Pitless Adapter Type: Drop Pipe Type: Length: FT Diameter: Inches Comments: AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Total Drawdown: 15.846 FT If water removal was less than 2 hr duration, reason why: Recommended pumping rate: 10 Gallons/Min Recommended pump intake: 82.021 FT			ump Data		
Pitless Adapter Type: Drop Pipe Type: Length: FT Comments: AIR TEST 12 GPM @ 18 METERS, 25 GPM @ 30 METERS, 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS 7. Contractor Certification		Chemistries taken By Dr	iller: No		
Drop Pipe Type: Length: FT Comments: AIR TEST 12 GPM @ 18 METERS, 25 GPM @ 30 METERS, 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS 7. Contractor Certification	Ì		Documents Held:		
Comments: AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Recommended pumping rate: 10 Gallons/Min Recommended pump intake: 7. Contractor Certification					
AIR TEST 12 GPM @ 18 METERS , 25 GPM @ 30 METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Recommended pumping rate: 10 Gallons/Min Recommended pump intake: 7. Contractor Certification 82.021 FT			Diameter: Inches	The state of the s) (((a)) Z ())
METERS. 115' - 121' HARD MG SS BOREHOLE DIAMETER - 8.75" & 4.875" SEAL - BENTONITE PRODUCT & CUTTINGS Recommended pumping rate: 10 Gallons/Min Recommended pump intake: 7. Contractor Certification 82.021 FT			8 METERS . 25 GPM @ 30		
PRODUCT & CUTTINGS Recommended pumping rate: 10 Gallons/Min Recommended pump intake: 7. Contractor Certification 82.021 FT 82.021 FT		METERS, 115' - 121' HA	ARD MG SS BOREHOLE		
Gallons/Min Recommended pump intake: 7. Contractor Certification 82.021 FT				Recommended pumping	rate: 10
7. Contractor Certification 82.021 FT		PRODUCT & CUTTING	3	Gallons/Min	
7. Contractor Certification					ake:
granuero riemo: Ilantisti un interior il ilitario della constituzione di c		7. Contractor Cert	ification		

A	\A/a4a	Mall Deillin	D	4	Well I.D.:	1495171
6	vvater	Well Drilling	Rep	ort	Map Verified:	Мар
	The data contained in this	report is supplied by the D responsibility for its accura-	riller. The	e province disclaims	Date Report Received:	2006/11/09
Designation of the last of the	nvironment		Су.		Measurements:	Imperial
	ntractor & Well Owner Informa	tion			2. Well Location	on
	ny Name: 'AYNE WATER WELL DRILLING SERV	ICCOLTD.		ompany Approval No.		
Mailing /	Address: City or To		118900 Postal Co	ode:	LSD 05 03 05:	M 3 02 5
BOX 4,	SITE 5, RR 1 CALAHOO	AB CA	TOG 0J0		Location in Quarte	
	ner's Name; Well Locat S, ROSS & SARAH	ion Identifier:			FT from N	
	x Number: Mailing Ad	dress: F	Postal Co	ode:	FT from E Lot Block	Boundan Plan
33	SITE 218,	RR 1	TOE 0H0		2 4	8020386
City: CARVEI	Province: L AB		Country: CA		The control of the co	low Obtain:
	ling Information		<i>-</i>		6. Well Yield	lot Oblain
	Work: New Well			Proposed well use:	Test Date	Start Time:
Reclaim				Domestic	(yyyy/mm/dd):	
Date Re	of Drilling: Rotary	ials Used: Unknown		Anticipated Water Requirements/day	2005/06/21 Test Method: Air	11:00 AM
Flowing	Well: No Rate:	Gallons		Gallons	Non pumping	72.08 FT
Gas Pres	sent: No Oil Pr	esent: No		1	static level:	
	mation Log	5. Well Completion			Rate of water removal:	10 Gallons/Min
Depth from		Date Started(yyyy/mm/dd		Completed mm/dd):	Depth of	318.209 FT
ground	Lithology Description	2005/06/20	2005/0		pump intake:	
level (feet)		Well Depth: 320 FT		ole Diameter: 5.125	Water level at end of	288.7 FT
48	Brown Silty Clay	Casing Type: Plastic	Inches	Type: Plastic	pumping:	
65	Gray Clay	Size OD: 6 Inches	Size C	DD: 4.5 Inches	Distance from top of	
80	Mixed Clay & Silt	Wall Thickness: 0.5 Inche	Wall T	hickness: 0.25	casing to ground level:	Inches
105 155	Fine Grained Sand Gray Sandy Clay	Trail Thekitess. 6.6 Here	inches		Depth To wate	r level (feet)
158	Gray Shale	Bottom at: 263 FT	320 F	60 FT Bottom:	Elapsed	Time
161	Gray Sandstone	Perforations		ations Size:	Drawdown Minutes 0:0	
165 169	Green Shale Gray Sandstone	from: 270 FT to: 317 FT from: FT to: FT		Inches x 12 Inches x Inches	1:0	
171	Gray Shale	from: FT to: FT		x Inches	2:0	
178	Gray Sandstone	Perforated by: Saw			3:0 4:0	
184 194	Green Shale	Seal: Shale Trap & Bento from: 0 FT	nite to: 263	FT	5:0	
200	Greenish Gray Medium Grained Shale Gray Sandstone	Seal: Cuttings		. 50000000	6:0	
207	Gray Shale	from: 0 FT Seal: Unknown	to: 263	3 FT	7:00 8:00	
209	Gray Sandstone	from: FT	to: FT		9:00	
215 218	Gray Shale Gray Sandstone	Screen Type: Unknown		n ID: Inches	10:0	
219 230	Green Shale	from: FT to: FT Screen Type: Unknown		ze: Inches n ID: Inches	12:0 14:0	
230	Gray Sandstone	from: FT to: FT	Slot Si	ze: Inches	16:0	
232 262	Green Shale Gray Sandstone	Screen Installation Method	d: Unkno	wn	20:0	0 154.035
267	Green Shale	Fittings Top: Unknown	Bottom	ı: Unknown	25:0 30:0	
276	Gray Sandstone	Pack: Unknown	Dotton	51111151111	35:0	
277 282	Green Shale	Grain Size:	Amoun	nt: Unknown	40:0	0 113.484
295	Gray Sandstone Green Shale	Geophysical Log Taken: Retained on Files;			50:0	0 103.773
297	Gray Sandstone	Additional Test and/or Pur			60:0 75:0	
312	Green Shale	Chemistries taken By Drill	er: No		90:0	
	Gray Sandstone Brownish Gray Shale	Held: Pitless Adapter Type:	Docum	nents Held:	105:0	00 83.629
320	Blownish Gray Shale	Drop Pipe Type:			Total Drawdown: 21	
		Length: FT	Diamet		lf water removal wa duration, reason wh	
		Comments; PLAN: LAKE COUNTRY E	ST			,
		I Sun Dune Gooden Tr				
					Recommended pur	ping rate: 8
				1	Gallons/Min	
		7.0		The state of the s	Recommended purn 216.535 FT	ip intake:
		7. Contractor Certifi Driller's Name:		PEDCETOFICED	Type Pump Installed	, —
		Codification No.	440EE	DENGO I KEISEK II.	Pump Type:	

A Water	Well Drilling F	Rena	ort	Well I.I	D.; erified:	17150 Map	41
The data contained in this	report is supplied by the Drill	er. The r	province disclaims	Date R	Report	2006/	10/12
Alberta	esponsibility for its accuracy.		or or more discontinuo	Receiv			
Environment					rements:	Imperi	aı
1. Contractor & Well Owner Information		W C	manu Annasual Na		Il Location	on Dage	Westo
Company Name: SUMMERS DRILLING LTD.		iling Cor 9554	npany Approval No.:	LSD	Sec IW	o rege	M
Mailing Address: City or Tow		stal Cod	e:	12	03 053		5
	AIN AB CA T7. on Identifier:	Z 1L4		Locatio	n in Quarte from N		oundan
TAYLOR, TRUDY BOWEN LA				FT	from E	В	oundary
P.O. Box Number: Mailing Add	dress: Po	stal Cod	e:	Lot 9	Block 2	Plar	า 0011
21 SITE 11 RF City: Province:		untry:		Well El		low Obta	
CARVEL AB	CA			FT	and the last of the last of the last	lot Obtai	n
3. Drilling Information					II Yield		
Type of Work: New Well			Proposed well use:	Test Da		Start 7	Time:
Reclaimed Well Date Reclaimed: Mater	ials Used: Unknown		Domestic Anticipated Water	2003/0	nm/dd): 2/26	11:00	AM
Method of Drilling: Rotary	iais Osca. Officiowii		Requirements/day	Test M	ethod: Air	0 10.5550	
Flowing Well: No Rate:	Gallons		Gallons	Non pu static le		70.013	3 FT
	esent: No			Rate of		6.001	
4. Formation Log	5. Well Completion	Date C	ompleted	remova	al:	Gallor	ns/Min
Depth from	Date Started(yyyy/mm/dd):	(yyyy/m	nm/dd):	Depth		180 F	Т
ground Lithology Description	2003/02/25	2003/0	2/26	pump i Waler i	level at	180 F	Т
level (feet)	Well Depth: 195 FT	Boreho Inches	le Diameter: 7.875	end of			
35 Silty Clay	Casing Type: Plastic		ype: Plastic	pumpir	ng: ce from top	of 19 Inc	hoe
70 Brown Silty Clay	Size OD: 6 Inches	Size O	D: 4.5 Inches		lo ground	or ro mc	1162
71 Coal 115 Gray Silty Sand	Wall Thickness: 0.39 Inches	Wall Th	nickness: 0.288	level:	_		
115 Gray Silty Sand 120 Gravel		Top: 14	I5 FT Bottom:	De	pth To wate Elapsed		eet)
135 Silty Clay	Bottom at: 156 FT	195 FT	Victoria de la companya de la compan	Drawd	lown Minute		ecovery
150 Gray Shale	Perforations from: 156 FT to: 195 FT		tions Size: ches x 2 Inches		0:0		180
180 Green Shale 195 Sandstone	from: FT to: FT		x Inches	_	1:0		122 108
Too Schablone	from: FT to: FT	Inches	x Inches	!	3:0		160
	Perforated by: Saw Seal: Bentonite Chips/Table	ote			4:0		152
	from: 0 FT	to: 156	FT	<u> </u>	5:0 6:0		143
	Seal: Unknown	to: CT		<u> </u>	7:0		126
	from: FT Seal: Unknown	to: FT			8:0	00	119
	from: FT	to: FT			9:0		115
	Screen Type: Unknown from: FT to: FT		ID: Inches ze: Inches		10: 12:		111 107
	Screen Type: Unknown		ID: Inches		14:		101
	from: FT to: FT	Slot Siz	ze: Inches		16:	00	93
	Screen Installation Method	: Unknov	vn	-	20: 25:		86 84
	Fittings Top: Unknown	Bottom	: Unknown	-	30:		82
	Pack: Unknown				35:	00	80
	Grain Size:	Amoun	t: Unknown		40:		78
	Geophysical Log Taken: Retained on Files:			-	50: 60:		77 76
	Additional Test and/or Purn				75:		75
	Chemistries taken By Drille		ents Held:		90:		74
	Held: Pitless Adapter Type:	DOCUIT	enta i ielu.	1-	105		73
	Drop Pipe Type:			Total C	120 Drawdown: 1		72 FT
	Length: FT	Diamet	er: Inches	If wate	r removal w	as less t	han 2 h
	Comments:				n, reason w		
					nmended pu Gallons/Min		ate:
	7. Contractor Certifi	cation			nmended pu	mp intak	e:
			(NEW) CAOUETTE	179.98	1/ -1		

Appendix B Production and Observation Well Logs

Matar	Wall Drilling	Dan	ort				
The data contained in this	Well Drilling report is supplied by the Dri	In The	DIL	Well I.D.: Map Verified:	1165411 Not Verified		
The data contained in this	responsibility for its accuracy		province disciains	Date Report	2009/03/05		
Alberta The information contains	d in this "Water Well Drilling		rt" is unverified by	Received: Measurements:	Imperial		
	Alberta Environment						
1. Contractor & Well Owner Information Company Name:		rilling Co	ompany Approval No.:	2. Well Locatio			
CALIBRE DRILLING LTD.		ming Co 28944	ompany Approval No.,	LSD Sec Twp	Rge vvestor		
Mailing Address: City or To	wn: P	ostal Co	de:	SE 04 053	02 5		
IHC X AUR 1	GROVE ALBERTA T	7X 3B3		Location in Quarter FT from N			
WellOwner's Name: Well Loca	tion Identifier:			FT from N	Boundary Boundary		
FAWN MEADOWS DEVELOPMENT INC.				Lot Block	Plan		
P.O. Box Number: Mailing Ad	Idress: P	ostal Co	de:	Well Elev: Ho	ow Obtain:		
SUITE 60	7 4603 VADCITY DDIVE	3A 2V7			ot Obtain		
City: NW Province:	200	ountry:		6. Well Yield			
CALGARY AB	C			Test Date	Start Time:		
3. Drilling Information				(yyyy/mm/dd): 2008/06/13	12:00 PM		
Type of Work: New Well			Proposed well use:	Test Method: Air			
Reclaimed Well Date Reclaimed: Mate	rials Used: Unknown		Domestic Anticipated Water	Non pumping static level:	19.259 FT		
Method of Drilling: Rotary	Hais Osed, Unknown		Requirements/day	Rate of water	30		
Flowing Well: No Rate	: Gallons		Gallons	removal:	Gallons/Min		
	resent: No		1	Depth of	140.092 FT		
4. Formation Log	5. Well Completion			pump intake: Water level at	110.3 FT		
Depth from	Date Started(yyyy/mm/dd)	_ Date (Completed mm/dd):	end of			
ground Lithology Description	2008/06/12	2008/		pumping:			
level	Well Depth: 240 FT		ole Diameter: 8.75	Distance from top o casing to ground	1 23.622 Inches		
(feet) 18 Brownish Yellow Till	Casing Type: Steel	Inches	Type: Plastic	level:	11101100		
43 Blue Gray Till	Size OD: 7 Inches		DD: 4.94 Inches	Depth To water			
52 Gray Fine Grained Sand	Wall Thickness: 0.231		hickness: 0.238	Elapsed Drawdown Minutes			
90 Blue Gray Till	Inches	Inche		0:00			
151 Blue Gray Clay & Rocks 153 Brown Shale	Bottom at: 159.5 FT	Top: 1 240 F		1:00			
155 Brown Soft Sandstone	Perforations		ations Size:	2:00			
165 Light Green Shale	from: 165 FT to: 179 FT		Inches x 12 Inches	4:00			
172 Gray Medium Grained Sandstone	from: 183 FT to: 201 FT from: 217 FT to: 231 FT		Inches x 12 Inches Inches x 12 Inches	5:00			
175 Green Shale 179 Gray Medium Grained Sandstone	Perforated by: Saw	0.002	mones x 12 mones	6:00			
183 Green Shale	Seal: Driven			7:00			
188 Gray Medium Grained Sandstone	from: 0 FT Seal: Shale Trap	to: 15	9.5 FT	8:00 9:00			
193 Light Gray Shale	from: FT	to: 18	FT	10:0			
201 Gray Medium Grained Sandstone 217 Light Green Shale	Seal: Shale Trap			12:0			
222 Gray Medium Grained Sandstone	from: FT Screen Type: Unknown	to: 16	n ID: Inches	14:0			
225 Green Shale	from: FT to: FT		ize: Inches	16:0 20:0			
231 Gray Medium Grained Sandstone	Screen Type: Unknown		n ID: Inches	25:0			
236 Green Medium Grained Shale 240 Dark Green Shale	from: FT to: FT		ize: Inches	30:0			
Dark Green Grale	Screen Installation Method Fittings	J. Unkno	own	35:0			
	Top: Unknown	Bottor	n: Unknown	40:0 50:0			
	Pack: Unknown	20 - 20 - 20 - 20 - 20 - 20 - 20 - 20 -		60:0			
	Grain Size: Geophysical Log Taken:	Amou	nt: Unknown	75:0	0 22.047		
	Retained on Files:			90:0			
	Additional Test and/or Pur	np Data		105:0			
	Chemistries taken By Drill			120:0 Total Drawdown: F1			
	Held: Pitless Adapter Type:	Docur	nents Held:	If water removal wa			
	Drop Pipe Type:			duration, reason wh	iy:		
	Length: FT	Diame	eter: Inches	1			
	Comments:	DIAME	TED 6 25 INCUES		- 200		
	ADDITIONAL BOREHOLE WATER USED TO DRILL			Recommended pur	nping rate: 20		
	SOURCE AT CITY OF SP	RUCE	SROVE ON THE DAY	Gallons/Min	an inteles:		
	OF 2008/06/12 AT 7:30 AI TAKEN WAS 9000 LITRE			Recommended pun 147.638 FT	ib inrake:		
į	LUKEN WAYS SOON FILKE	J. AIR I	LO 1 30 GFIN @ 42.1	<u> </u>			

MAY-21-2009 15:20

CALIBRE DRILLING LTD.

780 960 6060

P. 01/01

Calibre Drilling Ltd.

Longitude NS3° 32'90.7

Box 4083 Spruce Grove, AB Phone: 780-960-2992

Latitude 6/14 131 86.1

Date: May 13-20 Customer: Foun Mardon's Development INC Phone: 403-851-9500 From То Formation Comments From Formation Comments Gasing 0 54 157 till SH-Shelf 157 159 159 163 163 55-Sandstone 175 parse Pray Sard 193 195 195 shale 197 214 214 123 MEDIUM 6R 223 229 235 ¥ 235 241 IPPA SH 245 m555 Sand stone 245 257 Cicen SH 25% 4 Liner Mark Clives SH 268 MED Green SH 271 Well Depth: 200 277 Casing bottom at: Sealed Interval: Bottom: Screen top: Bottom: Liner top: To: Perforations from: Liner Overlap: Total Liner: Rate of Water (GPM): Static Water level: Depth of Pump Intake: Water level at end of Test: Recommended Pump Intake: Casing stick up: **Total Derrick Hours**

Appendix C Pumping Test Field Reports

From:

Barrie Ibsen [fmd@fbirealty.com]

Sent:

Wednesday, July 02, 2008 2:51 PM

To:

Sparks, Shane

Subject:

Fw: [24 HR TEST

Shane,

There is an error in the data below as it was transposed from the field work sheet.

The value at the 4 minute mark on the draw down column should read 43.60 not 53.60

Talk to you tomorrow.

Barrie

-----Original Message-----

From: Barrie Ibsen

Date: 27/06/2008 10:44:26 AM

To: shanesparks@jacqueswhitford.com Subject: Fw: [SPAM] 24 HR TEST

-----Original Message-----

From: L&B Water Services Ltd

Date: 06/26/08 12:28:19 To: fmd@fbirealty.com

Subject: [SPAM] 24 HR TEST

L & B WATER SERVICES LTD.

PHONE: 780-963-8134

BOX 2503 STONY PLAIN, ALBERTA T7Z 1X9

FAX: 780-963-3414

WATER WELL

PUMP TEST

FAWN MEADOWS CLIENT:

DEVELO

WELL SE 4 53 2-W5 LOCATION:

TEST RECOVERY

PUMPING

LAPSE

JUNE 24/08 DATE:

START TIME:

12.00 AM

TEST

PROBE

METHOD:

MEASUREMENTS:

(min's)

TIME

METERS FEET

STATIC

	0		LEVEL:	21.15'	
29.40	0.30		PUMP RATE:	35 GPM (IMPERIAL)	
33.55	1	54.30	T.O.C. TO GROUND:	24"	
39.50 41.80	1.30 2 3	48.35 45.30	COMMENTS:		TEEL CASING
53.60	4	43.60		PRE TESTED 1 HR.	WELL AT 35 GPM FOR
44.90 45.90 46.70 47.30 47.80 48.25 48.95 49.75 50.70 51.40	5 6 7 8 9 10 12 15 20 25	42.45 41.30 41.00 40.60 40.20 39.90 39.30 38.65 37.85 37.40			
51.95	30	36.70			
52.50	35	36.25	PUMPING	HOUR'S	RECOVERY
52.90	40	35.85	65.30	11	25.75
53.30	45	35.50	65.80	12	25.35
53.65	50	35.15	66.30	13	24.95
54.30	60	34.60	66.70	14	24.65
	Hrs/Min's		67.10	15	24.35
55.00	1.15	33.85	67.60	16	24.15
55.65	1.30	33.25	67.80	17	23.95
56.40	1.45	32.75	68.10	18	23.65
56.90	2	32.20	68.50	19	
57.85	2.30	31.35	68.80	20	
58.65	3	30.80	69.10	21	
59.60	3.30	30.20	69.30	22	
60.20	4	29.65	69.50	23	
61.15	5	28.85	69.70	24	
62.10	6	28.15	69.90	25	
62.90	7	27.50	70.10	26	
63.60	8	27.20	TRAVEL TIME:		
64.25	9	26.65	START-UP:		SHUTDOWN:
64.30	10	26.05	PUMP TEST:		

L & B WATER SERVICES LTD.

BOX 2503 STONY PLAIN, ALBERTA T7Z 1X9

PHONE: 780-963-8134

FAX:

780-963-3414

WATER WELL PUMP TEST

CLIENT: FAWN MEADOWS DEVELOPMENT WELL LOCATION: SE 4 53 2 W5						
PUMPING	LAPSE		TEST DATE:	MAY 21/09	START TIME: 7.00 PM	
1	TIME		TEST METHOD:	PROBE		
	(min's)		MEASUREMENTS:	METERS	FEET	
19.30	0	25.00	STATIC LEVEL:	19.30'	I Im In I	
19.35	1	25.00	PUMP RATE:	10.00		
19.35	2	25.00	T.O.C.:	24"		
19.35	3	20.00	N 53 32.880' W 114			
19.35	4		COMMENTS:	OBSERVATION W	/FI I	
19.40	5		COMMENTO.	ODOLINATION VI		
19.40	6			ELEVATION TO T.O.	C. 2395 FT	
10.40	7			ELEVATION TO T.O.		
	8					
	9	•				
	10					
	15				water the second second second	
	20					
	25	25.00				
	30	25.00				
	40	25.00				
	50					
19.40	60					
19.45	75					
19.45	90					
19.45	105					
19.45	120					
	<u>HOURS</u>		PUMPING	HOURS	RECOVERY	
19.50	2 1/2		21.60	20	23.80	
19.55	3		21.80	22	23.70	
19.55	3 1/2		21.95	24	23.60	
19.60	4	25.00	22.30	28		
19.70	5	24.90	22.65	32		
19.80	6	24.85	22.95	36		
19.90	7	24.80	23.50	42		
20.20	8	24.70	23.80	48		
20.40	9	24.60	24.20	56		
20.50	10	24.50	24.60	64		
20.60	11	24.40	25.00	72		
20.75	12	24.35				
20.95	14	24.25	TRAVEL TIME:			
21.20	16	24.10	START-UP:		SHUTDOWN:	
21.40	18	23.95	PUMP TEST:			

AQTESOLV for Windows

Data Set: V:\1918\active\1034043 Fawn Meadows\Water\Pump Test\Fawn Meadows OBWELL.aqt

Tate: 05/26/09 ime: 14:56:24

PROJECT INFORMATION

Company: Fawn Meadows Development, Inc.

Location: Carvel, AB Test Date: 5-21-09

Test Well: Production Well

AQUIFER DATA

Saturated Thickness: 236.6 ft Anisotropy Ratio (Kz/Kr): 0.1 Aquitard Thickness (b'): 10. ft Aquitard Thickness (b"): 10. ft

PUMPING WELL DATA

No. of pumping wells: 1

Pumping Well No. 1: Production Well

X Location: 0. ft Y Location: 0. ft

Casing Radius: 0.66 ft Well Radius: 0.66 ft

Fully Penetrating Well

No. of pumping periods: 2

Pumping Period Data

Time (min)

Rate (gal/min)

Time (min) 4320.

Rate (gal/min)

OBSERVATION WELL DATA

No. of observation wells: 1

Observation Well No. 1: OB Well

X Location: 650, ft Y Location: 0, ft

Radial distance from Production Well: 650. ft

Fully Penetrating Well

No. of Observations: 51

Observation Data

Time (min)	Displacement (ft)	Time (min)	Displacement (ft)	
1.	0.05	360.	0.5	
2. 3.	0.05	420 .	0.6	
3.	0.05	4 80.	0.9	
4. 5.	0.05	540.	1.1	
5.	0.1	600.	1.2	
6. 7.	0.1	660.	1.3	
7.	0,1	720.	1.45	
8.	0.1	840.	1.65	
9.	0.1	960.	1.9	
10.	0.1	1080.	2.1	
15.	0.1	1200.	2.3	
20.	0.1	1320.	2.5	
25.	0.1	1440.	2.65	
30.	0.1	1680.	3.	
40.	0.1	1920.	3.35	
50.	0.1	2160.	3.65	
60.	0.1	2520.	4.2	
75.	0.15	2880.	4.5	
90.	0.15	3360.	4.9	
105.	0.15	3840.	5.3	
120.	0.15	4320.	5.7	
150.	0.2	4321.	5. <u>7</u>	
180.	0.25	4620.	5.6	
210.	0.25	4680.	5.55	
240.	0.3	5520.	4.5	
 300.	0.4			

SOLUTION

Pumping Test

Aquifer Model: Leaky Solution Method: Hantush

VISUAL ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	
T	226.8	ft ² /day
S	0.000643	
r/B'	0.1	
ይ'	0.1	
r/B"	0.	
"מ	0.	

K = T/b = 0.9585 ft/day (0.0003381 cm/sec)

Ss = S/b = 2.718E-6 1/ftK'/b' = $3.727E-9 min^{-1}$

K' = 5.368E-5 ft/day

\UTOMATIC ESTIMATION RESULTS

Estimated Parameters

Parameter	Estimate	Std. Error	Approx. C.I.	t-Ratio	^
T	280.5	74.86	+/- 150.6	3.747	ft ² /day
S	0.0008714	0.0001605	+/- 0.0003229	5.429	
r/B'	1.0E-5	0.1212	+/- 0.2439	8.249E-5	
ß'	1.0E-5	0.07361	+/- 0.1481	0.0001359	
r/B"	0.	not estimated			
ß"	0.	not estimated			

C.I. is approximate 95% confidence interval for parameter t-ratio = estimate/std. error No estimation window

K = T/b = 1.186 ft/day (0.0004183 cm/sec) Ss = S/b = 3.683E-6 1/ft $K'/b' = 4.611E-17 \text{ min}^{-1}$ K' = 6.639E-13 ft/day

Parameter Correlations

	Т	S	r/B'	ß'
T	1.00	0.99	0.00	-1.00
S	0.99	1.00	0.00	-1.00
r/B'	0.00	0.00	1.00	0.00
ß'	-1.00	-1.00	0.00	1.00

Residual Statistics

for weighted residuals

Sum of Squares	0.6907 ft ²
Variance	0.0147ft^2
Std. Deviation	0.1212 ft
Mean	0.06657 ft
No. of Residuals	51
No. of Estimates	4

FAWN MEADOWS GROUNDWATER SUPPLY ANALYSIS

Closure July 20, 2009 REVISED JUNE 2011

Appendix D Water Quality Lab Reports

1
1
1
}

333 - 50th Avenue SE Calgary, AB T2G 2B3 Phone (403) 297-0868 Fax (403) 297-0869

E-mail: kaizenlab@kaizenenviro.com



ANALYTICAL DATA REPORT

Client Company: L & B Water Services Ltd.

Date Received: May 25 2009

Lab File #: 119089

Client Contact:

Bill Riedlinger

Date Reported:

Client Project #: Fawn Meadows Development, SE 4-53-2W5

Sample ID:

119089-1, Fawn Meadows @ 12:00pm

Date Sampled: May 24, 2009

Parameter Name	Units	Results	
Total Kjeldahl Nitrogen	mg/L	1.3	
Ammonia-N	mg/L	0.14	
Sulphide (H2S)	mg/L	<0.005	
Phenol Total	mg/L	TBA	
Package Name: Total Metals in Water			
Parameter Name	Units	Results	
Total Aluminium (AI)	mg/L	0.065	
Total Antimory (Ch)		0.0002	

Parameter Name	Units	Results	
Total Aluminium (AI)	mg/L	0.065	
Total Antimony (Sb)	mg/L	0.0003	
Total Arsenic (As)	mg/L	0.0045	
Total Barium (Ba)	mg/L	0.012	
Total Beryllium (Be)	mg/L	<0.0005	
Total Boron (B)	mg/L	0.3826	
Total Cadmium (Cd)	mg/L	0.0037	
Total Chromium (Cr)	mg/L	<0.005	
Total Cobalt (Co)	mg/L	0.0003	
Total Copper (Cu)	mg/L	0.0178	
Total Iron (Fe)	mg/L	0.141	
Total Lead (Pb)	mg/L	0.0041	
Total Manganese (Mn)	mg/L	0.0137	
Total Molybdenum (Mo)	mg/L	0.0006	
Total Nickel (Ni)	mg/L	<0.0004	
Total Selenium (Se)	mg/L	<0.0009	
Total Silver (Ag)	mg/L	0.0002	
Total Strontium (Sr)	mg/L	0.096	
Total Thallium (TI)	mg/L	<0.0003	
Total Tin (Sn)	mg/L	<0.0002	
Total Vanadium (V)	mg/L	0.0006	
Total Zinc (Zn)	mg/L	0.09	

Stantec

FAWN MEADOWS GROUNDWATER SUPPLY ANALYSIS

Closure

August 2009

Appendix D
Water Quality Lab Reports

333 - 50th Avenue SE Calgary, AB T2G 2B3 Phone (403) 297-0868 Fax (403) 297-0869

E-mail: kaizenlab@kaizenenviro.com



ANALYTICAL DATA REPORT

Client Company: L & B Water Services Ltd.

Date Sampled: May 24, 2009

Lab File #: 119089

Client Contact:

Bill Riedlinger

Date Received: May 25, 2009

Client Project #:

Fawn Meadows Development, SE 4-53-2W5

Date Reported:

Sample ID:

119089-1, Fawn Meadows @ 12:00pm

Parameters	Units	Results	CDWQG* Guideline Limits
pH @ 25°C		8.1	6.5-8.5 (AO)
EC @ 25°C	mS/cm	2.09	
Sodium	mg/L	389	≤200 (AO)
Potassium	mg/L	0.91	
Calcium	mg/L	5.80	
Magnesium	mg/L	0.49	
iron (dissolved)	mg/L	<0.01	≤0.3 (AO)
Fluoride	mg/L	0.95	1.5 (MAC)
Chloride	mg/L	0.66	≤250 (AO)
Nitrite	mg/L	<0.01	3.2 (MAC)
Nitrate	mg/L	<0.01	45 (MAC)
Phosphate	mg/L	<0.01	
Carbonate	mg/L	<0.01	
Bicarbonate	mg/L	764	
Sulphate	mg/L	374	≤500 (AO)
Total Alkalinity as CaCOs	mg/L	634	
Total Hardness as CaCOs	mg/L	16.5	
Total Dissolved Solids	mg/L	1152	≤500 (AO)
Odor (physical)		Odorless	
Turbidity (physical)		Few Sediments	
Appearance (physical)		Colorless	
Microbiology	THE EXPLICATION PROFESSIONAL PR		
Total Coliforms	CFU/100 mL	<1	0 (MAC)
Fecal Coliforms	CFU/100 mL	<1	0 (MAC)

Comments on Water Quality

The highlighted parameter(s) exceed the limit(s) - a suitable treatment system may be used to remove these parameters

*CDWQG = Canadian Drinking Water Quality Guidelines, CCME 2006	
MAC = Maximum Acceptable Concentration (affects health), AO = Aesthetic Objective (does not affect health but affects color, taste e	tc.)

Lab Manager:

QA/QC Reviewed By: _

Note: The results in this report relate only to the items tested. Information is available for any items in 5.10.2 of ISO/IEC 17025 that cannot be put on a test report.

Detailed test methodologies and QA/QC data available upon request.

333 - 50th Avenue SE Calgary, AB T2G 2B3 Phone (403) 297-0868 Fax (403) 297-0869

E-mail: kaizenlab@kaizenenviro.com



Sample ID: 119089-1, Fawn Meadows @ 12:00pm

Date Sampled: May 24, 2009

Package Name: Dissolved Metals In Water

Dissolved Aluminium	mg/L	<0.003
Dissolved Antimony	mg/L	<0.0002
Dissolved Arsenic	mg/L	<0.0004
Dissolved Barium	mg/L	0.008
Dissolved Beryllium	mg/L	<0.0005
Dissolved Boron	mg/L	0.3704
Dissolved Cadmium	mg/L	<0.0002
Dissolved Chromium	mg/L	<0.005
Dissolved Cobalt	mg/L	<0.0003
Dissolved Copper	mg/L	0.0097
Dissolved Iron	mg/L	<0.002
Dissolved Lead	mg/L	<0.0004
Dissolved Manganese	mg/L	0.0097
Dissolved Molybdenum	mg/L	0.0005
Dissolved Nickel	mg/L	<0.0004
Dissolved Selenium	mg/L	<0.0009
Dissolved Silver	mg/L	<0.0001
Dissolved Strontium	mg/L	0.092
Dissolved Thallium	mg/L	<0.0003
Dissolved Tin	mg/L	<0.0002
Dissolved Uranium	mg/L	<0.0003
Dissolved Vanadium	mg/L	<0.0002
Dissolved Zinc	mg/L	<0.02

Comments:

Phenols were subcontracted to a third party laboratory.

Test Methodologies*;

Ammonia (water): Based on APHA 4500-NH3 Dissolved Metals: Based on APHA 3120B

Sulphide: Based on APHA 4500- SE-Auto Colorimetry

TKN (water): Based on APHA 4500-N-C

Total metals (water): Based on APHA 3030E & 3120B

Total Phenol (water): Based on APHA 5530

Lab Manager:

QA/QC Reviewed By:	4			
		1100	32/1 20 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3	

Note: The results in this report relate only to the items tested. Information is available for any items in 5.10.2 of ISO/IEC 17025 that cannot be put on a test report.

*Detailed test methodologies and QA/QC data available upon request.









Wastewater System Analysis

Fawn Meadow Project NC-145

February 201

REPORT TO

NorCan Consulting

FOR

Wastewater System Analysis

ON

Fawn Meadows Development (NC-145)

PRINCIPAL CONTACT

Frank Florkewich

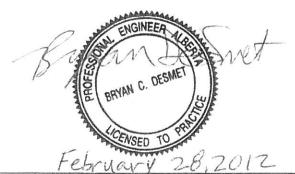
NorCan Consulting Group

February 2008

Revised February 2012

SD Consulting Group – Canada, Inc 796 Cherokee Ave St. Paul, MN 55107

I hereby certify that this report was prepared by me or under my direct supervision and that I am duly Registered Professional Engineer under the laws of the Province of Alberta.



Bryan DeSmet, P. Eng., SD Consulting Group

Alberta Permit to Practice #P10913

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APPENDICES

Appendix A - Soil Pit Logs

Appendix B - Cost Tables for Wastewater System

EXECUTIVE SUMMARY

REPORT PURPOSE

The purpose of this report is to provide an evaluation of the costs and benefits of various options for a community water and wastewater system at the Fawn Meadows Development. This report contains information and analyses on wastewater characteristics, quantities, and treatment alternatives.

ESTIMATED WASTEWATER FLOWS

It is assumed that there will only be domestic wastewater from residential development entering the wastewater facility. Wastewater design flows, based on water demand, are summarized in **Table ES-1**. Alberta's *Standard of Practice for Onsite Wastewater 2009* specifies a minimum flow of 0.34 m³/day per person (75 igpd). Therefore, the design flow of 0.378 m³/day per person, based on water demand, is a conservative assumption for the calculation of wastewater flow.

Table ES-1 Estimated Wastewater Flows

Unit Type		Residents/ Dwelling	Total Residents	Wastewater Flow Per Capita (m³/day)	Total Wastewater Flow (m³/day)	
Detached Dwellings	36	2	72	0.378	27.2	
Semi-Detached Dwellings	24	2	48	0.378	18.1	
Villa-Style Dwellings	56	2	112	0.378	42.4	
A	100	2	200	0.378	75.6	
Apartment-Style Dwellings	40	1	40	0.378	15.1	
Staff – Supportive Living Centre	-	-	10	0.378	3.78	
Staff – Café and Gas Bar			2	0.378	0.76	
Condominium Maintenance Staff			4	0,378	1.51	
Rec Center and Community Hall			10	0.378	3.78	
Totals	256		498		188.23	

ONSITE SOILS EVALUATION

On December 13, 2007, Jacques Whitford NAWE conducted a soils investigation consisting of 16 pits on the proposed development site. For the recommended disposal area, a soil loading rate of 13.2 liters per day per square meter is recommended due to the clay loam soils. Results from the soils investigation indicate that soil disposal is feasible at Fawn Meadows.

WASTEWATER TREATMENT FACILITY OPTIONS EVALUATED

The wastewater treatment process can be divided into three categories: collection, treatment, and disposal. Collection system options are not evaluated in this report.

The wastewater treatment stages include primary and secondary treatment. Primary treatment will be handled by the septic tanks. Three secondary treatment options have been evaluated, and are summarized is **Table ES-2**. We recommend that an application is sent to Alberta Environment to install an AdvanTex Treatment System. Both the total capital and life cycle costs are the lowest of the four treatment system alternatives. The AdvanTex system is an approved technology in Alberta and has over 500 installations.

Two disposal options are evaluated in this report, and are summarized in **Table ES-2**. Soil disposal is feasible at Fawn Meadows. The soils investigation has identified sufficient area to support the installation of a soil disposal system. JW NAWE recommends using both subsurface drip and chambered trenches for disposal. Drip requires less area to install and has significantly lower total capital costs. However, drip also has much higher maintenance requirements and is more susceptible to freezing. In contrast, trenches have lower maintenance requirements and are less likely to freeze during the winter months.

Table ES-2 Wastewater Technologies Evaluated

Treatment/Disposal Stage	Technologies Evaluated	
Primary	Septic Tanks	
Secondary	AdvanTex Units	
	FAST Units	
	Recirculating Gravel Filter	
	Coarse Sand Filter	
	Subsurface Drip Irrigation	
Disposal	Chambered Trenches	

COST AND AREA REQUIREMENTS

Each of the technologies listed in **Table ES-2** have been evaluated for both cost and land requirements. **Table ES-3** summarizes the recommended technologies for the community wastewater system. Each of the wastewater system options (left column of **Table ES-3**) includes both secondary treatment and disposal technologies.

Table ES-3 Recommended Wastewater Technology

Treatment / Disposal Stage	Technology	Total Capital Costs		Area, hectares
Secondary	AdvanTex	\$	991,206	0.3
Disposal	Chambered Trenches	\$	1,080,476	2.0
	Totals:	\$	2,071.682	2.3

1.0 Introduction and Existing Site Conditions

A new development, Fawn Meadows, is being proposed by Mr. Barrie Ibsen and Mr. Ambrose Comchi. The property is located south of Highway 16 and west of Highway 770 (West of Edmonton, Alberta). The ultimate build-out for the development will include:

- 36 Detached Single Family Homes
- 24 Semi-Detached Dwellings
- 56 Villa Style Dwellings
- 140 Supportive Living Units
- · Café and Gas Bar
- Rec Center and Community Hall

1.1 PURPOSE OF REPORT

The purpose of this report is to provide an evaluation of the costs and benefits of various options for a community wastewater system at Fawn Meadows. This report contains information and analyses on wastewater characteristics, quantities, and treatment alternatives. Included in the scope of the report are recommendations of the most viable methods of wastewater treatment and disposal.

1.2 EXISTING SITE CONDITIONS

Figure 1-1 is a map of the area surrounding the Fawn Meadows Development. **Figure 1-2** is a topographical map of the surrounding area.

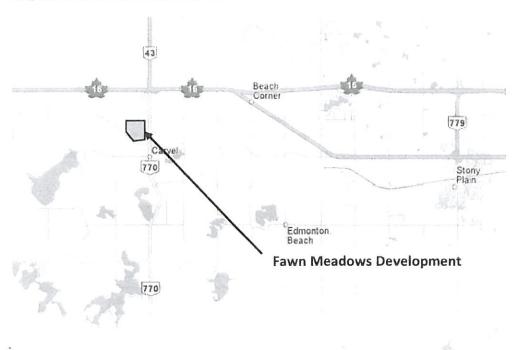


Figure 1-1 Map to the Fawn Meadows Site

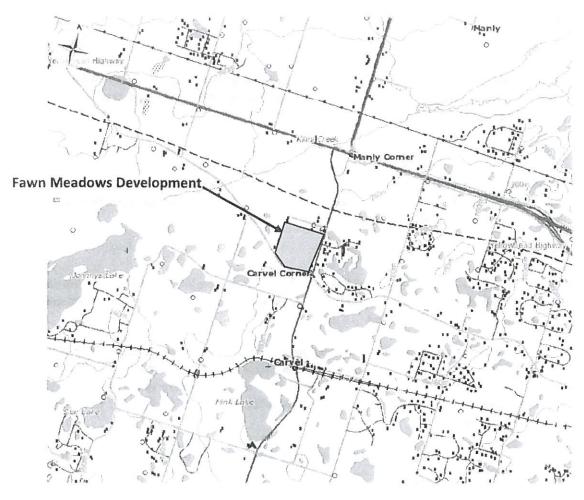


Figure 1-2 Topographical Map of the Fawn Meadows Site and Surrounding Area

1.3 CLIMATE SETTING OF PROJECT SITE

The climate in Parkland County is classified as a warm summer continental climate that experiences wet summers with drier winters. The average temperature in the region is 2.6 degrees Celsius and precipitation averages 468 mm per year, with an average of 338 mm falling between May and September.

1.4 GENERAL INFORMATION

The permit authority for a wastewater treatment and disposal system is Alberta Environment and Water (AEW). There are three documents that provide design guidance: (1) Standards and Guidelines for Municipal Waterworks, Wastewater and Storm Drainage System January 2006, (2) Alberta Private Sewage Systems Standard of Practice 2009, and (3) Municipal Policies and Procedures Manual.

The regulatory requirements for wastewater facilities, such as the one evaluated in this report for Fawn Meadows, are not completely identified in Alberta. While this system is a private onsite system, the estimated wastewater flow is larger than typical onsite systems; therefore, the regulations governing these systems are

not completely applicable. The other set of standards that exist in Alberta are for municipal wastewater systems; a wastewater facility for the Fawn Meadows Development will not be a public municipal system.

At this time, the SD Consulting Group (SD) is engaged in this permit process in all three regions of AEW. We have established good relationships with AEW and are now accepted as leaders in the decentralized field. In addition, we have received approval for the largest decentralized wastewater project in Alberta, which is also located in Rocky View County. This project was approved by Rocky View and AEW in 2011 and will be constructed in the spring of 2012.

Discussions with AEW have confirmed that provincial approval for a communal system may be granted by AEW upon the developer's application. This approval will be a requirement of Parkland County through the subdivision and endorsement process. Parkland County has indicated that the responsibility of ownership, operation, maintenance, and replacement of the wastewater system will not fall under their jurisdiction. This will be the responsibility of the utility formed by the condominium association.

1.5 SOIL INFILTRATION REQUIREMENTS

Regulations for soil infiltration systems exist for flows less than 25 m³/d (5,500 imperial gallons/day), but not greater than 25 m³. The document, *Alberta Private Sewage Systems Standard of Practice 2009* contains design standards for soil infiltration systems.

The exact regulations governing this proposed disposal facility are unknown. SD Consulting has estimated the size and cost of the drainfield with the 50% reduction (identified below). Septic tanks have been sized at 2.0 times the estimated daily flow unless the manufacturer of the treatment system recommends a different volume. During the design phase of the system, JW NAWE will work with regulators to determine the final sizing of the system.

- 1) Section 7.1.6: Wastewater effluent entering the drainfield shall have a vertical separation from the groundwater table of:
 - i. 0.9 meters if wastewater is treated by a packaged treatment system
 - ii. 1.5 meters if wastewater is septic tank effluent
- 2) Section 7A.1.3: A disposal field when supplied with effluent from a packaged sewage treatment plant may have a 50% reduction in area when effluent is pressure distributed.

2.0 WASTEWATER FACILITY DESIGN CONSIDERATIONS

2.1 DESIGN CONSIDERATIONS

The design flow for wastewater treatment facilities is based on a number of factors. For example, the design flow should consider the number of bedrooms in each house, the current or proposed population, the number of water using appliances, and the number of commercial enterprises. For appropriately sizing the proposed wastewater treatment facilities, projected population is the most important factor. Additional design parameters include the potential for expansion and inflow and infiltration of rainwater and groundwater into a gravity sewer collection system.

2.2 WASTEWATER FLOWS

Projected wastewater flows are summarized **Table 2-1**. Alberta's *Standard of Practice for Onsite Wastewater 2009 (SOP)* specifies a minimum flow of 0.34 m³/day (75 igpd) per person. Therefore, the design flow of 0.378 m³/day per person, based on water demand, is a conservative assumption for the calculation of wastewater flow.

According to the SOP, the peak wastewater flow is based on the estimated average daily wastewater flow multiplied by a peaking factor of 4.0. Based on this peaking factor, the peak flow for the development is estimated to be 0.523 m³/min. This peaking factor is built in to the design capacity and storage in the treatment system to handle peak flow events without overloading the system.

Table 2-1 Estimated Average Daily Wastewater Flows

Unit Type	# of Units	Residents/ Dwelling	Total Residents	Wastewater Flow Per Capita (m³/day)	Total Wastewater Flow (m³/day)
Detached Dwellings	36	2	72	0.378	27.2
Semi-Detached Dwellings	24	2	48	0.378	18.1
Villa-Style Dwellings	56	2	112	0.378	42.4
Apartment-Style Dwellings	100	2	200	0.378	75.6
	40	1	40	0.378	15.1
Staff – Supportive Living Centre	-	-	10	0.378	3.78
Staff – Café and Gas Bar			2	0.378	0.76
Condominium Maintenance Staff			4	0.378	1.51
Rec Center and Community Hall			10	0.378	3.78
Totals	256		498		188.23

2.3 WASTEWATER LOADINGS

The wastewater flows from the proposed Fawn Meadows Development are domestic in strength. The concentrations summarized in Table 2-2 are a combination of information taken from the US Environmental Protection Agency document Design Manual: Onsite Wastewater Treatment and Disposal Systems and Wastewater Engineering - Treatment, Disposal, and Reuse (Metcalf and Eddy, Inc., Fourth Edition).

Table 2-2 Typical Domestic Wastewater Concentrations

Parameter	Typical Domestic Wastewater Concentration (mg/L)		
BOD ₅ (5 day Biochemical Oxygen Demand)	265		
TSS (Total Suspended Solids)	300		
NH ₃ -N (Ammonia)	48		
TN (Total Nitrogen)	60		
TP (Total Phosphorus)	8		

3.0 POTENTIAL FOR SOIL INFILTRATION

3.0 Onsite Soils Investigation

On November 29, 2007, Jacques Whitford NAWE conducted a soils investigation consisting of 16 backhoe pits on the proposed development site. The soil pits were analyzed for texture, structure, consistence, root presence, limiting layers, depth to groundwater features, and depth of frost in order to identify the best location for a community wastewater treatment system. The site is characterized by hilly terrain with wetlands in the low lying areas and better drained dry soils on the highlands. A general soil profile for the upland areas is sandy loam topsoil over increasingly fine subsoil. The lowlands had an observed soil profile of silt or fine sandy loam topsoil with silt loam subsoil. Layers of silty clay loam soils were observed in pit 9. These lowlands had water table markers at 48-66 centimeters below ground surface (bgs), making them undesirable for water disposal. The mid slopes across the site were uniform with silt loam soils for the entire depth. Some borings (e.g. pit 2-3, 6-7) had subsoil layers of clay loam as well. Copies of all soil pit logs are provided in **Appendix A** and a soil pit map is provided in **Figure 3-1**.

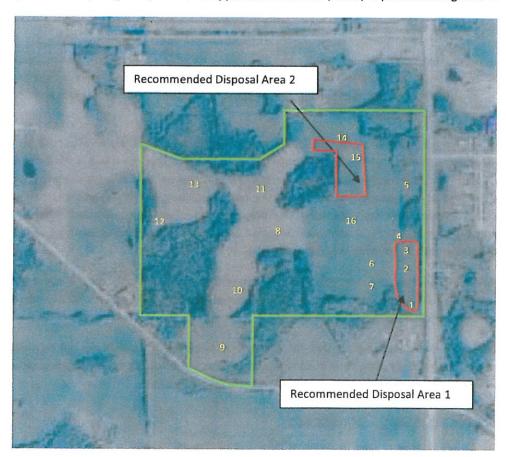


Figure 3-1 Test Pit Locations and Recommended Disposal Area

According to Alberta Environment Requirements, 0.9 meters of separation from the bottom of the drainfield to the depth of seasonal saturation is required for all onsite wastewater systems with soil disposal and pretreatment. Of the 16 soil pits, pits 1-3, 6-7, 10, and 15-16 achieved the necessary

separation distance. Therefore, these areas have been identified as "recommended soil areas" on Figure 3-1. A more detailed discussion of each area is provided below:

- "Recommended Disposal Area 1"— Conversations with the property owner indicate that the ideal location for the wastewater treatment and disposal field is along Route 770 where soil pits 1-4 were excavated. Soil Pits 1-3 consisted of well drained silt loam topsoil over loam subsoil. Pit 4 was located near a wetland and was unusable. Evidence of seasonal saturation was observed at approximately 1.3 meters below ground surface in pits 2 and 3 with no evidence observed in pit 1. Roughly 2 hectare was identified as suitable for soil disposal in this area. Additionally, the land surrounding pits 6 and 7 might be utilized for any additional disposal area that may be needed. This area provides approximately 1 hectare for soil disposal.
- "Recommended Disposal Area 2" Soil pits 15 was excavated in the north central portion of the site. This pits consisted of well drained silt loam and loam soils that might allow for a smaller disposal field for the site's wastewater. Evidence of seasonal saturation was observed at approximately 1 meter in pit 15. Conversations with the land owner indicate that this area is highly unfavorable with the development plan. However, this area may be necessary for soil disposal and provides approximately 1 hectare for soil disposal.
- Un-useable Soils Soil pits 4-5, 8-9, and 11-14 were investigated and determined to be unsuitable for soil disposal. Generally, the soils were poorly drained and fine textured, which are two characteristics of soils with poor infiltrative abilities. In addition, the required separation distance of 0.9 meters was not met in these soil pits.

Based on the information in **Section 3.1** and **Figure 3-1**, the area of the site most suitable for wastewater infiltration is about of 2.4 hectare. Another 1 hectare has also been identified in the event more area is needed. The soils in other regions of the site are not appropriate for wastewater disposal. For the recommended disposal area, a base soil loading rate of 13.2 liters/day/square meter is recommended due to the well structured clay loam soils. The base loading rate was selected based upon soil texture and structure from the *SOP*. Evidence of seasonal saturation (redoximorphic features) was identified at minimum depth of 1 meter below ground surface.

For Fawn Meadows, the wastewater will be treated prior to discharge to the soil and the treated wastewater will be dispersed using pumps instead of gravity. Therefore, the final recommended soil loading rate is 26.4 liters/day/square meter.

Because of the limited area available for soil disposal, two disposal technologies will be evaluated in this report: subsurface drip irrigation and infiltration trenches. A drip system will require approximately 1.3 hectare to be installed. A trench system will require about 2 hectare.

3.1 Hydrogeological Components

Hydrogeological information is used to evaluate how the wastewater system will affect existing groundwater conditions at the disposal site and to ensure the site has sufficient capacity to assimilate water in excess of its natural infiltration.

This process begins with a search for information from existing mapping, well logs and soil reports. The depth and direction of groundwater flow are then estimated. Based on this information, the locations of monitoring wells in

relation to the soil disposal system are decided. These monitoring wells are then sampled before startup of the wastewater system to identify background or existing groundwater conditions as a baseline sampling event. Slug testing can be performed to determine the rate of groundwater movement.

An unsaturated portion of the soil must be maintained in order to provide an aerated environment. This unsaturated, aerated zone below the discharge point provides additional filtration, nutrient uptake, adsorption, and ion exchange. For adequate treatment, soils with high permeability, such as coarse and medium sands, require a thicker unsaturated zone compared to less permeable soils like loam.

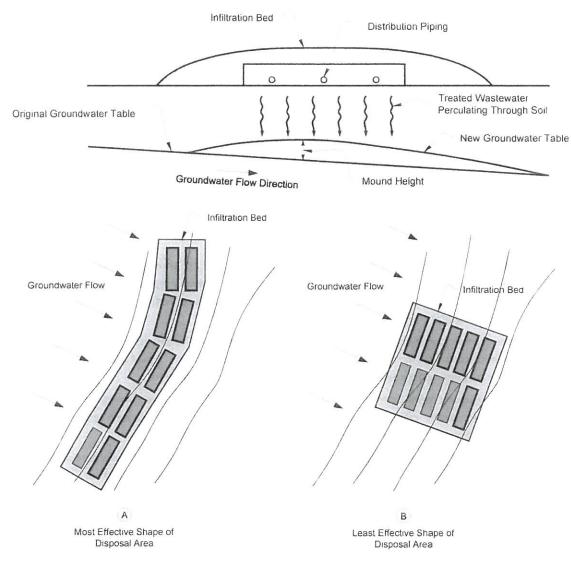
Designing a large onsite wastewater system requires avoiding the following conditions that can produce hydraulic and treatment failure:

- Lower saturated hydraulic conductivity than anticipated at the water table saturated hydraulic conductivity measures the ability of a soil to transmit water in saturated conditions.
- Lower saturated hydraulic conductivity from a limiting (restrictive) layer below the discharge point.
- Soil compaction during construction. Soil disturbance and compaction can ruin the soil's natural structure and the soil will lose its ability to infiltrate water.

Some factors that affect the design of a large soil disposal system include:

- Quality of the Applied Wastewater Wastewater treated to primary standards (i.e. septic tank
 effluent) requires more infiltrative area for the disposal system compared to wastewater treated to
 secondary standards. A biofilm on the infiltrative surface reduces the saturated hydraulic
 conductivity of the soil disposal system.
- Topography of Land and Hydraulic Gradient of Groundwater The steeper the hydraulic gradient, the
 faster groundwater travels and the less likely a mound will form. Level areas with shallow water
 tables may not be appropriate locations for a large soil disposal system.
- Limiting Layers below Discharge Point In particular, soils with clay and clay loams tend to not allow
 water to dissipate without forming a mound. Water must travel laterally and vertically fast enough
 through the soil layer that has the lowest saturated hydraulic conductivity.
- Soil Structure Besides soil texture, the structure of the soil strongly influences percolation rates. A
 silt loam with platy structure allows less water to percolate than a clay loam with strong structure.
- Direction of Groundwater Flow It is preferable to position the soil disposal system perpendicular to the direction of groundwater flow to allow better groundwater flow beneath the soil disposal system.
- Shape of Disposal System Related to groundwater flow direction, a rectangular-shaped soil disposal system aligned parallel to the ground surface contours is preferable to one that is circular or squareshaped. This reduces the hydraulic linear loading rate.
- Proximity to a Discharge or Drainage Point If the soil disposal system is located in a discharge zone,
 the potential for mounding is lower than in a recharge zone.
- Adjoining Surface Water Although the discharge of treated water is to the subsurface, wastewater
 could still impact a nearby body of water. The location of the soil disposal system will determine the
 potential and in what time frame this could happen. It is proposed that the hydrogeological
 investigation will consider the time of travel and potential for the subsurface discharge to reach
 surface water.

Figure 3-2 illustrates the importance of direction of groundwater flow, linear loading rate, and depth to groundwater. The basic concept is to design a large soil disposal system that can handle the flows applied to it. One basic strategy is to spread out the disposal system. The higher the flow, the more these hydrogeological factors affect final design of the disposal field.



A and B distribute the same amount of water per square foot. However, A distributes less water per lineal foot across the direction of groundwater flow.

Figure 3-2 Conceptual Drawing of Hydrogeological Issues for Large Soil Disposal Systems

4.0 Onsite Wastewater Treatment and Disposal

The treatment system options evaluated in this report are shown in **Table 4-1**. For any component that lists more than one option, either option could be chosen as a stand-alone technology for that component (for example, for disposal, either drip <u>or</u> trenches could be selected).

Table 4-1 Treatment Options Matrix

Treatment/Disposal Stage	Technologies Evaluated						
Primary	Septic Tanks						
	AdvanTex Units						
S	FAST Units						
Secondary	Recirculating Gravel Filter						
	Coarse Sand Filter						
Disassal	Subsurface Drip Irrigation						
Disposal	Infiltration Trenches						

4.0 PRIMARY TREATMENT

The first step in the treatment process is to remove large solids from the wastewater. Removal of these solids is accomplished by settling, skimming, or screening. Either septic tanks or mechanical screening can be used for solids removal. For small treatment systems, the same unit processes used for solids removal are also used for primary treatment. Primary treatment removes suspended solids from wastewater that can be easily settled or filtered.

A threshold of 80,000 igpd of wastewater is the typical transition point from a passive primary treatment system (e.g., septic tanks) to one that includes some mechanical components, such as screening. Since the design flow for the Fawn Meadows facility is below this threshold, only septic tanks will be evaluated for primary treatment. Those costs vary, depending on the treatment system and are therefore included in the four cost tables for secondary treatment.

4.1 SECONDARY TREATMENT

The secondary stage of treatment is where Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) are further removed down to concentrations of 25 mg/L each. A number of secondary treatment technologies are capable of treating wastewater with flows and strengths typical of those from the Fawn Meadows development. All of these technologies can be combined with the tertiary treatment and disinfection system evaluated in this report. The following technologies are described along with advantages and disadvantages: AdvanTex, FAST, Recirculating Gravel Filter, and Coarse Sand Filter.

4.1.1 ADVANTEX AEROBIC TREATMENT UNITS

The AdvanTex treatment system has been included in this evaluation. The AdvanTex units are one type of fixed media, attached growth treatment system. Individual fiberglass tanks house a number of textile fabric sheets that provide a medium for bacterial growth. Refer to Figure 4-1 for a picture of the AdvanTex unit. The advantages and disadvantages of these systems include:

Advantages of "AdvanTex Unit":

- · Minimal land area requirement
- Capable of a high level of treatment
- Prepackaged unit is simple to install
- · Textile fabric easily replaceable
- Single home model (AX-20) has NSF 40 certification, which increases likelihood of approval from Alberta Environment
- · Approved technology in Alberta

Disadvantages of "AdvanTex Unit":

- More complex piping and valving than other options
- No carbon cycle benefits
- Continual operation of aeration equipment needed to maintain treatment



Source: Orenco Systems Inc.

Figure 4-1 AdvanTex Treatment Unit

4.1.2 FAST AEROBIC TREATMENT UNITS

The FAST (Fixed Activated Sludge Treatment) system has been included in this evaluation. FAST units are another type of fixed media, attached growth treatment system. The media is placed inside a concrete or fiberglass tank and air is injected into the media to provide oxygen to the bacteria. A major advantage to this system is that there are already wastewater facilities in Alberta over 35 m³/day per day that use this technology. Refer to Figure 4-2 for a picture of the FAST unit. The advantages and disadvantages of these systems include:

Advantages of "FAST Unit":

- Minimal land area requirement
- · Capable of a high level of treatment
- Simple to operate
- Simple installation for contractor

 Single home models have NSF 40 certification, which increases likelihood of approval from Alberta Environment

Disadvantages of "FAST Unit":

- · Odor control can be an issue
- Large blowers increase cost of operations
- No carbon cycle benefits
- Continual operation of aeration equipment needed to maintain treatment
- Less operational flexibility without a recycle loop
- Less aesthetically pleasing

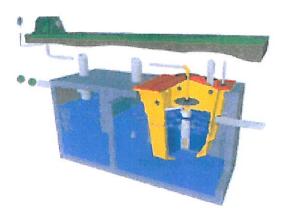


Figure 4-2 FAST Treatment Unit

4.1.3 RECIRCULATING GRAVEL FILTER

Recirculating gravel filters, also known as vertical flow treatment wetlands, are considered "attached growth" filters for advanced waste treatment of wastewater. Attached growth filters use a bed of media for bacteria to attach to and grow. The most common media are sand, gravel or peat. Effluent from the septic tank flows through a filter tank into a recirculation pump tank and is pressure distributed across the top of the attached growth filter media. The wastewater flows vertically through the media and is collected at the bottom to be returned to the filter tank. The treated wastewater cycles through the tanks and filter 5 to 12 times, depending on treatment requirements. In cold climates like Alberta, the filter bed must be covered to prevent freezing. Refer to Figure 4-3 for a schematic of a recirculating gravel filter, and Figure 4-4 for a photo.

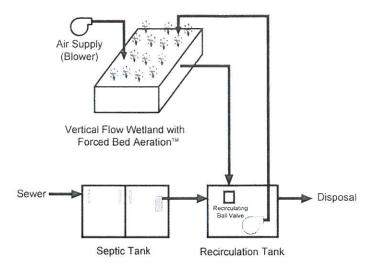


Figure 4-3 Schematic of a Recirculating Gravel Filter

Advantages to "Recirculating Gravel Filters":

- Small land area requirement
- Consistent operation not prone to upset
- Favorable aesthetics
- Reliable treatment
- Moderate detention times
- Has nitrogen removal capability

Disadvantages to "Recirculating Gravel Filters":

- Moderate operation and maintenance costs
- Alberta Environment may not be familiar with this technology
- · Approval time will likely be longer compared to other technologies evaluated in this report
- · Fine media like peat or sand may experience clogging over time
- · Requires recirculation pumps, blowers and controls



Figure 4-4 Photo of a Recirculating Gravel Filter in Minnesota

4.1.4 COARSE SAND FILTER

A single pass sand filter consists of a lined basin filled with sand. The wastewater flows vertically through the sand bed where treatment occurs through filtering action and bacterial decomposition. The bacteria are attached to the sand medía. In a sand filter, the water only passes through the system once before being sent to the disposal area.

Sand filters are a well accepted technology in Canada and the United States. Two types of single pass sand filters are described in the Alberta Private Sewage Systems Standard of Practice 1999 Handbook: coarse sand filters and fine sand filters. Because coarse sand filters are less likely to clog and have lower sizing requirements, only coarse sand filters were evaluated in this report.

Advantages to "Sand Filters":

- · Simple to operate
- Reasonable operation and maintenance requirements
- · High level of treatment
- Accepted technology in Alberta

Disadvantages to "Sand Filters":

- Requires dosing pumps and controls
- Large space requirements
- Moderate aesthetics

4.2 SOIL INFILTRATION

For soil infiltration, the soil dispersal options are limited to at-grade infiltration beds or subsurface drip irrigation. These soil infiltration technologies, along with the advantages and disadvantages of each, are discussed herein.

4.2.1 SUBSURFACE DRIP IRRIGATION

Drip irrigation utilizes specialized tubing that is placed into the ground to dispose of water over a large area. The tubing is usually 1.27 cm in diameter with emitters placed every 61 cm. The water is pumped to pressurize the tubing and distribute water evenly at a specific volume and rate. The tubing is placed between 30 cm and 61 cm below the surface. Greater depth reduces the potential for rodent damage.

Advantages of "Subsurface Drip Irrigation":

- · Easy to install with little construction impacts
- · Can be installed around trees or in odd shapes
- Works in most soil types
- Can apply wastewater over a large area
- Can be installed on slopes up to 20 percent
- Additional treatment accomplished in the soil

Disadvantages of "Subsurface Drip Irrigation":

- More complicated than other disposal methods
- Higher maintenance requirements
- Requires dosing pumps and controls
- Greater potential to freeze if not properly designed, installed, and operated

- · Rodents can damage tubing
- May need substantial quantities of soil brought in to achieve adequate cover

4.2.2 CHAMBERED INFILTRATION TRENCHES

Chambered infiltration trenches use a series of perforated pipes that pressure dose the bed. Infiltration chamber trenches are placed over the perforated pipes 14-22 centimeters into the topsoil. A chambered system does not require gravel; instead clean fill is placed on the chambers. The treated water percolates through the clean fill and into native soil. By partially placing the chambers into the topsoil, sidewall seepage is increased and the potential for mounding decreases. An example of infiltration trenches is provided in Figure 4-5.

Advantages of "Chambered Infiltration Trenches":

- · Efficient use of disposal area
- Pressure doses water over a large area
- · Able to utilize upper layers of soil for infiltration
- Increases sidewall seepage
- Easy to install chambers and piping
- · Has large capacity to handle variable flows

Disadvantages of "Chambered Infiltration Trenches":

- · Require placing sand or fill material beneath and/or over chambers
- · Require dosing pumps and controls
- · Require more area compared to drip

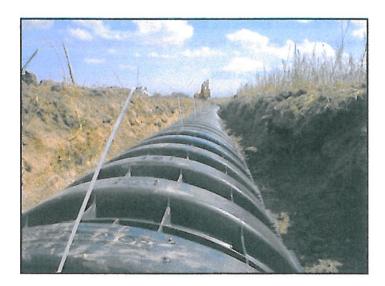


Figure 4-5 Installation of Chambered Infiltration Trench

5.0 WASTEWATER FACILITY AREA REQUIREMENTS

The estimated area requirements for each component evaluated in this analysis are summarized in **Table 5-1**. Due to the size of the proposed development, the land requirements of some technologies evaluated are large. Particularly, the soil infiltration system for treated water disposal requires a significant amount of land for installation.

Table 5-1 Wastewater System Area Requirements

Treatment/Disposal Stage	Technology	Area Requirements, hectares ²			
	AdvanTex Units	0.2			
Secondary ¹	FAST Units	0.2			
Secondary	Recirculating Gravel Filter	0.3			
	Coarse Sand Filter	0.5			
	Subsurface Drip Primary	1.3			
Direct l	Subsurface Drip Back-up (Recommended)	0.7			
Disposal	Infiltration Trenches Primary	2.0			
	Infiltration Trenches Back- up (Recommended)	1.0			

⁽¹⁾ Septic tanks are included in the secondary treatment options,

⁽²⁾ Approximate areas only.

6.0 COST EVALUATION

The estimated costs shown in this section for the water and wastewater treatment alternatives will include construction, engineering and operation, maintenance and replacement (OM&R) costs. In determining the cost-effectiveness of the various alternatives, cost will be presented in terms of year 2008 total capital costs, annual costs, OM&R costs, and total life cycle cost.

Preliminary construction costs are based on 2008 construction costs. Various material and equipment manufacturers and suppliers were contacted for information affecting cost estimates. Published and unpublished cost data for similar kinds of construction were also utilized.

Increases in construction costs due to inflation are not taken into account. The cost estimates presented are meant to guide the decision making process and to establish a budget for funding. After preparation of final drawings and specifications, the Engineer's Estimate of Construction Costs will be prepared. The final cost will be known only after bids are received.

6.0 FINANCIAL TERMS USED IN THIS REPORT

JW NAWE has included definitions of standard terminology to properly evaluate the figures calculated in this report. Below is a listing of these terms.

Construction Cost – The anticipated cost to build (construct) the facilities identified. Since construction costs are incurred at the beginning of the project, construction costs are a capital cost.

Total Capital Cost — The anticipated total of all capital costs. This includes the construction cost as well as the non-construction items such as contingencies, engineering, permitting, bidding, construction observation, legal, and administrative costs.

Annual Operating and Monitoring (OM&R) Costs – The annual (cost per year) total for items such as labor, laboratory (analytical), and utilities (gas and electric).

Present Worth of Annual O&M – The amount of money that would have to be deposited in the bank today to pay for all of the annual O&M over the next 30 years.

Life Cycle Cost – The total capital cost added to the present worth of the annual OM&R. Life cycle costs are used to identify the most cost-effective alternatives over the project period. The life cycle cost approach allows low construction/high OM&R cost alternatives to be compared on an "apples-to-apples" basis with high construction/low OM&R cost alternatives.

Contingency — A percentage of construction costs reserved for unforeseen project costs due to site conditions and construction. In this report, it was assumed that the Owner will have a contingency added to the overall cost of the project. Therefore, no contingency was included in the total capital costs.

6.1 WASTEWATER SYSTEM COSTS

Table 6-1 summarizes the estimated total capital costs of the individual wastewater system components for the proposed development. Appendix B of this report contains the line-item cost tables that developed the costs

presented below. **Table 6-3** summaries the estimated yearly operations and maintenance costs of each component of the wastewater system evaluated.

Table 6-1 Wastewater System Total Capital Costs

Stage	Technology	Estimated Total Capital Cost		
	AdvanTex Units	\$ 991,206		
Treatment	FAST Units	\$ 1,276,332		
Treatment	Recirculating Gravel Filter	\$ 1,095,917		
	Coarse Sand Filter	\$ 1,059,490		
Disposal	Subsurface Drip Irrigation	\$ 553,094		
Pishozai	Infiltration Beds	\$ 1,085,476		

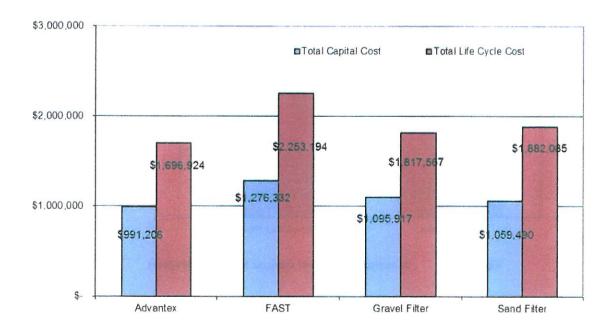


Figure 6-1 Wastewater Treatment Options for Fawn Meadows

Table 6-2 Wastewater System Yearly Operations and Maintenance Costs

Stage	Technology	Estimated Annual O&M Costs				
	AdvanTex Units	\$	17,757			
Treatment	FAST Units	\$	27,048			
Heatment	Recirculating Gravel Filter	\$	18,226			
	Coarse Sand Filter	\$	23,171			
Disposal	Subsurface Drip Irrigation	\$	28,430			
pishosai	Infiltration Beds	\$	10,128			

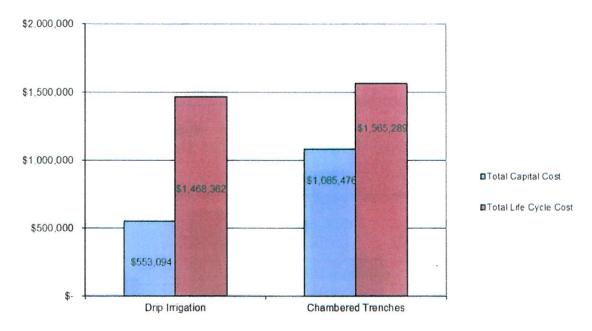


Figure 9-2 Wastewater Disposal Options for Fawn Meadows

6.2 OPERATIONAL AND FISCAL MANAGEMENT

All wastewater treatment systems require monitoring, operational adjustments, replacement of components, and fiscal management. Responsible management is essential to meet the requirements of governmental agencies, homeowners, and the environment. Without proper management, water and wastewater systems will have financial hardships, premature failure, environmental degradation, and potential health risks. Governmental officials are becoming increasingly concerned with the management of water and wastewater systems.

Fiscal management includes not only securing funding for the capital cost of the installation of the water and wastewater system, but also ensuring that sufficient funds are available for ongoing operation and maintenance, replacement of parts, and capital replacement when the system reaches the end of its useful life. The amount of money set aside for capital replacement varies depending on how and when the money is invested. It is ultimately the responsibility of the developer to determine how much to charge each user per month.

7.0 RECOMMENDATIONS

This report evaluates wastewater options and costs for the proposed Fawn Meadows Development. Recommendations for the development are based on total capital and yearly operations and maintenance costs as well as land requirements. The costs and area requirements presented in this section are for a system to treat all of the wastewater from the development (188.23 m³/day).

7.0 WASTEWATER SYSTEM RECOMMENDATIONS

SD recommends that Fawn Meadows approach Alberta Environment on the potential to install an AdvanTex treatment system. Both its total capital and life cycle costs are the lowest of the four treatment system alternatives. Alberta Environment is very familiar with this technology and there are over 500 installation in Alberta.

Soil disposal is feasible at Fawn Meadows. The soils investigation has identified sufficient area to support the installation of a soil disposal system. SD recommends using infiltration trenches for disposal. Drip requires less area to install and has significantly lower total capital costs. However, drip also has much higher maintenance requirements and is more susceptible to freezing. In contrast, trenches have lower maintenance requirements and are less likely to freeze during the winter months. A combination of both technologies may be feasible as well and will be investigated during the design phase.

Table 7-1 Wastewater System Costs and Area Requirements

Treatment / Disposal Stage	Technology	Tota	Capital Costs	Area, hectares		
Secondary	AdvanTex	\$	991,206	0.3		
Disposal	Chambered Trenches	\$	1,080,476	2.0		
	Totals:	\$	2,071.682	2.3		

APPENDIX A SOIL PIT LOGS

Jacques Whitford NAWE

SOIL DESCRIPTION REPORT

4444 Centerville Road, Suite 140

Jacques Whitford NAWE, Inc.

20014 ::00	HOCCLO	
SOIL DESCR	DESCRIPTION REPORT	White Bear Lake, MN 55127
		Phone: 651-255-5050
		Fax: 651-255-5060
Soil Eval Date: 11/29/07	Vegetation: Forest and Fallow	Parent Material: Glacial Till

Client Name:	Soil Eval Date: 11/29/07	Vegetation: Forest and Fallow	Parent Material: Glacial Till
Fawn Meadows			
Location:		Slope:	Slope Form: Multiple Slopes
Parkland County		Variable	
Lot legal Description:		System Loading Rate (I/m²/day):13.2	Shallowest Groundwater: 48.2 cm
Section 4, T52, R02			

		Site Conditions	
Disturbed Soil?	Floodplain?	Soil Survey Map Unit:	Map Unit Observed in Field?No
No	No	Orthic Gray Luvisols	

BORING NUMBER: 1	NUMBE	R: 1							
Horizon Depth	Depth (cm)	Dominant	Mottles (Qu. Sz. Cont. Color)	Texture	Structure (Gr.Sz.Sh.)	Consist- Roots	Roots	Boundary	Remarks
Ø	0-81	10YR4/3		Si Lo	2mbk	Mfr	1vf	Mg	
81	81-	10YR4/3		Fi Sa Lo	2mbk	Mfr	lvf	Gw	
82	110-	10YR4/4		Si Lo	1mbk	Mfr	0	Gw	CaCO3 deposits
	180								
Recomm	ended S	oil Loading R	Recommended Soil Loading Rate: 13.2 I/day/m²				Red	oximorphic	Redoximorphic Features Observed at N/A below ground surface (bgs).

	Remarks		25 cm Frost				Redoximorphic Features Observed at 130 cm below ground surface (bgs).
	Boundary		Gw	GW	Gw	Gw	morphic Fea
	Roots		1vf	1vf	1vf	0	Redoxi
	Consist-	ency	Mfr	Mfr	Mfr	Mfr	
	Structure	(Gr.Sz.Sh.)	2mbk	2mbk	2mbk	2mbk	
	Texture		Si Lo	Si Lo	CLLO	Si Lo	
	Mottles (Qu. Sz. Cont.	Color)				C2P 10YR 5/8	Recommended Soil Loading Rate: 13.2 I/day/m²
k: 2	Horizon Depth Dominant	Color	10YR4/3	10YR5/4	10YR5/4	10YR5/2	oil Loading F
NUMBEF	Depth	(cm)	0-20	96-09	96- 127	127- 175	ended S
BORING NUMBER: 2	Horizon		A	B1	82	83	Recomm

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Remarks	Frost to 38 cm				Redoximorphic Features Observed at 130 cm below ground surface (bgs).	1.0-1	Remarks	Frost to 12 cm					Redoximorphic Features Observed at 50 cm below ground surface (bgs).		Remarks		30 cm Frost	
Boundary	0 W	Gw	Gw	M9	norphic Fea		Boundary	Gw	Gw	Gw	МВ	Gw	imorphic Fe		Boundary	GW	Gw	Gw
Roots	1vf	1vf	1vf	1vf	Redoxir		Roots	1m	1m	1vf	0	0	Redox		Roots	1vf	1vf	1vf
Consist- ency		Mfr	Mvfr	Mvfr			Consist- ency		Mfr	Mfr	Mfi	Σ			Consist-	(and	Mvfr	Mfi
Structure (Gr.Sz.Sh.)		2fbk	2mbk	2mbk			Structure (Gr.Sz.Sh.)		2mbk	1mbk	0m	0m			Structure	2mbk	2fbk	1mbk
Texture	Si Lo	CILO	Si Lo	Si Lo			Texture	Peat	Si Lo	Si Lo	Si Lo	Si Lo			Texture	Si Lo	Fi Sa Lo	Si Cl Lo
Mottles (Qu. Sz. Cont. Color)		F1F 10YR5/2	C2D 10YR5/2 & C2P 10YR5/8	C2P 10YR5/8	Recommended Soil Loading Rate: 13.2 I/day/m²		Mottles (Qu. Sz. Cont. Color)			C2P 10YR5/2 & C2D 10YR4/6	C2D 10YR5/2 & C2P 10YR5/8	C2P 10YR5/8	Recommended Soil Loading Rate: 13.2 I/day/m²		Mottles (Qu. Sz. Cont.		C1D 10YR5/2 & 4/6	C1D 10YR5/2 & 4/6
Dominant Color	10YR3/3	10YR4/3	10YR5/4	10YR5/2	oil Loading R	1: 4	Dominant Color	10YR3/2	10YR3/1	10YR5/8	10YR5/4	10YR5/2	oil Loading R	1:5	Dominant	10YR3/3	10YR5/4	10YR5/4
Depth (cm)	0-37	37-82	82- 150	150-	ended Sc	NUMBER	Depth (cm)	0-25	25-50	50-	120-	200-	ended Sc	NUMBER	Depth	0-25	25-70	60-
Horizon	A	81	82	83	Recomm	BORING NUMBER: 4	Horizon	٧	81	82	83	84	Recomme	BORING NUMBER: 5	Horizon	А	81	82

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Redoximorphic Features Observed at 60 cm below ground surface (bgs).

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C1P 10YR4/6

10YR5/2

157-220

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Recommended Soil Loading Rate: 13.2 I/day/m²

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	Remarks	Frost to 27 cm					Redoximorphic Features Observed at 160 cm below ground surface (bgs).
	Roots Boundary	Gw	Gw	ΘW	Вw	Gw	morphic Fea
	Roots	1vf	1vf	1vf	1vf	0	Redoxin
	Consist- ency	Mfr	Ds	Mfr	Oh	Oh	
	Structure (Gr.Sz.Sh.)	2mbk	Zmbk	2mbk	2mbk	1mbk	
	Texture	Si Lo	Fi Sa Lo	CILO	Si Lo	Si Lo	
	Mottles (Qu. Sz. Cont. Color)			C1D 10YR5/2	F2D 10YR5/1	C2D 10YR6/1 & C2P 10YR5/8	Recommended Soil Loading Rate: 13.2 I/day/m²
ر: ٥	Dominant Color	10YR3/3	10YR6/3	10YR4/4	10YR6/3	10YR6/3	oil Loading F
VOIVIDE	Depth (cm)	0-30	30-55	55— 105	105- 157	157- 225	ended Sc
DONING NOINIBER: 0	Horizon	A	81	B2	B3	84	Recomme

1								_
	Remarks	30 cm Frost						Redoximorphic Features Observed at 150 cm below ground surface (bgs).
	Boundary	Gw	Gw	Gw	Gw	Gw	Gw	norphic Feat
	Roots	1vf	1vf	1vf	1vf	1vf	0	Redoxir
	Consist- ency	Mvfr	Mvfr	Ds	Mfr	ha	Ds	
	Structure (Gr.Sz.Sh.)	2mgr	2fbk	2fbk	2mbk	2mbk	1mbk	
	Texture	Fi Sa Lo	Fi Sa Lo	Fi Sa Lo	CILO	Si Lo	Si Lo	
	Mottles (Qu. Sz. Cont. Color)					F2D 10YR5/1 & F2P 10YR5/8	F2D 10YR5/1 & F2P 10YR5/8	Recommended Soil Loading Rate: 13.2 I/day/m²
1:7	Dominant Color	10YR4/3	10YR4/3	10YR6/3	10YR4/4	10YR6/3	10YR6/3	oil Loading R
NUMBER	Depth (cm)	0-48	49-72	72-95	95-	115-	175-	anded Sc
BORING NUMBER: 7	Horizon	A	81	82	83	υ	Ú	Recomme

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	Remarks		Frost to 30 cm"				
	Boundary	Gw	GW	Вw	Gw	Gw	
	Roots	2m	2f	1f	1vf	1vf	
	Consist- ency		Dh	ф	Dh	Dh	
	Structure (Gr.Sz.Sh.)		2mbk	1mbk	2mbk	2mbk	-
	Texture	Si Lo	Si Lo	Si Lo	Si Lo	Si Lo	
	Mottles (Qu. Sz. Cont. Color)		C1D 10YR5/2 & C1P 10YR5/8	C1D 10YR5/2 & C1P 10YR5/8	C2D 10YR5/2 & C2P 10YR5/8	C2D 10YR5/2 & C2P 10YR5/8	6 / 1/1000
۷: ۵	Dominant Color	10YR3/3	10YR5/4	10YR5/4	10YR5/4	10YR5/4	:
VOIMBER	Depth (cm)	0-22	22-70	70-	101- 135	135- 162	
BURING NOINIBER: 8	Horizon	٧	81	82	83	84	c

Recommended Soil Loading Rate: 13.2 I/day/m²

Redoximorphic Features Observed at 50 cm below ground surface (bgs).

BORING NUMBER: 9

						te (bes).
	Remarks	Frost to 40 cm				Redoximorphic Features Observed at 65 cm below ground surface (hgs).
	Boundary	gw G	Gw	Gw	Gw	morphic Feature
	Roots	1vf	1vf	1vf	1vf	Redoxi
	Consist- ency	Mfr	Mfr	Mfr	Mfi	
	Structure (Gr.Sz.Sh.)	2mgr	1mbk	1mbk	m0	
	Texture	Fi Sa Lo	Fi Sa Lo	Fi Sa Lo	Si Lo	
	Mottles (Qu. Sz. Cont. Color)		C1P 10YR4/6	C2P 10YR5/2	C2D 10YR5/2 & C2P 10YR5/8	Recommended Soil Loading Rate: 13.2 I/day/m²
٠.	Depth Dominant (cm) Color	10YR4/1	10YR5/1	10YR4/6	10YR5/4	il Loading Ra
CIVIDEN	Depth (cm)	0-48	48-	117-	162- 188	ended So
DOMING NOINIDEN. 3	Horizon	٨	81	B2	υ	Recomme

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Horizon	Depth	Dominant	Mottles (Qu. Sz. Cont.	Texture	Structure	Consist-	Roots	Boundary	Remarks
	(cm)	Color	Color)		(Gr.Sz.Sh.)	ency			
	0-23	10YR3/3					1f	GW	
	23-72	10YR5/4		Fi Sa Lo	1mbk	Mvfr	1f	Gw	Frost to 30 cm
	72-97	10YR4/4		Si Lo	2mbk	Mfr	1f	9w	
	-26	10YR4/4		Si Lo	1mbk	Mfr	1vf	GW	
-	132								
	132-	10YR5/3		Si Lo	1mbk	Ds	1vf	GW	
	150								
me	nded So	oil Loading F	Recommended Soil Loading Rate: 13.2 I/day/m²				Red	oximorphic	Redoximorphic Features Observed at N/A below ground surface (bgs).

BORING NUMBER: 11

	SOLING NOINIDEN. II							
_	Depth Dominant	Mottles (Qu. Sz. Cont.	Texture	Structure	Consist- Roots Boundary	Roots	Boundary	Remarks
(cm)	Color	Color)		(Gr.Sz.Sh.)	ency			
0-15	10YR3/3					1m	Gw	
10	15-80 10YR6/3	F1F 10YR5/2 &	Si Lo	2mbk	hO	1f	GW	Frost to 33 cm
		F1P 10YR5/8						CaCO3 deposits
	80- 10YR6/3	F1F 10YR5/2 &	Si Lo	1mbk	υh	1vf	GW	
162		F1P 10YR5/8						
	Soil Loading	Recommended Soil Loading Rate: 13.2 I/day/m²				Redox	imorphic Fe	Redoximorphic Features Observed at 73 cm below ground surface (bgs).

BORING NUMBER: 12

	Texture Structure Consist- Roots Boundary Remarks	(Gr.Sz.Sh.) ency	1m Gw Frost to 30 cm	Fi Sa Lo 2mbk Mfr 1m Gw	Fi Sa Lo 1mbk Mfr 1vf Gw		Si Lo 2mbk Mfr 1vf Gw		Redoximorphic Features Observed at 58 cm below ground surface (bgs).
	Structure			-o 2mbk	1mbk		2mbk		
	Mottles (Qu. Sz. Cont. Textu	Color)		Fi Sa	F2F 10YR5/2 & Fi Sa	F2D 10YR4/6	F2D 10YR5/2 & 4/6 Si Lo		:: 13.2 I/day/m²
	Depth Dominant	Color	10YR3/3	10YR4/3	10YR4/3		10YR5/4		Recommended Soil Loading Rate: 13.2 I/day/m²
1	Depth	(cm)	0-30	30-50	-05	120	120-	165	ended S
	Horizon		A	81	B2		B3		Recomm

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Remarks Frost to 33 cm	
Boundary Gw Gw Gw	Gw
Roots 2f 1vf 1vf 1vf	1vf
Consistency Dh Dh Dh	ha
Structure (Gr.Sz.Sh.) 2mbk 2fbk 2mbk	1mbk
Texture Sa Lo Si Lo	Si Lo
Mottles (Qu. Sz. Cont. Color) F1D 10YR5/1 & F1D 10YR5/8 F1D 10YR5/8 F1D 10YR5/1 &	F1P 10YR5/8 F1D 10YR5/1 & F1P 10YR5/8
Dominant Color 10YR3/3 10YR6/3 10YR6/3 10YR6/3	10YR6/3
(cm) (cm) 0-39 39-60 60-90 90-	132- 164
Horizon Depth Dom (cm) Cc A 0-39 10Y B1 39-60 10Y B2 60-90 10Y	B4

Recommended Soil Loading Rate: 13.2 I/day/m²

Redoximorphic Features Observed at 75 cm below ground surface (bgs).

BORING NUMBER: 14

]_:
Remarks		Frast to 27 cm			Redoximorphic Features Observed at 50 cm below ground surface (bgs).
Boundary	Gw	9 Gw	9 GW	Gw	imorphic Fea
Roots	1vf	1vf	1vf	1vf	Redox
Consist-	circy	Mfr	Mfr	Mfi	
Structure	(31:32:31:)	2fbk	2fbk	1fbk	
Texture		Sa Lo	Fi Sa Lo	Fi Sa Lo	
Mottles (Qu. Sz. Cont.	(1000)	C1D 10YR5/2 & C1P 10YR5/8	C2D 10YR5/2 & C2P 10YR5/8	C2P 10YR5/8	Recommended Soil Loading Rate: 13.2 I/day/m²
Dominant	10YR3/3	10YR5/4	10YR5/4	10YR5/2	il Loading R
Depth (cm)	0-50	20-55	55-90	90-	ended Sc
Horizon	A	81	82	83	Recomm
	Dominant Mottles (Qu. Sz. Cont. Texture Structure Consist- Roots Boundary	Mottles (Qu. Sz. Cont. Texture Structure Consist- Roots Boundary Color) ency 1vf Gr.Sz.Sh.) ency 1vf Gw	Mottles (Qu. Sz. Cont. Texture Color) Structure (Gr.Sz.Sh.) Consist- ency Roots Boundary Color) (Gr.Sz.Sh.) ency 1vf Gw C1D 10YR5/2 & Sa Lo C1P 10YR5/8 Sa Lo Zfbk Mfr 1vf Gw	Mottles (Qu. Sz. Cont.) Texture Color) Structure (Gr. Sz. Sh.) Consist- ency Roots Boundary C1D 10YR5/2 & C1D 10YR5/2 & C2D 10YR5/8 Sa Lo Sa Lo Sfbk Mfr Ivf Gw C2D 10YR5/8 Ti Sa Lo Sfbk Mfr Ivf Gw Gx Gx Ivf Gw Gx Ivf G	Mottles (Qu. Sz. Cont.) Texture Color) Structure (Gr. Sz. Sh.) Consist- ency Roots Boundary C1D 10YR5/2 & Sa Lo C2D 10YR5/2 & C2D 10YR5/8 Sa Lo Zfbk Mfr

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Horizon	Depth	Dominant	Mottles (Qu. Sz. Cont.	Texture	Structure	Consist-	Roots	Boundary	Remarks
	(cm)	Color	Color)		(Gr.Sz.Sh.)	ency			
A	0-35	10YR3/2		Salo	2mbk	Mfr	lvf	Gw	Frost to 28 cm
B1	35-70	10YR4/3		Salo	2mbk	Mvfr	1vf	GW	
82	-02	10YR6/4	C2D 10YR5/2 &	Loam	2mbk	Mfr	1vf	МĎ	
	123		C2P 10YR5/8						
B3	123-	10YR4/4	C2D 10YR5/2 & 4/6	Fi Sa Lo	1mbk	Mfr	0	Gw	
	157								
84	157-	10YR4/4	C2D 10YR5/2 & 4/6	Fi Sa Lo	0m	Mfi	0	Gw	
	185			20 5000000					
Recomm	ended S	oil Loading	Recommended Soil Loading Rate: 13.2 I/day/m²				Redox	imorphic Fe	Redoximorphic Features Observed at 94 cm below ground surface (bgs).

BORING NUMBER: 16

. -	Horizon Depth Dominant	Mottles (Qu. Sz. Cont.	Texture	Structure	Consist-	Roots	Boundary	Remarks
Color	the street and a street street,	Color)		(Gr.Sz.Sh.)	ency			
10YR3/3						1m	Gw	
10YR6/3			Si Lo	2mbk	Dh	1vf	Gw	Frost to 28 cm
10YR6/3			Si Lo	2mbk	DS	lvf	ΘW	
10YR6/3		F2D 10YR5/1 & 4/6	Si Lo	1mbk	Dm	0	Θw	
Recommended Soil Loading Rate: 13.2 I/day/m²	Rate:	13.2l/day/m^2				Redoxi	morphic Fea	Redoximorphic Features Observed at 175 cm below ground surface (bgs).

Recommended Soil Loading Rate: 13.2 I/day/m²

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NAWE Field Recommendation: On November 29, 2007, Jacques Whitford conducted a field investigation for the Fawn Meadows Property located 15 of kilometers west of Stony Plain, AB. The Fawn Meadows property consists of 30 hectares of land and is currently being evaluated for development residential and elderly communities.

increasingly fine subsoils. The lowlands had an observed soil profile of silt or fine sandy loam topsoils with silt loam subsoils. Layers of silty clay loam soils Sixteen test pits were dug by backhoe across the site. These test pits were evaluated for color, texture, structure, consistency, roots, depth to groundwater features, and frost in order to identify the best location for a community wastewater treatment system. The site is characterized by hilly terrain with wetlands in the low lying areas and better drained dry soils on the highlands. A general soil profile for the upland areas is sandy loam topsoils over were observed in pit 9. These lowlands had water table markers at48-65 cm below ground surface (bgs), making them undesirable for water disposal. The mid slopes across the site were uniform with silt loam soils for the entire depth. Some borings (e.g. pit 2-3, 6-7) had subsoil layers of clay loam. Conversations with the property owner indicate that the ideal location of a wastewater treatment and disposal field is on the slope along route 770 where area near pit 4 is unsuitable for disposal as it is a natural wetland. Seasonal groundwater indicators were observed at 125 and 126 cm bgs in pits 2 and 3 giving adequate depth for water disposal. Additionally, the land surrounding pits 6 and 7 might be utilized at the same loading rate if needed for additional pits 1-4 were excavated. Due to the clay loam soil layers in pits 2 and 3, a soil loading rate of 13.2 I/day/m² is recommended by Alberta Environment. disposal area.

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SOIL MODIFIER DEFINITIONS

SOIL MODIFIER DEFINITIONS (cont.)

	Dry	Loose - dl	Soft - ds	Slightly hard - dsh	Hard - dh	Very hard - dvh	Extremely hard - deh		ROOTS	Size	Very fine - vf	Fine - f	Medium - m	Coarse - co		BOUNDARY	Topography	Smooth - s	Wavy - w	Irregular - i Broken - b
CONSISTENCE	Moist	Loose - ml	Very friable - mvfr	Friable - mfr	Firm - mfi	Very firm - mvi	Extremely firm - mefi			Quantity	Few - 1	Common - 2	Many - 3				Distinctness	Abrupt -a	Clear - c	Gradual - g Diffuse - d
	Contrast:	Faint - f	Distinct - d	Prominent - p			Silt - si	Sandy clay loam - sa cl lo	Silty clay loam - si cl lo	Clay loam – cl lo	Clay - cl				Shape:	Platy - PI	Prismatic - Pr	Columnar - Cpr	Blocky - Bk	Angular blocky -Abk Subangular Blocky - Sbk Granular - Gr Single grain - Sg Massive - m
int. Color)	Size:	Fine - 1	Medium - 2					Sa						Sh.)	Size:	Very fine - vf	Fine - f	Medium - m	Coarse - c	Very coarse - vc
MOTTLES (Qu, Sz, Cont. Color)	Quantity:	Few - <2% - f	Common - 2-20% - c	Many - >20% - m		TEXTURE	Fine sand – fi sa	Medium sand - med sa	Coarse sand – co sa	Sandy loam - sa lo	Loam - lo	Silt loam - si lo		STRUCTURE (Gr, Sz, Sh.)	Grade:	Structureless - 0	Weak -1	Moderate - 2	Strong -3	

APPENDIX B COST TABLES FOR WASTEWATER SYSTEM

Table C.1
Treatment System
Engineer's Opinion of Cost

Packaged Sewage Treatment Plant Option 1: AdvanTex

Project:

Fawn Meadows

Flow:

41,405

Imperial gpd

ITEM	QUANTITY	UNIT		UNI	T PRICE	TO	OTAL PRICE
Raw Sewage Manhole	1	units		\$	1,500.00	\$	1,500
Septic Tanks	100,000	imp gallons		\$	1.67	\$	167,000
AdvanTex Pods (AX100)	24	units		\$	22,000.00	\$	528,000
Pumping Equipment	1	ls		\$	20,000.00	\$	20,000
Recirculating Ball Valve	2	units		\$	1,000.00	\$	2,000
Ventilation Fan Assembly	2	units		\$	3,000.00	\$	6,000
Miscellaneous Piping	1	Is		\$	7,200.00	\$	7,200
Flow Measurement	1	ls		\$	13,200.00	\$	13,200
Fencing	800	m		\$	9.00	\$	7,200
Site Work	0.37	На		\$	10,000.00	\$	3,747
Control Building	1	ls		\$	15,000.00	\$	15,000
Recirculation Tank	30,000	imp gallons		\$	1.67	\$	50,100
Site Electric and Advantex Control Panel	1	İs		\$	12,000.00	\$	12,000
CONSTRUCTION SUBTOTAL						\$	832,947
Contingency					0%	\$	-
Engineering, Permitting, and Bidding Services					12%	\$	99,954
Construction Observation					5%	\$	41,647
Surveying and Testing					2%	\$	16,659
CAPITAL COST TOTAL						\$	991,206
Annual Service Calls	6	calls		\$	177	\$	1,062
Annual Service Provider Costs	72	hours		\$	75	\$	5,400
Annual Utilities (single phase power)	58,138	kwh		\$	0.11	\$	6,395
Sampling and Analytical Costs						\$	2,400
Septic Tank Pumping	25,000	imp gallons		\$	0.10	\$	2,500
ANNUAL OPERATION AND MAINTENANCE COST	TS			and the second		\$	17,757
Present Worth Capital Replacement	50%	Replacement	× · · · · · · · · · · · · · · · · · · ·	\$	832,947	\$	416,473
Present Worth of Annual O&M	30	years	@		4.5%	\$	289,244
TOTAL LIFE CYCLE COST						\$	1,696,924

¹⁾ Fiberglass reinforced plastic tanks assumed to be installed. Cost estimate includes accessways.

²⁾ Flow measurement assumed to be ultrasonic flow meter and flume inside concrete vault.

Table C.2
Treatment System
Engineer's Opinion of Cost

Packaged Sewage Treatment Plant Option 2: FAST

Project:

Fawn Meadows

Flow:

41,405

Imperial gpd

ITEM	QUANTITY	UNIT		UNI	T PRICE	T	OTAL PRICE
Raw Sewage Manhole	1	units		\$	1,500.00	\$	1,500
Subtotal for Service and Equipment Scope of Su	pply (see items l	pelow)				\$	688,565
Equalization Tanks	50,000	imp gallons					
Pumps and Controls	2	units					
MicroFAST 9.0 with Tanks & 5 HP Blowers	5	units					
Dosing/Recirculation Tank	20,000	imp gallons					
One Year Maintenance/Monitoring Package	1	ls					
Training Package/Shop Drawings	1	Is					
Taxes, Delivery, and Labor Expenses					50%	\$	344,283
Fencing	500	m		\$	9.00	\$	4,500
Control Building	1	ls		\$	15,000.00	\$	15,000
Site Electric	7	units		\$	1,000.00	\$	7,000
Flow Measurement	1	Is		\$	13,200.00	\$	13,200
CONSTRUCTION SUBTOTAL					***************************************	\$	1,072,548
Contingency					0%	\$	-
Engineering, Permitting, and Bidding Services					12%	\$	128,706
Construction Observation					5%	\$	53,627
Surveying and Testing					2%	\$	21,451
CAPITAL COST TOTAL						\$	1,276,332
Annual Service Calls	6	calls		\$	177	\$	1,062
Annual Service Provider Costs	54	hours		\$	75	\$	4,050
Annual Utilities (single phase power)	154,877	kwh		\$	0.11	\$	17,036
Sampling and Analytical Costs						\$	2,400
Septic Tank Pumping	25,000	imp gallons		\$	0.10	\$	2,500
ANNUAL OPERATION AND MAINTENANCE COS	TS					\$	27,048
Present Worth Capital Replacement	50%	Replacement	A CONTRACTOR OF THE PARTY OF TH	\$	1,072,548	\$	536,274
Present Worth of Annual O&M	30	years	@		4.5%	\$	440,589
TOTAL LIFE CYCLE COST			-			\$	2,253,194

¹⁾ Concrete coated, fiberglass tanks assumed to be installed. Cost estimate includes accessways.

²⁾ Flow measurement assumed to be ultrasonic flow meter and flume inside concrete vault.

Table C.3
Treatment System
Engineer's Opinion of Cost

Recirculating Gravel Filter

Project:

Fawn Meadows

Flow:

41,405

Imperial gpd

ITEM	QUANTITY	UNIT		UNI	T PRICE	Ţ	OTAL PRICE
Raw Sewage Manhole	1	units		\$	1,500.00	\$	1,500
Septic Tanks	100,000	imp gallons		\$	1.67	\$	167,000
Recirculation Tank	21,000	imp gallons		\$	1.67	\$	35,070
Recirculating Ball Valve	2	units		\$	1,000.00	\$	2,000
Gravel	2,140	cu. m		\$	55.00	\$	117,700
Liner	27,725	sq. m			1.15	\$	31,884
Geotextile	27,725	sq. m		\$ \$ \$	0.25	\$	6,933
4x8 Plywood Sheet	148	each			50.00	\$	7,400
4x8 Styrofoam Sheet	148	each		\$	50.00	\$	7,400
Mulch	474	cu. m		\$	40.00	\$	18,963
Earthwork	2,140	cu. M		\$	5.00	\$	10,700
Distribution Piping	6,400	m		\$	6.00	\$	38,400
Infiltration Chambers	6,400	m		\$	7.00	\$	44,800
Underdrain Piping	3,200	m		\$	10.00	\$	32,000
Recirc. Pumps/Controls	8	units		\$	4,000.00	\$	32,000
Aeration System	5	units		\$	40,000.00	\$	200,000
Blower Enclosure	5	units		\$	2,000.00	\$	10,000
Plants	5,000	each		\$	6.00	\$	30,000
Fencing	900	m		\$ \$ \$	9.00	\$	8,100
Site Work	0.90	ha			10,000.00	\$	9,000
Control Building	1	ls		\$	15,000.00	\$	15,000
Site Electric	12	units		\$	1,000.00	\$	12,000
Flow Measurement	1	ls		\$	13,200.00	\$	13,200
CONSTRUCTION SUBTOTAL						\$	849,548
Contingency					10%	\$	84,955
Engineering, Permitting, and Bidding Services					12%	\$	101,946
Construction Observation					5%	\$	42,47
Surveying and Testing					2%	\$	16,993
CAPITAL COST TOTAL						\$	1,095,917
Annual Service Calls	6	calls		\$	177	\$	1,062
Annual Service Provider Costs	72	hours		\$	75	\$	5,400
Annual Utilities (single phase power)	62,397	kwh		\$	0.11	\$	6,86
Sampling and Analytical Costs	120					\$	2,40
Septic Tank Pumping	25,000	imp gallons		\$	0.10	\$	2,50
ANNUAL OPERATION AND MAINTENANCE COST	THE RESIDENCE OF THE PARTY OF T			200 Table - 5000.		\$	18,22
Present Worth Capital Replacement	50%	Replacement		\$	849,548	\$	424,77
Present Worth of Annual O&M	30	years	@	3.70	4.5%	\$	296,87
TOTAL LIFE CYCLE COST						\$	1,817,56

¹⁾ Fiberglass reinforced plastic tanks assumed to be installed. Cost estimate includes accessways.

Table C.4 Treatment System Engineer's Opinion of Cost

Project:

Fawn Meadows

Flow:

41,405

Imperial gpd

ITEM	QUANTITY	UNIT	U	NIT PRICE	T	OTAL PRICE
Raw Sewage Manhole	1	units	Ç	1,500.00	\$	1,500
Septic Tanks	100,000	imp gallons	\$	1.67	\$	167,000
Pump Tank	24,000	imp gallons	\$	1.67	\$	40,080
Pumps and Controls	12	units	Ş		\$	48,000
Sand	2,667	cu.m		40.00	\$	106,667
Gravel	1,111	cu.m			\$	50,000
Geotextile	41,464	m	\$	0.25	\$	10,366
Liner	41,464	sq. m	\$		\$	35,245
Mulch	889	cu.m		40.00	\$	35,556
4x8 Plywood Sheet	128	each			\$	6,375
4x8 Styrofoam Sheet	128	each			\$	6,375
Drainbed Rock	889	cu.m			\$	40,000
Earthwork	6,000	cu.m	\$	5.00	\$	30,000
Distribution Piping	12,000	m	\$	6.00	\$	72,000
Infiltration Chambers	12,000	m	\$	7.00	\$	84,000
Underdrain Piping	6,000	m			\$	60,000
Aeration System	6	units	Ş		\$	53,400
Site Work	1.08	ha	\$		\$	10,764
Control Building	1	ls	\$	15,000.00	\$	15,000
Site Electric	18	units	\$		\$	18,000
Flow Measurement	1	ls	\$	13,200.00	\$	13,200
CONSTRUCTION SUBTOTAL					\$	890,328
Contingency				0%	\$	-
Engineering, Permitting, and Bidding Services				12%	\$	106,839
Construction Observation				5%	\$	44,516
Surveying and Testing				2%	\$	17,807
CAPITAL COST TOTAL					\$	1,059,490
Annual Service Calls	6	calls	Ş	177	\$	1,062
Annual Service Provider Costs	108	hours	\$	75	\$	8,100
Annual Utilities (single phase power)	82,810	kwh	\$	0.11	\$	9,109
Sampling and Analytical Costs					\$	2,400
Septic Tank Pumping	25,000	imp gallons	\$	0.10	\$	2,500
ANNUAL OPERATION AND MAINTENANCE COST	S				\$	23,171
Present Worth Capital Replacement	50%	Replacement	\$	890,328	\$	445,164
Present Worth of Annual O&M	30	years	@	4.5%	\$	377,431
TOTAL LIFE CYCLE COST					\$	1,882,085

¹⁾ Fiberglass reinforced plastic tanks assumed to be installed. Cost estimate includes accessways.

²⁾ Flow measurement assumed to be ultrasonic flow meter and flume inside concrete vault.

Table C.5 Disposal System Engineer's Opinion of Cost

Drip Irrigation

Project:

Fawn Meadows

Flow:

41,405

Imperial gpd

ITEM	QUANTITY	UNIT		UNI	T PRICE	TC	OTAL PRICE
Transfer Pump Tank	24,000	imp gallons		\$	1.67	\$	40,080
Duplex Pump Station	1	ls		\$	10,000.00	\$	10,000
Forcemain to Dosing Tanks	2,000	m		\$	14.00	\$	28,000
Emitter Tubing	54,000	m		\$	1.50	\$	81,000
Pumps and Controls	9	units		\$	4,000.00	\$	36,000
Dosing Tank	30,000	imp gallons		\$	1.67	\$	50,100
Supply Manifold	8,100	m		\$	10.00	\$	81,000
Return Manifold	8,100	m		\$	10.00	\$	81,000
Air/Vacuum Relief Valves	18	units		\$	100.00	\$	1,800
Site Work	1.8	ha		\$	10,000.00	\$	18,000
Fencing	1,800	m		\$	9.00	\$	16,200
Site Electric	9	units		\$	1,000.00	\$	9,000
Monitoring Wells	6	units		\$	2,000.00	\$	12,000
CONSTRUCTION SUBTOTAL						\$	452,180
Contingency					0%	\$	-
Engineering, Permitting, and Bidding Services					12%	\$	54,262
Construction Observation					5%	\$	22,609
Hydrogeological Investigation	1	ls		\$	15,000	\$	15,000
Surveying and Testing					2%	\$	9,044
CAPITAL COST TOTAL						\$	553,094
Annual Service Calls	6	calls		\$	443	\$	2,655
Annual Service Provider Costs	270	hours		\$	75	\$	20,250
Annual Utilities (single phase power)	50,224	kwh		\$	0.11	\$	5,525
ANNUAL OPERATION AND MAINTENANCE COS	TS					\$	28,430
Present Worth Capital Replacement	100%	Replacement		\$	452,180	\$	452,180
Present Worth of Annual O&M	30	years	@		4.5%	\$	463,088
TOTAL LIFE CYCLE COST						\$	1,468,362

¹⁾ Fiberglass reinforced plastic tanks assumed to be installed. Cost estimate includes accessways.

Table C.6 Disposal System Engineer's Opinion of Cost

Chambered Trenches

Project:

Fawn Meadows

Flow:

41,405

Imperial gpd

ITEM	QUANTITY	UNIT		UNI	T PRICE	TO	OTAL PRICE
Transfer Pump Tank	24,000	imp gallons	Section 1997	\$	1.67	\$	40,080
Duplex Pump Station	1	ls		\$	10,000.00	\$	10,000
Forcemain to Dosing Tanks	2,000	m		\$	14.00	\$	28,000
Infiltration Chambers	36,000	m		\$	7.00	\$	252,000
Sand (3 inch Blanket)	1,000	cu.m		\$	45.00	\$	45,000
Soil Cover (6 inches)	2,000	cu.m		\$	40.00	\$	80,000
Earthwork	4,000	cu.m		\$	5.00	\$	20,000
Supply Manifold	1,200	m		\$	14.00	\$	16,800
PVC Distribution Piping	36,000	m		\$	6.00	\$	216,000
Fencing	2,000	m		\$	9.00	\$	18,000
Site Work	2.8	ha		\$	10,000.00	\$	28,000
Dosing Tank	24,000	imp gallons		\$	1.67	\$	40,080
Pumps / Controls	12	units		\$	4,000.00	\$	48,000
Forcemain	2,400	m		\$	14.00	\$	33,600
Site Electric	12	units		\$	1,000.00	\$	12,000
Monitoring Wells	6	units		\$	2,000.00	\$	12,000
CONSTRUCTION SUBTOTAL						\$	899,560
Contingency					0%	\$	-
Engineering, Permitting, and Bidding Services					12%	\$	107,947
Construction Observation					5%	\$	44,978
Hydrogeological Investigation	1	Is		\$	15,000	\$	15,000
Surveying and Testing					2%	\$	17,991
CAPITAL COST TOTAL						\$	1,085,476
Annual Service Calls	6	calls	NA CHINI COOPERATION	\$	177	\$	1,062
Annual Service Provider Costs	108	hours		\$	75	\$	8,100
Annual Utilities (single phase power)	8,778	kwh		\$	0.11	\$	966
ANNUAL OPERATION AND MAINTENANCE COS	TS					\$	10,128
Present Worth Capital Replacement	35%	Replacement		\$	899,560	\$	314,846
Present Worth of Annual O&M	30	years	@		4.5%	\$	164,967
TOTAL LIFE CYCLE COST			-			\$	1,565,289

¹⁾ Fiberglass reinforced plastic tanks assumed to be installed. Cost estimate includes accessways.

²⁾ Average values used for sand blanket and soil cover quantities.

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Nor Can Consulting Group Inc. Box 38, Site 219, RR2 Carvel, Alberta T0E 0H0

March 3, 2012 Our File: H0907-280 Your File: NC-145

Attention:

Mr. Frank Florkewich

Dear Sirs:

Re: Review of Slope Stability and Groundwater Table Considerations

For Cluster Residential Single and Multi-Family Units

Proposed Country Residential Subdivision - Fawn Meadows

Portion of NE and SE 4-53-2-W5M

Parkland County, Alberta

As requested, we have reviewed a proposed concept plan relative to slope stability and high groundwater considerations for the above referenced site. Specifically, we were requested to comment on the site adequacy for proposed cluster development relative to slope stability matters and high groundwater table conditions. Our comments do not pertain to proposed large buildings such as community services building, seniors living complex, water treatment plant and maintenance plant since a detailed site investigation was carried out for each facility. In this case, site grading, new fill, etc. will be was carried out as part of site development and construction.

There were two reports prepared by Hagstrom Geotechnical Services Ltd. (HGSL) for this site that were reviewed for the purposes of this assignment and these reports were submitted in September and October, 2009. One report was entitled "Geotechnical Site Investigation for Building Foundations and Roadways, Proposed Country Residential Subdivision –Fawn Meadows, Portion of NE and SE 4-53-2-W5M, Parkland County, Alberta", dated September 12, 2009. Another report was entitled "Slope Stability Assessment, Proposed Country Residential Subdivision, Fawn Meadows, Portion of Ne and SE 4-53-2-W5M, Parkland County, Alberta" dated October 14, 2009. During these two investigations, there were a total of nineteen boreholes drilled to depths of 4.5 and 12.0 metres across the site. It is noted that another report was issued on May 13, 2004 by Sabatini Earth Technologies Inc. for traditional country residential lots of which this information is considered to be out dated. A report that reflects the current concept plan should be carried out at a later date.

The current concept plan calls for a cluster conservation adult-oriented residential subdivision with privately owned potable water and sanitary sewer services. There will be total of five clusters located on the site that take advantage of topographic high features on the site, refer to Plate 1, attached. One

cluster will consist of numerous single family units and are located in the south east quadrant. These units are located on two large hills that have slopes inclined at 12 degrees or less. Based on slope stability calculations, the slope stability report indicated that no development setback restrictions or set-back distances are considered necessary for proposed lots on the site.

The groundwater table conditions across the site are summarized in Table 1, below and are approximate borehole locations are shown on Plate 1, attached. The results show that Boreholes 09-1 and 09-4 had a groundwater table depth less 2.1 metres. These two boreholes were located in the south west corner and north west quadrant. Based on this information, the areas of undevelopable lands were plotted and are shown on Plate 1, attached. As shown, there are five separate areas that are considered undevelopable for this type of development.

TABLE 1: SUMMARY OF BOREHOLE WATER LEVELS

Borehole Number	t= 9 and 10 Days Later	Borehole Number	t = 9 and 10 Days Later
09-1	2.0	09-11	4.4 (dry)
09-2	4.4(dry)	09-12	4.4 (dry)
09-3	4.4(dry)	09-13	4.3 (dry)
09-4	2.0	09-14	3.0
09-5	4.3(dry)	09-201	11.5 (dry)
09-6	4.3(dry)	09-202	11.8 (dry)
09-7	4.3(dry)	09-203	11.7 (dry)
09-8	4.4 (dry)	09-204	11.8 (dry)
09-9	4.2 (dry)	09-205	11.6 (dry)
09-10	4.3 (dry)		

Based on the above information, the proposed cluster developments are located outside the areas that are considered undevelopable. Therefore, the sites selected for the five clusters are considered adequate relative to shallow groundwater table and slope stability issues.

Yours truly,

Hagström Geotechnical Services Ltd.

ENGIN

Werle Hegstron

Senior Engineer 1998

Attachments: Plate 1

PERMIT TO PRACTICE
Hagstrom Geotechnical Services Ltd.
Signature Med. Hagstrom
Date March 3, 2012
PERMIT ROUGHEST P 9693
The Association of Professional Engineers,
Geologists and Geophysicists of Alberta

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 Tel: (780) 996-5621• Fax: (780) 475-5671 e-mail: h_gsl@telus.net

Norcan Consulting Group Ltd. Box 38, Site 219, RR2 Carvel, Alberta T0E 0H0

March 1, 2012 Our File: H0907-280 Your File: NC-145

Attention: Mr. Frank Florkewich

Dear Sir:

Re: Slope Stability Assessment

Proposed Country Residential Subdivision

Fawn Meadows

Portion of NE and SE 4-53-2-W5M

Parkland County, Alberta

1.0 INTRODUCTION

Hagstrom Geotechnical Services Ltd (hereinafter referred to as HGSL) was retained by Mr. Frank Florkewich of Norcan Consulting Group to carry out a slope stability assessment at the above referenced property. The purpose of the work was to determine the soil and groundwater conditions along slopes greater than 15 percent, determine the factor of safety against slope failure and to provide building development guidelines. Field drilling was carried out on August 5, 2009 and final water table measurements were taken on August 14, 2009.

2.0 BACKGROUND INFORMATION

2.1 Site Description

The proposed country residential subdivision contains about 52.6 hectares of agricultural land that occupies a portion of the northeast and southeast quarters of Section 4, Township 53, Range 2, West of the Fifth Meridian. The site is bounded on the east by Highway 770 and on the south by Parkland Drive. The site is open, vacant hayland and contains four large groups of trees and marshes that cover about 30 to 35 percent of the site. The site topography is moderately rolling with slopes typically less than 12 degrees (21 percent). No definite drainage pattern is apparent on the site.

It is understood that the proposed development is to consist of cluster type lots of about 36 single family residential homes, numerous duplex, semi detached and supportive living units. The lot boundaries have not been finalized although the sizes will range from 0.30 to 0.58 acres in area. It is further understood that the development will be serviced with centralized private sanitary sewers and potable water systems. Other facilities such as a community services building and assisted seniors living complex are proposed for the site.

3.0 SURFICIAL GEOLOGY

According to published surficial geology reports¹, the terrain in the area is broadly classified as ice-contact, undivided fluvial and lacustrine deposits consisting of gravel, sand, silt and clay and local till that are up to 25 meters thick. The deposits are in intermittent supraglacial lakes and streams, or at margins of ice-floored proglacial lakes. The local topography is classified as undulating to hummocky.

3.1 Scope of Work

The scope of work for the foregoing investigation included site reconnaissance, field drilling, laboratory testing, data analyses and slope stability assessment. Specifically, the scope of work consisted of the slope stability assessment is to determine the factor of safety against slope failure and to provide general design and construction recommendations.

4.0 FIELD EXPLORATION AND LABORATORY TESTING

4.1 Field Drilling

Five boreholes (Boreholes 09-201 to 09-205) were drilled on the site to depths of 12.0 metres on August 5, 2009 using a truck mounted drill rig equipped with continuous flyte, 150-millimeter diameter, solid-stem augers. Supervision of the drilling, soil sampling, and logging of the various soil strata were conducted by Mr. Merle Hagstrom, P. Eng. of HGSL. The soil encountered during drilling was classified in accordance with the Modified Unified Soil Classification System described on Plates 1 and 2, Appendix A. The soil and groundwater results are presented on borehole logs, (Plates 203 to 207A, Appendix A). A site plan showing the approximate borehole locations is presented on Plate 208, Appendix A.

Soil sampling for laboratory analysis generally consisted of disturbed auger soil samples at 0.75 meter intervals obtained from all five boreholes. In addition, pocket penetrometer (PP) readings were taken on intact cohesive soil samples at approximately 0.75 meter intervals from all boreholes to obtain an indication of the unconfined compressive strength (Q_u) of the soil. Other laboratory tests consisted of Atterberg limit tests.

Groundwater conditions were monitored during drilling, at drilling completion, 3 to 7 hours later and 9 days later. The individual results are presented on the borehole logs in Appendix A.

5.0 SOIL CONDITIONS

A total of five boreholes were drilled at the crest of the slopes of which the approximate location of the boreholes is shown on Plate 208, Appendix A. The subsoil profile encountered in the five boreholes generally consisted of thin cover of topsoil over silt followed by an extensive deposit of clay that extended below the bottom of boreholes. A 0.5 metres thick sand layer was encountered in the bottom of Borehole 09-201.

¹ Shetsen, I. 1990. Quaternary Geology, Central Alberta, Alberta Research Council. Map Scale 1:500000

A detailed description of the encountered stratigraphy is presented on the borehole logs in Appendix A and is further discussed in the following sections. It is noted that the soil properties discussed below such as internal friction angle and cohesion dictating slope stability are based on empirical correlation and pending verification based on slope stability analysis.

5.1 Topsoil

Topsoil was encountered in all five boreholes at the ground surface and extended to depths ranging from 5 to 17 centimeters. The topsoil was generally described as silty, dry, compressible, and dark brown to black in colour. Greater thick of topsoil may be encountered between borehole locations.

5.2 Silt

Silt was encountered below the topsoil in all five boreholes at depths ranging from 0.1 to 0.2 metres and extended to depths ranging from 2.7 to 8.5 metres. The silt was generally described as sandy, with a trace to some clay, medium dense and light brown in colour. Occasional sand and clay lenses were encountered within the silt. In-situ moisture contents in the silt ranged from 7 to 18 percent with most of the values between 13 and 17 percent. Two Atterberg limit tests conducted in the silt yielded liquid limits of 28 and 29 percent and plastic limits of 15 and 16 percent. The silt can be conservatively allocated an internal friction angle of 27 degrees and cohesion of 0 kPa.

5.3 Clay

Clay was encountered below the silt at variable depths and extended beyond the termination depth of four boreholes. The clay was described as silty, medium plasticity, stiff to hard consistency, damp to moist, with occasional silt and sand lenses and dark grey in colour. Some rust staining, gravel chips and clay till like clay lenses were encountered within the clay. In-situ moisture contents in the clay ranged from 11 to 26 percent. Pocket penetrometer readings in the clay ranged from 195 to 480 kPa thus confirming stiff to hard consistency. An internal friction angle of 25 degrees and cohesion of 0 kPa can be conservatively applied to the clay present on the site.

54 Sand

A 0.5 metre thick sand layer was encountered at the bottom of Borehole 09-201 and extended below the termination depth of the borehole. The sand was described as silty, coarse grained, damp, loose in relative density, and dark brown in colour. In-situ moisture contents in the sand were about 11 percent. The sand can be conservatively allocated an internal friction angle of 28 degrees and cohesion of 0 kPa.

6.0 GROUNDWATER CONDITIONS

The groundwater conditions encountered in the five boreholes are summarized in Table 1, below. As shown, the groundwater conditions extended below the termination depth of all boreholes and thus the ground water conditions are considered to be low at the site. In general, groundwater

levels can be expected to be highest during the spring due to snowmelt, or following periods of frequent or prolonged rainfall. The levels will generally decrease until the late fall at which time the lowest levels are expected and will continue over the winter months. The present groundwater measurements are considered to be slightly below normal conditions.

TABLE 1 SUMMARY OF GROUNDWATER OBSERVATIONS

Borehole Number	Depth of Groundwater	Water Levels After Drilling Completion (m)					
	Seepage (m)	t = 0 hours	t = 9 days				
09-201	Nil	11.8 (dry)	11.5 (dry)				
09-202	Nil	11.8 (dry)	11.8 (dry)				
09-203	Nil	11.8 (dry)	11.7 (dry)				
09-204	Nil	11.8 (dry)	11.8 (dry)				
09-205	Nil	11.9 (dry)	11.6 (dry)				

7.0 SLOPE EVALUATION

7.1 Potential Impacts on Slope Stability

There are moderately steep slopes within the study area that are situated in two distinct areas of the site where cluster type homes will be constructed. There were five deep boreholes drilled in the tow areas of which the approximate location of the boreholes are shown on Plate 208, Appendix A. The soil conditions across these slopes generally consist of a thin cover of topsoil over variable thick layers of predominately silt and clay with low groundwater conditions.

There are several factors, which are listed below that could potentially lead to instability of the slopes on this site. Such factors include:

- 1. Placement of fill soils near the crest-of-slope.
- 2. Disturbance of the existing vegetation on the slope or near the crest of a slope.
- 3. An increase in groundwater level and therefore increase in pore pressures within the soil due to general lot grading, general development of the site including excessive lawn watering, ponding of water, construction of swimming pools or leaking utility lines near the crest-of-slope.
- 4. Excessive surface runoff over the crest-of-slope leading to increased groundwater infiltration into the slope and possible surficial erosion and sloughing.
- 5. Removal or erosion at the toe of the slope.

All of the factors above can, to some degree, be controlled to minimize the negative impact on the stability of the adjacent slopes. The above factors were considered in the evaluation process to identify potential modes and degrees of slope instability on the site. Erosion at the toe of the slope is not considered to be a factor. Other factors such as loading the crest of the slope; removal at the toe of the slope; disturbance to the vegetation on the slope; an increase in groundwater levels and excessive surface runoff over the crest of slope can be controlled by proper planning and general maintenance of each proposed residential lot.

7.2 Slope Stability Analysis

An infinite slope stability analysis was undertaken on different cross sections for this project. A slope is generally considered stable if it possesses a factor-of-safety of 1.5 or greater.

Based on the information obtained from the drilling program, site reconnaissance and laboratory testing, soil properties were estimated for the various soil strata. A soil strength parameter of internal angle of friction of 27 degrees, 25 degrees and 28 degrees was assigned for the silt, clay and sand, respectively. The groundwater table was assumed at depth of 10.0 metres below ground surface.

The slope inclinations for the analysis were between 8 and 12 degrees (15 and 21 percent). The results of the slope stability analysis indicate that the factor of safety against slope failure is greater than 1.9. Based on the results of the analysis, the slopes on the site are considered stable and possess a factor-of-safety greater than 1.5 under the worst anticipated groundwater conditions. Therefore, no development setback restrictions or set-back distances are considered necessary for proposed lots on the site where the slopes are steeper than 8 degrees (15 percent).

8.0 CLOSURE

The report was based on the findngs at five borehole locations that are located in two different areas of the site that has moderately steep slopes. Should different subsoil and groundwater conditions be encountered during construction, Hagstrom Geotechnical Services Ltd. should be notified immediately and the recommendations submitted herein will be reviewed, and revised if necessary.

This report was prepared for the exclusive use by Nor Can Consulting Group and authorized users for the specific application to the project described in the report. It has been prepared in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made. It is recommended that a copy of this report be submitted with each lot land title and applied as a restrictive covenant to each lot.

Hagstrom Georgehnical Services Ltd.

Merie Hagstrom, B.Sc. B. Eng.
Schlor Engineer

PERMIT TO PRACTICE
Hapstrom Geotechnical Services Ltd.
Signature Mult Cognitud
Date March 1, 2012
PERMIT NUMBER: P 9893
The Association of Protessional Engineers,
Geologists and Geophysicists of Alberta

APPENDIX A

Explanation of Field and Laboratory Test Data Borehole Logs Site Plan

Explanation of Field and Laboratory Test Data

The following pages are an explanation of the terms and symbols used in the Test Hole Log

Soil Profile and Description

Soil types are described by the Modified Unified Soil Classification System. (See Plate 2 for terms and symbols)

Soils classified by particle size fall in the following ranges:

BOULDERS - greater than 200 mm SAND - 0.08 mm to 5 mm

COBBLES - 75 mm to 200 mm GRAVEL - 5 mm to 75 mm

SILT - 0.002 mm to 0.08 mm CLAY - finer than 0.002 mm

Additional graphic symbols include:

seepage

water level surface

Soil Sample Type

Standard Penetration Sample (D)

Undisturbed Sample (Shelby) (U)

В Bag Sample

Penetration Resistance

Field test indication number of blows (N) of a 140 pound hammer dropping 30 inches (76cm) required to drive a 2 inch (5 cm) O.D. open end sampler a distance of 1 foot (30 cm) from 0.5 to 1.5 feet (15 to 45 cm) into the undisturbed soil. This test is outlined in A.S.T.M., D1568.

Miscellaneous Tests

In this column are summarized results of all the laboratory test as indicated by the following symbols:

HVR Hydrocarbon Vapour Readings, ppm or % LEL

* MA Mechanical grain size analysis

G Specific gravity

k Coefficient of permeability

PP Pocket penetrometer strength kg/cm2

* q Triaxial compression test

* C Consolidation test

Qu Unconfined compressive strength kg/cm2

SO₄ Soluble sulphate concentration

Bulk unit weight

Dry unit weigh γd

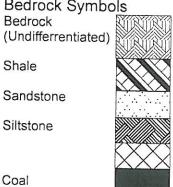
* Tests normally summarized on separate data sheets



Hagstrom Geotechnical Services Ltd.

Modified Unified Classification System For Soils

	lajor D	ivision	Group Symbol	Graph Symbol	Color Code	Typical Description		Classificatior
sieve	coarse	Clean Gravels	GW	4 5 5	Red	Well graded gravels, little or no fines	$C_{U} = (D_{60}/D_{10} D_{10}^{2}/(D_{10}^{*}D_{60}^{*})$) > 6 C _c = = 1 to 3
Coarse-Grained Soils (more than half by weight larger than 200 sieve)	half carger t	(intile of flo lifles)	GP		Red	Poorly graded gravels, and gravel sand mixtures, little or no fines		above
	Green Brann Brann Brann Branns	Dirty Gravel (with some fines)	GM		Yellow	Silty gravels, gravel-sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
	more		GC		Yellow	Clayey gravels, gravel-sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
	fine	Clean Sands	SW	a a	Red	Well graded sands, gravely sands, little or no fines	$C_{U} = (D_{60}/D_{10})$ $D_{30}^{2}/(D_{10}*D_{60})$	
	nds n half i naller ti sieve	(little or no fines)	SP		Red	Poorly graded sands, little or no fines	Not meeting requirements	
	more th grains s No.	Dirty Sands	SM		Yellow	Silty sands, sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
		(with some fines)	SC		Yellow	Clayey sands, sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
200 sieve)	Silts below "A" line negligible rganic content	W _L < 50%	ML		Green	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification upon plastici	
s asses 20	d P	W _L > 50%	МН		Blue	Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils		
ained eight pa	Clays above "A" line negligible organic content	W _L < 30%	CL		Oreen	Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean clays		
ne-Gra by we	Clays ove "A" I gible org content	30% < W _L < 50%	CI		Green-	Inorganic clays of medium plasticity, silty clays		
Fir In half	abo	W _L > 50%	СН			Inorganic clays of high plasticity		
Fine-Grained s (more than half by weight passes	Organic ilts & Clays Ilow "A" line on chart	W _L < 50%	OL		Green	Organic silts and organic silty clays of low plasticity	fine content determined in	t is designated
	Organia Silts & bellow on c	W _L > 50%	ОН		Blue	Organic clays of high plasticity	by the letter a mixture of clay	"F". E.G. SF is sand with silt or
ŀ	Highly Orga	inic Soils	PI		Orange		Strong color often fibrous	
Bedroo	ock Symbok k errentiated)		l l	<u>_</u>		50 <u>ui</u>	Line	Tine



Plasticity Index (IP) 30 CI ALine OH 20 МН CL 10 MI OI SF 0 20 50 10 40 PLATE No.202 Liquid Limit (W,)

Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows Hagstrom Geotechnical Services Ltd. LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST 5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 **BORING** JOB No.: H0907-280 09-201 DATE: August 5, 2009 TECH: MH DRILL TYPE: B-40 Solid Stem Auger MOISTURE CONDITIONS TEST RESULTS SOIL PROFILE & DESCRIPTION ATTERBERG LIMITS MOISTURE CONTENT % DEPTH IN FEET DEPTH (m) DATUM: MISCELLANEOUS TESTS 10 30 60 SURFACE ELEVATION: TOPSOIL; silty, dry, compressible, dark brown, 0 SILT; sandy, trace of clay, light yellowish brown 3 - occasional thin sand lenses - dry, loose 10 1 Ð - dry to damp, loose 15 5 0 0 - damp, loose Ð groundwater seepage 1 - clay till like 25 8 P CLAY; silty, very stiff, medium plasticity, damp to moist, dark brown PP = 430 kPa 30 -- clay till like PP = 360 kPa ----10 - very stiff, medium plasticity, dark brown PP = 310 kPa 35 Q, UNCONFINED COMPRESSION SO4 MOISTURE CONTENT SULPHATE CONTENT STANDARD PENETRATION SAMPLE PLATE \Box LIQUID LIMIT WATER TABLE UNDISTURBED SAMPLE (SHELBY) Y DRY UNIT WEIGHT PLASTIC LIMIT N B BAG SAMPLE No.203 PENETRATION RESISTANCE



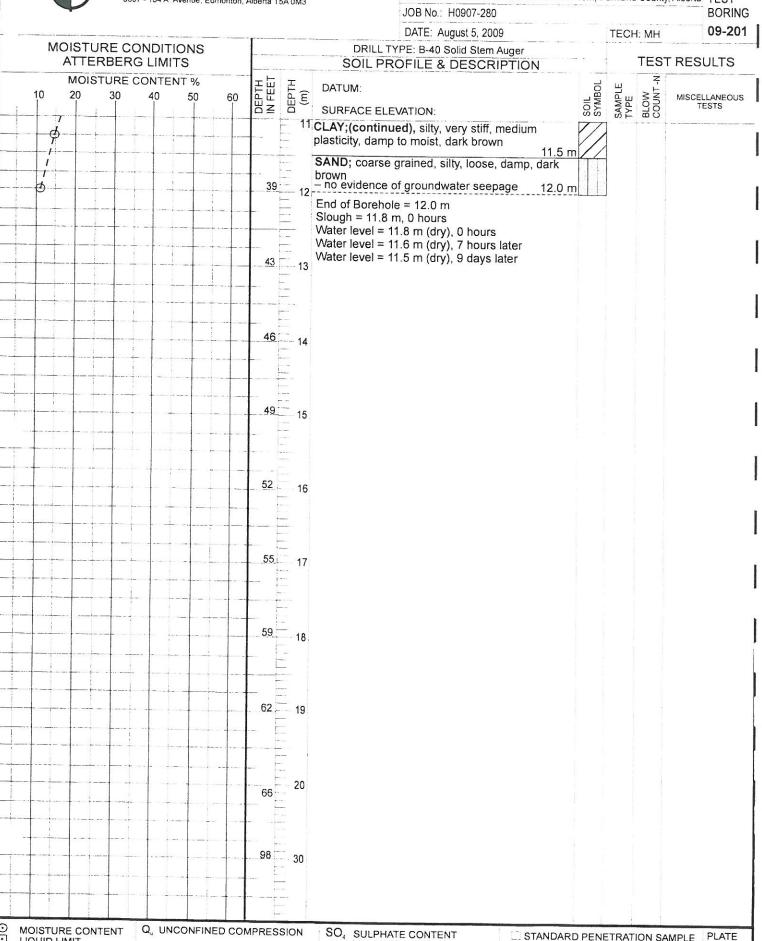
CLIENT: Nor Can Consulting Inc.

PROJECT: Proposed Country Residential Subdivision

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

BORING



MOISTURE CONTENT
 LIQUID LIMIT
 △ PLASTIC LIMIT

Y_d DRY UNIT WEIGHT

VATER TABLE

N PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE

No.**203A**

Hagstrom G	eotechnical Serv	CLIEN PROJE	IT: Nor Can Consulting Group ECT: Proposed Country Resider		ivision - Faw	n Meadows
	venue, Edmonlon, Alberta T5A	LOCAT	ION: Portions of NE & SE 4-53-2-V			Alberta TEST
	SSS control of the property and an arrangement of the state of the sta	JOB No				BORING
MOISTURE CONDITIO	NIC T	DRILL TYPE: B-4	August 5, 2009 10 Solid Stem Auger	Tt	ECH: MH	09-202
ATTERBERG LIMITS			& DESCRIPTION	-		RESULTS
MOISTURE CONTENT	「% 王田 臣			30L	J Z	
0 20 30 40	20 60 DEPTH N FEET HTG	DATUM: SURFACE ELEVATION	:	SOIL	SAMPLE TYPE BLOW COUNT -N	MISCELLANEOUS TESTS
		TOPSOIL; silty, dry, co	mpressible, dark brown,	FH	0	
P		11 cm thick SILT; sandy, some clay	11 cm/ , medium dense, light			
**************************************		yellowish brown	1 William Company of the Company of			
\	3 =	1 - frequent carbonate p	ockets			
<u> </u>						
		3				
	6	- 2				
· •						
	10	3 - medium dense				
						
1 +		4				
						
•	15	 damp, medium dense 	e, yellowish brown			
\\		5				
A D		Ĭ				
	+	0000				
(P)	20 —	6				
1						
1 - - - -		7				
		- clay layer from 7.2 o	7.4 m, very stiff			
0	25	- medium dense, dark	brown 7.7 m			
		CLAY; silty, very stiff, m	nedium plasticity, moist,			
D		8 occasional gravel chips	, dark grey		_	
					۲	P = 265 kPa
	30	9 - very stiff, occasional s	silt lenses		P	PP = 280 kPa
					<u>.</u>	
		10			H	PP = 240 kPa
	++++	- very stiff, moist, dark	brown		F	PP = 245 kPa
	35			//		

Hagstrom Geotechnical Services Ltd. 5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

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LIQUID LIMIT

PLASTIC LIMIT

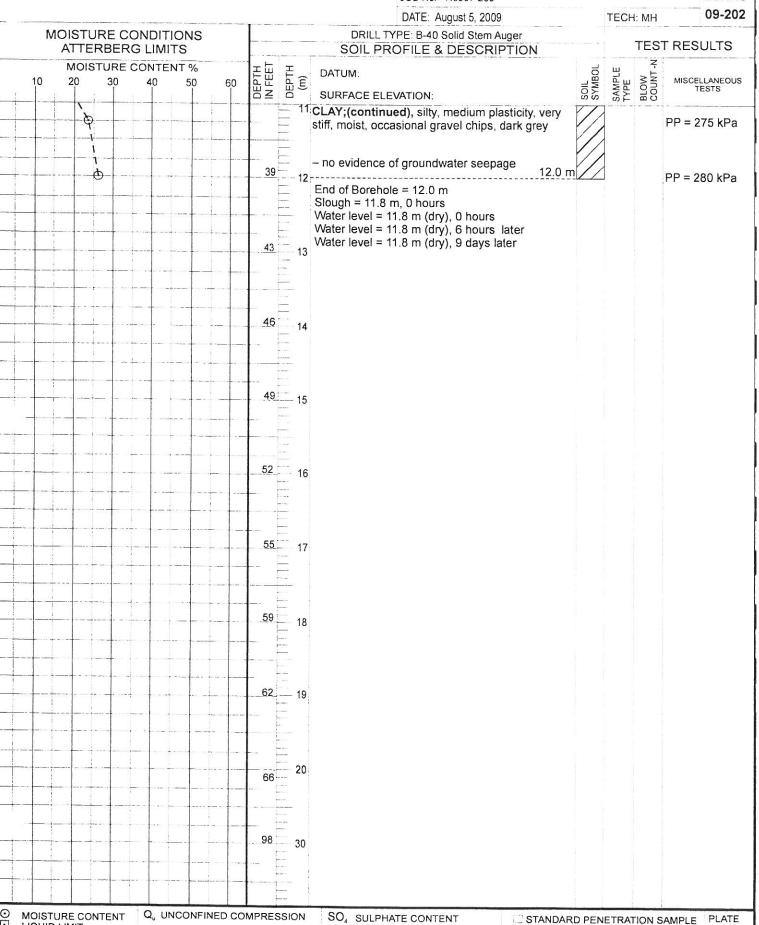
γ DRY UNIT WEIGHT

CLIENT: Nor Can Consulting Inc.

PROJECT: Proposed Country Residential Subdivision

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta
JOB No.: H0907-280

BORING



WATER TABLE

PENETRATION RESISTANCE

N

UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE

No. 204A

Hagstrom Geotechnical Services Ltd. 5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No. H0907-280 **BORING**

						_		DATE: August 5, 2009	TECH: MH 09-20			
	N		URE C			1S				DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION	TEST	RESULTS
-		-	STURE			%		ェ늡	I			
	10	20	30	40	5	0	60	DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SAMPLE TYPE BLOW COUNT-N	MISCELLANEOUS TESTS
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		φ			i		1	700		brown, 10 cm thick 10 cm/		
		b								SILT; sandy, some clay, medium dense, light yellowish brown		
-	-	<i>[</i> - -					-	3	1			
	+i		-					_				
									_	– medium dense		
	++	-			-			F.		<i>'</i>		
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	19						1	-				
	i											
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lacksquare	i							15	1.00	- medium dense		
-	i				-	L	-		5			
\vdash	Œ											
	$\pm i$			+								
	1		-	+			-	- !		5.8 m CLAY; silty, very stiff, medium plasticity, damp,		
	1			T	-			20	6	occasional gravel chips, dark brown	F	PP = 400 kPa
	1										1	
	1)		-							1	PP = 480 kPa
	-						-		7	- very stiff, moist] '	- 400 KFa
	1											
-	1						+	25		- cobble size rock, difficult to drill	F	PP = 255 kPa
	+			-						(/	}	
	i								8	- very stiff, medium plasticity, dark brown		
	0										F	P = 245 kPa
	4	`										
-		<u> </u>						30 -	9	- stiff, medium plasticity, occasional gravel chips		PP = 195 kPa
<u> </u>	-	-/-	<u> </u>				\vdash	[
	+-	/-	 	-								
		7	† 				1	!				PP = 210 kPa
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	10									- very stiff, moist, dark brown		DD = 255 kD=
								35	_	2.5.7 con, moiot, dank brown		PP = 255 kPa
0 1	MOIST	URE CO	DNTENT	Q	UNCO	NFINE	CON	MPRES	SION	SO₄ SULPHATE CONTENT ☐ STANDARD PEN ▼ WATER TABLE ☐ UNDISTURBED	IETRATION SA	MPLE PLATE
Ā	PLAST	IC LIMI		γ _d	DRY U	NIT WE	EIGHT			WATER TABLE N PENETRATION RESISTANCE BAG SAMPLE	SAMPLE (SHE	-BY) No. 205

CLIENT Nor Can Consulting Inc. PROJECT: Proposed Country Residential Subdivision Hagstrom Geotechnical Services Ltd. LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST 5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 **BORING** JOB No.: H0907-280 09-203 DATE: August 5, 2009 TECH: MH DRILL TYPE: B-40 Solid Stem Auger MOISTURE CONDITIONS TEST RESULTS ATTERBERG LIMITS SOIL PROFILE & DESCRIPTION MOISTURE CONTENT % DEPTH IN FEET DEPTH (m) SAMPLE TYPE DATUM: MISCELLANEOUS TESTS 10 30 60 SURFACE ELEVATION: 11 CLAY;(continued), silty, medium plasticity, very PP = 275 kPa stiff, damp, occasional gravel chips, dark brown 12.0 m 0 PP = 245 kPa End of Borehole = 12.0 m Slough = 11.8 m, 0 hours Water level = 11.8 m (dry), 0 hours Water level = 11.7 m (dry), 5 hours later Water level = 11.7 m (dry), 9 days later 43 46 14 49 15 52 16 55 17 59 18 62 20 66 98 30

MOISTURE CONTENT
 LIQUID LIMIT
 △ PLASTIC LIMIT

 $Q_{_{\rm U}}$ UNCONFINED COMPRESSION $\gamma_{_{\rm d}}$ DRY UNIT WEIGHT

SO₄ SULPHATE CONTENT

WATER TABLE

N PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE

PLATE No.205A

CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows Hagstrom Geotechnical Services Ltd. LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST 5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 **BORING** JOB No. H0907-280 09-204 DATE: August 5, 2009 TECH: MH DRILL TYPE: B-40 Solid Stem Auger MOISTURE CONDITIONS TEST RESULTS SOIL PROFILE & DESCRIPTION ATTERBERG LIMITS MOISTURE CONTENT % DEPTH (m) DEPTH IN FEET DATUM: MISCELLANEOUS TESTS 10 SURFACE ELEVATION: TOPSOIL; silty, compressible, loose, black, 5 cm 9 SILT; sandy, clayey, dry, medium dense, light yellowish brown 2 - occasional fine sand lenses damp, medium dense 10 4.3 m CLAY; silty, medium plasticity, very stiff, PP = 315 kPa 15 occasional gravel chips, dark brown PP = 290 kPa - very stiff PP = 275 kPa - very stiff, moist, medium plasticity, dark brown 1 PP = 300 kPa PP = 360 kPa 25 - clay till like, very stiff, medium plasticity PP = 340 kPa PP = 325 kPa 30 Φ PP = 280 kPa 10 PP = 300 kPa - very stiff, medium plasticity, dark brown 35

SULPHATE CONTENT

PENETRATION RESISTANCE

WATER TABLE

N

STANDARD PENETRATION SAMPLE

UNDISTURBED SAMPLE (SHELBY)

B BAG SAMPLE

PLATE

No. 206

Q. UNCONFINED COMPRESSION

γ DRY UNIT WEIGHT

MOISTURE CONTENT

LIQUID LIMIT

PLASTIC LIMIT

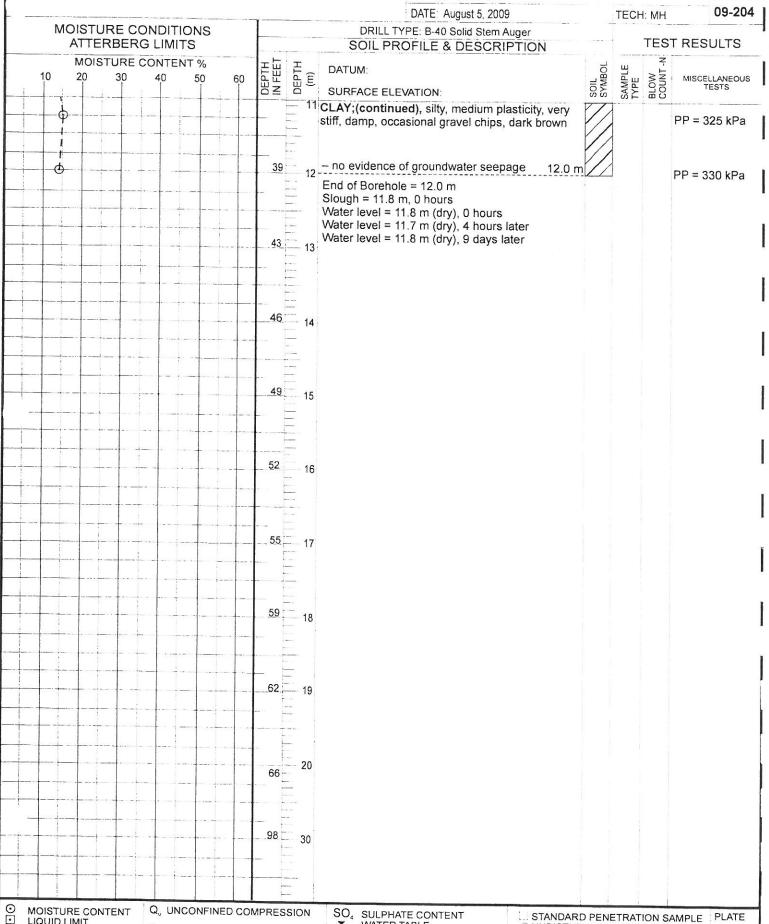
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LIQUID LIMIT

PLASTIC LIMIT

CLIENT: Nor Can Consulting Inc. PROJECT: Proposed Country Residential Subdivision LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST JOB No.: H0907-280 **BORING**



ΣN

γ DRY UNIT WEIGHT

WATER TABLE

PENETRATION RESISTANCE

UNDISTURBED SAMPLE (SHELBY)

No.206A

B BAG SAMPLE

CLIENT Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows Hagstrom Geotechnical Services Ltd. LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST 5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 JOB No.: H0907-280

IVI	ATTE	RRER	ONDIT G LIMI	IONS				DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION		TEST RESUL			
			CONTE			F =					÷		
10	20	30	40	50	60	E H	DEPTH (m)	DATUM:	SOIL	SAMPLE TYPE	BLOW COUNT-N	MISCELLA	
	Ĩ	Ī	1	30	1	E E	DEI C	SURFACE ELEVATION:	SOIL	YPE	000	MISCELLA TEST	
			T -	-		l		TOPSOIL; silty, dry, compressible, black,	- 1	<i>w</i> ⊢	шО		
φ				·	+	-		17 cm thick 17 cm	n/				
7			 	-				SILT; sandy, trace of sand, dry, loose, light brow					
+													
						3							
							-						
Φ													
Y								 medium dense, light brown 					
				T		-							
i					-	6	2						
ф													
1					1			2.7	m _				
1								CLAY; silty, very stiff, medium plasticity, clay till	1				
Ĭ						10	3	like dark brown	1//			PP = 425	
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	1							- very stiff, medium plasticity, dark brown					
+-+	Φ-											PP = 380	
	i-						4	- occasional gravel chips and coal chips					
-								grave, empe and esser simps					
- d													
1						15	100					PP = 410	
1						0.00 M m2	-						
1	and the first series				+		5						
a	}					-	-					PP = 350	
+					<u> </u>								
	1												
1	D -						6	- very stiff, medium plasticity, moist				PP = 320	
	Ī					20	_	very still, medium plasticity, moist				PP - 32U	
	;												
I I												PP = 320	
							7		//				
+-!							_						
								- very stiff, occasional silt lenses	11			DD - 275	
1						25	-	, , , , , , , , , , , , , , , , , , , ,	1//			PP = 375	
<u>i_</u>						Ĺ							
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1							_					PP = 275 I	
1					-								
1							_		1//				
-Ġ							9	– very stiff, dark brown				PP = 300	
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 -						[
9	++								1//			PP = 260	
1		1			1	35			1/			1 - 200	

BORING

STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE SULPHATE CONTENT WATER TABLE PLATE LIQUID LIMIT γ_{d} DRY UNIT WEIGHT PLASTIC LIMIT PENETRATION RESISTANCE No.207

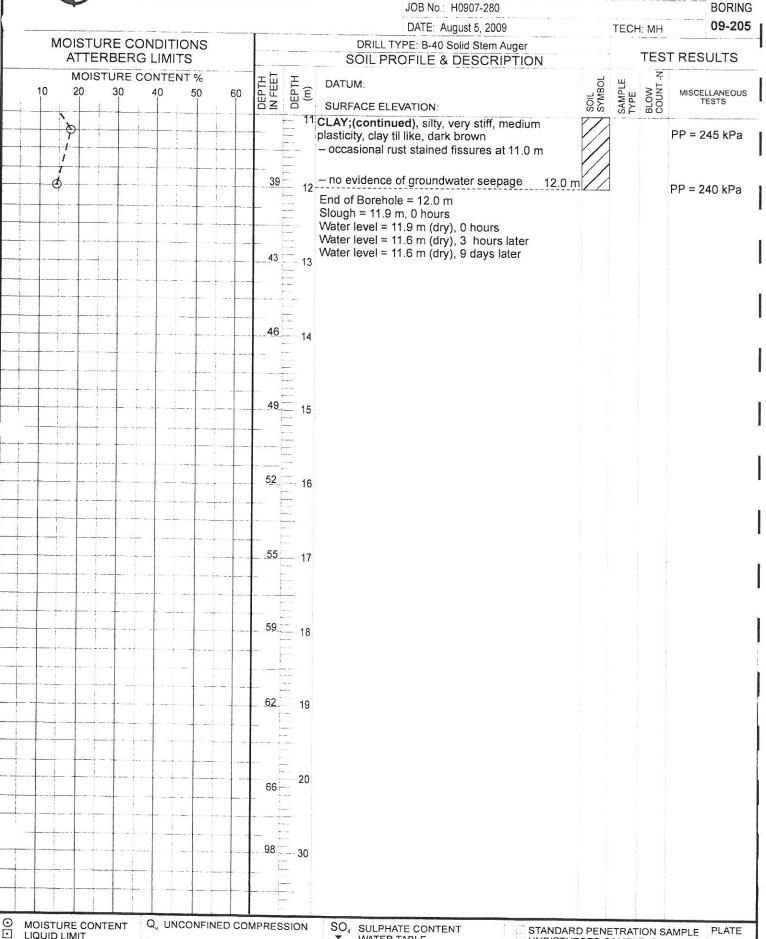


LIQUID LIMIT

PLASTIC LIMIT

γ DRY UNIT WEIGHT

CLIENT: Nor Can Consulting Inc. PROJECT: Proposed Country Residential Subdivision LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST JOB No.: H0907-280 **BORING**



WATER TABLE

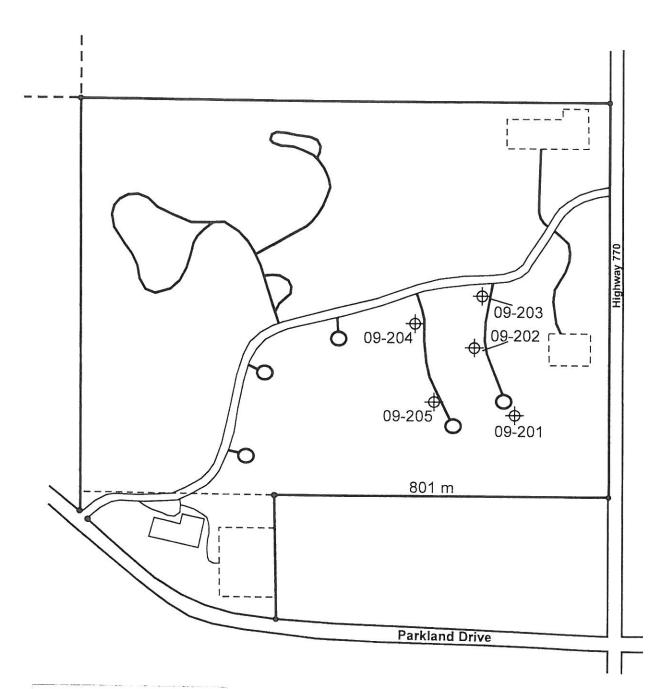
PENETRATION RESISTANCE

UNDISTURBED SAMPLE (SHELBY)

No.207A

B BAG SAMPLE





LEGEND

Borehole Location

Site Boundary

Scale: Not to Scale



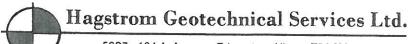
NOR CAN CONSULTING INC.

Proposed Country Residential Subdivision - Fawn Meadows
Portions of NE & SE 4-53-2-W5M,
Parkland County, Alberta
Site Plan

Job No: H0907-280 Date: Au

Date: August 11, 2009

Plate: 208



5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 Tel: (780) 996-5621= Fax: (780) 475-5671 e-mail: h_gsl@telus.net

Nor Can Consulting Group Inc. Box 38, Site 219, RR2 Carvel, Alberta T0E 0H0

March 1, 2012 Our File: H0907-280 Your File: NC-145

Attention:

Mr. Frank Florkewich

Dear Sirs:

Re: Geotechnical Site Investigation for Building Foundations and Roadways

Proposed Country Residential Subdivision - Fawn Meadows

Portion of NE and SE 4-53-2-W5M

Parkland County, Alberta

1.0 <u>INTRODUCTION</u>

As requested, a geotechnical site investigation was carried out by Hagstrom Geotechnical Services Ltd. (HGSL) for the design and construction of residential building foundations and roadways at the above referenced site. The investigation consisted of drilling a total of fourteen boreholes, soil sampling, laboratory testing, and evaluation of the results. Our recommendations are provided herein.

2.0 PROJECT DESCRIPTION

The proposed country residential subdivision contains about 52.6 hectares of agricultural land that occupies a portion of the northeast and southeast quarters of Section 4, Township 53, Range 2, West of the Fifth Meridian. The site is bounded on the east by Highway 770 and on the south by Parkland Drive. The site is open, vacant hayland and contains four large groups of trees and marsh that cover about 30 to 35 percent of the site. The site topography is moderately rolling with slopes typically less than 12 degrees. No definite drainage pattern is apparent on the site.

It is understood that the proposed development is to consist of cluster type lots that consist of 36 single family residential lots, numerous duplex, semi-detached and supportive living units. The single family units will range in size from 0.30 to 0.58 acres each. It is further understood that the development will be serviced with centralized municipal sanitary sewers and potable water systems. Other facilities such as a community services building and assisted seniors living complex is proposed for the site.

3.0 INVESTIGATION PROCEDURE

Fourteen boreholes were drilled at the subject site on to a depth of 4.5 metres on August 4, 2009. Supervision of drilling, soil sampling, and logging of the various soil strata was performed by Mr. Merle Hagstrom, P. Eng. of HGSL. The soils encountered during drilling were classified in accordance with the Modified Unified Soil Classification System which is explained on Plates 1 and 2, Appendix A. The soil and groundwater conditions encountered during field drilling were recorded and are presented on the borehole logs in Appendix A. The borehole locations are presented on Plate 17, Appendix A.

4.0 SUBSOIL AND GROUNDWATER CONDITIONS

The soil stratigraphy at the borehole locations consist of a thin cover of topsoil over variable thick layers of sand, silt and clay. The topsoil thickness ranged from 7 to 60 centimeters with an average thickness of 26 centimetres. The sand of about 30 centimetres in thickness was encountered in two boreholes and moisture contents in the sand were about 23 percent. The silt was encountered in eight boreholes and ranged in thickness from 0.5 to 4.4 metres. Moisture contents in the silt ranged from 7 to 23 percent. The clay was encountered in nine boreholes and ranged in thickness from 0.6 to 4.4 metres. Moisture contents in the clay ranged from 12 to 38 percent and pocket penetrometers readings in the clay ranged from 105 to 520 kPa. Moisture contents within the silt and clay within the top 1 to 2 metres are expected to be near or slightly below optimum moisture content for recompaction.

The groundwater levels in each borehole location were monitored during drilling, at drilling completion, several hours after drilling and 10 days later. Groundwater seepage was encountered during drilling in two of the fourteen boreholes. A tabular summary of the water table results in each of the boreholes is provided in Table 1, below and as shown, a majority of the stabilized groundwater table levels were below a depth of 4.5 metres. Lithologic descriptions of the subsoils encountered along with water table levels are presented in the boreholes logs, Appendix A.

4.1 CONCRETE

The results from soluble sulphates analyses conducted on fourteen selected soil samples revealed a "negligible" to "moderate" potential for sulphate attack on concrete in contact with native soils at this site. Therefore, all concrete in contact with the native soils relating to building foundations and underground services at this site should be made with CSA Type 50 Sulphate Resistant cement possessing a minimum 56-day compressive strength of 30 MPa. The maximum water cement ratio should be 0.50. An air entrainment agent of 5 to 7 percent is recommended for improved workability and freeze-thaw durability.

TABLE 1: SUMMARY OF BOREHOLE WATER LEVELS

Borehole Number	t= 10 Days Later	Borehole Number	t = 10 Days Later
09-1	2.0	09-8	4.4(dry)
09-2	4.4(dry)	09-9	4.2(dry)
09-3	4.4(dry)	09-10	4.3(dry)
09-4	2.0	09-11	4.4(dry)
09-5	4.3(dry)	09-12	4.4(dry)
09-6	4.3(dry)	09-13	4.3(dry)
09-7	4.3(dry)	09-14	3.0

5.0 RECCOMENDATIONS FOR SITE PREPARATION

The site has localized low areas that may contain a significant amount of topsoil and peat. All topsoil and peat should be removed from building and roadway areas. For the buildings that will have a basement, the excavation should be carefully inspected to ensure that all compressible organic soils and soft material has been removed from the building site.

Estimates of topsoil thickness at the borehole locations may be obtained from the borehole logs. However, it should be expected that the topsoil and organic material thicknesses might vary between the borehole locations. In particular, no boreholes were drilled in the bottom of the marshes/fens and thus significant amounts of compressible topsoil and organic soils may have to be wasted prior to placement of new fill.

Except for lower areas, the native sand, silt, and clay are expected to be suitable for general site grading. Uniformity and compactive effort of the engineered fill are important in minimizing the potential for differential settlement. The engineered fill should be compacted to the following standards.

- (1) All site-raising fill under building areas should be placed in 150 mm maximum lifts compacted to at least 98% of standard Proctor maximum dry density within ±2% of its optimum moisture content.
- (2) Site raising fill under the parking and roadway areas should be placed in 150 mm maximum lifts compacted thickness and compacted to at least 95% of standard Proctor maximum dry density within ±2% of its optimum moisture content.
- (3) General site grading fills outside the building footprint should also be placed in 150 mm lifts compacted thickness and compacted to at least 95% of standard Proctor maximum dry density within ±2% of its optimum moisture content.
- (4) All fill used for landscaping purposes needs only moderate compaction (i. e. 92 % of standard Proctor maximum dry density) to ensure future settlements do not adversely

6.0 RECOMMENDATIONS FOR BUILDING FOUNDATIONS

Spread footings and cast-in-place concrete friction piles are considered feasible foundation types for new homes in view of the observed soil and groundwater conditions. Design recommendations for spread footings and cast-in-place concrete friction piles are provided in the following sections.

6.1 Spread Footings

Spread footings should be designed and constructed according to the following recommendations:

- (1) Footings supporting heated structures should have a minimum soil cover of 1.5 m below finished ground level to provide adequate protection against frost. For unheated structures, exterior and interior footings should be founded at a minimum depth of 2.4 m below finished ground level.
 - In the case of basements, footings may be founded immediately below basement level provided the minimum depth of 1.5 m below finished exterior grade is maintained.
- (2) All footings should be founded on the undisturbed, inorganic, native mineral soils. Footings should not be supported on fill. Where local wet and soft zones are encountered in the footing excavations, it may be necessary to increase the size of the footings or to remove the wet and soft material and replace with lean concrete. Disturbed soil should not be allowed to remain in the footing excavations.
- (3) Strip and spread footings may be designed using an allowable bearing capacity of 80 kPa for footings founded in sand, silt or clay at the above noted depths. In no case, should the perimeter strip footings be less than 60 centimeters wide and 30 centimeters thick and should be reinforced with two 10 millimeter longitudinal steel bars.
- (4) Footings should be inspected by qualified geotechnical personnel to ensure that the footings are located in suitable native mineral soils.

6.2 Cast-in-Place Concrete Friction Piles

Foundation loads for new homes may be constructed on cast-in-place concrete friction piles. This may be an economical foundation type for any at-grade building development including attached garages to avoid construction of footing excavations. The piles should be designed and installed according to the recommendations given below.

(1) An allowable shaft adhesion of 19 kPa may be used for the design of concrete friction piles in native mineral soils. Shaft adhesion should not be included in the upper 1.5 m of the pile to allow for the possibility of the soil drying and shrinking away from the concrete pile shaft

for potential future settlement. A minimum pile length of 5.5 m below finished site grade for exterior piles is recommended to resist potential frost heave forces. Interior piles should also be 5.0 m deep if installation will be carried out during winter months.

- (2) End bearing resistance should not be included in calculating the allowable design load of a straight shaft friction pile.
- (3) A minimum pile shaft diameter of 300 mm is recommended to prevent voids from forming during pouring of concrete.
- (4) As a minimum and not including structural requirements, a nominal percentage of longitudinal reinforcement (0.5% of the sectional area of the pile shaft) should be provided and is required throughout the top 5.0 metres of the pile shaft to resist potential uplift forces on the pile due to frost action and seasonal moisture variations. If piles are designed as tension elements, the pile reinforcing should be designed to resist the anticipated uplift stresses.
- (5) Concrete should be poured immediately after drilling of the pile hole to reduce the risk of groundwater seepage and sloughing soil. It is expected that protective steel casing will be required where the pile drill holes penetrate below the groundwater table in wet sand.

6.3 Concrete Grade Beams

If piles are used to support garage structures, etc., a concrete grade beam is required along the top of the piles. Precautions should be taken to prevent heaving of the grade beams due to frost penetration, where the grade beams will lie less than 1.5 m below the ground surface.

The recommended construction procedure for preventing heave under the grade beam is to use crushable, non-degradable void filler that is incorporated at the base of the grade beam. In this method, the grade beam must be designed in accordance with the crushing strength of the void filler used and the piles must be available to take the resulting uplift.

6.4 Concrete Floor Slabs

Concrete slabs on grade may be supported on the native mineral soils or engineered fill. Some clay soils on the site have a moderate swelling potential and given this, the concrete floor slab should be designed to tolerate some movement and should be separated from the building structure.

A minimum of 100 mm of clean, well-graded sand or gravel is recommended directly beneath the floor slab for a new home. This should be increased to a thickness of 150 mm for a garage floor slab. Coarse material greater than 50 mm in diameter should be avoided directly beneath the floor slab to prevent stress concentrations within the slab. The granular levelling course should be compacted to a uniform dry density of about 98 percent of standard Proctor maximum dry density. A recommended typical gradation is provided in Table 2, below.

TABLE 2: TYPICAL GRADATION FOR SLAB-ON-GRADE FLOORS

SI	EVE	% PASSING
11/2	38 000 μm	100
3/8	10 000 μm	65-100
No. 4	5 000 μm	50-90
No. 10	2 000 μm	35-75
No. 40	400 μm	10-45
No. 100	150 μm	0-20
No. 200	75 μm	0-5

Other appropriate materials, which fall outside the above recommended gradation limits may be suitable. Alternate materials should, however, be evaluated by a geotechnical engineer prior to use.

6.5 Excavations and Backfilling of Basements

Temporary excavation slopes for basement construction should be cut at 1 horizontal to 1 vertical though the native mineral soils. Occupational Health and Safety regulations for excavations must be followed at all times.

Perimeter drains should be provided on the outside of the footings below the basement floor slab to prevent building up of hydrostatic pressure against the basement walls and promote a dry basement. The drains should be surrounded with at least 200 millimetres of free draining gravel. If the water table is located within 1.0 meter of the bottom of concrete foundations, interior perimeter dains along the strip footing and lateral drains should be provided below the floor slab at a spacing of no more than 4.0 meters apart. It is recommended that at least two test holes be drilled at each home location prior to construction to confirm the soil and groundwater conditions.

The native mineral soils may be used for backfilling around the basement walls provided it is free of organic soils. The soils should be carefully placed and hand tamped in lifts of 300 mm or less to obtain uniform compaction. If compacted backfill is used, the foundation walls should be designed using an equivalent fluid pressure of 10 kN/m³.

6.6 Subgrade Preparation for Paved Roadways

The clay is highly frost susceptible and the groundwater table in isolated areas of the site are considered to be generally high. In this case, the final grade for the top of asphalt should be constructed at least 1.5 metres above the groundwater table. The final subgrade for roadways should be drained towards drainage swales and ditches to prevent subgrade softening due to water accumulations. Subsequent to subgrade preparation to obtain design grade elevation, all loose or organic material should be removed from beneath paved areas. Proof-rolling of the entire surface area under pavement sections should be carried out to detect any local soft and weak spots. Soft spots

detected as a result of proof-rolling should be excavated and backfilled with general engineered fill. If large subgrade excavation is required, a suggested depth of 300 to 450 mm is recommended followed by placement of a woven geotextile (AMOCO 2002 or equivalent). Granular backfill consisting of 80 mm diameter pit-run should be placed over the geotextile in one lift and compacted using lightweight equipment.

Subsequent to proof-rolling and subgrade repair, the subgrade should be scarified to a depth of no less than 150 mm and recompacted to at least 100 percent of SPMDD at a moisture content of 0 to 2 percent over optimum moisture content. The near surface soils within the top 2.0 to 3.0 metres were found to be near or dry of optimum moisture content. In some areas, some moisture conditioning to optimum moisture content will likely be required to achieve this level of compaction.

Options for subgrade preparation for new roadways should be finalized at the time of construction in order to confirm the subgrade condition. Depending on weather conditions, it may be become necessary to consider Portland cement stabilization. Cement dosage in the order of 10 to 15 kilograms per square metre should be expected.

Preparation of the subgrade for roadways should be carried out in segmented areas. This is to avoid loosening of the prepared areas by site traffic before compaction of the subgrade and placement of the granular material have been completed. Protection of the prepared subgrade against precipitation and frost should be undertaken.

6.7 Asphalt Pavement Structure

It is expected that vehicle traffic will consist of low volumes of passenger cars, trucks and garbage trucks corresponding to a road classification of local residential. A 20-year design life, an assumed traffic volume of 3.5×10^4 ESALs and a soaked California Bearing Ratio (CBR) of 3 was used in the design of the pavement structure.

The recommended hot mix pavement structure is as follows:

- 40 mm asphaltic concrete at final acceptance certificate
- 75 mm asphaltic concrete over
- 200 mm crushed granular base course (100% SPMDD)
- 150 mm subgrade preparation (100% of SPMDD)

The properties of the material used in the above roadway structure, should conform to Parkland County specifications or AT & U specifications. All hot mix pavement structures should be compacted to a minimum of 98 percent of the 50 blow Marshall density.

It is recommended that the finished subgrade road surface be sloped at a minimum of 2 percent toward perimeter ditches. The purpose of this is to drain any subsurface water from the subgrade and thereby prevent ponding of water, which could result in softening and/or possible frost heaving of the subgrade. Some deterioration of the road structure may occur prior to placing the final lift of hot mix asphalt from construction traffic loading (i.e. delivery vehicles and concrete trucks). Prior to placing the final lift of asphalt, the existing road surface should be inspected and any deficiencies (i.e.

the final lift of asphalt, the existing road surface should be inspected and any deficiencies (i.e. potholes, cracks) should be repaired prior to construction of an asphalt overlay.

7.0 CLOSURE

The letter report was based on the findings at fourteen borehole locations. Should different subsoil and groundwater conditions be encountered during construction, Hagstrom Geotechnical Services Inc. should be notified immediately and the recommendations submitted herein will be reviewed, and revised if necessary.

Should you have any questions or require additional information, do not hesitate to contact our office at (780) 996-5621.

Yours truly,

Hagstrom Geotechnical Services Ltd.

PERMIT TO PRACTICE
Hagstrom Geotechnical Services Ltd.

Signature // USC

PERMIT NUMBER: P 9693

The Association of Professional Engineers, Geologists and Geophysicists of Alberts

Merle Hagstrom, B.Sc., P. Eng.

Senior Engineer

Distribution: (4) addressee

Attachments: Appendix A

APPENDIX A

Explanation of Field and Laboratory Test Data Borehole Logs Site Plan

Explanation of Field and Laboratory Test Data

The following pages are an explanation of the terms and symbols used in the Test Hole Log

Soil Profile and Description

Soil types are described by the Modified Unified Soil Classification System. (See Plate 2 for terms and symbols)

Soils classified by particle size fall in the following ranges:

BOULDERS - greater than 200 mm SAND - 0.08 mm to 5 mm COBBLES - 75 mm to 200 mm SILT - 0.002 mm to 0.08 mm GRAVEL - 5 mm to 75 mm CLAY - finer than 0.002 mm

Additional graphic symbols include:

seepage
water level surface

Soil Sample Type

Standard Penetration Sample (D)
Undisturbed Sample (Shelby) (U)

Bag Sample

Penetration Resistance

Field test indication number of blows (N) of a 140 pound hammer dropping 30 inches (76cm) required to drive a 2 inch (5 cm) O.D. open end sampler a distance of 1 foot (30 cm) from 0.5 to 1.5 feet (15 to 45 cm) into the undisturbed soil. This test is outlined in A.S.T.M., D1568.

Miscellaneous Tests

In this column are summarized results of all the laboratory test as indicated by the following symbols:

HVR Hydrocarbon Vapour Readings, ppm or % LEL

* MA Mechanical grain size analysis

G Specific gravity

k Coefficient of permeability

PP Pocket penetrometer strength kg/cm2

* q Triaxial compression test

* C Consolidation test

Qu Unconfined compressive strength kg/cm2

SO, Soluble sulphate concentration

γ Bulk unit weight

γd Dry unit weigh

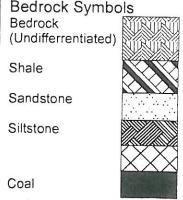
* Tests normally summarized on separate data sheets



Hagstrom Geotechnical Services Ltd.

Modified Unified Classification System For Soils

			·c				00115	
		ivision	Group Symbol	Graph Symbo	Color Code	Typical Description		Classificatior
sieve)	coarse chan	Clean Gravels	GW	4. 5.4	Red	Well graded gravels, little or no fines	$C_U = (D_{60}/D_{10})$ $D_{30}^2/(D_{10}^*D_{60})$	
200 ר	half c rger t sieve	(intre or no lines)	GP	4.	Red	Poorly graded gravels, and gravel sand mixtures, little or no fines	Not meeting requirements	
Soils er that	Gravels more than half grains larger No. 4 siev	Clean Gravels (little or no fines) Dirty Gravel (with some fines)	GM		Yellow	Silty gravels, gravel-sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
ained nt larg	more		GC		Yellow	Clayey gravels, gravel-sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
Fine-Grained s half by weight passes 200 sieve) (more than half by weight larger than 200 sieve) Clays Sands A line below "A" line pelow "A"	fine	Clean Sands	SW		Red	Well graded sands, gravely sands, little or no fines	$C_0 = (D_{60}/\overline{D}_{10})$ $D_{30}^2/(D_{10}^*D_{60})$) > 4 C _c =
	nds n half naller t sieve	Clean Sands (little or no fines)	SP		Red	Poorly graded sands, little or no fines	Not meeting above requirements	
	Sands more than half fine grains smaller than No. 4 sieve	Dirty Sands	SM		Yellow	Silty sands, sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
	E B	(with some fines)	SC		Yellow	Clayey sands, sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
00 sieve	ilts "A" line ligible content	W _L < 50%	ML		Green	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification upon plasticit	n is based ty chart
s Isses 20	Silts below "A" line negligible organic contel	W _L > 50%	МН			Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils		
ined ight pa	Clays above "A" line negligible organic content	W _L < 30%	CL		Orcen	Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean		
e-Gra by we	Clays above "A" line egligible organic content	30% < W _L < 50%	CI		Green-	clays Inorganic clays of medium plasticity, silty clays		
		W _L > 50%	СН		Blue	Inorganic clays of high plasticity		
(more than	Janic & Clays "A" line chart	W _L < 50%	OL			Organic silts and organic silty clays of low plasticity	fine content h	e nature of the nas not been is designated
	Orga Silts & (bellow ", on ch	W _c > 50%	ОН		Blue	Organic clays of high plasticity	by the letter "F". E.G. SF is a mixture of sand with silt o	
ŀ	Highly Orga	inic Soils	PI		Orange		Strong color of often fibrous t	
Bedroo	ock Symbol ck errentiated)		-	1		D'. Line	C.Line	CH CH



9 HATE No. 2

Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

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LIQUID LIMIT

PLASTIC LIMIT

Y. DRY UNIT WEIGHT

CLIENT Nor Can Consulting Group Inc.

PROJECT Proposed Country Residential Subdivision - Fawn Meadows

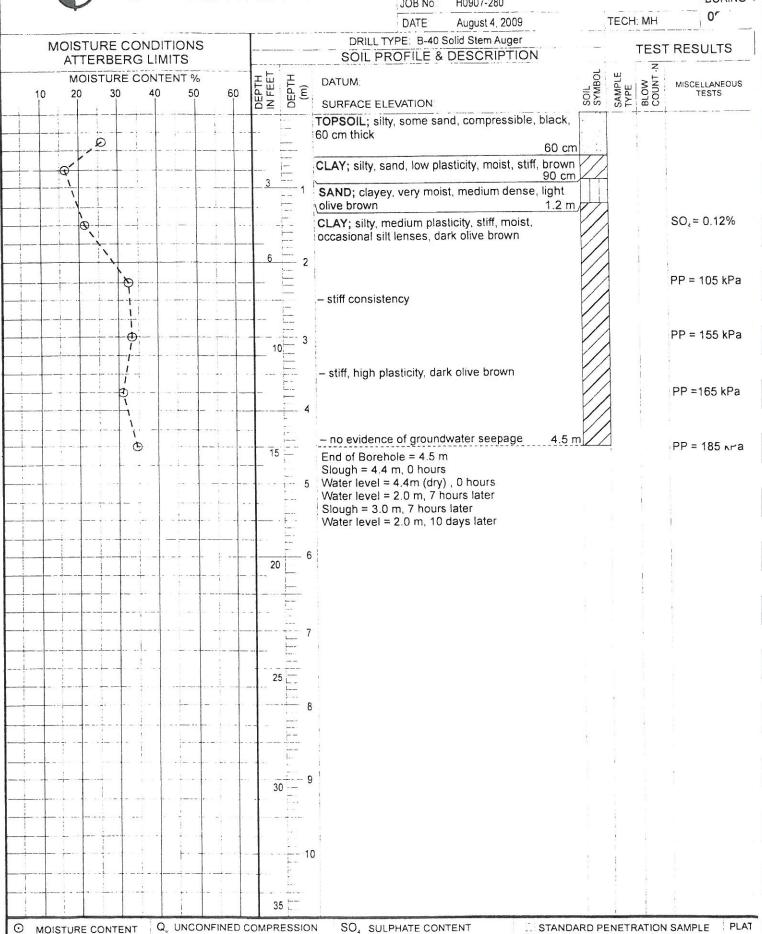
LOCATION Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No H0907-280 BORING

DATE August 4 2009 TECH: MH

_ UNDISTURBED SAMPLE (SHELBY)

No. 3



WATER TABLE PENETRATION RESISTANCE

	10	CLIENT Nor Can Consulting Group Inc PROJECT Proposed Country Residential S	uhdivision Foun Mondaus
Hagstrom Geotechnic		LOCATION: Portions of NE & SE 4-53-2-W5M, I	Parkland County, Alberta TEST
		JOB No H0907-280 DATE August 4, 2009	BORING
MOISTURE CONDITIONS ATTERBERG LIMITS		YPE: B-40 Solid Stem Auger	TEST RESULTS
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10 20 30 40 50 60	DATUM DATUM SURFACE ELE	NOIT SAMBOL	SAMP LE TYPE COUNT LESTS
	TOPSOIL; silty	, dry, compressible, dark brown,	N
Q P	20 cm thick	ry, loose, light yellowish brown	
	CI AY: silty ve	ry stiff, light olive brown	SO ₄ = 0.02%
	3 -1	y still, light slive slown	
	SILT: sandy s	1.7 m	PP = 515 kPa
	brown 2 brown	sine day, damp, loose, light dilve	l .
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	3 - occasional cl	ay lenses	
	10		
			DD. 455 LD
 	4 CLAY; silty, me	3.9 m	PP =155 kPa
	dark olive brow	of groundwater seepage 4.5 m	
→	15 End of Boreho	le = 4.5 m	PP = 185 kPa
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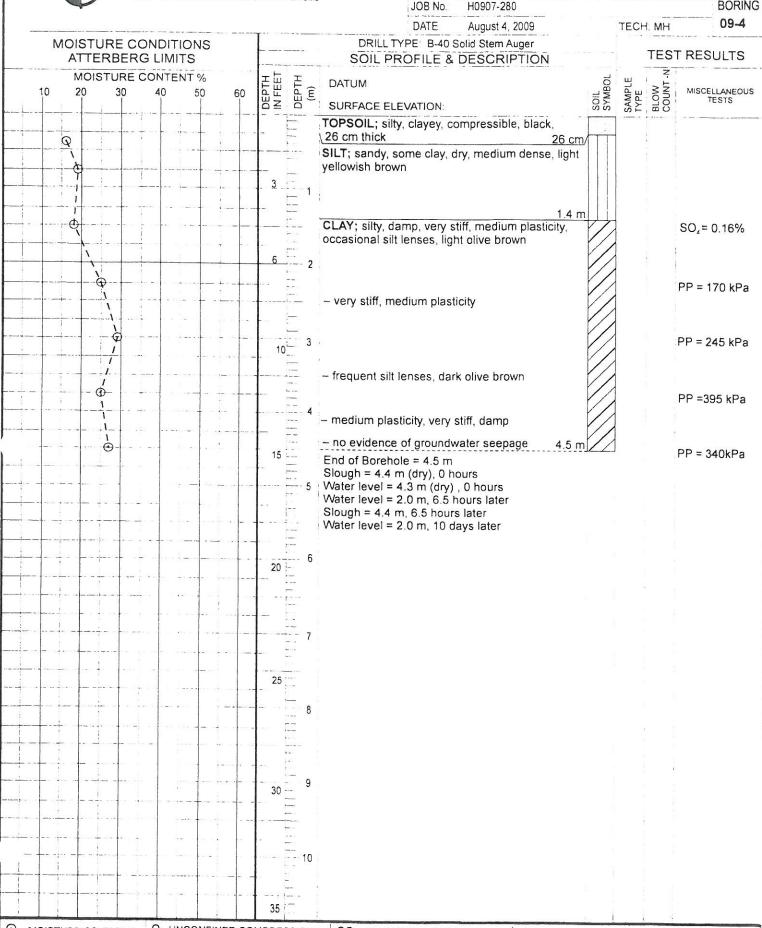


Nor Can Consulting Group Inc. CLIENT PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION. Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST BORING I H0907-280 JOB No.

		URE C ERBER						SOIL PROFILE & DESCRIPTION		7	T RESULTS
10	MO 20	ISTURE 30	CONTE 40	ENT % 50	60	DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION:	SOIL	TYPE TYPE BLOW COUNT -1	MISCELLANEOU TESTS
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		P				3	E 1	moist, light olive brown			PP = 325 kPa
		4						- very stiff			PP = 155 kPa SO ₄ = 0.14%
		+ ,	0				2				PP = 265 kPa
			- - - - - - - - - - -			11	3	- very stiff, medium plasticity, dark olive brown			PP =150 kPa
			<u> </u>					– occasional silt lenses			PP =185 kPa
			· · · · · · · · · · · · · · · · · · ·			15		 frequent rust stained fissures no evidence of groundwater seepage 4.5 m End of Borehole = 4.5 m Slough = 4.4 m, 0 hours 			PP = 125 kra
		- <u> </u> - -					5	Water level = 4.4 m (dry), 0 hours Water level = 4.4 m (dry), 6.5 hours later Slough = 4.4 m, 6.5 hours later Water level = 4.4 m (dry), 10 days later			
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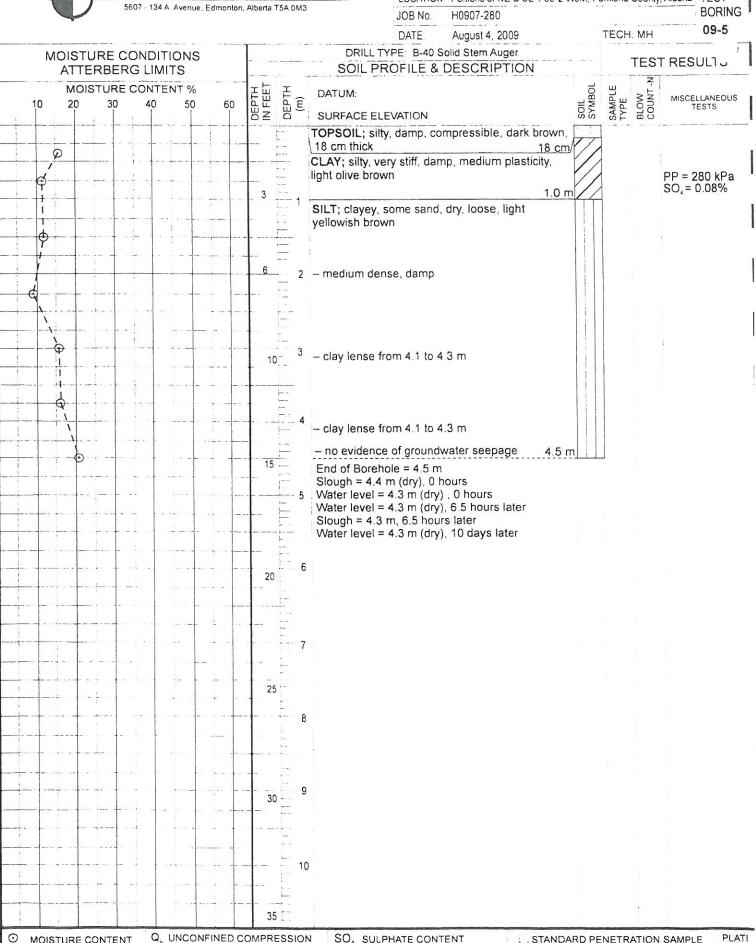
CLIENT Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST JOB No. H0907-280 **BORING**



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CLIENT Nor Can Consulting Group Inc PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta **BORING** H0907-280



MOISTURE CONTENT Ō

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LIQUID LIMIT PLASTIC LIMIT

Y. DRY UNIT WEIGHT

SO, SULPHATE CONTENT

WATER TABLE

PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE

UNDISTURBED SAMPLE (SHELBY) B BAG SAMPLE

No. 7



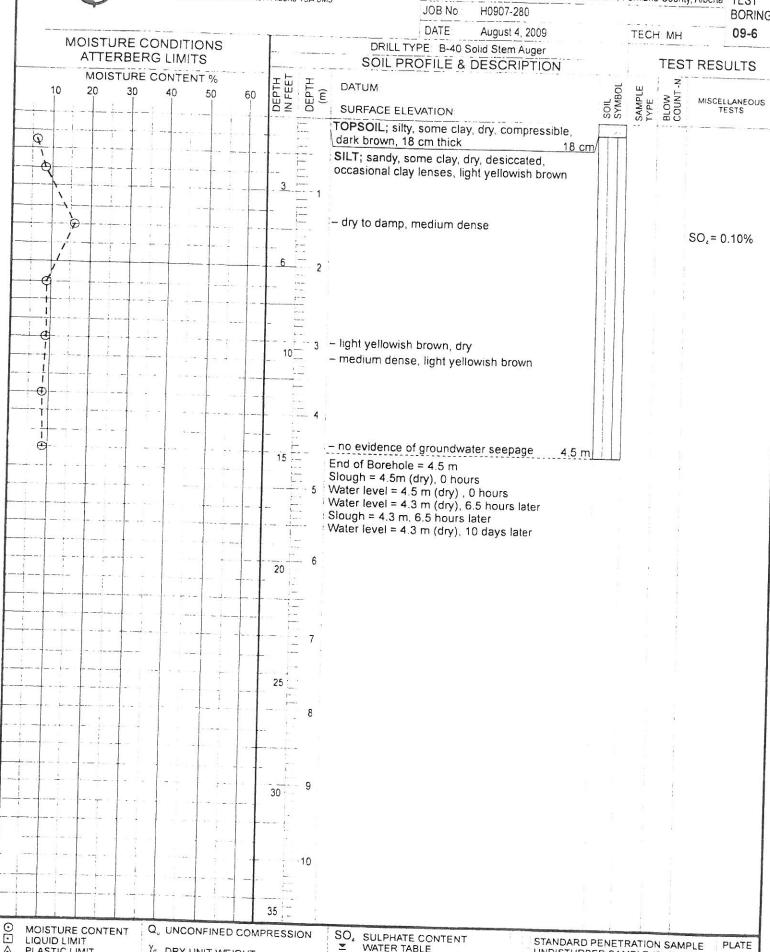
CLIENT Nor Can Consulting Group Inc. Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST JOB No. H0907-280 BORING

PLATE

No. 8

UNDISTURBED SAMPLE (SHELBY)

B BAG SAMPLE



WATER TABLE

PENETRATION RESISTANCE

PLASTIC LIMIT

Y. DRY UNIT WEIGHT

		CLIENT Nor Can Consulting Group		Foun Mandaus
Hagstrom Geotechnic	al Services Ltd.	PROJECT: Proposed Country Reside		
5607 - 134 A Avenue, Edmonlon	Alberta T5A 0M3	JOB No H0907-280	-W5M, Parkland Co	BORING
		DATE August 4, 2009	TECH N	۷H 0ن
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Φ 1	p tomat	some clay, dry, loose, light		CO = 0.000/
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	10,-			
	– more clay w	vith depth, dark olive brown		
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	Slough = 4.3	m, 6.5 hours later : 4.3 m (dry), 10 days later		
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WATER TABLE
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STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE

PLATE No. 9



NOT CAN CONSUITING Group Inc. CLIEN ! PROJECT Proposed Country Residential Subdivision - Fawn Meadows LOCATION Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

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		, , ,						+		-			CLAY; silty, damp, very stiff, medium plasticity.				
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			J .			_				-		1.	no evidence of groundwater seepage 4.5 r		1		
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MOISTURE CONTENT
LIQUID LIMIT
PLASTIC LIMIT

Yo DRY UNIT WEIGHT

SO₂ SULPHATE CONTENT WATER TABLE PENETRATION RESISTANCE STANDARD PENETRATION SAMPLE
UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE

PLATE No.10



LIQUID LIMIT

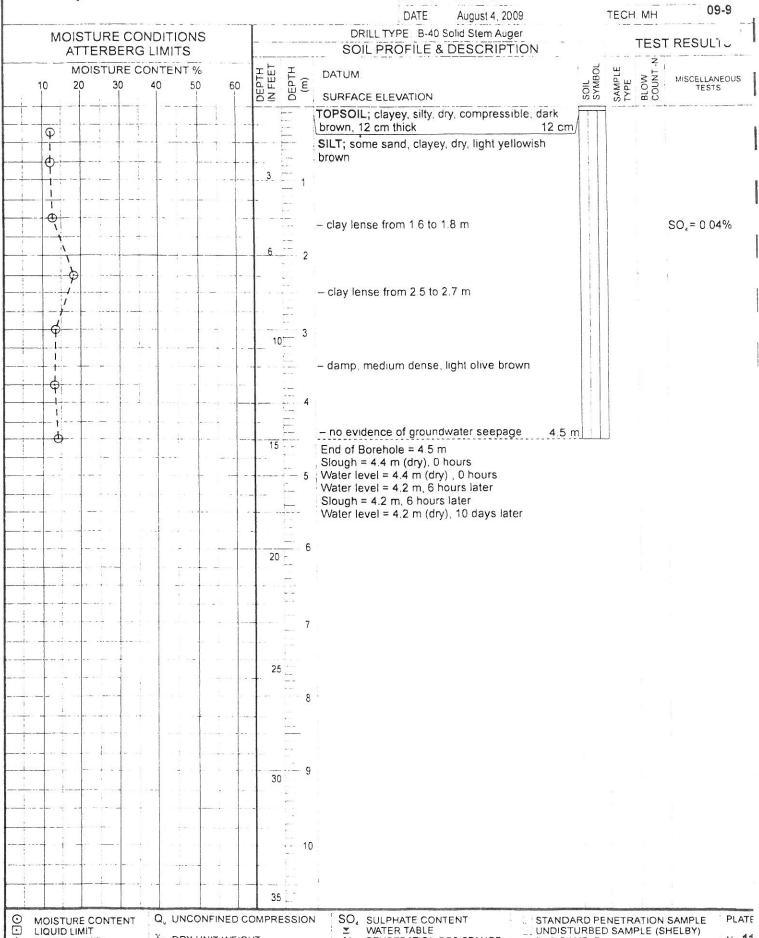
PLASTIC LIMIT

Yo DRY UNIT WEIGHT

NOT CALL COLLSBURING GLOUP HIC CLICIYI **PROJECT** Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST **BORING** JOB No. H0907-280

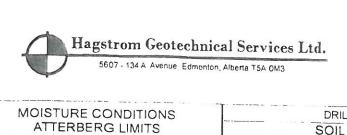
UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE

No.11



WATER TABLE

PENETRATION RESISTANCE



DEPTH IN FEET DEPTH

20

25

7

8

10

35

60

DATUM

MOISTURE CONTENT %

10

Q

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0

CLIENT Nor Can Consulting Group Inc. Proposed Country Residential Subdivision - Fawn Meadows PROJECT: LOCATION. Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST JOB No H0907-280 **BORING** DATE August 4, 2009 09-10 TECH: MH DRILL TYPE B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION TEST RESULTS SAMPLE TYPE BLOW COUNT -N MISCELLANEOUS TESTS SURFACE ELEVATION TOPSOIL; silty, dry, compressible, black, 56 cm PP = 520 kPa CLAY; silty, medium plasticity, very stiff, damp, PP = 450 kPa occasional silt lenses, dark olive brown PP = 230 kPa SO, = 0.12% very stiff, frequent rust staining PP = 190 kPa stiff to very stiff PP = 210 kPa 4.2 m SAND; fine grained, some clay, medium dense, PP = 180 kPa dark olive brown - free water, loose 4.5 m End of Borehole = 4.5 m Slough = 4.4 m (dry), 0 hours Water level = 4.3 m, 0 hours Water level = 4.3 m (dry), 5.5 hours later Slough = 4.3 m, 5.5 hours later Water level = 4.3 m (dry), 10 days later

MOISTURE CONTENT $\overline{\odot}$ LIQUID LIMIT PLASTIC LIMIT

Q. UNCONFINED COMPRESSION Y DRY UNIT WEIGHT

SO SULPHATE CONTENT ¥ N WATER TABLE PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY) B BAG SAMPLE

PLATE No.12

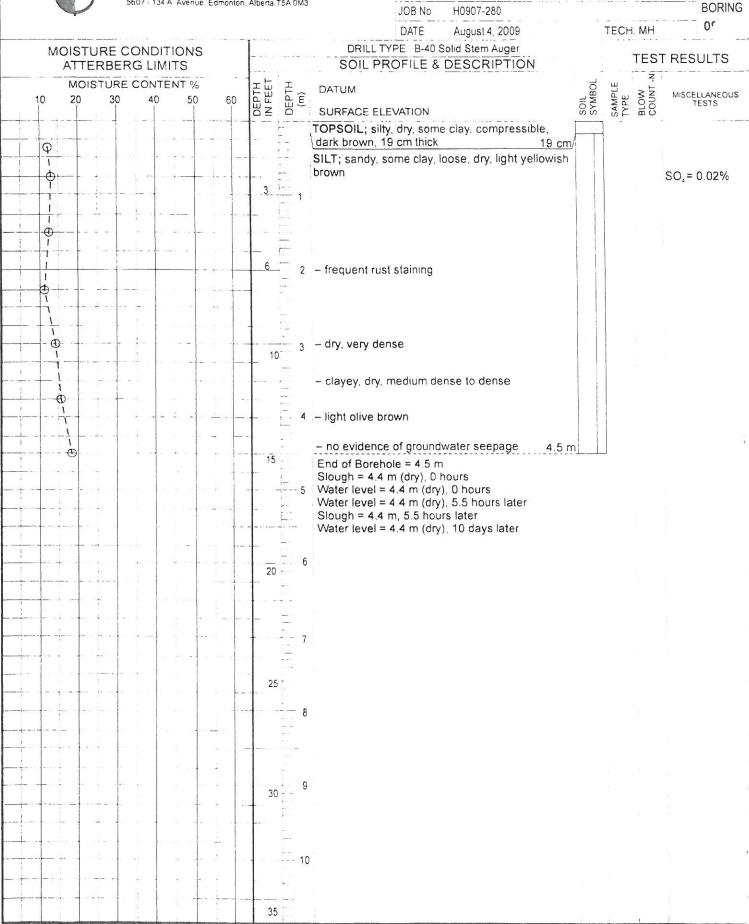
Hagstrom Geotechnical Services Ltd. 5607 · 134 A Avenue Edmonton, Alberta T5A 0M3

CLIENT Nor Can Consulting Group Inc

PROJECT Proposed Country Residential Subdivision - Fawn Meadows

LOCATION Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No H0907-280 BORING



○ MOISTURE CONTENT○ LIQUID LIMIT△ PLASTIC LIMIT

Q, UNCONFINED COMPRESSION

Yo DRY UNIT WEIGHT

SO₂ SULPHATE CONTENT ▼ WATER TABLE

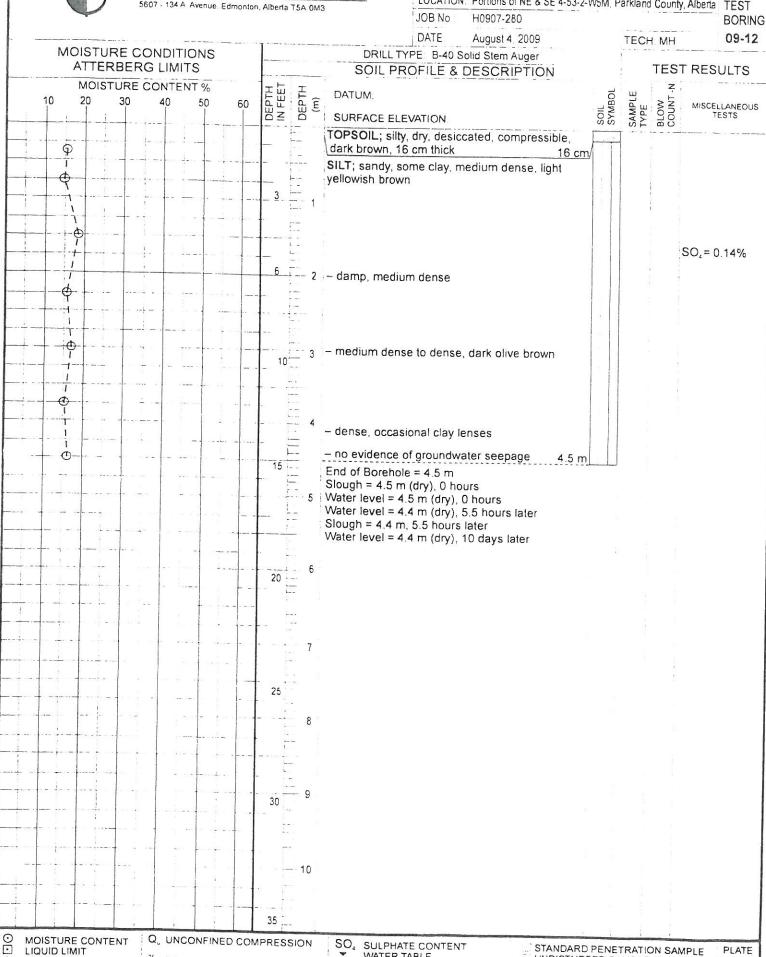
PENETRATION RESISTANCE

STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY)
B BAG SAMPLE

PLAT



CLIENT Nor Can Consulting Group Inc. PROJECT. Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta



WATER TABLE

PENETRATION RESISTANCE

N

Yo DRY UNIT WEIGHT

PLASTIC LIMIT

UNDISTURBED SAMPLE (SHELBY)

No.14

BAG SAMPLE



CLIENT Nor Can Consulting Group Inc

PROJECT Proposed Country Residential Subdivision - Fawn Meadows

LOCATION Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No H0907-280 BORING

DATE August 4, 2009 TECH MH 09-13

,		5607 - 13	4 A Avenue	Edmonton	Alberta T5A 0M3	3 JOB No H0907-280 BORIN
						DATE August 4, 2009 TECH MH 09-1;
M	OISTURE ATTERBE					DRILL TYPE B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION TEST RESULTS
	MOISTUR	ALCOHOLOGICA CONTRACTOR	400 (400 200 000 000 000		T	Z
10	20 30			60	DEPTH IN FEET DEPTH (m)	DATUM SURFACE ELEVATION DATUM NINCELLANFOL TESTS TESTS
	Q					TOPSOIL; silty, damp, compressible, some sand, black, 52 cm thick
	- 4				3 - 1	CLAY; silty, medium plasticity, damp, very silty, occasional silt lenses, dark olive brown
						PP = 310 kPs SO ₄ = 0.08%
		0 -			6 2	PP = 175 kP
						 occasional rust stained fissures softer with depth, moist PP = 160 kF
		-	- 0,		10 3	- softer with depth, moist
		∳ -			4	PP = 150 kP
		<u>d</u> – -			15	 medium to high plasticity, dark grey no evidence of groundwater seepage End of Borehole = 4.5 m Slough = 4.5 m (dry), 0 hours
		<u>.</u>			5	Water level = 4.5 m (dry), 0 hours Water level = 4.3 m (dry), 5 hours later Slough = 4.3 m, 5 hours later
_			1			Water level = 4.3 m (dry), 10 days later
					20 -	Б
						7
					25	
-			7 7 7		25	8
-					30 -	9
	 					
					1	10
					35	

SULPHATE CONTENT WATER TABLE PENETRATION RESISTANCE

Q, UNCONFINED COMPRESSION

Yo DRY UNIT WEIGHT

004

MOISTURE CONTENT LIQUID LIMIT

PLASTIC LIMIT

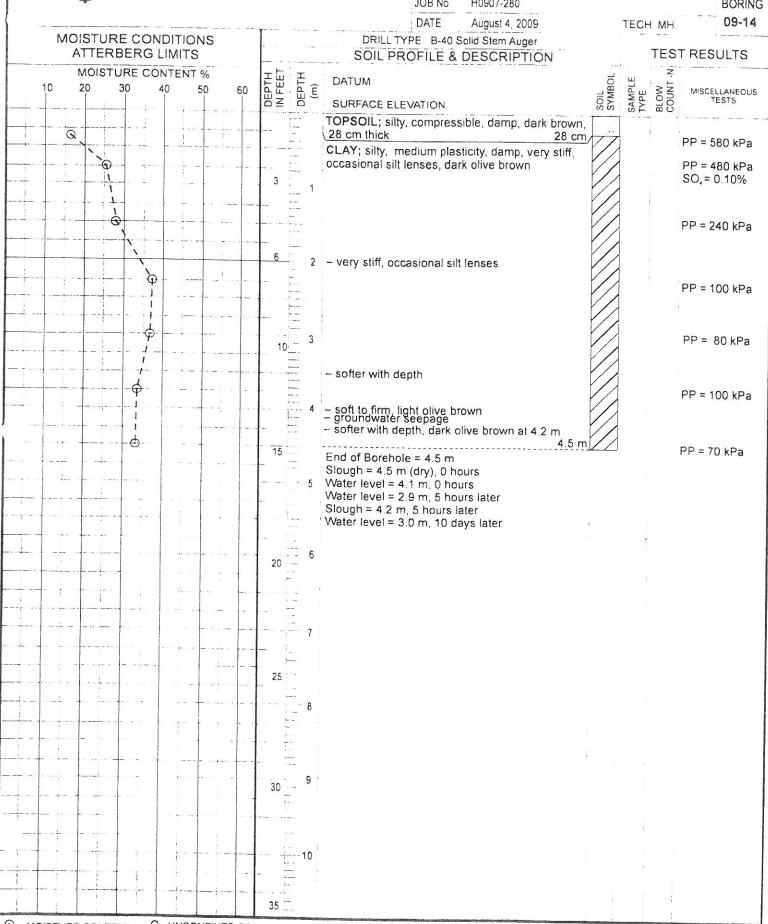
STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY)
BAG SAMPLE

PLAT

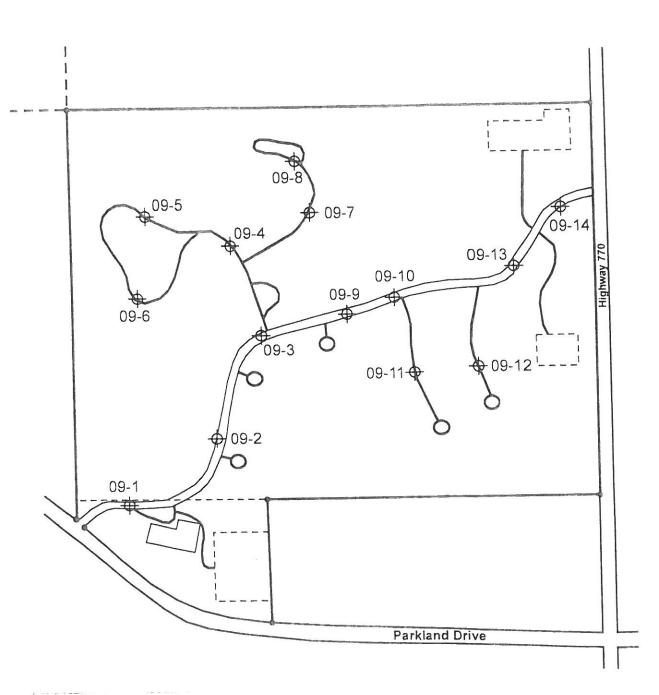
No.11



CLIENT Nor Can Consulting Group Inc
PROJECT Proposed Country Residential Subdivision - Fawn Meadows
LOCATION Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST
JOB No H0907-280 BORING







LEGEND

Borehole Location

Site Boundary

Scale: Not to Scale

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NOR CAN CONSULTING INC.

Proposed Country Residential Subdivision - Fawn Meadows
Portions of NE & SE 4-53-2-W5M,
Parkland County, Alberta
Site Plan

Job No: H0907-280

Date: August 10, 2009

Plate: 17



Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 Tel: (780) 996-5621 • Fax: (780) 475-5671 e-mail: h_gsl@telus.net

March 1, 2012

Our File: H0907-280

Norcan Consulting Group Ltd. Box 38, Site 219, RR2 Gravel, Alberta T0E OH0

Attention:

Mr. Frank Florkewich

Dear Sirs:

Re: Geotechnical Site Investigation

For Proposed Facilities

Proposed Country Residential Subdivision

Fawn Meadows

Portions of NE and SE 4-53-2-W5M

Parkland County, Alberta

1.0 INTRODUCTION

As requested, a geotechnical site investigation was carried out by Hagstrom Geotechnical Services Ltd. (HGSL) at the above referenced project. The scope of work for the investigation was to provide an assessment of the soil and groundwater conditions, provide recommendations for alternate foundation systems and preparation of this report. Field drilling was carried out on August 4, 2009 and final water table measurements were taken on October 14, 2009.

2.0 PROJECT DESCRIPTION

The proposed country residential subdivision contains about 52.6 hectares of agricultural land that occupies a portion of the northeast and southeast quarters of Section 4, Township 53, Range 2, West of the Fifth Meridian. The site is bounded on the east by Highway 770 and on the south by Parkland Drive. The site is open, vacant hayland and contains four large groups of trees and marshes that cover about 30 to 35 percent of the site. The site topography is moderately rolling with slopes typically less than 12 degrees (21 percent). No definite drainage pattern is apparent across the site.

It is understood that the proposed development is to consist of cluster type lots of about 55 to 60 residential lots varying in size from 1.0 to 2.5 acres. It is further understood that the development will be serviced with centralized municipal sanitary sewers and potable water systems. In addition, the proposed subdivision will consist of a community services building located in the south west corner, a water treatment plant and maintenance building in the south east corner and a seniors assisted living complex located in the north east corner. The size and

details of each facility were not finalized at the time of report submission.

3.0 INVESTIGATION PROCEDURE

Six deep boreholes were drilled on the site on August 4, 2009. Borehole 09-101 and 09-102 were drilled at the proposed services building, Boreholes 09-13 and 09-104 were drilled at the proposed water treatment plant/maintenance building and Boreholes 09-105 and 09-106 were drilled at the proposed seniors assisted living complex (Refer to Plate 109, Appendix A). It is noted that Boreholes 09-105 and 09-106 could not be drilled within the building footprint because of heavy tree cover. The boreholes were drilled to depths of 9.0 metres using a truck mounted drill rig equipped with a continuous flight, 150-millimeter diameter, solid-stem augers. Supervision of drilling, soil sampling, and logging of the various soil strata was performed by Mr. Merle Hagstrom, P. Eng of HGSL. The soils encountered during drilling were classified in accordance with the Modified Unified Soil Classification System described on Plates 1 and 2, Appendix A. The soil and groundwater conditions encountered during field drilling were recorded and are presented on borehole logs, Plates 103 to108, Appendix A. The borehole locations are presented on Plate 109, Appendix A.

Soil sampling for laboratory analysis generally consisted of disturbed auger soil samples at 0.75 meter intervals obtained from all boreholes. In addition, pocket penetrometer (PP) readings were taken on intact cohesive soil samples at approximately 0.75 metre intervals from all boreholes to obtain an indication of the unconfined compressive strength (Q_u) of the soil.

Groundwater conditions were monitored during drilling, at drilling completion, several hours later and 10 days after drilling completion. All of the water level results are presented on the boreholes logs in Appendix A.

In addition to the routine moisture content analysis, the laboratory analyses consisted of twelve soluble sulphates analyses and two Atterberg limit tests. The laboratory analyses results are presented on the borehole logs in Appendix A.

4.0 SUBSOIL AND GROUNDWATER CONDITIONS

The soil profile at the borehole locations generally consist of a thin cover of topsoil over variable thick layers of silt and clay. A thin layer of sand was encountered below the topsoil in one borehole. A description of various soil units and their properties are presented in the paragraphs below.

Topsoil was encountered at the ground surface in all boreholes and extended to depths between 18 and 67 centimeters. The topsoil was described as silty, dry to damp, with some sand, compressible and black in colour. Greater thickness of topsoil may be found between borehole locations.

Clay of variable thickness was encountered at random depths in all boreholes. The clay was described as silty, firm to hard consistency, low to medium plasticity, damp to very moist, brown to dark olive brown in colour. The clay was also noted to have frequent silt lenses with

rust staining and occasional gravel chips. In-situ moisture contents in the clay ranged from 11 to 34 percent. Pocket penetrometer readings taken on intact auger samples of clay revealed approximate unconfined compressive strengths Q_u , ranging from 90 to 515 kPa. Two Atterberg limit tests conducted on clay yielded liquid limits of 44 and 45 percent and plastic limits of 21 and 22 percent (medium plasticity). Based on a review of plastic limits in comparison with the natural moisture contents in the clay, the natural moisture contents are about 5 to 10 percent wet of optimum moisture content (OMC). The clay exhibits moderate compressibility under low to moderate loads. The clay also exhibits moderate swelling potential and thus may lift light loads such as floor slabs given access to free water.

Silt was encountered at variable depths in three of the six boreholes. The site was described as sandy, with some clay, damp to very moist, and pale olive brown to dark grey in colour. Below the groundwater table, the silt was noted to be very sensitive. In-situ moisture contents in the silt ranged from 12 to 32 percent. Pocket penetrometer readings taken on intact auger samples of silt revealed approximate unconfined compressive strengths Q_u , ranging from 115 to 185 kPa. The silt exhibits moderate compressibility under low to moderate loads.

Groundwater conditions were monitored during drilling, at drilling completion, several hours later and 10 days after drilling completion. Groundwater seepage was encountered during drilling in all six boreholes. All water table results are summarized in Table 1, below and the individual results are presented on the borehole logs in Appendix A.

TABLE 1: SUMMARY OF GROUNDWATER OBSERVATIONS

Borehole Number	Depth of Groundwater	Depth to Water (m)						
	Seepage (m)	At Drilling Completion	2 to 5 Hours Later	10 Days Later				
09-101	4.1	8.7	5.1	4.0				
09-102	4.2	6.7	3.8	3.7				
09-103	3.6	6.7	2.6	2.4				
09-104	8.0	8.8	8.7	5.8				
09-105	7.8	5.5	5.5	2.0				
09-106	7.0	8.7	8.6	8.6				

Based on a review of the above results, the groundwater table is considered to be variable across the site. The results indicate that groundwater may pose problems for caisson pile drill holes and other excavations that are left open for short and extended periods of time at depths below 2.0

metres.

It should be noted that groundwater levels will fluctuate seasonally and in response to climatic conditions and may be at a different depths when construction commences. Accordingly, groundwater levels should be monitored periodically until the start of construction.

4.1 FROST PENETRATION

The expected maximum depth of frost penetration for various soil types is given in Table 2, below. The penetration is based on a freezing index for a 25-year return period of 2200 degrees-days Celsius. The depth of frost penetration assumes a uniform soil type without topsoil or snow cover.

The native mineral soils encountered in the boreholes is considered to be frost susceptible, and with an adequate supply of moisture near the ground surface, significant frost heave may occur.

TABLE 2
ESTIMATED DEPTH OF FROST PENETRATION

Soil 7	Soil Type								
In-situ	Clay and Clay Till	2.5							
	Silt and Sand	2.9							
	Weathered Bedrock	3.0							
	Gravel	3.5							
Compacted Backfill	Clay and Clay Till	2.3							
(95 % SPMDD*)	Silt and Sand	2.7							
	Weathered Bedrock	2.9							
	Gravel	3.3							

^{*}SPMDD- Standard Proctor Maximum Dry Density

5.0 GEOTECHNICAL EVALUATION

All foundation design recommendations presented in this report are based on the assumption that an adequate level of construction monitoring during foundation excavation and installation will be provided, and that all construction will be carried out by a suitably qualified, experienced contactor. An adequate level of construction monitoring is considered to be: (a), design review and full-time monitoring during construction of foundations, and (b), full-time monitoring and compaction testing for earthworks by suitably qualified geotechnical personnel.

The soil conditions at the site are considered to be adequate for the proposed site facilities. The groundwater table is considered to be moderately high. Shallow foundations such as strip and spread footings can be considered for the site. Alternatively, deep foundations such as cast-in-place straight shaft or end bearing concrete piles may be considered.

5.1 SHALLOW FOUNDATIONS

Shallow concrete footings for all three facilities founded on the native mineral soil should be designed based on a net allowable bearing capacity of 90 and 120 kPa for strip and spread footings, respectively. This value utilizes a factor of safety of 3.0. The allowable bearing pressure may be increased by a factor of 1.5 to obtain a factored ultimate bearing resistance. The footings should be constructed at a minimum depth of 1.5 m and 2.5 metres below exterior grade for heated and unheated structures, respectively. It is recommended that footing excavations be inspected by a qualified geotechnical engineer prior to pouring concrete to confirm foundation soil conditions and bearing pressures.

All footings should be founded on the undisturbed, inorganic native mineral soil. Footings must not be placed on any topsoil, uncontrolled fill, organic soils or loose, disturbed or frozen soils. Footing excavations must be protected from frost, desiccation, or the ingress of water. Bearing soils, which become frozen, dried or softened, should be removed and replaced with concrete or the footings should be extended to reach soil in an unaffected condition. It is essential that the foundation soils not be allowed to freeze at any time before or after concrete for the footings have been placed.

5.2 DEEP FOUNDATIONS

Cast-in-place concrete piles can be considered for all three proposed facilities and should be designed as straight shaft concrete friction-type piles using allowable and factored skin friction parameters shown in Table 3, below. No allowance should be made for end bearing on straight shaft piles.

Concrete straight shaft piles should be embedded at least 6.0 and 7.5 metres below grade for heated and unheated foundations, respectively. The minimum center-to-center spacing for concrete cast-in-place piles should be greater than 3 pile diameters. The piles should be at least 400 mm in diameter. Void form that is approximately 100 millimetres thick should be used under a concrete grade beam or pile cap.

TABLE 3
ALLOWABLE SKIN FRICTION FOR CAST-IN-PLACE CONCRETE PILES

Depth Below Existing Grade (m)	Soil Type	Allowable Skin Friction (kPa)	Factored ULS Skin Friction (kPa)
0 to 1.5	Clay/ Silt/Sand	0	0
1.5 to 9.0	Clay/Silt/Sand	21	28

Longitudinal steel reinforcement in the upper 6.0 meters of the pile is recommended to prevent potential uplift forces of the pile due to frost action and seasonal moisture variations. If the piles are designated as tension elements including frost action, longitudinal reinforcing steel should extend into the bottom of the piles, and the piles should be designed to resist the anticipated uplift stresses using the design values provided below.

Concrete for piles should be poured immediately after drilling of the pile hole to reduce the risk of groundwater seepage and sloughing of the soil. Protective steel casing may be required where wet sand and groundwater seepage are encountered.

5.2.1 Settlement Considerations for Concrete Piles

Calculation of the potential settlement pattern is complex and difficult to assess without significant additional laboratory testing and detailed knowledge of the loading and foundation types. For structures supported on native, undisturbed soil, the following comments may be of some value:

• The settlement of an isolated cast-in-place concrete skin friction pile should be no more than 5 mm plus elastic compression of the pile upon full mobilization of shaft resistance.

Differential settlements, rather than total settlements, are usually the governing factor in structural and architectural design. Differential settlements between adjacent columns or wall units are typically about one-half of the values given above.

5.3 SEISMIC SITE CLASSIFICATION

Site classification for soil seismic response for this site is category "D" which is according to the requirements of the National Building Code of Canada (Table 4.1.8.4.A).

5.4 CONCRETE

Chemical testing for water-soluble sulphates concentrations on twelve selected samples of native soil revealed sulphate concentrations of 0.02 to 0.18 percent water-soluble sulphate by dry weight of soil. The results indicated a "negligible to moderate" potential for sulphate attack on concrete in contact with native soils at this site. Therefore, all concrete in contact with the native soils should be made from CSA Type 50 sulphate resistant cement possessing a minimum 56 days compressive strength of 30 MPa. The maximum water cement ratio should be 0.50. An air entrainment agent of 5 to 7 percent is recommended for improved workability and durability. If new fill is brought to the site, it should be tested for soluble sulphates to determine if Type 50 cement is required.

6.0 CLOSURE

This report is based on the findings at six deep borehole locations. Should different subsoil or groundwater conditions be encountered during construction, Hagstrom Geotechnical Services Ltd. must be notified immediately and the recommendations provided herein will be reviewed and revised as required.

Boreholes could not be drilled within the building footprint for the new seniors assisted living complex and thus is recommended that new boreholes be drilled within the new building footprint. In addition, if the other building locations are changed, it is recommended that new boreholes be drilled. During placement and compaction of new fill, soil compaction tests should

be carried out by a geotechnical engineering firm for all three facilities.

Should you have any questions or require additional information, do not hesitate to contact our office at (780) 996-5621.

Yours truly,

Hagstrom George Ltd.

Merle Hagstront, B.Sc. P. Eng

Senior Engineer

Distribution: (4) addressee

PERMIT TO PRACTICE
Magairon Geotechnical Services Ltd.
Signature Mult Lugitum
Data March 1, 2012
PERMIT LUGGET: P 9693
The Association of Professional Engineers,
Geologists and Geophysicists of Afberta

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Explanation of Field and Laboratory Test Data

The following pages are an explanation of the terms and symbols used in the Test Hole Log

Soil Profile and Description

Soil types are described by the Modified Unified Soil Classification System. (See Plate 2 for terms and symbols)

Soils classified by particle size fall in the following ranges:

BOULDERS - greater than 200 mm SAND - 0.08 mm to 5 mm COBBLES - 75 mm to 200 mm

SILT - 0.002 mm to 0.08 mm

GRAVEL - 5 mm to 75 mm

CLAY - finer than 0.002 mm

Additional graphic symbols include:

seepage

water level surface

Soil Sample Type

Standard Penetration Sample (D)

Undisturbed Sample (Shelby) (U)

B

Bag Sample

Penetration Resistance

Field test indication number of blows (N) of a 140 pound hammer dropping 30 inches (76cm) required to drive a 2 inch (5 cm) O.D. open end sampler a distance of 1 foot (30 cm) from 0.5 to 1.5 feet (15 to 45 cm) into the undisturbed soil. This test is outlined in A.S.T.M., D1568.

Miscellaneous Tests

In this column are summarized results of all the laboratory test as indicated by the following symbols:

HVR Hydrocarbon Vapour Readings, ppm or % LEL

* MA Mechanical grain size analysis

G Specific gravity

Coefficient of permeability

PP Pocket penetrometer strength kg/cm2

Triaxial compression test

* C Consolidation test

Unconfined compressive strength kg/cm2

SO, Soluble sulphate concentration

Bulk unit weight

Dry unit weigh

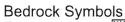
* Tests normally summarized on separate data sheets



Hagstrom Geotechnical Services Ltd.

Modified Unified Classification System For Soils

М	ajor D	ivision	Group Symbol	Graph Symbol	Color	Typical Description	8	y Classification Criteria	
sieve)	oarse	Clean Gravels	GW	4. 5. 5	Red	Well graded gravels, little or no fines	$C_u = (D_{60}/D_1)$ $D_{30}^2/(D_{10}^*D_{60})$		
200	Gravels an half con larger the starter of sieve	(little or no fines)	GP		Red	Poorly graded gravels, and gravel sand mixtures, little or no fines	Not meeting requiremen		
Soils er than	Gravels more than half coarse grains larger than No. 4 sieve	Clean Gravels (little or no fines) Dirty Gravel (with some fines)	GM		Yellow	Silty gravels, gravel-sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4	
Coarse-Grained Soils alf by weight larger tha	more	(will some inles)	GC		Yellow	Clayey gravels, gravel-sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7	
se-Gra weigh	ine	Clean Sands	SW		Red	Well graded sands, gravely sands, little or no fines	$C_{U} = (D_{60}/D_{1})$ $D_{30}^{2}/(D_{10}^{*}D_{60})$		
Coars alf by	Sands more than half fine grains smaller than No. 4 sieve	(little or no fines)	SP		Red	Poorly graded sands, little or no fines	Not meeting requiremen		
than h	Sal more that grains sm No. 4	Dirty Sands	SM		Yellow	Silty sands, sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4	
(more		(with some fines)	sc		Yellow	Clayey sands, sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7	
0 sieve)	Silts below "A" line negligible organic content	W _L < 50%	ML		Green	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification upon plastic		
oils sses 20		W _L > 50%	МН		Blue	Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils			
Fine-Grained Soils alf by weight passe	Clays above "A" line negligible organic content	W _L < 30%	CL		Green	Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean clays			
e-Gra by we	Clays ove "A" I gible org content	30% < W _L < 50%	CI			Inorganic clays of medium plasticity, silty clays			
Fin half	abo	W _ι > 50%	СН		Blue	Inorganic clays of high plasticity			
Fine-Grained Soils (more than half by weight larger than 200 sieve)	Organic Silts & Clays bellow "A" line on chart	W ₁ < 50%	OL	i t 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Green	Organic silts and organic silty clays of low plasticity	fine content determined	he nature of the has not been it is designated	
(c	Org Silts & bellow on o	W _L > 50%	ОН		Blue	Organic clays of high plasticity	by the letter "F". E.G. SF a mixture of sand with sil clay		
ŀ	Highly Orga	nic Soils	Pl	****	Orange	Peat and other highly organic soils	Strong color often fibrous	or odor, and s texture	



Bedrock (Undifferrentiated)

Shale

Sandstone

Siltstone

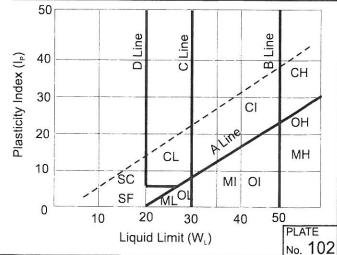
Fill

Coal



Hagstrom Geotechnical Services Ltd.

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Hagstrom Geotechnical Services Ltd. 5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

PLASTIC LIMIT

CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta BORING JOB No.: H0907-280 09-101

TECH: MH DATE: August 4, 2009 DRILL TYPE: B-40 Solid Stem Auger MOISTURE CONDITIONS **TEST RESULTS** SOIL PROFILE & DESCRIPTION ATTERBERG LIMITS DEPTH (m) MOISTURE CONTENT % DEPTH IN FEET SOIL DATUM: BLOW SAMPLI MISCELLANEOUS 10 TESTS SURFACE ELEVATION: TOPSOIL; silty, damp, compressible, some small roots, black, 38 cm thick P SILT; some sand, some clay, damp, stiff, pale olive brown PP = 185 kPa 0 $SO_4 = 0.08\%$ 3 PP = 115 kPa Φ SO4 = 0.14% 1.8 m CLAY; silty, stiff, medium plasticity, damp, occasional silt lenses, dark olive brown PP = 170 kPa - very stiff, occasional silt lenses 1 0 PP = 135 kPa1 10 - softer with depth PP = 170 kPa soft to firm, light olive brown
groundwater seepage softer with depth, dark olive brown at 4.2 m 0 PP = 90 kPa15 5.3 m PP = 210 kPa SILT; sandy, very moist, free water, very sensitive, brown 1 6 PP = 85 kPa20 1 - soft to firm PP = 75 kPa 7 ¢ PP = 85 kPa 7.7 m 25 CLAY; silty, low plasticity, firm, very moist, dark - 8 grey PP = 100 kPa stiff, medium plasticity 9.0 m PP = 115 kPa End of Borehole = 9.0 m 30 Slough = 8.8 m, 0 hours Water level = 8.7 m, 0 hours Water level = 5.1 m, 5 hours later Slough = 5.5 m, 5 hours later Water level = 4.0 m, 10 days later Slough = 5.3 m, 10 days later 35 Q UNCONFINED COMPRESSION SO4 SULPHATE CONTENT MOISTURE CONTENT ☑ STANDARD PENETRATION SAMPLE PLATE ٠ LIQUID LIMIT ▼ N WATER TABLE ☐ UNDISTURBED SAMPLE (SHELBY)
☐ BAG SAMPLE γ DRY UNIT WEIGHT No.103

PENETRATION RESISTANCE

Hagstrom Geotechnical Services Ltd. 5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

DATE: August 4, 2009

TECH: MH

09-102

						DATE: August 4, 2009 TECH: MH	09-10		
		ONDITIONS				DRILL TYPE: B-40 Solid Stem Auger TEST RE	TEST RESULTS		
	TERBER		-			SOIL FROM ILL & DESCRIPTION			
M 10 20		CONTENT %	60	DEPTH IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION: SURFACE ELEVATION: MISC	ELLANEOUS TESTS		
φ						TOPSOIL; silty, compressible, moist, black, 20 cm thick 20 cm/ SAND; silty, some clay, medium dense, moist,			
Φ,				3	1	brown 80 cm PP =	375 kPa		
	() -						240 kPa : 0.02%		
	3			6	2		145 kPa		
							0.08%		
	 			10	3	- firm, medium plasticity, dark olive brown 3.4 m SILT; sandy, loose, some clay lenses, dark brown	145 kPa		
	-				4		130 kPa		
	-			15		- groundwater seepage PP =	115 kPa		
					5	CLAY; silty, firm to stiff, medium plasticity, moist, brown	85 kPa		
	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\			20	6	PP =	125 kPa		
	ф 				7	- silt layer from 6.6 to 6.9 m	105 kPa		
	+			25			105 kPa		
	+				8	- stiff consistency	155 kPa		
	Φ			30	9 9	End of Borehole = 9.0 m Slough = 6.8 m, 0 hours	140 kPa		
						Water level = 6.7 m, 0 hours Water level = 3.8 m, 4 hours later Slough = 3.9 m, 4 hours later Water level = 3.7m, 10 days later			
				35		Slough = 3.8 m, 10 days later			
MOISTURE LIQUID LIM		Q _u UNCONF		MPRES	SSION	SO₄ SULPHATE CONTENT ⊠ STANDARD PENETRATION SAMPL ▼ WATER TABLE □ UNDISTURBED SAMPLE (SHELBY)			

Hagstrom Geotechnical Services Ltd. 5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST BORING JOB No.:

											DATE: August 4, 2009		TE	ECH:	МН		09-10
M	10IST					IS					DRILL TYPE: B-40 Solid Stem Auger		TEST RES				SULTS
	ATTE							1			SOIL PROFILE & DESCRIPTION	T	1	-	Z.	i ita	0210
10	20 	STUR 30 		10 		% 0 	60	DEPTH IN FFFT	DEPTH	(E)	DATUM: SURFACE ELEVATION:	SOIL		SAMPLE	BLOW COUNT.	MISCEL TE	LANEOU ESTS
				†		1		1			TOPSOIL; silty, dry, compressible, black,		1				
	Q)0						3		1	23 cm thick 23 cm CLAY; very silty, medium plasticity, moist, stiff, occasional silt lenses, dark olive brown					PP = 1	35 kPa
		,/ *							1		- firm to stiff consistency					PP = 1 SO ₄ = 0	
		4						- 6		2	 stiff consistency, occasional silt lenses 					PP = 1	55 kPa
		+ +						1	0 3							PP = 2 SO ₄ = (20 kPa 0.06%
			?					AMERICAN TO SERVICE AND ADDRESS OF THE PERSON NAMED IN COLUMN TO SERVICE AND ADDRESS			– groundwater seepage					PP = 1	70 kP:
			\$					15	55	5	- firm to stiff consistency					PP = 1	75 kP:
			φ 1 1													PP = 1	05 kPa
		#)					20) = 6	West of Francisco	- stiff, very moist					PP = 1	75 kPa
		φ - 1							E 7		– occasional silt lenses					PP = 1	35 kPa
		4						25			- firm consistency					PP = 9	0 kPa
		1									– dark grey, very moist9.0 m					PP = 1	
		Φ						30	5		End of Borehole = 9.0 m Slough = 6.9 m, 0 hours Water level = 6.7 m, 0 hours Water level = 2.6 m, 3 hours later	/				PP = 1	05 kPa
									10	0	Slough = 2.7 m, 3 hours later Water level = 2.4 m, 10 days later Slough = 2.4 m, 10 days later						
MOIST	TURE CO	DAUTT	, T) "	NCO	MEIN	IED C	OMPRI	ESSIOI	NI.	SO₄ SULPHATE CONTENT ⊠ STANDAR	D 55	NIE	TD AT	ON 6	AMOUT	PLAT



CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST **BORING** JOB No.: H0907-280

MOISTURE CONDITIONS									DATE: August 4, 2009 TECH: MH									
										DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION TEST RES								
	_	ATTE	200000000000000000000000000000000000000						۱,	_		SOIL FROM ILL & DESCRIPTION	OOLIO					
10	8	MOIS 20	TURI 30		40 		% 50 	60	DEPTH	N FEE	DEPTH (m)	DATUM:	CELLANEOUS TESTS					
	+	+		-	+	+	1	H	+=:	-	=	TOPSOIL; silty, damp, compressible, black,						
		Q,										18 cm thick 18 cm/CLAY; silty, very stiff, medium plasticity,						
		+	3							3		frequent rust stained fissures, dark olive brown PP =	= 135 kPa = 0.12%					
			(D -					+				= 130 kPa = 0.04%					
		<u>A</u> (/			+				5	2 2	- firm to stiff	: 105 kPa					
-							-				=							
			1							10	3 	- low to medium plasticity	= 220 kPa					
	+	-	9								4	4.1 m	= 190 kPa					
				φ-						15	=	SILT; clayey, stiff, trace of sand, dark brown PP = - stiff	= 175 kPa					
				 							5 	CLAY; silty, firm consistency, low plasticity, very moist	= 105 kPa					
				 						20	6	- stiff, moist, occasional silt lenses	= 175 kPa					
			1								 	PP =	= 110 kPa					
		8								25		- firm consistency	= 90 kPa					
		<u>т</u>									8 8	- groundwater seepage	= 120 kPa					
		- (-						+	30		End of Borehole = 9.0 m Slough = 8.9 m, 0 hours	= 105 kPa					
									-		 	Water level = 8.8 m, 0 hours Water level = 8.7 m, 2.5 hours later Slough = 8.8 m, 2.5 hours later Water level = 5.8, 10 days later Slough = 6.1 m, 10 days later						
										35								
LIQU	JID L	RE CO IMIT	NTEN	08				NED (COMPF SHT	RES	SSION	SO₄ SULPHATE CONTENT ✓ WATER TABLE N PENETRATION RESISTANCE S STANDARD PENETRATION SAMPLE UNDISTURBED SAMPLE (SHELBY) B BAG SAMPLE	E PLAT					



CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST BORING H0907-280 JOB No.: 09-105 August 4, 2009 TECH: MH DATE:

									_			DATE: August 4, 2009 TECH: MH	09-10
M	MOISTURE CONDITIONS ATTERBERG LIMITS								-			DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION TEST RES	ULTS
				RG L			%		+	Е	Ţ	SOIL PROFILE & DESCRIPTION	
10	2	0	30	4	40 	5	0	60 	EPT	IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION: DATUM: SURFACE ELEVATION: DATUM: SURFACE ELEVATION: DATUM: MISCELL MORO MISCELL TORNA MIS	LLANEO! ESTS
		102	-+		+	-			╁	-		TOPSOIL; silty, some sand, compressible, black,	
	Q			-	-				+			67 cm thick	80 kP
+	~	`	+	+-	1	-			\forall		_	67 cm	
-		O	-	-				-	+		=	dark olive brown	20 kP
-+					+-	-	-		+	3	1		
			\	+	-	+		-	+			PP = 2	75 kP
			0		+				+			SO ₄ =	
			1	-	+			+	+				
	-		+		+	-		\dashv	+	6	2	- stiff consistency	
			+	-	+-	+			+		_	PP = 1	20 kP
+	-		1		-	-			+				
+-			+	+	-				+				140 1.0
	-		-	-	-	-		-	+	10	3	PP = 1 SO ₄ =	0.16%
-			1	-	+			_	+	10	_		
+			/	+-	+				+	-		- very moist	
-		-0	-	+	+				+		=	PP = 1	10 kP
-			+	+	+			+	+		4		
+			1	+-	+	+-		+	+				
	-		D	+	-			-	+	15		PP = 1	75 kP
-			1		+	+		-	+				
-		-	1	-	k a r			+	+		5	- very moist, occasional silt lenses	
-			\dot{p}	+	-	+-	-		-			PP = 1	20 kP
_				+	-	 		-	+	-			
+	_			+	+-	+-		-	+				
		•	- -	-		ļ .	-		十	20	6	PP = 9	5 kPa
		$-\dot{\tau}$			+			+	+			- frequent silt lenses and rust staining	
+	-	1		-	-	-							
		0		_					+		E	PP = 1	10 kP
	i	1			-				†		7		
	 		-			+		-+	+-				
			0		+		1		+-	25		PP = 1	115 kP
	Η-	,	1	-+	+				+			- groundwater seepage	
	1			+		 			\top		8	- clay till like, moist, occasional graver crips,	
19	<u> </u>		-		+	 -		-	+			dark grey	230 kP
	-				-	-			T			- very stiff, medium plasticity	
	-					+			+			9.0 m	
-	(D)				+-		\vdash	-	+	30	_ 9	End of Borehole = 9.0 m	315 kF
	 					+	-		+-	-	E	Slough = 9.0 m, 0 hours	
-	-		+		-	 			+			Water level = 5.5 m, 0 hours Water level = 5.5 m, 2.5 hours later	
-	-				+		H	+	+			Slough = 5.6 m, 2.5 hours later	
	ĺ		+		+		11	+	+		10	Water level = 2.0 m, 10 days later	
				+	-	+			+			Slough = 2.1m, 10 days later	
			1			-			+	35			
MOIS	TUR	- CO	NTEN	T	Q, L	JNC	ONFIN	VED (COMF	RE	SSION	N SO₄ SULPHATE CONTENT ⊠ STANDARD PENETRATION SAMPLE	PLA
	DLIN							WEIG				▼ WATER TABLE SUNDISTURBED SAMPLE (SHELBY) N PENETRATION RESISTANCE BAG SAMPLE	No.



CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST

JOB No.: H0907-280

BORING

No.108

09-106 TECH: MH DATE: August 4, 2009 DRILL TYPE: B-40 Solid Stem Auger MOISTURE CONDITIONS TEST RESULTS SOIL PROFILE & DESCRIPTION ATTERBERG LIMITS SAMPLE TYPE MOISTURE CONTENT % DEPTH (m) DATUM: BLOW MISCELLANEOUS TESTS 10 SURFACE ELEVATION: TOPSOIL; silty, damp, compressible, black, 18 cm/ Q PP = 530 kPa CLAY; silty, very stiff, medium plasticity, damp, PP = 515 kPa dark olive brown SO₄ = 0.12% SILT; sandy, some clay, medium dense, light vellowish brown - damp, medium dense medium dense SO4 = 0.14% 3 10 - dense, light yellowish brown 3.7 m PP = 325 kPa CLAY; silty, medium plasticity, moist, very stiff, occasional silt lenses, dark grey PP = 410 kPa 15 5 - very stiff PP = 375 kPa very stiff PP = 330 kPa PP = 345 kPa groundwater seepage PP = 385kPa clay till like 25 8 very stiff, moist, occasional gravel chips PP = 385 kPa 9.0 m PP = 325 kPa End of Borehole = 9.0 m 30 Slough = 8.9 m, 0 hours Water level = 8.7 m, 0 hours Water level = 8.6 m, 2 hours later Slough = 8.5 m, 2 hours later Water level = 8.6 m, 10 days later Slough = 8.7 m, 10 days later 35 Q UNCONFINED COMPRESSION SO SULPHATE CONTENT STANDARD PENETRATION SAMPLE PLATE MOISTURE CONTENT ☐ UNDISTURBED SAMPLE (SHELBY)
☐ BAG SAMPLE

▼ N

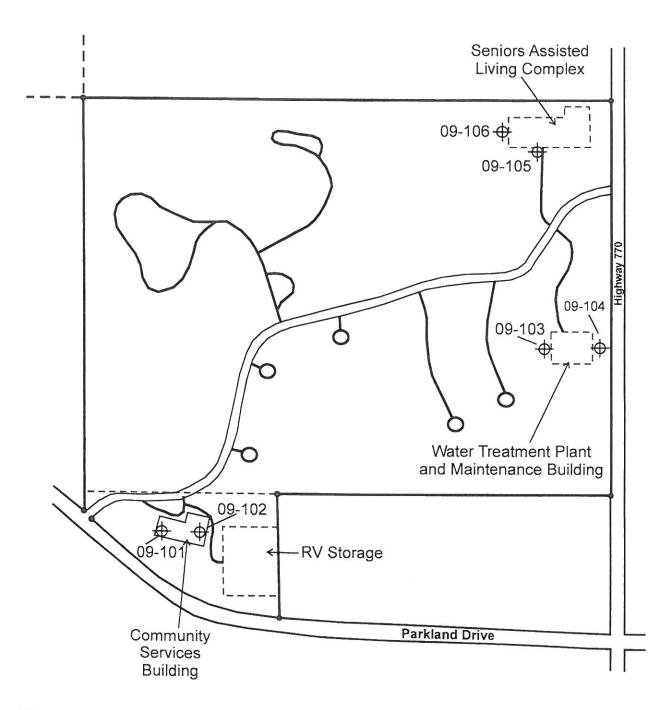
LIQUID LIMIT

PLASTIC LIMIT

WATER TABLE

PENETRATION RESISTANCE





LEGEND

Borehole Location

Site Boundary

Scale: Not to scale

0

Hagstrom Geotechnical Services Ltd.

5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

NOR CAN CONSULTING INC.

Proposed Country Residential Subdivision - Fawn Meadows
Portions of NE & SE 4-53-2-W5M,
Parkland County, Alberta
Site Plan

Job No: H0907-280

Date: August 11, 2009

Plate: 109



LAND TITLE CERTIFICATE

S

LINC SHORT LEGAL 0022 814 537 5;2;53;4;NE

TITLE NUMBER 042 286 912

LEGAL DESCRIPTION

MERIDIAN 5 RANGE 2 TOWNSHIP 53
SECTION 4
QUARTER NORTH EAST
CONTAINING 64.7 HECTARES (160 ACRES) MORE OR LESS
EXCEPTING THEREOUT:
(A) THE NORTHERLY 693 FEET THROUGHOUT
CONTAINING 17.0 HECTARES (42 ACRES) MORE OR LESS
(B) 0.624 HECTARES (1.54 ACRES) MORE OR LESS AS SHOWN
ON ROAD PLAN 466JY
EXCEPTING THEREOUT ALL MINES AND MINERALS

ESTATE: FEE SIMPLE

MUNICIPALITY: PARKLAND COUNTY

REFERENCE NUMBER: 832 050 645

REGISTERED OWNER(S)

REGISTRATION DATE(DMY) DOCUMENT TYPE VALUE CONSIDERATION

OWNERS

FAWN MEADOWS DEVELOPMENT INC.. OF 3215 UTAH PLACE NW CALGARY ALBERTA T2N 4A8

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 2
REGISTRATION # 042 286 912

NUMBER DATE (D/M/Y) PARTICULARS

052 267 815 05/07/2005 CAVEAT

RE: AGREEMENT CHARGING LAND CAVEATOR - AMBROSE WILLIAM COMCHI 3215 UTAH PLACE NW CALGARY

ALBERTA T2N4A8

082 319 992 01/08/2008 MORTGAGE

MORTGAGEE - AXCESS MORTGAGE FUND LTD.. SUITE 1410, 10665 SOUTHPORT ROAD SW

CALGARY

ALBERTA T2W4Y1

AS TO 60/580

MORTGAGEE - B2B TRUST.

404, 130 ADELAIDE ST WEST

TORONTO

ONTARIO M5H3P5

MORTGAGEE - CANADIAN WESTERN TRUST COMPANY.

600 - 750 CANCIE STREET

VANCOUVER

BRITISH COLUMBIA V6B4Y7

MORTGAGEE - WILLIAM HEALEY

MORTGAGEE - CHRISTIAN STEVENSON

MORTGAGEE - MARLENE STEVENSON

MORTGAGEE - RAYMOND STEVENSON

ALL OF :

C/O AXCESS CAPITAL PARTNERS

1410, 10655 SOUTHPORT RD SW

CALGARY

ALBERTA T2W4Y1

AS TO 520/580

ORIGINAL PRINCIPAL AMOUNT: \$580,000

(DATA UPDATED BY: TRANSFER OF MORTGAGE 102107963)

082 319 993 01/08/2008 CAVEAT

RE : ASSIGNMENT OF RENTS AND LEASES

CAVEATOR - B2B TRUST.

C/O 212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - CANADIAN WESTERN TRUST COMPANY.

212 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - WILLIAM HEALEY

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION NUMBER DATE (D/M/Y) PARTICULARS

PAGE 3 # 042 286 912

CAVEATOR - CHRISTIAN STEVENSON CAVEATOR - MARLENE STEVENSON CAVEATOR - RAYMOND STEVENSON

ALL OF :

C/O #212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - GREENTREE MORTGAGE CORPORATION.

C/O 212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

AGENT - DOUGLAS M SEFCIK

082 360 125 21/08/2008 POSTPONEMENT

OF CAVE 052267815

TO MORT 082319992 CAVE 082319993

112 380 928 25/11/2011 WRIT

CREDITOR - CALIBRE DRILLING LTD..

431 SOUTH AVENUE SPRUCE GROVE ALBERTA T7X3B3

DEBTOR - FAWN MEADOWS DEVELOPMENT INC..

3215 UTAH PLACE NW

CALGARY

ALBERTA T2N4A8

AMOUNT: \$38,663 AND COSTS IF ANY

ACTION NUMBER: 1103 07382

TOTAL INSTRUMENTS: 005

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 5 DAY OF MARCH, 2012 AT 10:48 A.M.

ORDER NUMBER: 20739743

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 0029 960 656 0323261;1;1 042 286 913

LEGAL DESCRIPTION PLAN 0323261 BLOCK 1 LOT 1

EXCEPTING THEREOUT ALL MINES AND MINERALS AREA: 4.048 HECTARES (10 ACRES) MORE OR LESS

ESTATE: FEE SIMPLE

ATS REFERENCE: 5;2;53;4;SE

MUNICIPALITY: PARKLAND COUNTY

REFERENCE NUMBER: 032 218 815

REGISTERED OWNER(S)

REGISTRATION DATE(DMY) DOCUMENT TYPE VALUE CONSIDERATION

042 286 913 12/07/2004 TRANSFER OF LAND \$90,000 CASH/MORTGAGE

OWNERS

FAWN MEADOWS DEVELOPMENT INC.. OF 3215 UTAH PLACE NW CALGARY ALBERTA T2N 4A8

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS

752 145 223 15/10/1975 UTILITY RIGHT OF WAY

GRANTEE - WEST PARKLAND GAS CO-OP LTD.

082 319 992 01/08/2008 MORTGAGE

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

REGISTRATION

NUMBER DATE (D/M/Y) PARTICULARS

PAGE 2 # 042 286 913

MORTGAGEE - AXCESS MORTGAGE FUND LTD.. SUITE 1410, 10665 SOUTHPORT ROAD SW

CALGARY

ALBERTA T2W4Y1

AS TO 60/580

MORTGAGEE - B2B TRUST.

404, 130 ADELAIDE ST WEST

TORONTO

ONTARIO M5H3P5

MORTGAGEE - CANADIAN WESTERN TRUST COMPANY.

600 - 750 CANCIE STREET

VANCOUVER

BRITISH COLUMBIA V6B4Y7

MORTGAGEE - WILLIAM HEALEY

MORTGAGEE - CHRISTIAN STEVENSON

MORTGAGEE - MARLENE STEVENSON

MORTGAGEE - RAYMOND STEVENSON

ALL OF :

C/O AXCESS CAPITAL PARTNERS

1410, 10655 SOUTHPORT RD SW

CALGARY

ALBERTA T2W4Y1

AS TO 520/580

ORIGINAL PRINCIPAL AMOUNT: \$580,000

(DATA UPDATED BY: TRANSFER OF MORTGAGE 102107963)

082 319 993 01/08/2008 CAVEAT

RE: ASSIGNMENT OF RENTS AND LEASES

CAVEATOR - B2B TRUST.

C/O 212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - CANADIAN WESTERN TRUST COMPANY.

212 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - WILLIAM HEALEY

CAVEATOR - CHRISTIAN STEVENSON

CAVEATOR - MARLENE STEVENSON

CAVEATOR - RAYMOND STEVENSON

ALL OF :

C/O #212, 20 SUNPARK PLAZA SE

CALGARY

ALBERTA T2X3T2

CAVEATOR - GREENTREE MORTGAGE CORPORATION.

C/O 212, 20 SUNPARK PLAZA SE

(CONTINUED)

ENCUMBRANCES, LIENS & INTERESTS

PAGE 3 # 042 286 913

REGISTRATION

NUMBER DATE (D/M/Y)

PARTICULARS

CALGARY

ALBERTA T2X3T2

AGENT - DOUGLAS M SEFCIK

102 113 781 09/04/2010 CAVEAT

RE : AGREEMENT CHARGING LAND

CAVEATOR - L & B WATER SERVICES LTD..

C/O MAIN STREET LAW OFFICES

BOX 4307,115 MAIN ST

SPRUCE GROVE

ALBERTA T7X3A7

AGENT - FRANK C DEANGELIS

112 380 928 25/11/2011 WRIT

CREDITOR - CALIBRE DRILLING LTD..

431 SOUTH AVENUE SPRUCE GROVE ALBERTA T7X3B3

DEBTOR - FAWN MEADOWS DEVELOPMENT INC..

3215 UTAH PLACE NW

CALGARY

ALBERTA T2N4A8

AMOUNT: \$38,663 AND COSTS IF ANY

ACTION NUMBER: 1103 07382

TOTAL INSTRUMENTS: 005

THE REGISTRAR OF TITLES CERTIFIES THIS TO BE AN ACCURATE REPRODUCTION OF THE CERTIFICATE OF TITLE REPRESENTED HEREIN THIS 5 DAY OF MARCH, 2012 AT 10:48 A.M.

ORDER NUMBER:20739743

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).

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 Tel: (780) 996-5621 • Fax: (780) 475-5671 e-mail: h_gsl@telus.net

March 1, 2012

Our File: H0907-280

Norcan Consulting Group Ltd. Box 38, Site 219, RR2 Gravel, Alberta T0E OH0

Attention:

Mr. Frank Florkewich

Dear Sirs:

Re: Geotechnical Site Investigation

For Proposed Facilities

Proposed Country Residential Subdivision

Fawn Meadows

Portions of NE and SE 4-53-2-W5M

Parkland County, Alberta

1.0 INTRODUCTION

As requested, a geotechnical site investigation was carried out by Hagstrom Geotechnical Services Ltd. (HGSL) at the above referenced project. The scope of work for the investigation was to provide an assessment of the soil and groundwater conditions, provide recommendations for alternate foundation systems and preparation of this report. Field drilling was carried out on August 4, 2009 and final water table measurements were taken on October 14, 2009.

2.0 PROJECT DESCRIPTION

The proposed country residential subdivision contains about 52.6 hectares of agricultural land that occupies a portion of the northeast and southeast quarters of Section 4, Township 53, Range 2, West of the Fifth Meridian. The site is bounded on the east by Highway 770 and on the south by Parkland Drive. The site is open, vacant hayland and contains four large groups of trees and marshes that cover about 30 to 35 percent of the site. The site topography is moderately rolling with slopes typically less than 12 degrees (21 percent). No definite drainage pattern is apparent across the site.

It is understood that the proposed development is to consist of cluster type lots of about 55 to 60 residential lots varying in size from 1.0 to 2.5 acres. It is further understood that the development will be serviced with centralized municipal sanitary sewers and potable water systems. In addition, the proposed subdivision will consist of a community services building located in the south west corner, a water treatment plant and maintenance building in the south east corner and a seniors assisted living complex located in the north east corner. The size and

details of each facility were not finalized at the time of report submission.

3.0 INVESTIGATION PROCEDURE

Six deep boreholes were drilled on the site on August 4, 2009. Borehole 09-101 and 09-102 were drilled at the proposed services building, Boreholes 09-13 and 09-104 were drilled at the proposed water treatment plant/maintenance building and Boreholes 09-105 and 09-106 were drilled at the proposed seniors assisted living complex (Refer to Plate 109, Appendix A). It is noted that Boreholes 09-105 and 09-106 could not be drilled within the building footprint because of heavy tree cover. The boreholes were drilled to depths of 9.0 metres using a truck mounted drill rig equipped with a continuous flight, 150-millimeter diameter, solid-stem augers. Supervision of drilling, soil sampling, and logging of the various soil strata was performed by Mr. Merle Hagstrom, P. Eng of HGSL. The soils encountered during drilling were classified in accordance with the Modified Unified Soil Classification System described on Plates 1 and 2, Appendix A. The soil and groundwater conditions encountered during field drilling were recorded and are presented on borehole logs, Plates 103 to108, Appendix A. The borehole locations are presented on Plate 109, Appendix A.

Soil sampling for laboratory analysis generally consisted of disturbed auger soil samples at 0.75 meter intervals obtained from all boreholes. In addition, pocket penetrometer (PP) readings were taken on intact cohesive soil samples at approximately 0.75 metre intervals from all boreholes to obtain an indication of the unconfined compressive strength (Q_u) of the soil.

Groundwater conditions were monitored during drilling, at drilling completion, several hours later and 10 days after drilling completion. All of the water level results are presented on the boreholes logs in Appendix A.

In addition to the routine moisture content analysis, the laboratory analyses consisted of twelve soluble sulphates analyses and two Atterberg limit tests. The laboratory analyses results are presented on the borehole logs in Appendix A.

4.0 SUBSOIL AND GROUNDWATER CONDITIONS

The soil profile at the borehole locations generally consist of a thin cover of topsoil over variable thick layers of silt and clay. A thin layer of sand was encountered below the topsoil in one borehole. A description of various soil units and their properties are presented in the paragraphs below.

Topsoil was encountered at the ground surface in all boreholes and extended to depths between 18 and 67 centimeters. The topsoil was described as silty, dry to damp, with some sand, compressible and black in colour. Greater thickness of topsoil may be found between borehole locations.

Clay of variable thickness was encountered at random depths in all boreholes. The clay was described as silty, firm to hard consistency, low to medium plasticity, damp to very moist, brown to dark olive brown in colour. The clay was also noted to have frequent silt lenses with

rust staining and occasional gravel chips. In-situ moisture contents in the clay ranged from 11 to 34 percent. Pocket penetrometer readings taken on intact auger samples of clay revealed approximate unconfined compressive strengths Q_u , ranging from 90 to 515 kPa. Two Atterberg limit tests conducted on clay yielded liquid limits of 44 and 45 percent and plastic limits of 21 and 22 percent (medium plasticity). Based on a review of plastic limits in comparison with the natural moisture contents in the clay, the natural moisture contents are about 5 to 10 percent wet of optimum moisture content (OMC). The clay exhibits moderate compressibility under low to moderate loads. The clay also exhibits moderate swelling potential and thus may lift light loads such as floor slabs given access to free water.

Silt was encountered at variable depths in three of the six boreholes. The site was described as sandy, with some clay, damp to very moist, and pale olive brown to dark grey in colour. Below the groundwater table, the silt was noted to be very sensitive. In-situ moisture contents in the silt ranged from 12 to 32 percent. Pocket penetrometer readings taken on intact auger samples of silt revealed approximate unconfined compressive strengths Q_u , ranging from 115 to 185 kPa. The silt exhibits moderate compressibility under low to moderate loads.

Groundwater conditions were monitored during drilling, at drilling completion, several hours later and 10 days after drilling completion. Groundwater seepage was encountered during drilling in all six boreholes. All water table results are summarized in Table 1, below and the individual results are presented on the borehole logs in Appendix A.

TABLE 1: SUMMARY OF GROUNDWATER OBSERVATIONS

Borehole	Depth of	I	Depth to Water (m)		
Number	Groundwater Seepage (m)	At Drilling Completion	2 to 5 Hours Later	10 Days Later	
09-101	4.1	8.7	5.1	4.0	
09-102	4.2	6.7	3.8	3.7	
09-103	3.6	6.7	2.6	2.4	
09-104	8.0	8.8	8.7	5.8	
09-105	7.8	5.5	5.5	2.0	
09-106	7.0	8.7	8.6	8.6	

Based on a review of the above results, the groundwater table is considered to be variable across the site. The results indicate that groundwater may pose problems for caisson pile drill holes and other excavations that are left open for short and extended periods of time at depths below 2.0

metres.

It should be noted that groundwater levels will fluctuate seasonally and in response to climatic conditions and may be at a different depths when construction commences. Accordingly, groundwater levels should be monitored periodically until the start of construction.

4.1 FROST PENETRATION

The expected maximum depth of frost penetration for various soil types is given in Table 2, below. The penetration is based on a freezing index for a 25-year return period of 2200 degrees-days Celsius. The depth of frost penetration assumes a uniform soil type without topsoil or snow cover.

The native mineral soils encountered in the boreholes is considered to be frost susceptible, and with an adequate supply of moisture near the ground surface, significant frost heave may occur.

TABLE 2
ESTIMATED DEPTH OF FROST PENETRATION

Soil T	уре	Depth of Frost Penetration (r			
In-situ	Clay and Clay Till	2.5			
	Silt and Sand	2.9			
	Weathered Bedrock	3.0			
	Gravel	3.5			
Compacted Backfill	Clay and Clay Till	2.3			
(95 % SPMDD*)	Silt and Sand	2.7			
	Weathered Bedrock	2.9			
	Gravel	3.3			

^{*}SPMDD- Standard Proctor Maximum Dry Density

5.0 GEOTECHNICAL EVALUATION

All foundation design recommendations presented in this report are based on the assumption that an adequate level of construction monitoring during foundation excavation and installation will be provided, and that all construction will be carried out by a suitably qualified, experienced contactor. An adequate level of construction monitoring is considered to be: (a), design review and full-time monitoring during construction of foundations, and (b), full-time monitoring and compaction testing for earthworks by suitably qualified geotechnical personnel.

The soil conditions at the site are considered to be adequate for the proposed site facilities. The groundwater table is considered to be moderately high. Shallow foundations such as strip and spread footings can be considered for the site. Alternatively, deep foundations such as cast-in-place straight shaft or end bearing concrete piles may be considered.

5.1 SHALLOW FOUNDATIONS

Shallow concrete footings for all three facilities founded on the native mineral soil should be designed based on a net allowable bearing capacity of 90 and 120 kPa for strip and spread footings, respectively. This value utilizes a factor of safety of 3.0. The allowable bearing pressure may be increased by a factor of 1.5 to obtain a factored ultimate bearing resistance. The footings should be constructed at a minimum depth of 1.5 m and 2.5 metres below exterior grade for heated and unheated structures, respectively. It is recommended that footing excavations be inspected by a qualified geotechnical engineer prior to pouring concrete to confirm foundation soil conditions and bearing pressures.

All footings should be founded on the undisturbed, inorganic native mineral soil. Footings must not be placed on any topsoil, uncontrolled fill, organic soils or loose, disturbed or frozen soils. Footing excavations must be protected from frost, desiccation, or the ingress of water. Bearing soils, which become frozen, dried or softened, should be removed and replaced with concrete or the footings should be extended to reach soil in an unaffected condition. It is essential that the foundation soils not be allowed to freeze at any time before or after concrete for the footings have been placed.

5.2 DEEP FOUNDATIONS

Cast-in-place concrete piles can be considered for all three proposed facilities and should be designed as straight shaft concrete friction-type piles using allowable and factored skin friction parameters shown in Table 3, below. No allowance should be made for end bearing on straight shaft piles.

Concrete straight shaft piles should be embedded at least 6.0 and 7.5 metres below grade for heated and unheated foundations, respectively. The minimum center-to-center spacing for concrete cast-in-place piles should be greater than 3 pile diameters. The piles should be at least 400 mm in diameter. Void form that is approximately 100 millimetres thick should be used under a concrete grade beam or pile cap.

TABLE 3
ALLOWABLE SKIN FRICTION FOR CAST-IN-PLACE CONCRETE PILES

Depth Below Existing Grade (m)	Soil Type	Allowable Skin Friction (kPa)	Factored ULS Skin Friction (kPa)
0 to 1.5	Clay/ Silt/Sand	0	0
1.5 to 9.0	Clay/Silt/Sand	21	28

Longitudinal steel reinforcement in the upper 6.0 meters of the pile is recommended to prevent potential uplift forces of the pile due to frost action and seasonal moisture variations. If the piles are designated as tension elements including frost action, longitudinal reinforcing steel should extend into the bottom of the piles, and the piles should be designed to resist the anticipated uplift stresses using the design values provided below.

Concrete for piles should be poured immediately after drilling of the pile hole to reduce the risk of groundwater seepage and sloughing of the soil. Protective steel casing may be required where wet sand and groundwater seepage are encountered.

5.2.1 Settlement Considerations for Concrete Piles

Calculation of the potential settlement pattern is complex and difficult to assess without significant additional laboratory testing and detailed knowledge of the loading and foundation types. For structures supported on native, undisturbed soil, the following comments may be of some value:

• The settlement of an isolated cast-in-place concrete skin friction pile should be no more than 5 mm plus elastic compression of the pile upon full mobilization of shaft resistance.

Differential settlements, rather than total settlements, are usually the governing factor in structural and architectural design. Differential settlements between adjacent columns or wall units are typically about one-half of the values given above.

5.3 SEISMIC SITE CLASSIFICATION

Site classification for soil seismic response for this site is category "D" which is according to the requirements of the National Building Code of Canada (Table 4.1.8.4.A).

5.4 CONCRETE

Chemical testing for water-soluble sulphates concentrations on twelve selected samples of native soil revealed sulphate concentrations of 0.02 to 0.18 percent water-soluble sulphate by dry weight of soil. The results indicated a "negligible to moderate" potential for sulphate attack on concrete in contact with native soils at this site. Therefore, all concrete in contact with the native soils should be made from CSA Type 50 sulphate resistant cement possessing a minimum 56 days compressive strength of 30 MPa. The maximum water cement ratio should be 0.50. An air entrainment agent of 5 to 7 percent is recommended for improved workability and durability. If new fill is brought to the site, it should be tested for soluble sulphates to determine if Type 50 cement is required.

6.0 CLOSURE

This report is based on the findings at six deep borehole locations. Should different subsoil or groundwater conditions be encountered during construction, Hagstrom Geotechnical Services Ltd. must be notified immediately and the recommendations provided herein will be reviewed and revised as required.

Boreholes could not be drilled within the building footprint for the new seniors assisted living complex and thus is recommended that new boreholes be drilled within the new building footprint. In addition, if the other building locations are changed, it is recommended that new boreholes be drilled. During placement and compaction of new fill, soil compaction tests should

Explanation of Field and Laboratory Test Data

The following pages are an explanation of the terms and symbols used in the Test Hole Log

Soil Profile and Description

Soil types are described by the Modified Unified Soil Classification System. (See Plate 2 for terms and symbols)

Soils classified by particle size fall in the following ranges:

BOULDERS - greater than 200 mm SAND - 0.08 mm to 5 mm COBBLES - 75 mm to 200 mm SILT - 0.002 mm to 0.08 mm GRAVEL - 5 mm to 75 mm CLAY - finer than 0.002 mm

Additional graphic symbols include:

seepage
water level surface

Soil Sample Type

Standard Penetration Sample (D)

Undisturbed Sample (Shelby) (U)

Bag Sample

Penetration Resistance

Field test indication number of blows (N) of a 140 pound hammer dropping 30 inches (76cm) required to drive a 2 inch (5 cm) O.D. open end sampler a distance of 1 foot (30 cm) from 0.5 to 1.5 feet (15 to 45 cm) into the undisturbed soil. This test is outlined in A.S.T.M., D1568.

Miscellaneous Tests

In this column are summarized results of all the laboratory test as indicated by the following symbols:

HVR Hydrocarbon Vapour Readings, ppm or % LEL

* MA Mechanical grain size analysis

G Specific gravity

k Coefficient of permeability

PP Pocket penetrometer strength kg/cm2

* q Triaxial compression test

* C Consolidation test

Qu Unconfined compressive strength kg/cm2

SO₄ Soluble sulphate concentration

γ Bulk unit weight

γd Dry unit weigh

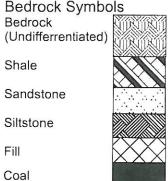
Tests normally summarized on separate data sheets



Hagstrom Geotechnical Services Ltd.

Modified Unified Classification System For Soils

M	ajor D	ivision	Group Symbol	Graph Symbol	Color Code	Typical Description		y Classification Priteria
sieve)	barse	Clean Gravels	GW	4 5 7	Red	Well graded gravels, little or no fines	$C_u = (D_{60}/D_{10})^2/(D_{10}^*D_{60})^2$	
200	vels nalf co ger th sieve	(little or no fines)	GP		Red	Poorly graded gravels, and gravel sand mixtures, little or no fines	Not meeting requirement	ts
soils r than	Gravels more than half coarse grains larger than No. 4 sieve	Clean Gravels (little or no fines) Dirty Gravel (with some fines)	GM		Yellow	Silty gravels, gravel-sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
Coarse-Grained Soils alf by weight larger tha	it large more gra	(with some lines)	GC		Yellow	Clayey gravels, gravel-sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
e-Gra weigh	ine	Clean Sands	SW		Red	Well graded sands, gravely sands, little or no fines	$C_{U} = (D_{60}/D_{10})^{2}$ $D_{30}^{2}/(D_{10}^{*}D_{60})^{2}$) = 1 to 3
Coars alf by	Sands more than half fine grains smaller than No. 4 sieve	(little or no fines)	SP		Red	Poorly graded sands, little or no fines	Not meeting requiremen	
than h	San re than ins sma No. 4 s	Dirty Sands	SM		Yellow	Silty sands, sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
(more	mo	(with some fines)	sc		Yellow	Clayey sands, sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
0 sieve)	Silts below "A" line negligible organic content	W ₁ < 50%	ML		Green	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classification upon plastic	
oils sses 200	Si below negli organic	W _L > 50%	МН		Blue	Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils		
Fine-Grained Soils alf by weight passe	Clays above "A" line negligible organic content	W _L < 30%	CL		Green	Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean clays		
e-Gra oy we	Clays ve "A gible c	30% < W _L < 50%	CI		Green- Blue	Inorganic clays of medium plasticity, silty clays		
Fin half I		W _L > 50%	СН		Blue	Inorganic clays of high plasticity		
Fine-Grained Soils (more than half by weight passes 200 sieve)	Organic Silts & Clays bellow "A" line on chart	W _ι < 50%	OL		Green	Organic silts and organic silty clays of low plasticity	Whenever the nature of the fine content has not been determined it is designated	
L)	Org Silts & bellow	W _L > 50%	ОН	ОН		Organic clays of high plasticity	by the letter "F". E.G. SF is a mixture of sand with silt o clay	
ŀ	Highly Orga	nic Soils	PI		Orange	Peat and other highly organic soils	Strong color often fibrous	or odor, and texture
Bedro	ck Symb	ols		-301		50		



Plasticity Index (I_P) 40 СН 30 CI OH 20 МН 10 MI OI 0 20 10 30 50 40 PLATE Liquid Limit (W_L) No. 102

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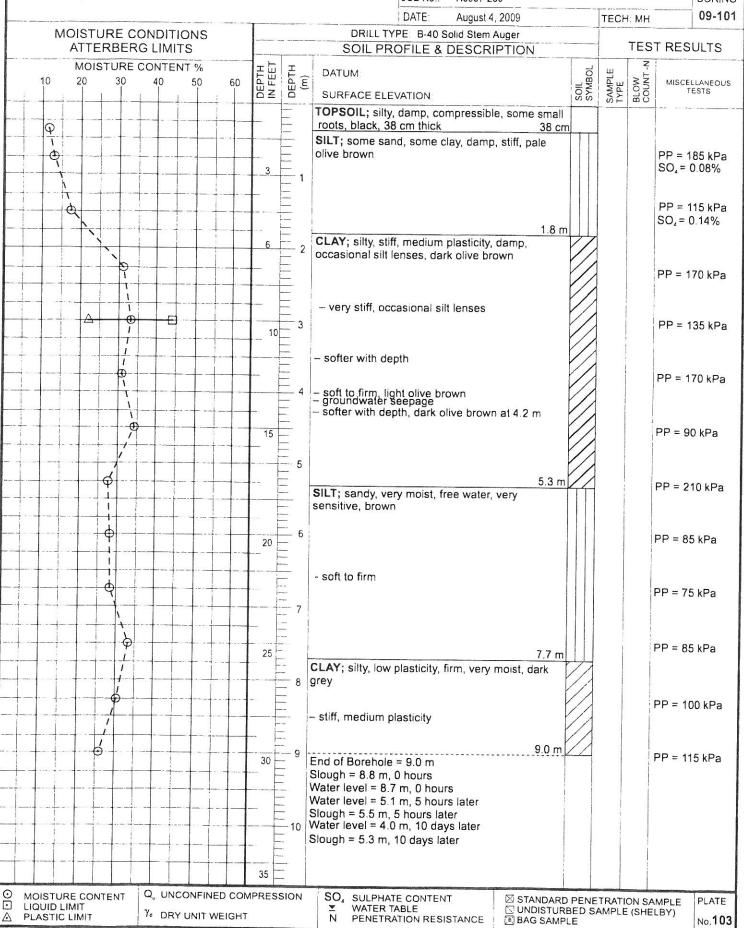
CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No.: H0907-280 BORING

DATE: August 4 2009 TECH: MH 09-101



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CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

DATE: August 4, 2009

TECH MH

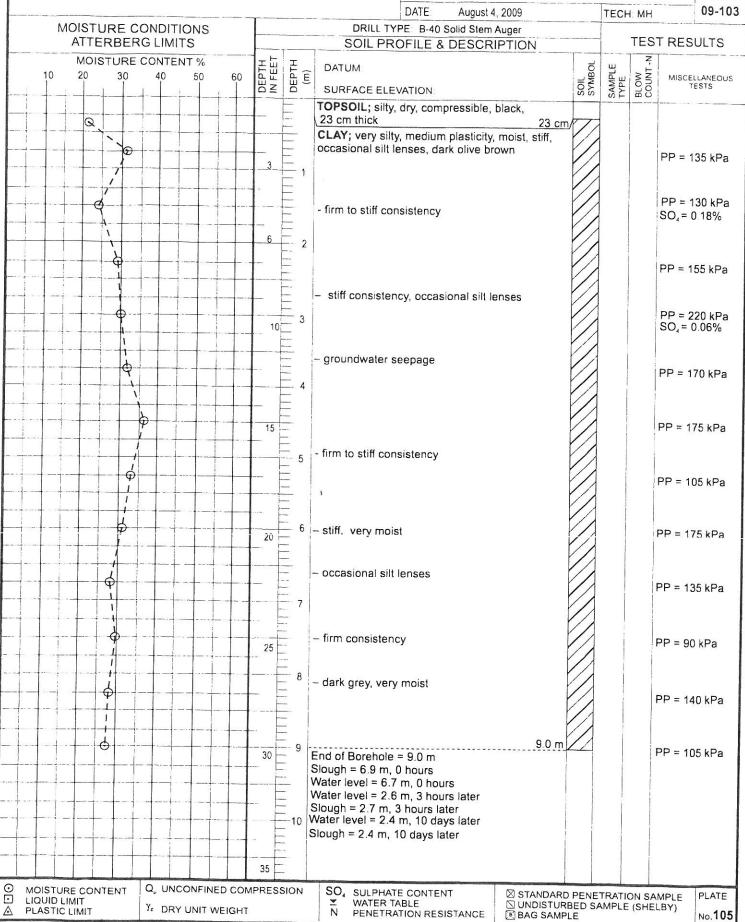
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CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST JOB No.: H0907-280 BORING

No.105



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CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

DATE: August 4, 2009

TECH: MH

09-104

			·		DATE: August 4,		TECH: MH	09-10
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LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

BORING

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10		MOIS 20	STURE 30		NTE 40		% 50	60	EPTH	IN FEET	DEPTH (m)	DATUM: SURFACE ELEVATION: DATUM: SURFACE ELEVATION: DATUM: SURFACE ELEVATION: N. MISC	ELLANEOI TESTS		
	+-	+	-	+	+	-		1	+	=		TOPSOIL; silty, some sand, compressible, black,			
	(2		+					1	-		67 cm thick	480 kP		
	-	6		-	ļ				+	3	_ _ 1	CLAY: silty damp very stiff medium plasticity	320 kP		
	-		(A)	-					+				275 kP 0.02%		
									‡	6	_ _ _ 2		0.02 /6		
	-		01	-					+			PP =	120 kP		
+	-		- 	+					t	10		PP =	110 kP 0.16%		
	-	+-	/						1	10		- very moist	0.1076		
		4							ŧ		_ 4	PP =	110 kP;		
			1001						Ħ	15		PP =	175 kP:		
] 								_ 5 	- very moist, occasional silt lenses	120 kPa		
		1							F						
	-	1							F	20	0	- frequent silt lenses and rust staining	35 kPa		
		0 1		-					-		_ _ _ _ 7	PP = 1	10 kPa		
	-	/	Ð -							25		PP = 1	15 kPa		
ę	1								-		8 	- clay till like, moist, occasional gravel chips, dark grey	230 kPa		
	1								F	F		- very stiff, medium plasticity			
					1					30	- 9 	End of Borehole = 9.0 m Slough = 9.0 m, 0 hours Water level = 5.5 m, 0 hours	815 kPa		
-		-						- 100 National Proc. (10 June				Water level = 5.5 m, 2.5 hours later Slough = 5.6 m, 2.5 hours later Water level = 2.0 m, 10 days later			
												Slough = 2.1m, 10 days later			
MOIST		4		1	1 1 1 1 1		VIC.	ED CO		35	010:	SO ₄ SULPHATE CONTENT STANDARD PENETRATION SAMPLE	PLAT		

Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

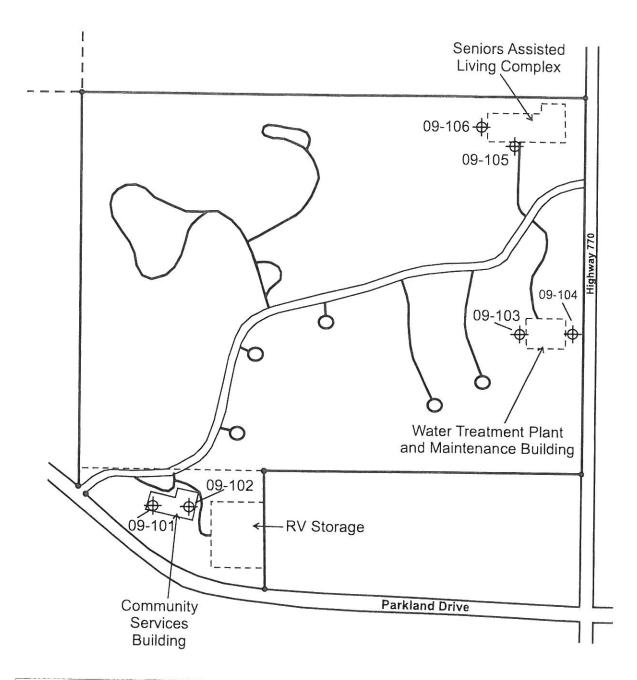
LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

BORING

												DATE: August 4, 2009		TECH	I: MH		09-10
M			RE CO				3					DRILL TYPE: B-40 Solid Stem Auger			TEC	TRES	UITS
Managara I and A	ATT	ER	BER	G LII	MIT	S	MURE DITE RATE			1		SOIL PROFILE & DESCRIPTION		+	7	TRES	ULIS
10	MC 20	DIST	URE (CON 40		T %		60	DEPTH IN FEET	DEPTH	(E	DATUM:	SOIL	SAMPLE	BLOW COUNT -N	MISCE	LANEOU! ESTS
	-	-				_	_		N N	20	_	SURFACE ELEVATION:	S SC	SA T	B 0		
4					_	4		-	_			TOPSOIL; silty, damp, compressible, black, 18 cm thick 18 cm		1		DD 6	20.10
	Q				_	-		+		F		CLAY; silty, very stiff, medium plasticity, damp,		1			30 kPa
	-		-			+	_		_	E		dark olive brown				PP = 5 SO ₄ =	15 kPa
	1	-+-				+	+	-	3		1	1.1	m /			004	D. 12 70
	1					+			_			SILT; sandy, some clay, medium dense, light					
	ϕ				+	-+		-				yellowish brown					
-	1	+	-		+		+	-		E							
+	!	+			\dashv	+	+	-	6_		2	- damp, medium dense					
9	+	-			+	+	-+	-	r : an								
		\top	1			1				E							
1		+										madium dana				00	
φ-									10		3	– medium dense				SO ₄ =	0.14%
1										E		- dense, light yellowish brown					
}	} +	_	-		_	_			_			3.7	m			PP = 3	325 kPa
			4-	-	_	4	_				4	CLAY ; silty, medium plasticity, moist, very stiff, occasional silt lenses, dark grey					
1	-	_			_	4	_										
	-	+	-		+	+	-	-	15							PP = 4	10 kPa
++		+	+-		+	+	-+	-	-	=							
<u></u> i		-+	+		+	+	-	+-			5	- very stiff		1			
1			-		-			+								PP = 3	375 kPa
1						1	1			E				1			
1							\exists				6	– very stiff				DD - 1	30 kPa
7									20		U	– very still				PP = 3	SSU KPa
1																	
- •						_				_						PP = 3	345 kPa
		_			_					Ξ	7	- groundwater seepage					
- 1					_	1		-		_							
-6-				_		-						- clay till like				PP = 3	885kPa
		-				-+		+-	25 				/				
			+		+	+		+		E	8			1			
	\$	+	-	-	-+-	+	+	+-				 very stiff, moist, occasional gravel chips 	//			PP = 3	885 kPa
++		+-			+		-+	+		\vdash				1			
		+	-		+	+	+	+		E	•	9.0	m			D.5	205 : -
0									30	E	9	End of Borehole = 9.0 m				PP = 3	325 kPa
												Slough = 8.9 m, 0 hours Water level = 8.7 m, 0 hours					
												Water level = 8.6 m, 2 hours later					
										E ₁	10	Slough = 8.5 m, 2 hours later Water level = 8.6 m, 10 days later					
		_						- _		E '	∓ii	Slough = 8.7 m, 10 days later					
			-	-	+	-		-		E							
				4	and all the property like				35		-						
MOIST	URE (TENT					ED CO		SSIC	NC	SO₄ SULPHATE CONTENT STANDA ▼ WATER TABLE N PENETRATION RESISTANCE BAG SA					PLAT No.1





LEGEND



Borehole Location



Site Boundary

Scale: Not to scale



Hagstrom Geotechnical Services Ltd.

5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

NOR CAN CONSULTING INC.

Proposed Country Residential Subdivision - Fawn Meadows Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta Site Plan

Job No: H0907-280

Date: August 11, 2009

Plate: 109

Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Porlions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

BORING

	-								TOA UIV		JOB No.:	H0907-280)		2007 - 250 F			BORING
											DATE:	August 4, 2	2009		TECH.	МН		09-101
	MOIS											Solid Stem A	The second secon					
	TTA	ERBE	ERG	LIMIT	S		-			SOIL PRO	OFILE &	DESCRIP	PTION				T RESI	JLTS
				NTEN			F	EET	DEPTH (m)	DATUM:				SOL	LE	N- TI		
10	20	30)	40	50	60	0 1	N E	JEP I	SURFACE ELEV	/ATION:			SOIL	SAMPLE	BLOW COUNT		LANEOUS STS
11		+++	+	+		+	-+		=	TOPSOIL; silty,		mnressible	Some email	00.00	SE	∞ ∪		
0	F	+++	- +	++	+	+	+	-		roots, black, 38	cm thick	pressible	, some small 38 cm					
	1	+ +		++		+	+			SILT; some sand	d, some c	lay, damp,	stiff, pale					
	4	++				-				olive brown							PP = 18	
	· † -				-+	+-+		_3	1								SO ₄ = 0	1.08%
	-1/-			+					_									
	0		-+-							1							PP = 1	
		4-1		4-4		1	-4	-					1.8 m				SO ₄ = 0	.14%
		1					_	6	_ 2	CLAY; silty, stiff,	medium	plasticity, d	lamp.	1				
		k	<u> </u>						_ •	occasional silt le	nses, dar	k olive brov	wn	1/				
			Ĭ				Γ										PP = 17	70 kPa
			1											11		1		
			1				1			- very stiff, occa	asional sil	l lenses		1/	Ì			
		1	0				1	10	3	İ						-	PP = 1:	35 kPa
			7	1-1-			-	-						//		1		
			1	1			1			- softer with dep	th					ĺ		
		1		1	+		+		_						i	ļ	PP = 17	70 kPa
			1	1					4	 soft to firm, light groundwater se 	nt olive bro	own						
+-+-	-+	+-+	1	++			+		-	- softer with dept	th, dark o	live brown	at 4.2 m					
+++		+++	D	++-			-4	15	_							!	PP = 90) kPa
+		+-+:	<i>i</i> +	+-+-			+-	-						//				- www.s553
++		+ /	-	++				‡	5									
+		 		++-		-		Ī					5.3 m				PP = 21	0 kPa
		- <u> -</u> -				-	+		_	SILT; sandy, very	y moist, fr	ee water, v	very			1	21	UKFA
										sensitive, brown								
		+6	-						6							1,	PP = 85	₽Do
		+4+	_			L	1	20	_							1	r - 00	Krd
				<u> </u>	4			-	-									
		4								- soft to firm								
		7	İ					<u> </u>									PP = 75	кРа
		1							_ 7						ļ			
		11	b				1	[_									
		TT	ψ.			1	1	25					7.7 m		ĺ	1	PP = 85	kPa
		1 1	1	1-1-	+ +	+	-		_	CLAY; silty, low p	lasticity, f	firm, very m						
+++		+ +			1 - 1		+		8	grey	6597	676		//				
+	+-+-	+ 🔅		+-+-			+	-	_					//		ı	PP = 10	0 kPa
1	++-	1	+-		1		+		_	– stiff, medium pla	asticity			//				
		1			+	+		F						//	İ			
+		6-					+-	20	9				9.0 m				PP = 11:	5 kPa
		1-1-			4-4	1	4	30 [-	_	End of Borehole = Slough = 8.8 m, 0							200 4 7) 2522 2 4 1 4	- ni a
		+			4		_	- ‡	-	Water level = 8.7	m, 0 hour							
11		1	44		1_1			F	-	Water level = 5.1	m, 5 hour	rs later			ļ			
ļļ	.	1-1-							_ 10	Slough = 5.5 m, 5 Water level = 4.0	hours lat	ler vs later						
								E	10	Slough = 5.3 m, 1	0 days la	ter				į		
					11	1		-	- 1	J -19 111 2	,-,	900 TAN						
		TT	1		7	-1-		35	-									
) ,,,,,-) LINIC	ONED	FDS	-	-	agent to see all	100	********							
LIQUI	TURE CO		1	UNC				KES!	SION	SO₄ SULPHATE ▼ WATER TA	E CONTEN ABLE	IT	STANDARD UNDISTUR	PENE	TRATIC	N SA	MPLE	PLATE
L PLAS	TIC LIMIT	Γ	1	DRY	ו דואט	VEIG	HT			N PENETRA		STANCE	BAG SAMP	LE	ment to the	OHE		No.103

0

Hagstrom Geotechnical Services Ltd.

5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No: H0907-280 BORING

DATE: August 4, 2009

							4	DATE: August 4, 2009 TE	CH: MH	09-10		
	MOISTURE CONDITIONS ATTERBERG LIMITS							DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION	TEST RESULTS			
N	OISTUR	E CON	TENT	%	60	DEPTH IN FEET	DEPTH (m)	DATUM: MBOL	BLOW COUNT -N	SCELLANEOU TESTS		
		++	-	 	-	≥۵		SURFACE ELEVATION: S & S S S S S S S S S S S S S S S S S	<u> </u>			
φ-								20 cm thick 20 cm/ SAND; silty, some clay, medium dense, moist, brown 80 cm				
						3	1	CLAY; silty, medium plasticity, very stiff, occasional silt lenses, brown	PP	= 375 kPa		
	0 /									= 240 kPa ₄ = 0 02%		
	3					6	2	- firm to stiff consistency , moister with depth		= 145 kPa ₄ = 0.08%		
	,						3			= 145 kP;		
		1			-	10		- firm, medium plasticity, dark olive brown 3.4 m SILT; sandy, loose, some clay lenses, dark brown		- 140 KI		
		→	+		-		4	SILT, Sandy, loose, some clay lenses, dark blown	PP	= 130 kPa		
						15		- groundwater seepage	PP	= 115 kPa		
	- + -						5 5	CLAY; silty, firm to stiff, medium plasticity, moist, brown – silt layer from 5.1 to 5.3 m	PP	= 85 kPa		
	1	b				20	6		PP	= 125 kPa		
		1	-			20		– silt layer from 6.6 to 6.9 m				
		φ					<u> </u>		PP	= 105 kPa		
		∳ 				25	=	- stiff consistency	PP	= 105 kPa		
							8		PP	= 155 kPa		
	i	100					9	9 0 m	PP	= 140 kPa		
						30		End of Borehole = 9.0 m Slough = 6.8 m, 0 hours Water level = 6.7 m, 0 hours Water level = 3.8 m, 4 hours later		(C)		
								Slough = 3.9 m, 4 hours later Water level = 3.7m, 10 days later Slough = 3.8 m, 10 days later				
						35	_					
MOISTURE LIQUID LIM PLASTIC L	IIT			NFINED			SSION	SO, SULPHATE CONTENT WATER TABLE N PENETRATION RESISTANCE STANDARD PENETR UNDISTURBED SAM B BAG SAMPLE	ATION SAMP	PLE PLAT		

Hagstrom Geotechnical Services Ltd. 5607 · 134 A Avenue, Edmonton, Alberta T5A DM3

CLIENT . Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION. Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

DATE: August 4, 2009

								· · · ·		DATE: August 4, 2009		TECH	: MH		09-103
	M	OISTL	JRE C	ON RG L	DITIC	SNC S				DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION			TES'	T RES	ULTS
			TURE						1				Z	Ī	
	10	20	30		10	50	60	DEPTH IN FEET	DEPTH (m)	DATUM SURFACE ELEVATION	SOIL	SAMPLE TYPE	BLOW COUNT -N	MISCE	LLANEOUS
				+	\vdash		†=	+		TOPSOIL; silty, dry, compressible, black,	SS	- 3 €	<u>в</u> С		
		Q			+++	-+	+-	+		23 cm thick 23 cm					
		+	`		-		-	+		CLAY; very silty, medium plasticity, moist, stiff					
-		-+	10	+			-	-		occasional silt lenses, dark olive brown				PP = 1	135 kPa
-			-1-	1			-	3	1						JOO INI U
			/		ļ.,			4.							
								 -		- firm to stiff consistency					130 kPa
			A							The still consistency				SO ₄ =	0.18%
		_	1	1	l i			6	_ 2				ĺ		
			Ŋ.												
			1	-										PP = 1	55 kPa
			4		li					- stiff consistency, occasional silt lenses					
								T	E	and controlled by occasional silt lenses	//			- מם	20 kPa
			Ψ					10	3					SO ₄ =	20 kPa 0.06%
			i										į	•	
								1	_	groundwater seepage		į			
						1		†					į	PP = 1	70 kPa
	11	1	1				-	1	4				İ		- 1
					-+-	+		+					į		- 1
	1-1	$+$ \pm		P		-		15						PP = 1	75 kPa
1				/				+-	=			1			
-	-1	+++	+!	+				+	- 5	- firm to stiff consistency		İ	i		I
-					-			-	_					PP = 1	05 kPa
li-	-+			\vdash		-		ļ							OD KI a
			+i						_			i			
			- b -	-				ļ- <u>-</u> -	6	- stiff, very moist				PP = 1	75 kPa
			- -					20	_	50 56 34 300 FORESCONDENS		ĺ	ï	L I C	,3 Kr.
-			4					ļ							
<u></u> .			6							 occasional silt lenses 			ı,	DD - 44	25.15
						11			- 7				ľ	PP = 1:	35 KPa
L			1						_ ′						- 1
									-	firm parallelana		į			
			1					25		- firm consistency		į	41	PP = 9() kPa
			!				1	1				ę.			
			1	7	1	7	-		8	- dark grey, very moist	//				
	-1-1		0	-		1		†	-	out \$504 S			ı	PP = 14	40 kPa
	7-1	Ti	1	7		1-1	-		_						
	++	1 1	1			+-+							İ		
	1-1	++++	5			++		30	9	9.0 m End of Borehole = 9.0 m				PP = 10	05 kPa
	+	++	-+-+					- "		Slough = 6.9 m, 0 hours		1			
	+	+++								Water level = 6.7 m, 0 hours					- 1
						1-4		-	_	Water level = 2.6 m, 3 hours later Slough = 2.7 m, 3 hours later		1			
			+	+-				ļ‡	10	Water level = 2.4 m, 10 days later					1
		4-4-				4			-	Slough = 2.4 m, 10 days later					
	+					1-1		1	_						1
								35	_				Ì		
0	MOISTUR	RE CON	TENT	Q,	UNC	ONFIN	ED CO	MPRES	SION	SO, SULPHATE CONTENT STANDARD	DENE	TDATE	N 5 :	MC: =	DIATE
		IMIT		1	DRY					WATER TABLE UNDISTUR	FENE	INAIL	JN SA	MPIF	PLATE

Hagstrom Geotechnical Services Ltd. 5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

BORING

									DATE: A		TEOU			09-10
	4010	rupe (2011	NITION	10				DATE: August 4,		TECH:	MH		05 10
V		TURE (ERBE			NS	-			DRILL TYPE: B-40 Solid Stem A SOIL PROFILE & DESCRI		-	TES	T RESU	JLTS
					0.4	\perp	_ _	_				Z		
10	20 	ISTURE 30	40N 		% 50 6	DEPTH	IN FEET	E (E)	DATUM: SURFACE ELEVATION:	SOIL	SAMPLE	BLOW COUNT -N	MISCELI TE	LANEOUS STS
							E		TOPSOIL; silty, damp, compressible 18 cm thick	e, black,				
	G					3			CLAY; silty, very stiff, medium plast frequent rust stained fissures, dark	icity, olive brown			PP = 13 SO ₄ = 0	35 kPa .12%
		1						-1 -					PP = 1: SO ₄ = 0	
		¢'					5	_ 2 2	- firm to stiff				PP = 10)5 kPa
		•					10	3	– low to medium plasticity				PP = 2	20 kP:
+		4						_ 4		4.1 m			PP = 19	90 kPa
		1	Þ			<u></u>	15		SILT; clayey, stiff, trace of sand, dat - stiff	rk brown			PP = 17	75 kPa
			 			1	E	- 5 -	CLAY; silty, firm consistency, low pl very moist	5.1 m			PP = 1(05 kPa
							20	- 6	– stiff, moist, occasional silt lenses				PP = 17	75 kPa
		j				-		- - 7					PP = 11	0 kPa
	8	1					25		– firm consistency				PP = 90) kPa
							E	8	– groundwaler seepage				PP = 12	20 kPa
		Ф -				3	30 =	- 9 -	End of Borehole = 9.0 m Slough = 8.9 m, 0 hours Water level = 8.8 m, 0 hours	9.0 m			PP = 10	05 kPa
								-10	Water level = 8.7 m, 2.5 hours later Slough = 8.8 m, 2.5 hours later Water level = 5.8, 10 days later Slough = 6.1 m, 10 days later					
MOIST LIQUII PLAST	DLIMIT				NFINED	СОМРЕ	RESSI	ION	SO ₄ SULPHATE CONTENT WATER TABLE N PENETRATION RESISTANCE	⊠ STANDARD PE S UNDISTURBED ® BAG SAMPLE				PLAT

Hagstrom Geotechnical Services Ltd. 5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No.: H0907-280

BORING **09-105**

		DATE: August 4, 2009		TECH: M	н 09-105
MOISTURE CONDITIONS ATTERBERG LIMITS		DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION		TE	ST RESULTS
MOISTURE CONTENT %	1-57-		ار		
10 20 30 40 50 60	DEPTH IN FEET DEPTH (m)	DATUM:	SOIL	SAMPLE TYPE BLOW	MISCELLANEOUS
		SURFACE ELEVATION:	SY	SAN	TESTS
	L E I	TOPSOIL; silty, some sand, compressible, black, 67 cm thick			
		67 cm			PP = 480 kPa
		CLAY; silty, damp, very stiff, medium plasticity, dark olive brown			PP = 320 kPa
	3 1	dark onve brown			-
					DD 075 (D
					PP = 275 kPa SO ₄ = 0.02%
	+ =	num e e			
	6 2	- stiff consistency			
0	H E I				PP = 120 kPa
	TEI		1		DD 445
9	10 3	ļ			PP = 110 kPa SO ₄ = 0.16%
//					1
		- very moist			
					PP = 110 kPa
\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \		<u>t</u>			
1					
	15				PP = 175 kPa
	5	- very moist, occasional silt lenses			
		, many managers and sended			DD 400 LD
					PP = 120 kPa
	L E I	<u>k</u>			
	6				PP = 95 kPa
	20 =				i i oo ki a
		- frequent silt lenses and rust staining			
	_ =				PP = 110 kPa
	7				-
- 	25				PP = 115 kPa
- 		- groundwater seepage			
	8 _	- clay till like, moist, occasional gravel chips,			
+	- E	dark grey			PP = 230 kPa
		very stiff, medium plasticity			
	30 9 E	9.0 m grid of Borehole = 9.0 m	/		PP = 315 kPa
	- s	Slough = 9.0 m, 0 hours			
	- V	Vater level = 5.5 m, 0 hours Vater level = 5.5 m, 2.5 hours later			
		Slough = 5.6 m, 2.5 hours later			
		Vater level = 2.0 m, 10 days later			
	- E s	lough = 2.1m, 10 days later			
	35				
MOISTURE CONTENT Q, UNCONFINED CO		SO₄ SULPHATE CONTENT ⊠ STANDARD	DENES	EDATION:	SAMPLE PLATE
☐ LIQUID LIMIT Δ PLASTIC LIMIT γ₀ DRY UNIT WEIGHT		▼ WATER TABLE	ED SA	MPLE (SI	HELBY)
1 . D.O. TO E.M. T		N PENETRATION RESISTANCE BAG SAMPL	.E		No.107

Hagstrom Geotechnical Services Ltd.

•

LIQUID LIMIT

PLASTIC LIMIT

γ DRY UNIT WEIGHT

CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 **BORING** JOB No.: H0907-280 09-106 TECH: MH DATE: August 4, 2009 MOISTURE CONDITIONS DRILL TYPE: B-40 Solid Stem Auger **TEST RESULTS** SOIL PROFILE & DESCRIPTION ATTERBERG LIMITS Ŗ MOISTURE CONTENT % DEPTH IN FEET SOIL SYMBOL DEPTH (m) BLOW COUNT. DATUM: SAMPLI MISCELLANEOUS 10 60 TESTS SURFACE ELEVATION: TOPSOIL; silty, damp, compressible, black, 18 cm thick 18 cm/ PP = 530 kPa 0 CLAY; silty, very stiff, medium plasticity, damp, dark olive brown PP = 515 kPaSO4 = 0.12% 3 1.1 m SILT; sandy, some clay, medium dense, light yellowish brown - damp, medium dense ф medium dense SO4= 0.14% 10 - dense, light yellowish brown 3.7 m PP = 325 kPa CLAY; silty, medium plasticity, moist, very stiff, occasional silt lenses, dark grey PP = 410 kPa 15 5 - very stiff 4 PP = 375 kPa - very stiff PP = 330 kPa 20 PP = 345 kPa groundwater seepage - clay till like PP = 385kPa25 8 - very stiff, moist, occasional gravel chips PP = 385 kPa 9.0 m 6 PP = 325 kPaEnd of Borehole = 9.0 m 30 Slough = 8.9 m, 0 hours Water level = 8.7 m, 0 hours Water level = 8.6 m, 2 hours later Slough = 8.5 m, 2 hours later ---10 Water level = 8.6 m, 10 days later Slough = 8.7 m, 10 days later Q, UNCONFINED COMPRESSION SO₄ SULPHATE CONTENT STANDARD PENETRATION SAMPLE PLATE MOISTURE CONTENT

WATER TABLE

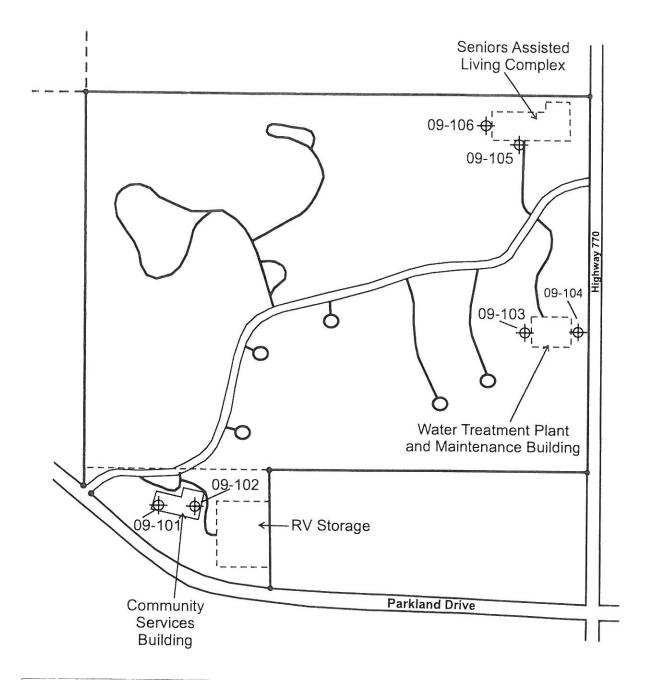
PENETRATION RESISTANCE

UNDISTURBED SAMPLE (SHELBY)

BAG SAMPLE

No.108





LEGEND

 Φ

Borehole Location

-

Site Boundary

Scale: Not to scale



Hagstrom Geotechnical Services Ltd.

5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

NOR CAN CONSULTING INC.

Proposed Country Residential Subdivision - Fawn Meadows
Portions of NE & SE 4-53-2-W5M,
Parkland County, Alberta
Site Plan

Job No: H0907-280

Date: August 11, 2009

Plate: 109



5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3 Tel: (780) 996-5621 • Fax: (780) 475-5671 e-mail: h_gsl@telus.net

March 1, 2012

Our File: H0907-280

Norcan Consulting Group Ltd. Box 38, Site 219, RR2 Gravel, Alberta T0E OH0

Attention: Mr. Frank Florkewich

Dear Sirs:

Re: Geotechnical Site Investigation

For Proposed Facilities

Proposed Country Residential Subdivision

Fawn Meadows

Portions of NE and SE 4-53-2-W5M

Parkland County, Alberta

1.0 INTRODUCTION

As requested, a geotechnical site investigation was carried out by Hagstrom Geotechnical Services Ltd. (HGSL) at the above referenced project. The scope of work for the investigation was to provide an assessment of the soil and groundwater conditions, provide recommendations for alternate foundation systems and preparation of this report. Field drilling was carried out on August 4, 2009 and final water table measurements were taken on October 14, 2009.

2.0 PROJECT DESCRIPTION

The proposed country residential subdivision contains about 52.6 hectares of agricultural land that occupies a portion of the northeast and southeast quarters of Section 4, Township 53, Range 2, West of the Fifth Meridian. The site is bounded on the east by Highway 770 and on the south by Parkland Drive. The site is open, vacant hayland and contains four large groups of trees and marshes that cover about 30 to 35 percent of the site. The site topography is moderately rolling with slopes typically less than 12 degrees (21 percent). No definite drainage pattern is apparent across the site.

It is understood that the proposed development is to consist of cluster type lots of about 55 to 60 residential lots varying in size from 1.0 to 2.5 acres. It is further understood that the development will be serviced with centralized municipal sanitary sewers and potable water systems. In addition, the proposed subdivision will consist of a community services building located in the south west corner, a water treatment plant and maintenance building in the south east corner and a seniors assisted living complex located in the north east corner. The size and

details of each facility were not finalized at the time of report submission.

3.0 INVESTIGATION PROCEDURE

Six deep boreholes were drilled on the site on August 4, 2009. Borehole 09-101 and 09-102 were drilled at the proposed services building, Boreholes 09-13 and 09-104 were drilled at the proposed water treatment plant/maintenance building and Boreholes 09-105 and 09-106 were drilled at the proposed seniors assisted living complex (Refer to Plate 109, Appendix A). It is noted that Boreholes 09-105 and 09-106 could not be drilled within the building footprint because of heavy tree cover. The boreholes were drilled to depths of 9.0 metres using a truck mounted drill rig equipped with a continuous flight, 150-millimeter diameter, solid-stem augers. Supervision of drilling, soil sampling, and logging of the various soil strata was performed by Mr. Merle Hagstrom, P. Eng of HGSL. The soils encountered during drilling were classified in accordance with the Modified Unified Soil Classification System described on Plates 1 and 2, Appendix A. The soil and groundwater conditions encountered during field drilling were recorded and are presented on borehole logs, Plates 103 to108, Appendix A. The borehole locations are presented on Plate 109, Appendix A.

Soil sampling for laboratory analysis generally consisted of disturbed auger soil samples at 0.75 meter intervals obtained from all boreholes. In addition, pocket penetrometer (PP) readings were taken on intact cohesive soil samples at approximately 0.75 metre intervals from all boreholes to obtain an indication of the unconfined compressive strength (Q_u) of the soil.

Groundwater conditions were monitored during drilling, at drilling completion, several hours later and 10 days after drilling completion. All of the water level results are presented on the boreholes logs in Appendix A.

In addition to the routine moisture content analysis, the laboratory analyses consisted of twelve soluble sulphates analyses and two Atterberg limit tests. The laboratory analyses results are presented on the borehole logs in Appendix A.

4.0 SUBSOIL AND GROUNDWATER CONDITIONS

The soil profile at the borehole locations generally consist of a thin cover of topsoil over variable thick layers of silt and clay. A thin layer of sand was encountered below the topsoil in one borehole. A description of various soil units and their properties are presented in the paragraphs below.

Topsoil was encountered at the ground surface in all boreholes and extended to depths between 18 and 67 centimeters. The topsoil was described as silty, dry to damp, with some sand, compressible and black in colour. Greater thickness of topsoil may be found between borehole locations.

Clay of variable thickness was encountered at random depths in all boreholes. The clay was described as silty, firm to hard consistency, low to medium plasticity, damp to very moist, brown to dark olive brown in colour. The clay was also noted to have frequent silt lenses with

rust staining and occasional gravel chips. In-situ moisture contents in the clay ranged from 11 to 34 percent. Pocket penetrometer readings taken on intact auger samples of clay revealed approximate unconfined compressive strengths Q_u , ranging from 90 to 515 kPa. Two Atterberg limit tests conducted on clay yielded liquid limits of 44 and 45 percent and plastic limits of 21 and 22 percent (medium plasticity). Based on a review of plastic limits in comparison with the natural moisture contents in the clay, the natural moisture contents are about 5 to 10 percent wet of optimum moisture content (OMC). The clay exhibits moderate compressibility under low to moderate loads. The clay also exhibits moderate swelling potential and thus may lift light loads such as floor slabs given access to free water.

Silt was encountered at variable depths in three of the six boreholes. The site was described as sandy, with some clay, damp to very moist, and pale olive brown to dark grey in colour. Below the groundwater table, the silt was noted to be very sensitive. In-situ moisture contents in the silt ranged from 12 to 32 percent. Pocket penetrometer readings taken on intact auger samples of silt revealed approximate unconfined compressive strengths Q_u , ranging from 115 to 185 kPa. The silt exhibits moderate compressibility under low to moderate loads.

Groundwater conditions were monitored during drilling, at drilling completion, several hours later and 10 days after drilling completion. Groundwater seepage was encountered during drilling in all six boreholes. All water table results are summarized in Table 1, below and the individual results are presented on the borehole logs in Appendix A.

TABLE 1: SUMMARY OF GROUNDWATER OBSERVATIONS

Borehole	Depth of Groundwater	Depth to Water (m)							
Number	Seepage (m)	At Drilling Completion	2 to 5 Hours Later	10 Days Later					
09-101	4.1	8.7	5.1	4.0					
09-102	4.2	6.7	3.8	3.7					
09-103	3.6	6.7	2.6	2.4					
09-104	8.0	8.8	8.7	5.8					
09-105	7.8	5.5	5.5	2.0					
09-106	7.0	8.7	8.6	8.6					

Based on a review of the above results, the groundwater table is considered to be variable across the site. The results indicate that groundwater may pose problems for caisson pile drill holes and other excavations that are left open for short and extended periods of time at depths below 2.0

metres.

It should be noted that groundwater levels will fluctuate seasonally and in response to climatic conditions and may be at a different depths when construction commences. Accordingly, groundwater levels should be monitored periodically until the start of construction.

4.1 FROST PENETRATION

The expected maximum depth of frost penetration for various soil types is given in Table 2, below. The penetration is based on a freezing index for a 25-year return period of 2200 degrees-days Celsius. The depth of frost penetration assumes a uniform soil type without topsoil or snow cover.

The native mineral soils encountered in the boreholes is considered to be frost susceptible, and with an adequate supply of moisture near the ground surface, significant frost heave may occur.

TABLE 2
ESTIMATED DEPTH OF FROST PENETRATION

Soil T	уре	Depth of Frost Penetration (m)
In-situ	Clay and Clay Till	2.5
	Silt and Sand	2.9
	Weathered Bedrock	3.0
	Gravel	3.5
Compacted Backfill	Clay and Clay Till	2.3
(95 % SPMDD*)	Silt and Sand	2.7
	Weathered Bedrock	2.9
	Gravel	3.3

^{*}SPMDD- Standard Proctor Maximum Dry Density

5.0 GEOTECHNICAL EVALUATION

All foundation design recommendations presented in this report are based on the assumption that an adequate level of construction monitoring during foundation excavation and installation will be provided, and that all construction will be carried out by a suitably qualified, experienced contactor. An adequate level of construction monitoring is considered to be: (a), design review and full-time monitoring during construction of foundations, and (b), full-time monitoring and compaction testing for earthworks by suitably qualified geotechnical personnel.

The soil conditions at the site are considered to be adequate for the proposed site facilities. The groundwater table is considered to be moderately high. Shallow foundations such as strip and spread footings can be considered for the site. Alternatively, deep foundations such as cast-in-place straight shaft or end bearing concrete piles may be considered.

5.1 SHALLOW FOUNDATIONS

Shallow concrete footings for all three facilities founded on the native mineral soil should be designed based on a net allowable bearing capacity of 90 and 120 kPa for strip and spread footings, respectively. This value utilizes a factor of safety of 3.0. The allowable bearing pressure may be increased by a factor of 1.5 to obtain a factored ultimate bearing resistance. The footings should be constructed at a minimum depth of 1.5 m and 2.5 metres below exterior grade for heated and unheated structures, respectively. It is recommended that footing excavations be inspected by a qualified geotechnical engineer prior to pouring concrete to confirm foundation soil conditions and bearing pressures.

All footings should be founded on the undisturbed, inorganic native mineral soil. Footings must not be placed on any topsoil, uncontrolled fill, organic soils or loose, disturbed or frozen soils. Footing excavations must be protected from frost, desiccation, or the ingress of water. Bearing soils, which become frozen, dried or softened, should be removed and replaced with concrete or the footings should be extended to reach soil in an unaffected condition. It is essential that the foundation soils not be allowed to freeze at any time before or after concrete for the footings have been placed.

5.2 DEEP FOUNDATIONS

Cast-in-place concrete piles can be considered for all three proposed facilities and should be designed as straight shaft concrete friction-type piles using allowable and factored skin friction parameters shown in Table 3, below. No allowance should be made for end bearing on straight shaft piles.

Concrete straight shaft piles should be embedded at least 6.0 and 7.5 metres below grade for heated and unheated foundations, respectively. The minimum center-to-center spacing for concrete cast-in-place piles should be greater than 3 pile diameters. The piles should be at least 400 mm in diameter. Void form that is approximately 100 millimetres thick should be used under a concrete grade beam or pile cap.

TABLE 3
ALLOWABLE SKIN FRICTION FOR CAST-IN-PLACE CONCRETE PILES

Depth Below Existing Grade (m)	Soil Type	Allowable Skin Friction (kPa)	Factored ULS Skin Friction (kPa)
0 to 1.5	Clay/ Silt/Sand	0	0
1.5 to 9.0	Clay/Silt/Sand	21	28

Longitudinal steel reinforcement in the upper 6.0 meters of the pile is recommended to prevent potential uplift forces of the pile due to frost action and seasonal moisture variations. If the piles are designated as tension elements including frost action, longitudinal reinforcing steel should extend into the bottom of the piles, and the piles should be designed to resist the anticipated uplift stresses using the design values provided below.

Concrete for piles should be poured immediately after drilling of the pile hole to reduce the risk of groundwater seepage and sloughing of the soil. Protective steel casing may be required where wet sand and groundwater seepage are encountered.

5.2.1 Settlement Considerations for Concrete Piles

Calculation of the potential settlement pattern is complex and difficult to assess without significant additional laboratory testing and detailed knowledge of the loading and foundation types. For structures supported on native, undisturbed soil, the following comments may be of some value:

• The settlement of an isolated cast-in-place concrete skin friction pile should be no more than 5 mm plus elastic compression of the pile upon full mobilization of shaft resistance.

Differential settlements, rather than total settlements, are usually the governing factor in structural and architectural design. Differential settlements between adjacent columns or wall units are typically about one-half of the values given above.

5.3 SEISMIC SITE CLASSIFICATION

Site classification for soil seismic response for this site is category "D" which is according to the requirements of the National Building Code of Canada (Table 4.1.8.4.A).

5.4 CONCRETE

Chemical testing for water-soluble sulphates concentrations on twelve selected samples of native soil revealed sulphate concentrations of 0.02 to 0.18 percent water-soluble sulphate by dry weight of soil. The results indicated a "negligible to moderate" potential for sulphate attack on concrete in contact with native soils at this site. Therefore, all concrete in contact with the native soils should be made from CSA Type 50 sulphate resistant cement possessing a minimum 56 days compressive strength of 30 MPa. The maximum water cement ratio should be 0.50. An air entrainment agent of 5 to 7 percent is recommended for improved workability and durability. If new fill is brought to the site, it should be tested for soluble sulphates to determine if Type 50 cement is required.

6.0 CLOSURE

This report is based on the findings at six deep borehole locations. Should different subsoil or groundwater conditions be encountered during construction, Hagstrom Geotechnical Services Ltd. must be notified immediately and the recommendations provided herein will be reviewed and revised as required.

Boreholes could not be drilled within the building footprint for the new seniors assisted living complex and thus is recommended that new boreholes be drilled within the new building footprint. In addition, if the other building locations are changed, it is recommended that new boreholes be drilled. During placement and compaction of new fill, soil compaction tests should

Explanation of Field and Laboratory Test Data

The following pages are an explanation of the terms and symbols used in the Test Hole Log

Soil Profile and Description

Soil types are described by the Modified Unified Soil Classification System. (See Plate 2 for terms and symbols)

Soils classified by particle size fall in the following ranges:

BOULDERS - greater than 200 mm SAND - 0.08 mm to 5 mm

COBBLES - 75 mm to 200 mm GRAVEL - 5 mm to 75 mm

SILT - 0.002 mm to 0.08 mm CLAY - finer than 0.002 mm

Additional graphic symbols include:

seepage

water level surface

Soil Sample Type

Standard Penetration Sample (D)

Undisturbed Sample (Shelby) (U)

B

Bag Sample

Penetration Resistance

Field test indication number of blows (N) of a 140 pound hammer dropping 30 inches (76cm) required to drive a 2 inch (5 cm) O.D. open end sampler a distance of 1 foot (30 cm) from 0.5 to 1.5 feet (15 to 45 cm) into the undisturbed soil. This test is outlined in A.S.T.M., D1568.

Miscellaneous Tests

In this column are summarized results of all the laboratory test as indicated by the following symbols:

HVR Hydrocarbon Vapour Readings, ppm or % LEL

* MA Mechanical grain size analysis

G Specific gravity

Coefficient of permeability k

PP Pocket penetrometer strength kg/cm2

Triaxial compression test q

* Ċ Consolidation test

Qu Unconfined compressive strength kg/cm2

SO₄ Soluble sulphate concentration

Bulk unit weight

Dry unit weigh γd

* Tests normally summarized on separate data sheets



Hagstrom Geotechnical Services Ltd.

Modified Unified Classification System For Soils

<u> </u>					,			
	lajor D	ivision	Group Symbol	Graph Symbol	Color Code	Typical Description		y Classification Criteria
sieve)	oarse han	Clean Gravels	GW	4 6 8	Red	Well graded gravels, little or no fines	$C_{U} = (D_{60}/D_{1})^{2}$ $D_{30}^{2}/(D_{10}^{*}D_{60})^{2}$) = 1 to 3
200	Gravels an half c s larger the	(little or no fines)	GP		Red	Poorly graded gravels, and gravel sand mixtures, little or no fines	Not meeting requiremen	
Soils er than	Gravels more than half coarse grains larger than No. 4 sieve	Clean Gravels (little or no fines) Dirty Gravel (with some fines)	GM		Yellow	Silty gravels, gravel-sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
Coarse-Grained Soils alf by weight larger tha	more	(with some lines)	GC		Yellow	Clayey gravels, gravel-sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
se-Gra weigh	ine	Clean Sands	SW		Red	Well graded sands, gravely sands, little or no fines	$C_{U} = (D_{60}/D_{1})$ $D_{30}^{2}/(D_{10}^{*}D_{60})$	
Coars	ands ian half f maller the	(little or no fines)	SP		Red	Poorly graded sands, little or no fines	Not meeting requiremen	
than h	Sands more than half fine grains smaller than No. 4 sieve	Dirty Sands	SM		Yellow	Silty sands, sand-silt mixtures	Content of fines	Below "A" line P.I. less than 4
Coarse-Grained Soils (more than half by weight larger than 200 sieve)		(with some fines)	SC		Yellow	Clayey sands, sand-(silt) clay mixtures	exceeds 12%	Above "A" line P.I. more than 7
0 sieve)	Silts below "A" line negligible organic content	W _L < 50%	ML		Green	Inorganic silts and very fine sands, rock flour, silty sands of slight plasticity	Classificatio upon plastic	
oils sses 20	S below negl organic	W _ι > 50%	МН		Blue	Inorganic silts, micaceous or diatomaceous, fine sandy or silty soils		
Fine-Grained Soils alf by weight passe	Clays above "A" line negligible organic content	W ₁ < 30%	CL		Green	Inorganic clays of low plasticity, gravelly, sandy, or silty clays, lean clays		
e-Gra by we	Clays we "A" I gible org content	30% < W _L < 50%	CI			Inorganic clays of medium plasticity, silty clays		
Fin n half	abo	W _L > 50%	СН		Blue	Inorganic clays of high plasticity		
Fine-Grained Soils (more than half by weight passes 200 sieve)	Organic Silts & Clays bellow "A" line on chart	W ₁ < 50%	OL		Green	Organic silts and organic silty clays of low plasticity	fine content determined	he nature of the has not been it is designated
) 	Org Silts & bellow on o	W _ι > 50%	ОН		Blue	Organic clays of high plasticity	a mixture of clay	"F". E.G. SF is sand with silt or
ŀ	Highly Orga	nic Soils	PI		Orange	Peat and other highly organic soils	Strong color often fibrous	or odor, and texture

50

40

Bedrock Symbols Bedrock (Undifferrentiated) Shale Sandstone Siltstone Fill

Coal

Plasticity Index (IP) 30 CI ОН 20 CL MH 10 MI OI SF 0 20 50 30 40

Liquid Limit (WL)

CH

PLATE

No. 102

Hagstrom Geotechnical Services Ltd.

5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

BORING

-	ue, Edmonton, Alberta T5A DM	JOB No.: H0907-280	TOM, TUMBIN		BORING
		DATE: August 4, 2009	TECH	MH	09-10
MOISTURE CONDITION	S	DRILL TYPE: B-40 Solid Stem Auger		TECT DE	211172
ATTERBERG LIMITS		SOIL PROFILE & DESCRIPTION		TEST RE	SULIS
MOISTURE CONTENT 9 10 20 30 40 50		DATUM:	SOIL SYMBOL SAMPLE TYPE	N MISC	ELLANEOUS
			SYN	MISC COUNT.	TES1S
		TOPSOIL; silty, damp, compressible, some small roots, black, 38 cm thick 38 cm			
		SILT; some sand, some clay, damp, stiff, pale			
	- - - -	olive brown		PP =	185 kPa
	3 1			SO,=	0.08%
+ + + + + + + + + + + + + + + + + + + +	+++			PP =	115 kPa
	++	1.8 m		30,-	0.14%
	6 2	CLAY; silty, stiff, medium plasticity, damp, occasional silt lenses, dark olive brown			
	+++-	and a service of a service of the se		PP =	170 kPa
	+++=			1	IIUKEA
	++	- very stiff, occasional silt lenses			
	10 3			PP =	135 kPa
		 softer with depth 			
				PP =	170 kPa
	4	 soft to firm, light olive brown groundwater seepage softer with depth, dark olive brown at 4.2 m 			
		 softer with depth, dark olive brown at 4.2 m 			
	15			PP = 9	90 kPa
	5				
+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$		5.3 m			
	E	SILT; sandy, very moist, free water, very		PP = 2	10 kPa
		sensitive, brown			
				PP = 8	C LD-
+	20			PP = 6	5 кРа
	+++	- soft to firm			
+ + + + + + + + + + + + + + + + + + + +	+++- =	- SOIL TO IIIIII		PP = 7	5 kPa
	++7			,, -,	ONIA
+ + + + + + + + + + + + + + + + + + + +				İ	
+ + + + + + + + + + + + + + + + + + +				PP = 8	5 kPa
	25	7.7 m CLAY; silty, low plasticity, firm, very moist, dark	 		u
+ + + + + + + + + + + + + + + + + + + +		grey			
+-	+++ =			PP = 1	00 kP=
	+++	- stiff, medium plasticity		1.7 = 1	oo ni a
 	+++ =				
+++++++++++++++++++++++++++++++++++++++	30 - 9	9.0 m		PP = 1	15 kPa
	+++ F !	Slough = 8.8 m, 0 hours			
		Water level = 8.7 m, 0 hours Water level = 5.1 m, 5 hours later			
		Slough = 5.5 m. 5 hours later			
	10 \	Water level = 4.0 m, 10 days later			
	++- =	Slough = 5.3 m, 10 days later			
	35				
MOISTURE CONTENT Q, UNCONF	INED COMPRESSION	20			San Section Section 18 Section
LIQUID LIMIT		SO₄ SULPHATE CONTENT ✓ STANDARD ✓ WATER TABLE ✓ UNDISTURB	PENETRATION	N SAMPLE	PLATE
PLASTIC LIMIT Y. DRY UNI	WEIGHT	N PENETRATION RESISTANCE BAG SAMPL	E	or ictor)	No.103

0

Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

DATE: August 4, 2000

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	†	φ i			- 1-	_	-	-			-		1	20 cm thick	20 cm/					
		i O			1		1					Ē		SAND; silty, some clay, medium dense, i prown	moist, 80 cm				PP = 37	5 LD
		1	-			-		-		-	3	<u> </u>		CLAY; silty, medium plasticity, very stiff, occasional silt lenses, brown					C - 31	JAI
	-		\	-+		-	+	+		\dashv		E		occasional sill lenses, brown					PP = 24	IN kP
			0		İ							E	İ						SO ₄ = 0	
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	-							-					•	SILT; sandy, loose, some clay lenses, da	3.4 m ark brown	4				
	-	\vdash			+	+		+	1 1	\dashv	_								PP = 13	80 kP
				1			1					- 4		- groundwater seepage						
				•	_			4		4	15	E							PP = 11	5 kPa
				1		4-		+-	-	\dashv			,	CLAY; silty, firm to stiff, medium plasticit	4.8 m					
	<u> </u>		-+	1	1		+	1		-1		_ 5	It	prown	y, moist,					
			1	4									-	- silt layer from 5.1 to 5.3 m					PP = 85	kPa
	ļ			1		-+-	-		1	4		E								
				-	7		-	+	+	\dashv	20	E 6	3						PP = 12	5 kP
					1						_	E								
					φ-			1					-	silt layer from 6.6 to 6.9 m					PP = 10	5 kPi
	-		+	-	+	+	-		+			<u> </u>								
				+	1	-	+	+-		-										
			1		∳	7	-		11	\exists	25								PP = 10)5 kP
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		\dashv	- -	1	-	+	+	+	+-+	-+										
				- 1	7		1		11	_†		9			9.0 m				DD - 4	10 I-C
		_		1			ļ			1	30	9	E	End of Borehole = 9.0 m Blough = 6.8 m, 0 hours					PP = 14	iu KP
-			+				+	+					1	Vater level = 6.7 m, 0 hours						
			+			-	+-	 		-	-		15	Vater level = 3.8 m, 4 hours later Slough = 3.9 m, 4 hours later						
			1	+	-	†	+			\forall		10		Vater level = 3.7m, 10 days later Slough = 3.8 m, 10 days later						
				1	1		1			1				and 200 and 2						
											35									
LIC	QUID	URE LIMI IC LII	T	ITEN	Ţ				NED (10122	1	▼ WATER TABLE □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □ □	STANDARI UNDISTUR BAG SAMF	BED S	ETRAT	ION S E (SH	AMPLE ELBY)	PLA No.1

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

DATE: August 4 2009

TECH MH

09-103

													JOB No.: H0907-280		- 7			BORING
									and 100 personal liverage of the				DATE: August 4, 2009		TECH	H: MH		09-103
		N	MOIS	TUF	RE C	CONE	OITIC	ONS					DRILL TYPE: B-40 Solid Stem Auger					
						RG L							SOIL PROFILE & DESCRIPTION		1	TES	TRES	SULTS
1						CON				1		7				7	T	
		10	20		30	41		50	60	唐出	1 1 2	ē	DATUM:	Ş	빌	> =	Micci	III ANEONA
)		Ĭ	1	ĺ	, 1		Ī		DEPTH IN FFFT	DEPTH (m)	=	SURFACE ELEVATION:	SOIL	SAMPLE	BLOW COUNT -N	MISCE	LLANEOUS TESTS
	-†	-	1-1-	+	_	+-+		-+	++-	+	=	-		S	1 0 F	mÖ	ļ	
-		+-	1	<u> </u>	-				 	1			OPSOIL; silty, dry, compressible, black, 23 cm thick					
-	-4		1-10	2					1				23 cm thick 23 cm	m//	1			
				_ `	6					1		0	ccasional silt lenses, dark olive brown		1			
					70					1 3		Ī	oddionar ant lenses, dark onve brown		1		PP =	135 kPa
	i				./				1-1-	1-3-	<u>†</u> 1	1		//				
-				-/						1								
-		_+		0		14				1		-	firm to atiff an arist				PP =	130 kPa
1			<u> </u>						-		_	-	firm to stiff consistency		1		SO ₄ =	0.18%
	j			1						1-,					1		ĺ	
	T			1	\Box	+		_		6	2	2			1			
-			+		A –	+				1					1	İ		
-			ll		<u>i</u>	1	.			_		- T			1		PP = 1	55 kPa
					4							-	stiff consistency conscional -:	1/				
	Ī			-7	I	17				1		i	stiff consistency, occasional silt lenses	//			No. Company	
	T	1	1	+	Ψ	1-1		+	 	-	3	3		1/			PP = 2	220 kPa
-	-		+		1-	+-	-+	-	 	10					1		SO₄=	U.06%
-		-		-	4	11					E				1			
	_				0							-	groundwater seepage		1			
					9							-		//	1		PP = 1	70 kPa
		1	-	+	+-+	1		-		1	4	4		11]			
-	+			+	+	1-	-		-	_				//				
-					-	6					_							200
L	Ĺ					1				15	-				1		PP = 1	75 kPa
				į		1			1000			1.	from to all ff	1//	1			
	T	1		-	+ ;	-		+			5	1	firm to stiff consistency		1	1		
-				+	10	-				_		ĺ		//	1		DD - 4	05.0
	-			<u> </u>	11	1	-1-				_				1		PP = 1	U5 KPa
l		ĺ		į	1!										1			
	7	1		1	1,	T				-	_			//				
F		1			P	+-+	-+	+		2ŭ	6	-	stiff, very moist	1/	1 1	ì	PP = 1	75 kPa
				+-	ļ	 - -		4				i		1//	4	ĺ		
L				1	1_	<u> </u>	_					ĺ			1			
		,		1								- 1	occasional silt lenses	//		1		
				4	1											1	PP = 1:	35 kPa
	+	-	-+	1-1	 		-+-	+	-++		7			1/				
	ļ			+-	i			4						//		1		
	1_			1	1								firm anniata	1/				
	1			1	1					25		-	firm consistency	//	Ì	-	PP = 90) kPa
-	1	1 1	-	7 7	1			+-+	+					1/				1
ļ	-	++		++	+		+	++			8		d==1 == = =============================	1//				- 1
_	ļ	-		4				1	_	_		-	dark grey, very moist	//				
_				J										1/1	İ		PP = 14	10 kPa
		7		1			1	1-1										
	+	+	+	+-+-				+-+			_			//	- 1			
				9	ļļ		4	1	44		q		9.0 r	1/			DD -	
		1								30	_		d of Borehole = 9.0 m		- 1		PP = 1(05 kPa
												Sid	ough = 6.9 m, 0 hours					- 1
	1	Ti	+	†	!		1	1-+		-+	_	Wa	ater level = 6.7 m, 0 hours		İ			- 1
										_		VV	ater level = 2.6 m, 3 hours later					1
	ļ	+		<u> </u>			4	 -	-4-1		 10	Wa	ough = 2.7 m, 3 hours later ter level = 2.4 m, 10 days later					
										}	_ '0	Sin	ugh = 2.4 m, 10 days later					
			7	T	i		1	1	_†:-†	- [-3 Living to days later					
		t-i-		1		-	†	+-+	++	{								
-										35	_							
0		OISTU		NTE	NT	Q,	JNCC	ONFINE	ED CON	IPRES	SION	T	SO, SULPHATE CONTENT STANDAR	D DCT	====	0115	A A Prince of the Control of the Con	DIATE
Ď	LI	QUID	TIMIL										▼ WATER TABLE	RBED S	SAMPIE	ON SA	MPLE	PLATE
Δ	PL	ASTIC	LIMIT			10	JKY (ע דומר 🔥	VEIGHT				N PENETRATION RESISTANCE BAG SAM	PLE	WALL FE	(One	201)	No.105
								-	THE RESERVE OF THE PARTY OF THE	1000		-	The state of the s					

Hagstrom Geotechnical Services Ltd.

5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST **BORING** JOB No.: H0907-280

09-104

		DATE: August 4, 2009		TECH: MH	09-104
MOISTURE CONDITIONS ATTERBERG LIMITS	MARKET STATE OF THE STATE OF TH	DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION	1	TEST	RESULTS
	_	GOILT NOT ILL & BLOCKIT TION		7	
MOISTURE CONTENT % 10 20 30 40 50 60	다 H (E)	DATUM: SURFACE ELEVATION:	SOIL	SAMPLE TYPE BLOW COUNT -N	MISCELLANEOUS TESTS
		OPSOIL; silty, damp, compressible, black		0,7 20	
		8 cm thick LAY; silty, very stiff, medium plasticity, equent rust stained fissures, dark olive br	18 cm/		PP = 135 kPa
1	3 = 1	,			SO ₄ = 0.12%
					PP = 130 kPa SO₄= 0.04%
4	6 2 -	firm to stiff			PP = 105 kPa
	10 3 -	low to medium plasticity			PP = 220 kPa
ф	4		4.1 m		PP = 190 kPa
\(\frac{1}{2}\)	15 —	ILT; clayey, stiff, trace of sand, dark brow		and the state of t	PP = 175 kPa
+ + + + + + + + + + + + + + + + + + +	5 C	CLAY; silty, firm consistency, low plasticity ery moist	5.1 m		PP = 105 kPa
φ	20 - 6 -	stiff, moist, occasional silt lenses			PP = 175 kPa
	7				PP = 110 kPa
*	25	firm consistency			PP = 90 kPa
•	8 -	groundwater seepage			PP = 120 kPa
	30 — 9 —	nd of Borehole = 9.0 m	9.0 m		PP = 105 kP
	-	lough = 8.9 m, 0 hours Vater level = 8.8 m, 0 hours Vater level = 8.7 m, 2.5 hours later Jough = 8.8 m, 2.5 hours later			
	10 W	Vater level = 5.8, 10 days later Slough = 6.1 m, 10 days later			
MOISTURE CONTENT Q, UNCONFINED CO LIQUID LIMIT PLASTIC LIMIT		▼ WATER TABLE □ U	TANDARD PEN NDISTURBED AG SAMPLE		

CLIENT: Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta | TEST BORING JOB No.: H0907-280

										r		-	DATE: August 4, 2009 TECH: MH	09-10
V			JRE RBE										DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION TEST RI	ESULTS
			TUR							- H	T_		ZOILT NOT ILL & BLOOKIII TION	
10		20	30		40	LINI	50	1	60	DEPTH IN FEET	DEPTH	(E)	DATUM: SURFACE ELEVATION: DATUM: SURFACE ELEVATION: DATUM: SURFACE ELEVATION: SURFACE ELEVATION:	SCELLANEOU TESTS
		1			T	1		+-			E		TOPSOIL; silty, some sand, compressible, black,	
	Q							1					67 cm thick	= 480 kPa
		1		1			1	and the same of th			E		CLAY: silby damp, you stiff, modium placticity.	
		P				Ť	1	†-	T	3			dark olive brown	= 320 kP
				7		1		İ			F	1		
		1	1					1		_	E		PP	= 275 kP
	1		0			\top	1	1			F			= 0.02%
	T	1	İ	+		+		1		- 6	\equiv		at/4	
		1	i			\top		1		-0	F	2	- stiff consistency	
			0				_	T	\Box		E		PP	= 120 kP
			İ					1	\Box		F			
								†	\Box		Ξ			= 110 kP:
			P			T		+	\Box	10		3	So,	= 0.16%
			/				1							
	-		-					T	П		Ε		- very moist	
		T C						T				4	PP	= 110 kPa
												4		
			1							-	F			
			1							15			PP:	= 175 kPa
			1							2020	=	5	- very moist, occasional silt lenses	
			1									5		
													PP:	= 120 kPa
		1									E	6		- OF I-D-
		I								20				= 95 kPa
		1									=		- frequent silt lenses and rust staining	
		0		4	1							İ	, pp.	= 110 kPa
		_1	_		1	1	J				E	7		TIOKI
							1_					1		
		1	9	_ _		4		1					PD:	= 115 kPa
	_	1		+			1			25			- groundwater seepage	HORIE
	_/			-	_	+-	4		-1			8		
e	/		_		+	-	1			_		1	- clay till like, moist, occasional gravel chips, dark grey	= 230 kPa
					-			<u> </u>	$\vdash \dashv$				very stiff, medium plasticity	ZOU KE'C
					4		-	<u> </u>			_			
	b d	{	-		-	-	+	-		20		9	9.0 m	= 315 kPa
					+	-			\sqcup	30	_		End of Borehole = 9.0 m Slough = 9.0 m, 0 hours	
			+	-	+-	+-	-	 	\vdash				Water level = 5.5 m, 0 hours	
		-+	+			-	-	-	\dashv		_		Water level = 5.5 m, 2.5 hours later Slough = 5.6 m, 2.5 hours later	
		- +	-+	+		+-	-		\dashv		1		Water level = 2.0 m, 10 days later	
	_		-	+-	+	-			4				Slough = 2.1m, 10 days later	
+		-+		+	+		+	-	\dashv					
				1						35	_			
MOIST			NTEN	Т	Q _v 1	JNC	ONFI	NED	CON	IPRE:	SSIC	N	SO₄ SULPHATE CONTENT ⊠ STANDARD PENETRATION SAMPL ▼ WATER TABLE □ UNDISTURBED SAMPLE (SHELBY	E PLAT
		MIT			Yd [DRY	UNIT	WE	GHT				N PENETRATION RESISTANCE BAG SAMPLE (SHELBY	No.1

Hagstrom Geotechnical Services Ltd.

5607 - 134 A Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

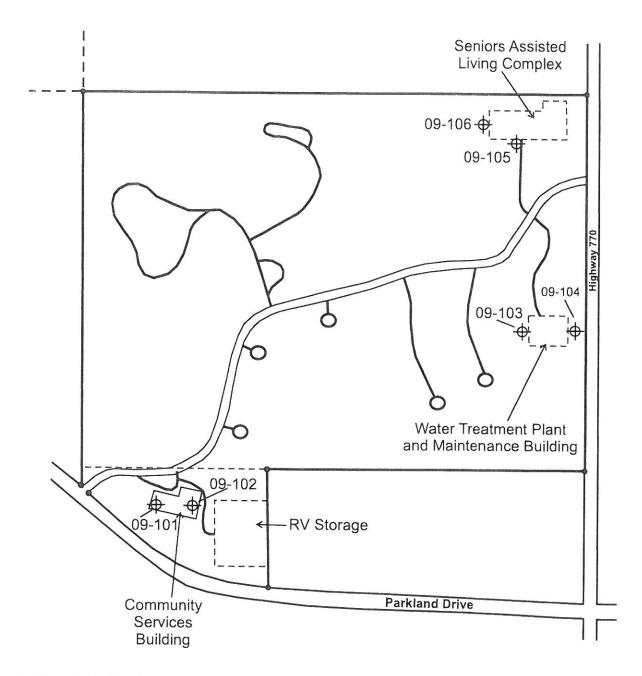
LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No.: H0907-280

BORING 09-106

										DATE: August 4, 2009 TECH: MH	09-10
	OISTU				NS		-			DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION TEST RE	SULTS
		TURE			0/			Τ.,		7	
10	20	30	40		50	60 1	DEPTH IN FEET	DEPT	E (E)	DATUM:	ELLANEOUS TESTS
-				1			+	-		TOPSOIL; silty, damp, compressible, black,	
	Q			+	<u> </u>		+	E		18 cm thick 18 cm/ PP =	530 kPa
11	7						1	F		CLAY; silty, very stiff, medium plasticity, damp, dark olive brown PP =	515 kPa
++	P			+	\dagger		3	E		SO ₄ =	0.12%
11	1			_			1-3	+	1	1.1 m	
-+-+	7			+	+-		+	E		SILT; sandy, some clay, medium dense, light yellowish brown	
1	P			+	 		1	\vdash		Janomen, Brenn	
+ 1	1			_	1		+.	E			
+;							6		2	- damp, medium dense	
10				+	 		+				
1				+			+-	=	-		
-							1	E			
9				1			1	0	3	– medium dense SO₄:	= 0.14%
17				1			Τ.	=			
+1							1		=00	- dense, light yellowish brown 3.7 m	00515
4	P						T	E	4	CLAY; silty, medium plasticity, moist, very stiff,	325 kPa
								E	- 4	occasional silt lenses, dark grey	
								F			440 1.0.
Ψ							15	E	>>	PP =	410 kPa
Ţ.								F			
1								E	- 5	- very stiff	375 kPa
9								E			3/3 KP
!								\vdash			
+								E	- 6	- very stiff PP =	330 kPa
- 1							20				000 111 0
1								E	_		
ф								E		PP =	345 kPa
	_				<u></u>		1	-	- 7	– groundwater seepage	
$-\downarrow \downarrow \downarrow$					_						
¢-				-	ļ		1_	丰		clay till like	385kPa
					-		25	E			
		-	-		-				- 8		
	D						-	E		- very stiff, moist, occasional gravel chips	385 kPa
		+	-	- +	-		-	E	22		
				+				E			
6						-	30	E	- 9	9.0 m PP =	325 kP
-						-		F		Slough = 8.9 m, 0 hours	
					-	-		-	-	Water level = 8.7 m, 0 hours	
-+-+					-	-	+	F		Water level = 8.6 m, 2 hours later Slough = 8.5 m, 2 hours later	
	-+-	-		+-	-			E	-10	Water level = 8.6 m, 10 days later	
++			\vdash	+			+			Slough = 8.7 m, 10 days later	
++			-	+			35	F			
110:55	105.55	NAC: -		LINICO	MEIN	NED CO		_	1001	SO₄ SULPHATE CONTENT ⊠ STANDARD PENETRATION SAMPL	E PLA
	URE CO	NIENI				WEIGH		ادد	ON	SO₄ SULPHATE CONTENT	No.1





LEGEND

Borehole Location

- Site Boundary

Scale: Not to scale



Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

NOR CAN CONSULTING INC.

Proposed Country Residential Subdivision - Fawn Meadows
Portions of NE & SE 4-53-2-W5M,
Parkland County, Alberta
Site Plan

Job No: H0907-280

Date: August 11, 2009

Plate: 109

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No.: H0907-280 BORING

DATE: August 4 2009

MOISTURE CONTENT % 10 20 30 40 50 60 DATUM: SURFACE ELEVATION: TOPSOIL; silty, damp, compressible, some small	MH 09-1 EST RESULTS MISCELLANEOU TESTS
ATTERBERG LIMITS SOIL PROFILE & DESCRIPTION TOPSOIL; silty, damp, compressible, some small	Z
MOISTURE CONTENT % 10 20 30 40 50 60 40 50 SURFACE ELEVATION: TOPSOIL; silty, damp, compressible, some small	Z
10 20 30 40 50 60 GU SURFACE ELEVATION: TOPSOIL; silty, damp, compressible, some small	MISCELLANEOU TESTS
TOPSOIL; silty, damp, compressible, some small	TESTS
TOPSOIL; silty, damp, compressible, some small	
roots black 38 cm thick	
SILT; some sand, some clay, damp, stiff, pale olive brown	PP = 185 kPa
	SO ₄ = 0.08%
	PP = 115 kPa
1.8 m	SO ₄ = 0.14%
6 CLAY; silty, stiff, medium plasticity, damp, occasional silt lenses, dark olive brown	
occasional slit lenses, dark olive brown	DD - 470 LD
	PP = 170 kPa
- very stiff, occasional silt lenses	
3	PP = 135 kPa
- softer with depth	
	PP = 170 kPa
4 - soft to firm, light olive brown - groundwater seepage	
softer with depth, dark olive brown at 4.2 m	
15 -	PP = 90 kPa
5	
SILT; sandy, very moist, free water, very	PP = 210 kPa
sensitive, brown	
	PP = 85 kPa
	FF - 03 KPA
- soft to firm	
	PP = 75 kPa
7.7 m	PP = 85 kPa
CLAY; silty, low plasticity, firm, very moist, dark	
8 grey	
	PP = 100 kPa
- stiff, medium plasticity	
9.0 m	
30 9 End of Borehole = 9.0 m	PP = 115 kPa
Slough = 8.8 m, 0 hours	
Water level = 8.7 m, 0 hours Water level = 5.1 m, 5 hours later	
Slough = 5.5 m, 5 hours later	
10 Water level = 4.0 m, 10 days later Slough = 5.3 m, 10 days later	
	j
35	
MOISTURE CONTENT Q, UNCONFINED COMPRESSION LIQUID LIMIT PLASTIC LIMIT V₀ DRY UNIT WEIGHT SO₄ SULPHATE CONTENT WATER TABLE N PENETRATION RESISTANCE BAG SAMPLE	SAMPLE PLATE HELBY) No.10

CLIENT Nor Can Consulting Group Inc. PROJECT: Proposed Country Residential Subdivision - Fawn Meadows LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

		STURE					<u> </u>		DATE: August 4, 2009 DRILL TYPE: B-40 Solid Stem Auger		TECH: MH	ST RESU	UTS.
ATTERBERG LIMITS MOISTURE CONTENT %								·	SOIL PROFILE & DESCRIPTION		1 7 2		JEIO
		MOISTUR 0 30		NTENT 40	% 50	60	DEPTH IN FEET	DEPTH (m)	DATUM	SOIL	SAMPLE TYPE BLOW	MISCELL	LANEOU
ļ				<u> </u>	-		۵≥	۵	SURFACE ELEVATION: TOPSOIL; silty, compressible, moist, black,	SC	& & B	<u> </u>	
-	Φ			++-	+			_	20 cm thick 20	cm/T			
	+			1-1-	+	+-+		-	SAND; silty, some clay, medium dense, moist,				
	+ +			+	1	++-	3	E	CLAY; silty, medium plasticity, very stiff,	cm	4	PP = 37	75 kPa
			1-	17	1	1-1	J	_ 1	occasional silt lenses, brown				
İ-	+			11	+	1						PP = 24	40 kPa
												SO ₄ = 0	
		1	1	T	1		- 6	Ε,					
		i						2	- firm to stiff consistency, moister with depth			PP = 14	45 kPa
												SO ₄ = 0	
	11-			1-1	1								
			-		1			3				PP = 14	45 kP:
			<u> </u>	4-4-	4_	ļļ	10		- firm, medium plasticity, dark olive brown				
	++		-	 -	-	-			SILT; sandy, loose, some clay lenses, dark bro	m / wn	H		
-	+-+		∳ ⊹	++	+			=				PP = 13	30 kPa
_	+		I	+-+-	+	1-1-	ļ	4					
	++-				+		-		- groundwater seepage				
	1-1-	1 + 9			1	1-+-	15			3 m		PP = 11	15 kPa
		1							CLAY; silty, firm to stiff, medium plasticity, mois		7		
		إ						5 	brown – silt layer from 5.1 to 5.3 m			DD 61	
		1	1					_	Sin layer from 5.1 to 5.5 m			PP = 85	кРа
	11		ļ	1		ļ	_	-					
			>		-			6				PP = 12	25 kPa
			<u>i</u>				20						
0.000	 - 		++-	++					- silt layer from 6.6 to 6.9 m				
-	+		ф-									PP = 10	05 kPa
-	1		1	1	1	1-1-		7					
	+ + + -	1	1-1-	1	+	+							
		1 1	†				25	_				PP = 1(05 kPa
									- stiff consistency		7	İ	
								8				DD.	
		- 1		I.L								PP = 15	ob KPa
			1		1	-		_					
_			b		4			_ 9		$m \angle$	4	PP = 14	40 kPs
	1-1-1				-		30	_	End of Borehole = 9.0 m Slough = 6.8 m, 0 hours				
					+	ļļ		_	Water level = 6.7 m, 0 hours				
- 100	+				-		_	_	Water level = 3.8 m, 4 hours later Slough = 3.9 m, 4 hours later				
	+-+-			1-				10	Water level = 3.7m, 10 days later				
	+		-+		-			_	Slough = 3.8 m, 10 days later				
-		-+-		1-1-	†		35			İ			
	OISTURE	CONTEN	IT (J UNC	DNFI	NED CO	-	SSION	SO₄ SULPHATE CONTENT ⊠ STAND ▼ WATER TABLE □ UNDIS	ARD PI	ENETRATION D SAMPLE (S	SAMPLE	PLAT

CLIENT . Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No.: H0907-280 BORING

1	1101071177 00117171	ι		DATE: August 4, 2009		TECH	: MH	09-103	
	MOISTURE CONDITIONS ATTERBERG LIMITS			DRILL TYPE: B-40 Solid Stem Auger SOIL PROFILE & DESCRIPTION		TEST RESULTS			
-	MOISTURE CONTENT %	ΞĦ	E		7		Z		
	10 20 30 40 50 60	DEPTH IN FEET	DEPTH (m)	SURFACE ELEVATION	SOIL	SAMPLE TYPE	BLOW COUNT.	MISCELLANEOUS TESTS	
				TOPSOIL; silty, dry, compressible, black,	0, 0,	- O ←	8 C		
ļ	Q			23 cm thick 23 cm CLAY; very silty, medium plasticity, moist, stiff,	7				
		_		occasional silt lenses, dark olive brown				PP = 135 kPa	
		3	_ 1					FF - 133 KPB	
		-	E					DD 40045	
				- firm to stiff consistency				PP = 130 kPa SO ₄ = 0.18%	
	\	6	2						
-								PP = 155 kPa	
				 stiff consistency, occasional silt lenses 					
		10	3			ĺ		PP = 220 kPa SO ₄ = 0.06%	
		10	=				Ì	304 - 0.00%	
			=	– groundwater seepage					
			4					PP = 170 kPa	
		_ [=				į		
		15	_					PP = 175 kPa	
1			=	- firm to stiff consistency					
	6		5	min to still consistency					
-								PP = 105 kPa	
			=						
H	-+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	20	_ 6	- stiff, very moist			1	PP = 175 kPa	
			=						
		E	-	occasional silt lenses					
							F	PP = 135 kPa	
-		_	- /			1			
-				– firm consistency				PP = 90 kPa	
		25				1		F - 90 KPa	
	+++++++++++++++++++++++++++++++++++++++	-	8	– dark grey, very moist					
							F	PP = 140 kPa	
			_						
		E		9.0 m					
	+ + - + - + - + - + - - + - + - + - +	30		End of Borehole = 9.0 m Slough = 6.9 m, 0 hours			F	PP = 105 kPa	
	+++++++++++++++++++++++++++++++++++++++		_	Water level = 6.7 m, 0 hours					
	┼┼┼┼┼┼┼┼┼┼┼┼┼┼	- E	- 15	Water level = 2.6 m, 3 hours later Slough = 2.7 m, 3 hours later		1			
		F	- 10 V	Vater level = 2.4 m, 10 days later Slough = 2.4 m, 10 days later					
				500gn - 2.4 m, To days later					
		35							
	MOISTURE CONTENT Q, UNCONFINED COM	PRESS	SION	SO. SULPHATE CONTENT STANDARD	PENF.	TRATIC	N SA!	MPLE PLATE	
	LIQUID LIMIT PLASTIC LIMIT Yo DRY UNIT WEIGHT			▼ WATER TABLE N PENETRATION RESISTANCE □ BAG SAMPL	BED SA	MPLE	(SHEL	.BY) No.105	

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

 LOCATION:
 Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta
 TEST

 JOB No.:
 H0907-280
 BORING

 DATE:
 August 4, 2009
 TECH: MH
 09-104

	•								DATE: August 4 2000	09-10
	010=	IDE C	011515			_1			DATE: August 4, 2009 TECH: MH DRILL TYPE: B-40 Solid Stem Auger	33 10
MOISTURE CONDITIONS ATTERBERG LIMITS						+			SOIL PROFILE & DESCRIPTION TEST	T RESULTS
10		TURE 30				0	IN FEET	DEPTH (m)	7	MISCELLANEOUS TESTS
				+-+	-		5 Z			
	Q			+-+		+		E	TOPSOIL; silty, damp, compressible, black, 18 cm / 18 cm / 2	
		9-1-1					3		CLAY; silty, very stiff, medium plasticity, frequent rust stained fissures, dark olive brown	PP = 135 kPa SO ₄ = 0.12%
		0					-			PP = 130 kPa SO₄ = 0.04%
	<u> </u>	/		#			6	2	- firm to stiff	PP = 105 kPa
		1		+			10	3	- low to medium plasticity	PP = 220 kPa
		4						4	4.1 m	PP = 190 kPa
		φ - †					15		SILT; clayey, stiff, trace of sand, dark brown - stiff	PP = 175 kPa
		— і ф						5	CLAY; silty, firm consistency, low plasticity, very moist	PP = 105 kPa
		*					20	6	- stiff, moist, occasional silt lenses	PP = 175 kPa
		<i>*</i>								PP = 110 kPa
	*						 		– firm consistency	PP = 90 kPa
	+ +							8	– groundwaler seepage	PP = 120 kPa
	- 1	-					30	9	9.0 m End of Borehole = 9.0 m Slough = 8.9 m, 0 hours	PP = 105 kPa
								10	Water level = 8.8 m, 0 hours Water level = 8.7 m, 2.5 hours later Slough = 8.8 m, 2.5 hours later Water level = 5.8, 10 days later Slough = 6.1 m, 10 days later	
							35			
LIQUID	URE CO LIMIT IC LIMIT	NTENT		JNCON DRY UN			PRE:	SSION	SO₄ SULPHATE CONTENT ✓ WATER TABLE N PENETRATION RESISTANCE STANDARD PENETRATION S \(\text{UNDISTURBED SAMPLE} \) (SH	SAMPLE PLATELERY) No.1

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta TEST

JOB No.: H0907-280 BORING
DATE: August 4 2009 TECH: MH 09-105

					DATE: August 4, 2009		TECH: N	ИΗ	09-1
N	MOISTURE CONDITION	IS			DRILL TYPE: B-40 Solid Stem Auger		ТІ	STE	RESULTS
	ATTERBERG LIMITS			SOIL PROFILE & DESCRIPTION					LOOLIG
10	MOISTURE CONTENT 9 20 30 40 5	% 0 60	DEPTH IN FEET	DEPTH (m)	DATUM:	SOIL	SAMPLE TYPE BLOW	COUNT -N	MISCELLANEO
ı			N N	DE T	SURFACE ELEVATION:	SOII	SAM	000	TESTS
					TOPSOIL; silty, some sand, compressible, black,				
	Q				67 cm thick			PF	P = 480 kP
				E	67 cm CLAY; silty, damp, very stiff, medium plasticity,				
			3	E	dark olive brown			PF	P = 320 kP
	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			1					
1 1-								P	P = 275 kP
									$D_4 = 0.02\%$
+	†	1 1							
1			6	2	- stiff consistency				
++				_				PF	e 120 kP
+	1			-					
+-+									
1	+ + + + + + + + + + + + + + + + + + + +			3				PF	P = 110 kP D ₄ = 0.16%
-			10	_				30	J ₄ - U. 1076
			No. of Street Street, and the		- very moist			ĺ	
-	6		_		200			PF	e 110 kP
				4					
 			-123						
	→		15					PP	= 175 kP
-			13	E					
				5	- very moist, occasional silt lenses				
-				_				PP	= 120 kP
								1.	120 Ki
<u> </u>									
				6				PP	= 95 kPa
			20					1.	00 M u
4-4			_		- frequent silt lenses and rust staining				
				_				PP	= 110 kPa
									11010
1 . 1			_	_ ′					
								DD	= 115 kPa
			_ 25	_			1	FF	- 115 KP2
					- groundwater seepage				
				8	- clay till like, moist, occasional gravel chips,				
				=	dark grey			PP	= 230 kPa
				_	 very stiff, medium plasticity 				
			-	_	9.0 m				
			30	9	End of Borehole = 9.0 m			PP	= 315 kPa
			_	_	Slough = 9.0 m, 0 hours				
					Water level = 5.5 m, 0 hours Water level = 5.5 m, 2.5 hours later				
1-1-1			- [Slough = 5.6 m, 2.5 hours later				
					Water level = 2.0 m, 10 days later				
1-1-1			[_	Slough = 2.1m, 10 days later				
T-			35	_					
) ,,,,,,,	HIRE CONTENT O LINCON	NFINED CON			SO SUBSUATE SOUTE :				
LIQUID	LIMIT			SION	SO₄ SULPHATE CONTENT ⊠ STANDARD ▼ WATER TABLE □ UNDISTUR N PENETRATION RESISTANCE ■ BAG SAMP	BED S	TRATION	SAME	V)
PLAST	IC LIMIT 10 DRY UN	VIT WEIGHT			N PENETRATION RESISTANCE BAG SAMP	LE	(' No.1

Hagstrom Geotechnical Services Ltd.

5607 - 134 A. Avenue, Edmonton, Alberta T5A 0M3

CLIENT: Nor Can Consulting Group Inc.

PROJECT: Proposed Country Residential Subdivision - Fawn Meadows

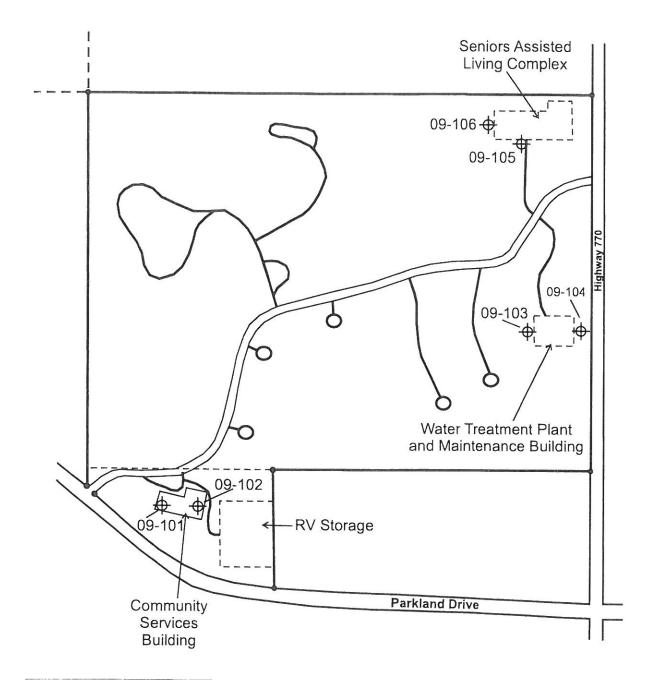
LOCATION: Portions of NE & SE 4-53-2-W5M, Parkland County, Alberta

JOB No.: H0907-280

BORING

09-106 TECH: MH DATE: August 4, 2009 DRILL TYPE: B-40 Solid Stem Auger MOISTURE CONDITIONS **TEST RESULTS** SOIL PROFILE & DESCRIPTION ATTERBERG LIMITS MOISTURE CONTENT % DEPTH IN FEET DEPTH (m) SOIL SYMBOL SAMPLE TYPE BLOW COUNT. DATUM: MISCELLANEOUS TESTS 20 10 SURFACE ELEVATION: TOPSOIL; silty, damp, compressible, black, 18 cm thick 18 cm/ 0 PP = 530 kPa CLAY; silty, very stiff, medium plasticity, damp, PP = 515 kPa dark olive brown $SO_4 = 0.12\%$ 3 SILT; sandy, some clay, medium dense, light yellowish brown - damp, medium dense - medium dense $SO_4 = 0.14\%$ - dense, light yellowish brown 3.7 m PP = 325 kPa CLAY; silty, medium plasticity, moist, very stiff, occasional silt lenses, dark grey PP = 410 kPa 15 - very stiff PP = 375 kPa - very stiff PP = 330 kPa 20 PP = 345 kPa - groundwater seepage 1 PP = 385kPa clay till like 25 6 - very stiff, moist, occasional gravel chips PP = 385 kPa9.0 m PP = 325 kPa 30 End of Borehole = 9.0 m Slough = 8.9 m, 0 hours Water level = 8.7 m, 0 hours Water level = 8.6 m, 2 hours later Slough = 8.5 m, 2 hours later Water level = 8.6 m, 10 days later Slough = 8.7 m, 10 days later 35 Q, UNCONFINED COMPRESSION SO4 SULPHATE CONTENT PLATE STANDARD PENETRATION SAMPLE MOISTURE CONTENT ☐ UNDISTURBED SAMPLE (SHELBY)
☐ BAG SAMPLE • ¥ N WATER TABLE LIQUID LIMIT Y. DRY UNIT WEIGHT PENETRATION RESISTANCE No.108 PLASTIC LIMIT





LEGEND



Borehole Location



Site Boundary

Scale: Not to scale

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NOR CAN CONSULTING INC.

Proposed Country Residential Subdivision - Fawn Meadows
Portions of NE & SE 4-53-2-W5M,
Parkland County, Alberta
Site Plan

Job No: H0907-280

Date: August 11, 2009

Plate: 109