TOWN OF CALMAR REGULAR COUNCIL MEETING
TO BE HELD Hybrid via GoToMeetings ON July 28, 2025
COMMENCING AT 06:30 PM
GoToMeeting Public Access Code: 211-016-493

AGENDA

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1. Call to Order

2. Adoption of Agenda

3. Consent Agenda

4. Public Hearings

5. Delegations

5.a Glenn Wurban - Business Promotion Discussion

5.b April McDonald - Petro Canada Concerns

5.c Ingrid Kaczmarski - Parking Concerns

6. Adoption of Minutes

7. Unfinished Business

8. Policies and Bylaw

9. New Business

9.f Devon Annual Parking Pass - Discussion

9.g CIB Evaluation Update - Discussion

10. Financial

TOWN OF CALMAR

REGULAR MEETING OF COUNCIL
OF THE TOWN OF CALMAR
WAS HELD Hybrid via GoToMeetings
ON June 16, 2025

PRESENT: Mayor Carnahan, Councillor Faulkner, Councillor Gardner, Councillor McKeag Reber and Councillor Benson
STAFF PRESENT: DCS Bryans

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1. Call to Order

THE Regular Council Meeting of June 16, 2025 was called to order at 6:33pm.

Mayor Carnahan joined the meeting at 6:31 PM.
Councillor Faulkner joined the meeting at 6:31 PM.
Councillor Gardner joined the meeting at 6:31 PM.
Councillor McKeag Reber joined the meeting at 6:31 PM.
Councillor Benson joined the meeting at 6:31 PM.
DCS Bryans joined the meeting at 6:31 PM.

2. Adoption of Agenda

R-2025-06-0164
Moved By Councillor Faulkner
THAT the agenda is hereby adopted as amended.

CARRIED

Addition of Closed Session - Personnel - (Pursuant to Section 24(1)(b)(i) of the Freedom of Information and Protection of Privacy Act).

3. Public Hearings

4. Delegations

5. Adoption of Minutes

a. Regular Council Meeting - June 02, 2025

R-2025-06-0165
Moved By Councillor Gardner
THAT the minutes of the Regular Council Meeting of June 02, 2025 are hereby approved as presented.

CARRIED

b. Committee of the Whole - June 06, 2025

R-2025-06-0166
Moved By Councillor McKeag Reber
THAT the minutes of the Committee of the Whole Meeting of June 06, 2025 are hereby approved as presented.

CARRIED

6. Unfinished Business

7. Policies and Bylaw

8. New Business

a. Weeds/Unsightly Bylaw Enforcement

R-2025-06-0167
Moved By Councillor Gardner
THAT Council directs Administration to create an SOP for grass, weed and unsightly property enforcement.

CARRIED

R-2025-06-0168
Moved By Councillor Gardner
THAT Council directs Administration to bring Bylaw 2020-16 Community Standards Bylaw back to the next Policy and Bylaw Committee meeting.

CARRIED

Mayor Carnahan left the meeting at 7:12 PM
Councillor Benson was appointed Chair of the meeting
Mayor Carnahan rejoined the meeting at 7:19 PM

R-2025-06-0169
Moved By Councillor McKeag Reber
THAT Council directs Administration to remove the compliant properties from the list provided to the contactor as they have been made compliant within the specified time period.

CARRIED

R-2025-06-0170
Moved By Councillor Gardner
THAT Council directs Administration to continue to send remedial orders through regular mail (Canada Post).

CARRIED

b. 1,000 Miles Sponsorship Request

R-2025-06-0171
Moved By Councillor Gardner
THAT Council commits to allocate $10.00 for each mile crossed by our community members from the Council special projects budget up to a maximum of $10,000.00. Furthermore, Council agrees to waive any rental fees associated with this event (rental of diamonds and usage of BBQ facilities including tents, tables and chairs). With the 1,000 miles organizing committee to present to Council following the event.

CARRIED

R-2025-06-0172
Moved By Councillor Benson
THAT Council directs Administration to provide support in ways of advertising on social media, website and print for this community event.

CARRIED

c. Police Funding Model Review Engagement Session

9. Financial

10. Department Reports

11. Council and Committee Reports

R-2025-06-0173
Moved By Councillor Faulkner
THAT Council accepts these reports as information.

CARRIED

a. Mayor Carnahan - not submitted

b. Councillor Faulkner

c. Councillor Gardner

d. Councillor McKeag Reber - not submitted

e. Councillor Benson

12. Correspondence

a. Ray Owen - Resident Complaints

R-2025-06-0174
Moved By Councillor Gardner
THAT Council directs Administration to respond to Mr. Owens.

CARRIED

13. Clarification of Agenda Business - (Open mic)

14. Closed Session

a. Personnel – (Pursuant to Section 24(1)(b)(i) of the Freedom of Information and Protection of Privacy Act).

R-2025-06-0175
Moved By Councillor Gardner
THAT the Regular Council Meeting temporarily adjourn and Council sit in Closed Session at this time being 8:26pm.

CARRIED

DCS Bryans remained in chambers for the closed session.

R-2025-06-0176
Moved By Councillor Faulkner
THAT the Regular Council Meeting reconvenes from Closed Session at this time being 8:31pm.

CARRIED

15. Adjournment

THE Regular Council Meeting adjourned at 8:32pm.

_____

Mayor Carnahan

_____

CAO Losier

Item 6.b

COMMITTEE OF THE WHOLE MEETING
OF THE TOWN OF CALMAR
WAS HELD Council Chambers
ON June 25, 2025

PRESENT: Mayor Carnahan, Councillor Faulkner and Councillor Gardner
STAFF PRESENT: CAO Losier, DCS Bryans and ADIG Nielson

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1. **Call to Order**

   THE Committee of the Whole Meeting of June 25, 2025 was called to order at 1:33pm.

   Mayor Carnahan joined the meeting at 1:27 PM.
   Councillor Faulkner joined the meeting at 1:27 PM.
   Councillor Gardner joined the meeting at 1:27 PM.
   CAO Losier joined the meeting at 1:27 PM.
   DCS Bryans joined the meeting at 1:27 PM.
   ADIG Nielson joined the meeting at 1:27 PM.

2. **Adoption of Agenda**

   CR-2025-06-0177
   Moved By Councillor Gardner
   THAT the agenda is hereby adopted as amended.

   CARRIED

   Addition of discussion on toboggan hill at the elementary school.

3. **Delegations - None**

4. **Unfinished Business**

   a. Organics Discussion

5. **Bylaws or Policies - None**

6. **New Business**

   a. Masterplan Update - Discussion Only

   b. AB Munis - Preliminary Recommendations on Recall of a Municipal Elected Official

   c. Elementary School Toboggan Hill - Discussion Only

7. **Financial - None**

8. **Department Reports - None**

9. **Council and Committee Reports - None**

10. **Correspondence - None**

11. **Clarification of Agenda Business - (Open mic)**

12. **Closed Session**

    a. Public Body Interest (Pursuant to Section 25(1)(b) of the Freedom of Information

and Protection of Privacy Act).

CR-2025-06-0178
Moved By Councillor Gardner
THAT the Committee of the Whole meeting temporarily adjourn and sit in Closed Session at the time being 2:43 pm.

CARRIED

CAO Losier, DCS Bryans and ADIG Nielson remained in Council Chambers for the Closed Session.

CR-2025-06-0179
Moved By Councillor Faulkner
THAT the Committee of the Whole meeting reconvene from Closed Session at the time being 3:07 pm.

CARRIED

13. Adjournment

The meeting adjourned at 3:08pm

_____

Mayor Carnahan

_____

CAO Losier

Item 6.c

SPECIAL COUNCIL MEETING OF THE
TOWN OF CALMAR
WAS HELD Hybrid via GoToMeetings
ON July 10, 2025

PRESENT: Sean Carnahan, Don Faulkner, Krista Gardner and Carey Benson
STAFF PRESENT: Sylvain Losier, Heather Bryans and Graydon Nielson

---

1. **Call to Order**

   THE Special Council Meeting of July 10, 2025, was called to order at 7:03 pm.

2. **Adoption of Agenda R-2025-07-180**
   Moved By Don Faulkner
   THAT the agenda is hereby adopted as presented.

CARRIED

3. **Delegations - None**

4. **Unfinished Business - None**

5. **Bylaws or Policies - None**

6. **New Business - None**

7. **Financial**

   7.a 2026 - 2029 Operating Budget - Discussion Only

8. **Department Reports - None**

9. **Council and Committee Reports - None**

10. **Correspondence - None**

11. **Clarification of Agenda Business - (Open mic)**

12. **Closed Session**

    12.a Development - (Pursuant to Section 25(1)(b) of the Freedom of Information and Protection of Privacy Act)

    12.b Personnel – (Pursuant to Section 24(1)(b)(i) of the Freedom of Information and Protection of Privacy Act).

R-2025-07-0181
Moved By Krista Gardner
THAT the Special Council meeting temporarily adjourn and sit in Closed Session at the time being 8:12pm.

CARRIED

CAO Losier, DCS Bryans and ADIG Nielson remained in Council Chambers for the Closed Session.

R-2025-07-0182
Moved By Carey Benson
THAT the Special Council meeting reconvene from Closed Session at the time being 9:18pm.

CARRIED

R-2025-07-0183

Moved By Krista Gardner
THAT Council directs the Mayor and the CAO to endorse the DA as amended in the Closed Session and that the securities and off-site levies have been paid.

CARRIED

13. Adjournment

The meeting adjourned at 9:22pm.

_____

Mayor Carnahan

_____

CAO Losier

Item 7.a

24 July 2025

Town of Calmar
4901 – 50 Avenue
PO Box 750
Calmar, AB
T0C 0V0

File No.: C25-0030

Attention: Sylvain Losier, M.ATDR, MCIP, RPP
Chief Administrative Officer

RE: HAWKS LANDING PHASE 2 – DEVELOPMENT AGREEMENT CONDITIONS – SECURITIES

Dear Sylvain,

On behalf of the Ownership Group (1275191 Alberta Ltd.), V3 has been asked to respectfully inquire whether Council would be amenable to revising select provisions within the Hawks Landing Phase 2 Development Agreement.

Specifically, we refer to the Draft Development Agreement dated June 19, 2025, between the Town of Calmar and 1275191 Alberta Ltd. The Owner is seeking Council's consideration of modifications to the conditions governing the securities to be retained as part of the development.

While we recognize the Town's standard requirement of a two-year warranty period from the issuance of the Construction Completion Certificate (CCC), the Owner submits the following requests for Council's review, based on the context and history of the Hawks Landing Phase 2 Development:

1) **Underground Improvements:** The majority of the underground infrastructure for the Hawks Landing Phase 2 development was installed in 2013, and Final Acceptance Certificates (FACs) have since been issued for these works. In light of this, the Owner is requesting that the securities for "Underground Improvements" be eligible for 100% released upon the completion of this work, contingent upon a joint inspection with the Town. This inspection would confirm that all previously installed infrastructure, as well as any new components, meet the Town's standards and have been completed to its satisfaction.

2) **Surface Improvements:** Given the age of the underground infrastructure and the anticipated soil consolidation over the past decade within the Phase 2 boundary limits, it is reasonable to expect enhanced subgrade stability and minimal settlement associated with new roadway construction. Based on this context, the Owner is requesting the opportunity to reduce the two-year warranty period for surface improvements, to one year.

We appreciate Council's time and consideration of these proposed amendments. The Owner is prepared to proceed with execution of the Development Agreement in accordance with Council's direction and any collaborative resolution that may be reached.

Sincerely,

V3 Companies of Canada

Aaron Parsons, P.Eng.
Project Manager

Town of Calmar

Request for Decision (RFD)

Meeting:	Regular Meeting of Council
Meeting Date:	July 28, 2025
Originated By:	CAO Losier
Title:	Apex Franchise Agreement
Approved By:	CAO Losier
Agenda Item Number:	8 A

BACKGROUND/PROPOSAL:
In 2015 the Town of Calmar signed a 10-year agreement with Apex Utilities (formerly Alta Gas) with the franchise fee rate set at 20%. In 2022 the Town increased the franchise fee rate to the maximum allowable, 35%. As the current agreement expires in August 2025, the Town must renew the agreement. On June 2, 2025, proposed bylaw #2025-08 received first reading.

On July 24, Administration received a confirmation from Apex that the Town's process had received from the Alberta Utilities Commission the permission to move forward. This came following the advertisement of the renewal process for more than two weeks on the Calmar's website and main office.

DISCUSSION/OPTIONS/BENEFITS/DISADVANTAGES:
Section 45(1) of the MGA states that a council may grant the right to provide utilities in the municipality for not more than 20 years. Section 45(3) states that before the agreement is made, amended or renewed it must be advertised and approved by the Alberta Utilities Commission.

Now that we have received the permission to proceed, Administration believes that completing the bylaw process and directing the Mayor and the CAO to sign the agreement is the next logical step considering that the franchise fees are already part of the budget and that no changes are proposed into the franchise agreement. Administration does not believe that there are other options than to proceed with the bylaw and the agreement.

COSTS/SOURCE OF FUNDING (if applicable)
There is no cost to the passing of the bylaw and at this point in the process, it would not be advisable to change the rate.

RECOMMENDED ACTION:
Council pass 2nd and 3rd reading of the bylaw and direct the Mayor and CAO to initialize the agreement.

Item 8.a

Disposition: 30191-D01-2025

July 23, 2025

Irv Richelhoff
Apex Utilities Inc.
5509 - 45 ST
Leduc, Alberta, T9E 6T6

Apex Utilities Inc. and the Town of Calmar
Franchise Agreement and Rate Rider
Proceeding 30191

1. On July 22, 2025, Apex Utilities Inc. applied to the Alberta Utilities Commission for approval of a natural gas franchise agreement with the Town of Calmar. The application was filed in accordance with Rule 029: *Municipal Franchise Agreements*. The application included a copy of the proposed franchise agreement and franchise fee rider schedule.

2. Notice of the proposed franchise agreement was advertised as follows:

Advertising method	Media name/description	Advertising date
Webpage	Town of Calmar	June 5, 2025

3. No objections or concerns related to the proposed franchise agreement were received by the municipality or the utility.

4. The proposed franchise agreement is based on the approved natural gas franchise agreement template referred to in Rule 029. The agreement will be in effect on the later of August 1, 2025, or the first day after it has received both AUC approval and the Town of Calmar has passed third reading of Bylaw No. 2025-08 approving the franchise agreement.

5. The proposed franchise agreement includes that Apex Utilities Inc. agrees to pay the Town of Calmar a franchise fee. The proposed franchise fee will be calculated as 35.00 per cent of Apex Utilities Inc.'s revenue from its distribution tariff excluding any amounts collected or refunded through other rate riders, as shown on the franchise fee rider schedule. The proposed franchise fee is a continuation of the current franchise fee and will continue as an estimated $34.38 monthly charge for an average residential customer.

6. The AUC accepts that the right granted to Apex Utilities Inc. by the Town of Calmar to provide distribution service, to construct, operate and maintain the gas distribution system, and to use lands owned, controlled or managed by the municipality to provide this service, is necessary and proper for the public convenience and properly serves the public interest based on the following:

- The municipality's council has determined to grant the utility the right to provide utility service in the municipality.
- The municipality and the utility consent to the franchise agreement.
- No person has objected to the franchise agreement.
- The franchise agreement complies with the requirements set out in the applicable legislation, including that the term does not exceed 20 years and the agreement was advertised.

7. Accordingly, pursuant to Section 45 of the *Municipal Government Act*, and Section 106 of the *Public Utilities Act*, the AUC approves the franchise agreement as filed.

8. Given the approval of the franchise agreement, and in accordance with Section 49 of the *Gas Utilities Act*, the AUC approves Apex Utilities Inc.'s rate rider of 35.00 per cent effective on the later of August 1, 2025, or the first day after it has both received AUC approval and the Town of Calmar has passed third reading of Bylaw No. 2025-08 approving the franchise agreement.

9. Prior to any change in the level of the franchise fee pursuant to the franchise agreement, customers shall be notified as outlined in Section 7 of Rule 029.

10. The Commission may, within 60 days of the date of this disposition and without notice, correct typographical, spelling and calculation errors and other similar types of errors and post the corrected disposition on its website.

Alberta Utilities Commission

BYLAW NO. 2025-08

OF THE TOWN OF CALMAR, ALBERTA

related to the

NATURAL GAS DISTRIBUTION SYSTEM
FRANCHISE AGREEMENT

BYLAW NO. 2025-08
OF THE TOWN OF CALMAR, ALBERTA (the "**Municipality"**)

A Bylaw of the Municipality to authorize the Mayor and Chief Administrative Officer to enter into an agreement granting AltaGas Utilities Inc. (the "**Company"**), the right to provide natural gas distribution service within the Municipality.

WHEREAS pursuant to the provisions of the Municipal Government Act S.A. 2000 c. M-26, as amended (the "**Act"**), the Municipality desires to grant and the Company desires to obtain, an exclusive franchise to provide natural gas distribution service within the Municipality for a period of Ten (10) years subject to the right of renewal as set forth in the said agreement and in the said Act;

WHEREAS the Council of the Municipality and the Company have agreed to enter into a Natural Gas Distribution System Franchise Agreement (the "**Agreement"**), in the form annexed hereto;

WHEREAS it is deemed that the Agreement would be to the general benefit of the consumers within the Municipality.

NOW THEREFORE the Council of the Municipality enacts as follows:

1) THAT the Natural Gas Distribution System Franchise Agreement, a copy of which is annexed hereto as Schedule "A", be and the same is hereby ratified, confirmed and approved, and the Mayor and Chief Administrative Officer are hereby authorized to enter into the Natural Gas Distribution System Franchise Agreement for and on behalf of the Municipality, and the Chief Administrative Officer is hereby authorized to affix thereto the corporate seal of the Municipality.

2) THAT the Natural Gas Distribution System Franchise Agreement annexed hereto as Schedule "A" is hereby incorporated in, and made part of, this Bylaw.

3) THAT the Council consents to the exercise by the Company within the Municipality of any of the powers given to the Company by the Water, Gas and Electric Companies Act, R.S.A. 2000 c. W-4, as amended.

4) THAT this Bylaw shall come into force upon the Natural Gas Distribution System Franchise Agreement being approved by the Alberta Utilities Commission and upon being given third reading and finally passed.

Read a First time in Council assembled this 2nd day of June, 2025

_____
Mayor (seal)

_____
Chief Administrative Officer

Read a Second time in Council assembled this 28 day of July, 2025

Read a Third time in Council assembled and passed this 28 day of July, 2025

_____
Mayor (seal)

_____
Chief Administrative Officer

Town of Calmar

Request for Decision (RFD)

Meeting:	Regular Council Meeting
Meeting Date:	July 28,2025
Originated By:	CAO Losier
Title:	Incentive Program
Approved By:	CAO Losier
Agenda Item Number:	9 A

BACKGROUND/PROPOSAL:

The Incentive Program through economic development has funded many great programs in the past. The Downtown Façade program for two years and the Developer's Incentive Grant for four years before that. Over $79,000.00 was funded through DIG and $21,545.00 through the Façade program, with 25 new house builds and 5 businesses taking advantage of the programs. Administration would like to keep the momentum going.

DISCUSSION/OPTIONS/BENEFITS/DISADVANTAGES:

The Incentives Program budget line could be used to help incentivise new commercial and/or industrial builds. The grant would be an incentive that would fund the cost of the Building and Development Permit fees.

- For a brand-new build (land purchase, new building(s) for a new business coming to Calmar). The Incentive Program will cover the costs of the Development and Building permit fees, up to a maximum of $10,000.00.
- This program would allow for 3 new businesses to buy land and build their business in Calmar.

COSTS/SOURCE OF FUNDING (if applicable)

The funding would come from the Incentive Reserve in the 2026 budget.

RECOMMENDED ACTION:

Administration is asking Council to approve the budget line amount to be lowered to $25,000.00 to help attract new businesses to Calmar.

Calmar Playdates- Indoor

The Calmar Playdates has really taken off in our community. Each week was always a different blend of parents and kids. Some are very consistent, some just drop in once in a while. Every week we see a new face.

Week 1- Missing Stats.

Week 2 - 4 adults- 3 from Calmar, 1 Leduc County

3 moms, 1 dad.

8 kids- 7 from Calmar, 1 Leduc County

5 boys and 3 girls.

Ages 1 < 1 years old, 2- 1 year old, 2- 2 year old, 2-3 year old, 1-4 year old.

Week 3 We had 7 adults and 8 kids.

2 Male Parents, 1 grandparent, 4 Moms

2 under 1 years old , 2 under 2 years old, 4 under 3 years old.

1 family from Leduc County, and the rest were from Calmar.

Week 4- Valentines Day Edition sponsored by Councillor Gardner

6 Parents

5 female, 1 male two of them brand new

5 Calmar, 1 Leduc County

9 kids

2 female, 7 boys

2 under 1, 3 under 2, 1 under 3, 3 under 4

7 Calmar, 2 Leduc County

Week 5- 3 parents for Play dates today. 2 Calmar, 1 Leduc County

1 kid Leduc County under 3

5 kids from Calmar

1 under 1, 2 under 2, 4.

Week 6- Missing Stats

Week 7- 7 parents- 6 moms and 1 Dad 5 from Calmar, 2 from Leduc County

11 kids

2 under 1, 4 under 2, 2 under 3, 3 under 4

7 Calmar, 4 Leduc County

Week 8 - 5 parents - 3 Calmar 2 Leduc County

9 kids : 5 Calmar, 4 Leduc County

2 under 1, 2 under 2, 1 under 3, 3 under 4. 1 - 5 year old.

Week 9- St. Patrick's Day edition. Bingo Dabbers were a terrible/hilarious idea.

4 parents, 3 from Calmar 1 from Leduc County

9 kids : 7 Calmar, 2 Leduc County

2 under 1, 3 under 2, 2 under 4, 1 under 5, 1 under 6.

Week 10- Play DOH Edition- Terrible mess. Great fun!

4 parents 3 Calmar, 1 Leduc County

7 kids

2 under 1, 1 under 2, 1 under 3, 2 under 4 and a 5 year old.

Week 11 4 adults: 2 Calmar, 2 Leduc county

8 kids: 3 under 1, 2 under 2, 2 under 3 and 1 under 4

Week 12: 7 Caregivers

3 from Leduc County

4 from Calmar- one was just brand new to Calmar as of Friday.

12 Kids- 5 kids from Leduc County, 7 kids from Calmar

3 under 1, 3 under 2, 2 under 3, 3 under 4, 1 under 5.

Week 13: EASTER EDITION

6 parents 4 from Calmar, 2 Leduc County

10 kids.

2 under 1, 1 under 2, 2 under 3, 4 under 4, 1 under 5.

Week 14: FAMILY DANCE PARTY.

11 kids and 7 parents in total. 1 Parent and 2 Kids from LC, the rest Calmar.

Week 15- Missing Stats

Week 16- 5 caregivers, all from Calmar 7 kids. Ranging from 4 months to 3 years old.

Week 17 Fire Hall Edition

27 kids I think 20-21 parents

Our best attendance yet and it was pure chaos. Too wild to get accurate ages of all the kids.

Open Gym/Family Gym

Week 1- 8 parents and 14 kids in total

Week 2- 15 adults, 12 Kids, a mix of Calmar, Leduc County and a Leduc Family.

Week 3- Missing Stats

Week 4- 6 parents, 9 Kids

Week 5- 2 Parents, 5 Kids.

Week 6- Cancelled.

Overall, the feedback from parents is how much they are loving the opportunity for FREE PLAY for their kids. I think the open gym will be a great thing to do in the Winter however, this was a big task for a volunteer to bring my own children, equipment and then stay for the entire time when my kids needed to go to bed. Going forward I would be happy to Volunteer for 1 Family Open Gym a month but I don't think I could Commit to every week, personally.

We saw lots of elementary school aged kids with 1 or 2 parents. Lots of Families came together or met Dad there. I really enjoyed seeing one dad show up almost every week with his kid to play soccer for an hour.

Some feedback I received about the teenagers, as we had ZERO kids show up for the Teen time, was that if it was more structured, they might come. Floor hockey night, basketball night and such. I am a little out of the realm of teenagers at this time, but without access to the equipment, this makes it more challenging. It would be nice if the school itself hosted something like this and we could help.

The Morning Playdates is a lot of younger children who are not school aged yet or young homeschooled kids with 1 parent or caregiver and sometimes 2 parents. They really enjoyed the playdoh days, working with their hands and more. The feedback received is that doing more hands-on crafts with a support person would be lovely, the Creative Family Dance class was a huge hit and although it was free play, every week I tried to do something a little different to keep the kids excited between crafts, obstacle courses, different games and such.

I think this has been great for the kids but also great for the parents! We've had great conversations, and it feels like we are building a strong community of our parents. Some of these parents I have now seen volunteer in different capacities, so I do believe that we are even seeing an ROI.

Since Mid-May the playdates have been moved to the parks which has been a great success but far too chaotic to get any kind of real data on who is who. The kids are having fun and the Parents look forward to it.

Leduc County has reached out with some programing that they would like to put on in Calmar and I have a meeting with Mikayla and Ian in the works of being booked to go over our schedule for September- December.

Item 9.c

Town of Calmar

Request for Decision (RFD)

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	DCS Bryans
Title:	26 Southbridge Crescent Water Bill Refund Request
Approved By:	CAO Losier
Agenda Item Number:	9 C

BACKGROUND/PROPOSAL:
At the beginning of July Mr. Christian reached out to our utilities clerk regarding how high his water bill was. The last two bills of 2024 were $235.38 and $225.00. The next three in 2025 were $347.31, $483.16 and $574.97.

In reviewing the leak report which is generated each billing cycle this property shows up for the first time on the March/April report indicating that there is a continuous leak in the property for at least 35 days. The property appears on the May/June leak report as well with the same indicators.

DISCUSSION/OPTIONS/BENEFITS/DISADVANTAGES:
Standard procedure when generating the bi-monthly water bills is that when the bills are printed to be mailed, they are all looked over and any that appear to be out of the ordinary are looked at in closer detail (i.e. confirm if they are on the leak report and if so put a sticker on the bill to notify the recipient). However, our system does not provide billing details for those users who choose to get their bill via email, so there is no way to review the bills. The leak at this property was confirmed in by a plumber in July and is what drove the consumption up.

In looking at the billing history of this property for 2024 the average bill was $237.34.

Option 1:
Council directs Administration to refund the resident the $600.00 requested. As well, put in place a standard procedure that a letter is sent to all properties who appear on the leak report with a continuous leak of 35 days to advise them of the leak.

Option 2:
Council directs Administration not to refund the resident the $600.00 requested. However, put in place a standard procedure that a letter is sent to all properties who appear on the leak report with a continuous leak of 35 days to advise them of the leak.

Option 3:
Council directs Administration to refund a different amount than requested. As well, put in place a standard procedure that a letter is sent to all properties who appear on the leak report with a continuous leak of 35 days to advise them of the leak.

COSTS/SOURCE OF FUNDING (if applicable)
Up to $600.00 depending on what Council chooses to refund the resident.

RECOMMENDED ACTION:
THAT Council directs Administration to refund the property owner. As well, Administration is directed to put in place a standard procedure that a letter is sent to all properties who appear on the leak report with a continuous leak of 35 days to advise them of the leak.

July 6, 2025

Wayne and Rea Christian
26 Southbridge Crescent
[redacted]
Calmar, Alberta
T0C 0V0

Attention: Utility
Mayor-Council
CAO

Firstly, Town of Calmar – thank-you for our more than fine living here in Calmar, coming into our 4th year.

Secondly; thank-you for the recent email and telephone responses in regards to anomaly/s in bi-monthly February, April and June 2025 **Utility Invoices.**

It was startling to say the least our water consumption for 26 Southbridge Crescent as stated on the utility invoice June 30 2025 indicated water used as 14,335.8 cubic metres.

Also note:
April Utility was north of 10,000 cubic metres
February was north of 5,000 cubic metres

Looking back at previous mailed (paper) Utility Invoices, the high majority of bi-monthly water usage was seldom above 1,500-2,000 cubic meters with the exception of August and October invoices in the years of a dry summer.

Note – I am a retired Federal Government employee classified as a Weather Specialist who worked for Environment and Climate Change Canada for 31 years.

As advised by the wonderful helpful lady (Calmar employee in Utility - dialed 222), she advised to check for toilet leaks; in doing so as advised - we found a leak in our secondary toilet - although it was not audible to us. As a result, the toilet is now shut off and we are getting a plumber to install a new toilet on Tuesday July 8th 2025.

We were advised via mail from the Town of Calmar by switching from a mailed utility invoice to electronic would result in a savings of $2 per mailing. Although being a senior of sound mind and still working full time hours and loving paper – I took the plunge for electronic billing.

When I discussed the anomaly with the Town of Calmar Utility, she informed me that our water usage was the 2nd highest in Calmar (I assume she was talking residential). Also, in conversation

she stated that if my Utility Invoice was not emailed but rather mailed (paper) the discrepancy would likely would have been caught.

Therefore, with the above in mind; I am requesting a $600 refund or credit for the 3 excessive utility bills (for the 6 months in question), calculated by comparing excessive use billing versus normal use billing

As stated on my last call to the Town of Calmar Utility, I prefer to have our utility invoices mailed as this seems to be very important for the Town of Calmar Utility to find discrepancies in utility bills especially here at 26 Southbridge Crescent with 3 consecutive abnormal utility bills.

Sincerely,
Wayne and Rea Christian

Item 9.d

Town of Calmar

Request for Decision (RFD)

Meeting:	Regular Council Meeting
Meeting Date:	July 28,2025
Originated By:	DCS Bryans/CAO Losier
Title:	CNRL
Approved By:	CAO Losier
Agenda Item Number:	9 D

BACKGROUND/PROPOSAL:

Canadian Natural Resources Ltd. (CNRL) has been working for several years towards the remediation of the parcel located directly south of the ball diamonds (within NE25-049-27-W4M). The purpose of the remediation was to enable recreational uses of the area.

To complete the process with Alberta Environment, Calmar must submit a signed form attesting that we have no objections to the risk management plan that was prepared by CNRL. The form, an information package, and the management plan are attached to this report.

DISCUSSION/OPTIONS/BENEFITS/DISADVANTAGES:

The environmental analysis done post the remediation enable CNRL to identify and map the sensitive areas. For these, a set of rules are being proposed to minimize any risk associated with the exposure/contact of the pollutants.

This information will enable the Town to finally move forward with the redevelopment of the park area once the storm water master plan is done. Knowing the opportunities and constraints of the site will also allow the Town to plan for their other recreational needs.

COSTS/SOURCE OF FUNDING (if applicable)
There is no cost to proceed with the form, and it will enable the Town to move forward with the recreational development of the land.

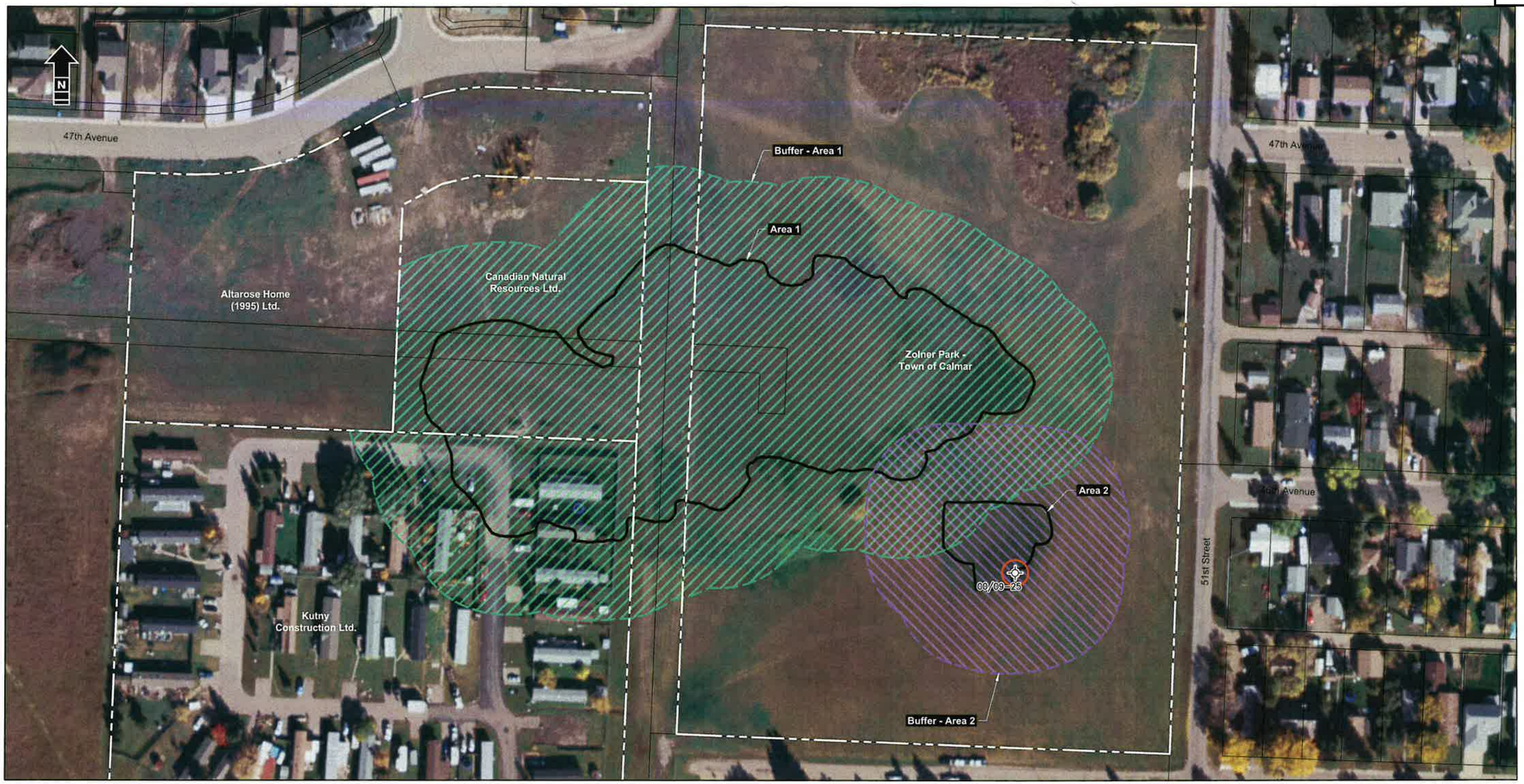
RECOMMENDED ACTION:

Council accepts this report as information and directs the CAO to sign the no objection form and return it to CNRL.

Plot = 1 = Tabloid (L)

Easting (m)

Northing (m)



Wellhead - Abandoned

Area Outline

Minimum Setback as per Directive 079

Reference:
Aerial imagery (September 28, 2017) obtained from Valtus © (2021) used under license.
Nichols Environmental Ltd.; Project #:12-380-TOC dated December 2012.

1:1500 metres
15 0 15 30
NAD 1983 UTM Zone 12N

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Canadian Natural Resources Limited
09-25-049-27 W4M

DRAFT

Site Plan

Date:	Project:	Submitter:	Reviewer:
November 2024	17295-SP-24	L. Oiffer	S. Brown

Figure 1

F:\17295\Drafting\2024\17295-SP-24.dwg - Hist - November 21, 2024 11:24:42 AM - Gary Evinson

Item 9.d

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

RISK MANAGEMENT PLAN
FORMER CALMAR 09-25 BATTERY
09-25-049-27 W4M

Prepared for:
CANADIAN NATURAL RESOURCES LIMITED

Prepared by:
MATRIX SOLUTIONS INC.

Version 1.0
May 2021
Calgary, Alberta

Suite 600, 214 - 11 Ave. SW
Calgary, AB T2R 0K1
T 403.237.0606 F 403.263.2493
www.matrix-solutions.com

RISK MANAGEMENT PLAN

FORMER CALMAR 09-25 BATTERY

09-25-049-27 W4M

Prepared for Canadian Natural Resources Limited, May 2021

Sara Brown, P.Eng.
Senior Environmental Engineer

reviewed by
Margaret Allan, M.Eng., P.Eng., P.Geo., FGC
Principal Engineer

VERSION CONTROL

Version	Date	Issue Type	Filename	Description
V0.1	23-Apr-2021	Draft	17295-508 RMP 2021-04-23 draft V0.1.docx	Issued to client for review
V1.0	13-May-2021	Final	17295-508 RMP 2021-05-13 final V1.0.docx	Issued to client

EXECUTIVE SUMMARY

Canadian Natural Resources Limited retained Matrix Solutions Inc. to prepare a risk management plan (RMP) for the former Calmar Battery located at 09-25-049-27 W4M, within Zolner Park in the Town of Calmar, Alberta.

The oil well was drilled in 1951 and by 1975 all battery-related facilities were removed and the site was issued a reclamation certificate. Phase 2 environmental site assessments were completed between 2012 and 2016 and identified salinity, petroleum hydrocarbon, metals, and polycyclic aromatic hydrocarbon impacts associated with the former flare pit, production area, and wellhead. Impacts exceeding *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019a) were fully delineated and were estimated to cover a combined area of approximately 17,000 m^2, to a maximum depth of 10 m.

A risk management plan was developed in 2015 (Matrix 2015a). A numerical model was completed to predict impact migration and chloride concentration peaks at freshwater aquatic life (FAL) receptors and the domestic use aquifer (DUA). The model concluded that impacts will not migrate far enough laterally in groundwater to reach the nearest FAL receptor. The model also concluded that the chloride plume in groundwater is so slow moving that it will remain contained by Town of Calmar town limits and as drinking water for the town is sourced from the City of Edmonton, the DUA as a receptor is administratively managed. As part of the RMP, site-specific guidelines were also developed for salinity impacts, based on the intended long-term land use of the majority of the site as parkland.

A 2016 remedial excavation was completed, aimed at achieving the site-specific guidelines (Matrix 2017a). The excavation targeted all constituents posing a risk to human health in the former flare pit and production areas, shallow (<1 m) impacts near the wellhead, and salinity impacts in the top 3 m. The total soil volume excavated in 2016 was 38,300 m^3. In the flare pit and production areas, all constituents that posed a risk to human health were excavated.

Near the wellhead, remaining human health risks will require long-term management with administrative controls by limiting development. The combined volume of remaining impacts is 16,700 to 38,200 m^3, primarily salinity impacts deeper than 3 m in the flare pit and production areas. The total volume of impacts remaining for long-term management near the wellhead is 3,070 m^3.

Constituents remaining following the 2016 remedial excavation by area and exposure pathway are summarized in Table i.

TABLE i Constituents Exceeding Tier 1 Guidelines

Source Area	Soil 0 to 1.5 m Depth	Soil/Bedrock >1.5 m Depth	Groundwater
Former Flare Pit	**Boron** – soil contact (eco)	**EC, SAR, Boron** – soil contact (eco)	**Metals, chloride**– FAL **Metals, chloride, sodium, sulphate, TDS** – potable GW
Former Production Area	---	**EC, SAR** – soil contact (eco)	**Metals, chloride** – FAL **Metals, chloride, sodium, sulphate, TDS** – potable GW
Wellhead	**PHCs F1, F2** – soil contact (eco) **Ethylbenzene** - DUA	**PHCs F1, F2, F3, and barium** – soil contact (eco) **Benzene, Ethylbenzene** – DUA **PAHs** – FAL **PHCs F2, F3, and Lead** – soil contact (human) **Vapour Inhalation (slab)** – F2 **Vapour Inhalation (basement)** – F2 **Management Limit -** PHCs F2 and F3 – management limit	**Metals, chloride** – FAL **Metals, sulphate, TDS** – potable GW

"—" – Indicates no reported exceedances
PHCs – petroleum hydrocarbons including one or more of benzene, toluene, ethylbenzene and/or xylenes (BTEX), PHC fraction 1 (F1; $C_{>6}$-C_{10}, excluding BTEX), PHC fraction 2 (F2; $C_{>10}$-C_{16}), fraction 3 (F3; $C_{>16}$-C_{34})
DUA – domestic use aquifer exposure pathway
EC – electrical conductivity
FAL – freshwater aquatic life exposure pathway
GW - groundwater
TDS – total dissolved solids
PAHs – polycyclic aromatic hydrocarbons
SAR – sodium adsorption ratio

Long-term management of the DUA for chloride impacts requires preventing drinking water wells from being drilled within the Town of Calmar. Administrative controls are also required long term to manage impacts remaining below 1 m near the wellhead; Directive 079 (AER 2014) and the planned long-term land use as parkland should limit development of this location.

Groundwater was monitored for 3 years following the remedial excavation and observed chloride concentration decreases were consistent with those predicted by the model. Based on this confirmation and increased confidence in the model outcomes, no additional groundwater monitoring is planned for the site. Vegetation assessment is required to confirm that equivalent land capability has been met.

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APPENDICES

1 INTRODUCTION

Canadian Natural Resources Limited retained Matrix Solutions Inc. to prepare a risk management plan (RMP) for the former Calmar 09-25 Battery, which is located at 09-025-049-27 W4M, within the Town of Calmar (Figure 1).

Development of this RMP is based on past environmental site assessments (ESAs) that identified impacts resulting from historical site operations, a site-specific predictive fate and transport model, and a large remedial excavation program (Matrix 2017a).

Phase 2 ESAs (Matrix 2017b, 2015b, 2013, Nichols Environmental 2012) determined that residual salts, petroleum hydrocarbons (PHCs), and metals remained in soil and/or groundwater particularly near the former flare pit, production area, and well centre. The first intrusive investigation was informed by a Phase 1 ESA completed in 2012 (Marquis Alliance 2012).

In accordance with the *Alberta Risk Management Plan Guide* (AEP 2017), contact information for the RMP proponent (Canadian Natural) and consultant (Matrix) is tabulated in Appendix A.

2 PROBLEM FORMULATION: CONCEPTUAL SITE MODEL

2.1 Background Site Information

The former Calmar 09-25 battery site is in Zolner Park, in the southwest portion of the Town of Calmar, Alberta (Figure 1) and currently overlaps areas zoned for residential (manufactured home park), parks and recreation, and urban reserve land uses. The majority of the risk-managed area is owned by the Town of Calmar (parks and recreation zoning), with a portion owned by Kutny Construction Ltd. (residential manufactured home park zoning) and a portion owned by Canadian Natural (urban reserve zoning). There is an active sports field to the north; permanent housing to the northwest, south, and east; and a privately owned trailer park to the west, which partially overlaps the former lease area (Figure 2). When ESAs began in 2012, a portion of the impacted area was owned by Calmar Southbridge Developers Inc.; prior to the 2016 remedial investigation, Canadian Natural purchased the parcel of land from the developers.

The land was historically a well site and oil battery; records indicate that an oil well (RUNDLE #2-9) was drilled in 1951 and produced until 1959. In addition to the wellhead and associated flow lines, there were process buildings, surface production tanks, and a flare pit. Battery-related facilities were removed between 1969 and 1975, and in 1975 the Alberta Department of the Environment issued a reclamation certificate (no. 14391). The only infrastructure remaining from operation and assessment of the well site is the abandoned wellbore and a network of groundwater monitoring wells, as shown on Figure 2.

2.1.1 Regional Physiography

The site is situated approximately 727 m above sea level (asl). Local topography is generally flat to undulating, with low-relief landforms and a limiting slope of 2% (AARD 2013). The site is situated within the Central Parkland Subregion of the Lake Edmonton Plain, in which land is predominantly utilized for oil and gas production and agriculture (Natural Regions Committee 2006).

Regional surface drainage is mainly towards the northwest, towards tributaries of the North Saskatchewan River with the nearest tributary, Conjuring Creek, located approximately 1 km west of the site (Figure 3). Local drainage is towards the engineered drainage ditch on the west side of the lease area, in between the trailer park and undeveloped north-south road on the west side of Zolner Park. The drainage ditch flows into a storm sewer outside the northeast corner of the trailer park property, then drains to a man-made stormwater holding pond approximately 270 m northwest of the site. Minimal details of the stormwater holding pond obtained from the Town of Calmar indicate that it is clay-lined, approximately 4 to 5 m in depth, and is manually discharged to Conjuring Creek through a weir gate.

2.1.2 Regional Geology

Surficial soil deposits near the site consist of unconsolidated till and glaciofluvial deposits (Ceroici 1979). The till is a poorly sorted mixture of clay, silt, sand, and gravel, with higher clay content soil typical and usually having a thickness of less than 20 m. Where buried valleys are present, glaciofluvial deposits are common and can have a thickness in excess of 30 m. Buried valleys are potential sources of groundwater in this region. Several buried valleys exist in the region; the Calmar buried valley is located 2 km west of the site and the Devon buried valley is located 4 km east of the site. In most areas, surficial deposits typically contain less than 25% sand and gravel but can be in excess of 50% in buried valleys (HCL 1999).

2.1.3 Site Stratigraphy

Stratigraphic cross-sections are provided on Figures 4 and 5; cross-section lines are shown on Figure 6a. Soils beneath the site are composed of clay with some silt and varying proportions of sand. The clay soils were dark brown with increased gleying with a depth of medium to high plasticity and typically soft to firm. Near surface soils (less than 1.0 m bgs) were generally moist and the water table was identified with wet soil at depths from 1 to 2 m bgs. Locally continuous, fine- to medium-grained, well-sorted sand layers were encountered at various depths throughout the soil column, with a maximum thickness of 3 m noted at monitoring well 13-B26. A single water table was identified with subsoil being fully saturated below the depth of 1 to 3 m bgs.

Bedrock consisting of a combination of siltstone and sandstone characteristic of the Upper Horseshoe Canyon Formation was identified at depths ranging from 9 to 16.5 m bgs; bedrock was generally identified at shallower depths on the west side of the site where a topographic bedrock high was interpreted to exist. These observations are consistent with the regional site setting indicative of the site being situated on the western edge of the buried Calmar Valley (HCL 1999).

2.1.4 Hydrogeology and Groundwater Conditions

Regional groundwater flow is generally to the north and northwest towards the North Saskatchewan River. Locally, groundwater flow is generally to the northwest, towards Conjuring Creek (HCL 1999). The local groundwater supply is generally obtained from the Horseshoe Canyon Formation and the sand and gravel units of the overlying surficial deposits. The availability of groundwater in the Horseshoe Canyon Formation is extremely variable due to formation heterogeneity (Ceroici 1979).

Based on the information obtained from the Groundwater Information Centre (AEP 2021), there were 26 registered water wells identified within a 1 km radius of the site (Table 1). The wells are reportedly used for municipal, domestic, and/or stock purposes. The locations of the wells identified in the water well search have not been field-verified by Matrix personnel, and their current status and uses have not been confirmed.

Based on the reported bottom-of-casing and total well depths, all wells appear to have been completed in the bedrock aquifer at depths of greater than 15 m bgs, suggesting that surficial sediment aquifers are not used near the site.

The closest water supply wells are reportedly located to the south-southwest and to the northwest of the site and are owned by the Town of Calmar. Currently, the Town of Calmar does not use these wells for municipal domestic water supply as it receives potable water from the City of Edmonton (Town of Calmar 2021).

Based on 2019 groundwater sampling (Matrix 2019), groundwater parameters are summarized in Table A.

TABLE A Groundwater Flow Parameters

	Shallow Groundwater	Deep (Bedrock) Groundwater
Water level (m bgs)	0.01 to 2.54	3.44 to 5.91
Horizontal hydraulic gradient (i; m/m)	0.20	0.60
Geomean hydraulic conductivity (K; m/s)	2.6×10^{-7}	6.3×10^{-9}
Effective porosity (n_e; %)	10	20
Horizontal groundwater velocity (v_L; m/year)	1.6	0.06

Hydraulic conductivity of the surficial sediments associated with shallow groundwater was calculated to range from 9.3×10^{-7} to 1.6×10^{-6} m/s. Matrix conducted a pump test on the groundwater monitoring well with the highest hydraulic conductivity (M12-17d; 6.0×10^{-6} m/s), which is screened across till and sand from 3.6 to 4.6 m bgs, and determined that the long-term yield was approximately 0.28 L/minute (Matrix 2015b). This is substantially less than the minimum yield of 0.76 L/minute specified for a domestic use aquifer (DUA) in the *Alberta Tier 2 Soil and Groundwater Remediation Guidelines* (Tier 2; AEP 2019b); thus, the shallow deposits underlying the site do not constitute a DUA.

Vertical gradients consistently indicate downward flow between the surficial deposits and the underlying bedrock, confirming that the site is situated within a groundwater recharge zone (Matrix 2019).

2.1.5 Outstanding Legal Requirements

To Matrix's knowledge, there are no outstanding legal requirements for the facility that need to be considered in developing the RMP.

2.2 Conceptual Site Model

2.2.1 Remediation Guideline Selection

The land surrounding the site is primarily used for residential purposes and the geology underlying the site is generally composed of clay with a shallow semi-connected sand unit overlying siltstone and sandstone bedrock. Previous ESAs confirmed that in the well centre area, PHC and polycyclic aromatic hydrocarbon (PAH) impacts were confined to the fine-grained soils and minor amounts of sand were localized and not part of connected sand units. Conversely, connected sand units were identified within the flare pit and production areas, and salinity impacts extend through these units and into bedrock. Fine-grained guidelines for residential/parkland land use were therefore used for comparison in the well centre area, and coarse-grained guidelines were applied in the flare pit and production areas under a Tier 1 scenario.

In 2015, Matrix developed a RMP that assessed the risk of each contaminant exceeding *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* and *Salt Contamination Assessment and Remediation Guidelines* (SCAR guidelines) for each receptor-exposure pathway combination (Matrix 2015a). The plan aimed to provide protection for the potential human/ecological receptors by proposing remediation and/or risk management measures to address each exposure pathway potentially compromised. A numerical model was conducted to assess the potential risk to groundwater receptors, and site-specific salinity and sodicity criteria were developed. Remediation and long-term risk management were therefore based on a Tier 2 approach.

2.2.2 Contaminants of Potential Concern

Based on ESAs conducted between 2012 and 2016 (Matrix 2015b, 2014, 2013, Nichols Environmental 2012), salinity-impacted soils exceeding the SCAR guidelines (AENV 2001) were identified in soil and groundwater in the former production and former flare pit areas. PHC, PAH and metals-impacted soils exceeding the *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (Tier 1; AEP 2019a) were identified in the wellhead and former production areas. Metals-impacted soils were also identified in the former flare pit area. Borehole locations from the historical drilling programs are presented on Figure 6a.

Impacts were fully delineated in all directions laterally and vertically. Elevated chloride at bedrock well 14-11c to the north (757 mg/L in 2019; Matrix 2019) is expected to be localized based on defined source areas and stratigraphy.

Prior to the 2016 remedial excavation, salinity-impacted soils were interpreted to cover an area of approximately 14,800 m^2 across the former production and flare pit areas with a maximum depth of impact of 10 m bgs. PHC-impacted soils were interpreted to cover an area of approximately 2,400 m^2 in the wellhead and former production areas with a maximum depth of impact of 6.5 m bgs in the wellhead area and 3.5 m bgs in the former production area. Metal-impacted soils were interpreted to cover an area of approximately 1,750 m^2 in the former flare pit and wellhead areas with a maximum depth of impact of 6 m bgs in the flare pit area and 6.5 m bgs in the wellhead area. PAH-impacted soil was identified in the wellhead area at 5.3 m, and in the production area between 2.3 and 5.3 m (Nichols Environmental 2012); these were localized areas as Matrix was unable to replicate these results in subsequent drilling events. The total impacted soil volume prior to remediation was calculated and was estimated to range between 55,000 to 76,500 m^3 (Matrix 2013). Historical investigation results are presented in Appendix B and historical drilling locations shown on Figure 6a.

A remedial excavation completed in 2016 targeted removal of PHCs, PAHs, and metals in concentrations and at depths that posed a risk to human health (Matrix 2017a). Soils exhibiting high electrical conductivity (EC; a measure of salinity) and sodium adsorption ratio (SAR; a measure of sodicity) were also removed, up to 3 m depth based on site-specific criteria developed (discussed in Section 4, below). Post-remediation, the maximum EC (60.9 dS/m), SAR (48.8) and chloride concentration in soil (11,700 mg/kg) remaining are located in the former flare pit area. The chloride plume remaining is generally well represented by the areal extent of chloride concentrations in shallow groundwater as shown on Figure 7. The excavation was backfilled with clay and topsoil from a neighbouring development.

Constituents remaining above Tier 1 guidelines are summarized as follows:

- EC and SAR remain elevated beneath the flare pit and production areas from 3 m to a maximum of 10 m, within the 2016 excavation boundaries (16,683 m^2). The impacted soil volume remaining is estimated to be in the range of 16,700 to 38,200 m^3 (Figure 6a).

- Boron concentrations (analyzed using the now-outdated hot water soluble method) in the flare pit area are elevated in two locations; at 3 to 5.5 m over 1,280 m^2 and from 0 to 0.3 m over 270 m^2. The volume of boron-impacted soil is 3,281 m^3 (Figure 6a).

- Beneath the wellhead area, 170 m^3 of elevated PHC concentrations remain northeast of the wellhead from 1 to 2.5 m in selected areas, and 1,050 m^3 of elevated PHC, PAH, barium, and lead concentrations remain southwest of the wellhead from 3 to 6.1 m (Figure 6b). The total estimated volume of elevated concentrations remaining in the wellhead area is 3,070 m^3.

Impacts remaining following the 2016 remedial excavation are outlined by area in Table B and areas, depths and volumes are shown on Figures 6a and 6b.

TABLE B Constituents Exceeding Tier 1 Guidelines by Area

Source Area	Soil 0 to 1.5 m depth	Soil/Bedrock >1.5 m depth	Groundwater
Former Flare Pit	**Boron** - soil contact (eco)	**EC, SAR, boron** - soil contact (eco)	**Metals, chloride**- FAL **Metals, chloride, sodium, sulphate, TDS** - Potable GW
Former Production Area	---	**EC, SAR** - soil contact (eco)	**Metals, chloride** - FAL **Metals, chloride, sodium, sulphate, TDS** - Potable GW
Wellhead	**PHCs F1, F2** -soil contact (eco) **Ethylbenzene** - DUA	**PHCs F1, F2, F3, and barium** - soil contact (eco) **Benzene, Ethylbenzene** - DUA **PAHs** - FAL **PHCs F2, F3 and Lead** - soil contact (human) **Vapour Inhalation (slab)** - F2 **Vapour Inhalation (basement)** - F2 **Management Limit -** PHCs F2 & F3	**Metals, chloride** - FAL **Metals, sulphate, TDS** - Potable GW

"---" - Indicates no reported exceedances
PHCs - petroleum hydrocarbons including one or more of benzene, toluene, ethylbenzene and/or xylenes (BTEX), PHC fraction 1 (F1; $C_{>6}$-C_{10}, excluding BTEX), PHC fraction 2 (F2; $C_{>10}$-C_{16})
FAL - freshwater aquatic life exposure pathway
DUA - domestic use aquifer exposure pathway
TDS - total dissolved solids
PAHs - polycyclic aromatic hydrocarbons

2.2.3 Receptors and Exposure Pathways

Based on the site's location and surrounding land use, the residual contaminants of potential concern (CoPCs) are implicated with the receptors and exposure pathways summarized in Table C.

TABLE C Constituents Exceeding Guidelines for Applicable Receptor/Exposure Pathways

Receptor/ Exposure Pathway	Soil 0 to 1.5 m Depth	Soil/Bedrock >3.0 m Depth	Groundwater
Human			
Domestic use aquifer	**Ethylbenzene** (WH; various excavation samples at 1.5 m)	—	**Arsenic** (17-13c) **Boron** (14-12a, 17-12a) **Cadmium** (17-12a) **Sodium** (14-10c, 14-11c, 14-8c, 14-8d, 14-9c, 17-10a, 17-12a, 17-12c, 17-13a, 17-13c, 17-2, 17-4) **Uranium** (13-1, 13-3, 13-5, 14-11a, 17-12a, 17-13a, 17-2) **Chloride** (13-3, 14-11c, 17-12a, 17-12c, 17-13a, 17-2, 17-4) **Sulphate** (13-1, 13-3, 13-5, 13-6b, 14-10a, 14-11c, 14-8c, 14-9c, 17-10a, 17-12a, 17-12c, 17-13a, 17-13c, 17-2, 17-4) **TDS** (13-1, 13-3, 13-5, 13-7, 14-10a, 14-10c, 14-11a, 14-11c, 14-8a, 14-8c, 14-8d, 14-9a, 14-9d, 17-10a, 17-12a, 17-12c, 17-13a, 17-13c, 17-2, 17-4, M12-12, M12-15)
Vapour inhalation – basement	—	**F2** (WH; M12-02)	
Vapour inhalation – slab	—	**F2** (WH; M12-02)	—
Direct soil contact	—	**Lead** (WH; M12-02) **F2** (WH; M12-02) **F3** (WH; M12-02)	—
Management Limit	—	**F2** (WH; M12-02) **F3** (WH; M12-02)	—
Ecological			
Direct soil contact	**F1** (WH; various excavation samples) **F2** (WH; various excavation samples) **EC** (FP, Production Area; various) **pH** (various) **SAR** (FP, Production Area; various) **Boron** (FP; 13-B16)	**F1** (WH; 13-B30, 13-B37, M12-02, 16-X88) **F2** (WH; 13-B30, 13-B37, 16-X72) **F3** (WH13-B37) **EC** (FP, Production Area; various) **pH** (various) **SAR** (FP, Production Area; various) **Boron** (FP; 13-B3, 13-B21) **Barium** (WH; M12-02)	—
Livestock soil and food ingestion	—	—	—
Livestock watering	—	—	—
Wildlife soil and food ingestion	—	—	—
Wildlife watering	—	—	—
Freshwater aquatic life	—	**Acenaphthene** (WH; M12-02) **Flourene** (WH; M12-02) **Naphthalene** (WH; M12-02) **Phenanthrene** (WH)	**Silver** (17-12a, 17-4) **Arsenic** (14-9d, 17-12a, 17-13c) **Boron** (17-12a) **Copper** (17-12a) **Mercury** (14-9d)

Receptor/ Exposure Pathway	Soil 0 to 1.5 m Depth	Soil/Bedrock >3.0 m Depth	Groundwater
			Selenium (13-7, 17-10a, 17-12a, 17-13c) **Uranium** (13-1, 13-3, 13-5, 13-7, 14-11a, 17-10a, 17-12a, 17-13a, 17-2, 17-4, M12-12) **Zinc** (13-1, 14-11a, 14-11c, 14-8, 14-8c, 14-8d, 14-9a, 14-9c, 14-9d, 17-12a) **Chloride** (13-3, 13-7, 14-11a, 14-11c, 14-12a, 14-12c, 17-12a, 17-12c, 17-13a, 17-2, 17-4, M12-12)
Irrigation water	—	—	—

F1 - petroleum hydrocarbons fraction 1 ($C_{>6}$-C_{10}, excluding BTEX)
F2 - petroleum hydrocarbons fraction 2 ($C_{>10}$-C_{16})
F3 - petroleum hydrocarbons fraction 3 ($C_{>16}$-C_{34})
EC - electrical conductivity
FP - flare pit
SAR - sodium adsorption ratio
TDS - total dissolved solids
WH - wellhead

3 HAZARD IDENTIFICATION

Below is a summary of the origin of the soil and water guidelines for constituents that exceeded Tier 1/SCAR guidelines at the Calmar site. Many of these guidelines are at least partially based on risk assessment principles. None of the remaining CoPCs exist in concentrations sufficient to alter physical or chemical properties of the soil or groundwater, except for SAR. Based on the depth of remaining elevated SAR (>3 m), groundwater mounding may be observed. However, based on the land use as residential or parkland, and the fact that drinking water in the Town of Calmar is sourced from the City of Edmonton, the degree to which deep groundwater movement may be affected by remaining SAR is not a concern.

3.1 Hydrocarbons

Benzene and ethylbenzene are monoaromatic hydrocarbons associated with the petroleum industry because they are present in crude oil, natural gas condensate, and formation water produced along with the petroleum products. They are volatile and water soluble so are of particular concern for exposure pathways involving vapours or groundwater.

PAHs have a higher molecular weight than benzene, toluene, ethylbenzene and xylene (BTEX) but are also associated with the petroleum industry. Only the lowest molecular weight PAH (naphthalene) is considered volatile. Compared to benzene and ethylbenzene, PAHs are poorly soluble in water. However, they can adsorb to particulate matter and be transported in water in that form.

Aliphatic and aromatic hydrocarbons other than BTEX and PAHs are grouped into four fractions, PHCs fraction 1 (F1; C_6-C_{10}, excluding BTEX), fraction 2 (F2; $C_{>10}$-C_{16}), fraction 3 (F3; $C_{>16}$-C_{34}), and fraction 4

(F4; $C_{>34}$), based on molecular weight for contaminant fate, transport, and toxicity evaluations. The lower-numbered fractions are more volatile and water soluble than the higher-numbered fractions.

3.1.1 Human Health

The effects of hydrocarbons such as BTEX, PHCs F1 to F4, and PAHs on human health have been studied by toxicologists and the findings have been made available by organizations such as the United States Environmental Protection Agency (U.S. EPA), Health Canada, and the Canadian Council of Ministers of the Environment (CCME). In Alberta, this body of knowledge has been summarized as human toxicity reference values provided in the Tier 2 guidelines.

Of these hydrocarbon constituents, benzene is considered carcinogenic (cancer-causing). An oral slope factor is provided for benzene (CCME 2008a; Health Canada 2004)and due to its volatility, an inhalation unit risk is also provided for benzene (Health Canada 2004). The remaining hydrocarbons of concern, namely ethylbenzene, the aliphatic and aromatic constituents of PHCs F1 to F3, and the PAHs naphthalene, acenaphthene, fluorene, and fluoranthene are considered threshold toxicants. As such, they are assigned tolerable daily intakes (TDIs; AEP 2019b) based on toxicity measures published by the CCME (2008b; aliphatic and aromatic constituents of PHCs F1 to F3), and the U.S. EPA (U.S. EPA 2014; ethylbenzene and PAHs). Volatile non-carcinogenic hydrocarbons (ethylbenzene, aliphatic and aromatic constituents of PHCs F1 and F2, and PAHs) are also assigned inhalation tolerable concentrations (TCs) by the same organizations that assessed the TDIs.

Human direct contact with contaminated soil is evaluated based on TDIs and oral slope factors, whereas inhalation risk is evaluated based on inhalation TCs and inhalation unit risk.

Risks arising from ingestion of drinking water that passes through contaminated soil are based on TDIs and oral slope factors (after modelling portioning from soil into groundwater), whereas risks attributable to the groundwater itself (rather than soil quality) are based on comparison to drinking water standards themselves, such as the *Guidelines for Canadian Drinking Water Quality* (Health Canada 2020). Drinking water guidelines for benzene, PHCs F1 to F3, and PAHs are based on protecting against adverse health effects, whereas the guidelines for ethylbenzene are based on aesthetic concerns for odour (Health Canada 2020).

3.1.2 Ecological

Soil quality guidelines for PHCs F1 to F3 were developed by the CCME to be protective of both soil invertebrates and plants. The scientific technical supporting document (CCME 2008b) explains that PHCs appear to cause membrane disruption, increased membrane fluidity, loss of membrane polarization, and a host of related biochemical perturbations when the concentration in an organism's lipid pool exceeds a critical threshold. Effects of individual organic chemicals are believed to be additive and affected by their lipophilicity, bioavailability, and resistance to metabolic modification and elimination from the body. The direct soil contact guidelines for PHCs F1 to F3 are based on consideration of all the constituents

together in the respective PHC fractions. Separate guidelines are developed for coarse-grained soils versus fine-grained soils.

Guidelines for PHCs surface water are also based on the ecotoxicity of the constituents within these fractions (CCME 2008b). Freshwater aquatic life (FAL) guidelines have not been proposed for PHC F3 because of their limited solubility, but are provided for PHCs F1 and F2.

The CCME determined that FAL is sensitive to PAHs in the water column, particularly in the presence of ultraviolet light. Guidelines for individual PAHs were derived by applying appropriate safety factors to acute or chronic toxicity measures, and are based on protecting water flea (*Daphnia*) species (fluoranthene and fluorene) or brown or rainbow trout (acenaphthene, naphthalene, and phenanthrene).

3.2 Metals

3.2.1 Human Health

3.2.1.1 Direct Soil Contact

The Tier 1 guideline for lead in soil is 140 mg/kg in residential/parkland settings. This guideline is based on soil ingestion by toddlers, the most sensitive age group (CCME 1999). Lead can affect the central nervous system and has been linked to behavioural disorders and lower intelligence scores (CCME 1999).

3.2.1.2 Drinking Water

Alberta Environment adopted the *Guidelines for Canadian Drinking Water Quality* (Health Canada 2020) version in effect at the time Tier 1 guidelines were written) for metals in drinking water.

- **Boron** - The drinking water guideline is 5 mg/L, which is a health-based maximum acceptable concentration (MAC) intended to reduce the risk of reproductive effects on men. The guideline is based on water treatment achievability.

- **Cadmium** - The drinking water guideline is 0.005 mg/L, which is a health-based MAC based on guarding against kidney damage and softening of bone.

- **Iron** - The drinking water guideline is 0.3 mg/L, which is an aesthetic objective based on taste of drinking water and staining of laundry and plumbing fixtures. Iron is not considered toxic to humans in their diet.

- **Manganese** - The drinking water guideline is 0.05 mg/L, which is an aesthetic objective based on taste of drinking water and staining of laundry and plumbing fixtures.

- **Uranium** - The drinking water guideline is 0.02 mg/L, which is a health-based MAC based on guarding against kidney damage. Uranium is only weakly radioactive and is rapidly eliminated from the body. The MAC also considers water treatment achievability.

3.2.2 Ecological

3.2.2.1 Direct Soil Contact

Most of Alberta's soil quality guidelines for ecological direct soil contact were adopted from the CCME and were developed upon consideration of published ecotoxicity results for plants and terrestrial invertebrates. Below is a summary of the origin of the direct soil contact guidelines for metals that exceeded Tier 1 ecological guidelines in soil at the Calmar site following the 2016 excavation, namely barium and boron.

- **Barium** - The Tier 1 guideline is 500 mg/kg, the same as the CCME guideline issued in 1999. Some plants exhibit sensitivity to barium; in animals, barium concentrates in the bones and competes with calcium (CCME 2013). However, ecotoxicity data appear sparse, and in 2013 the CCME reported that there was insufficient/inadequate data to update the direct soil contact guideline according to their current protocols for environmental soil quality guideline derivation.

- **Boron** - The Tier 1 guideline is 3.3 mg/kg, which is derived from ecotoxicity data and based on the saturated paste method (AEP 2016). Prior to 2016, the guideline was based on the hot-water soluble method of analysis, which is a method designed to diagnose boron deficiency, not toxicity, and is known to remove more boron than a saturated paste analysis (Lintott and Huber 2012).

3.2.2.2 Freshwater Aquatic Life

Most of Alberta's surface water quality guidelines for FAL (AEP 2018) were developed upon consideration of ecotoxicity results published by the CCME and the U.S. EPA. For copper and mercury, Alberta-derived guidelines are provided in the Alberta *Environmental Quality Guidelines for Alberta Surface Waters* (AEP 2018). Below is a summary of the origin of the FAL guidelines for metals that exceeded Tier 1 ecological guidelines in groundwater, namely aluminum, arsenic, boron, iron, mercury, selenium, and zinc.

- **Aluminum** - The guideline for protecting FAL is 0.05 to 0.1 mg/L, depending on pH (AEP 2018). At the former Calmar 09-25 battery site, the aluminum guideline was exceeded only north of the former flare pit (at monitoring well 14-12a) where the pH value was 6.49 in February 2014 and the corresponding guideline for FAL is 0.05 mg/L. The concentration at monitoring well 14-12a was 0.29 mg/L in February 2014 (Matrix 2017c). The guideline is 0.1 mg/L at a pH value greater than 6.5.

- **Arsenic** - Alberta's FAL guideline is 0.005 mg/L, which is derived from CCME guidance. This value is based on protecting algae (CCME 2001).

- **Boron** - The Tier 1 guideline is 1.5 mg/L, which is a value considered to be protective of 95% of freshwater aquatic species including fish, invertebrates, and plants (CCME 2009). Plants appear to be more susceptible to boron than fish or invertebrates, and at concentrations above 1.5 mg/L some aquatic plant species could disappear and cause repercussions along the food chain.

- **Iron** - The FAL guideline for iron is 0.3 mg/L (identical to the drinking water guideline) and is derived from CCME (2008c) guidance summarized in Alberta's surface water quality guidelines (AEP 2018).

- **Mercury** – The Tier 1 guideline is 0.000005 mg/L for FAL. Based on CCME guidance, this is based on a 10 times safety factor for effects on flathead minnow spawn and eggs (CCME 2003).

- **Selenium** - The FAL guideline is 0.001 mg/L and is derived from CCME (2008c) guidance summarized in Alberta's surface water quality guidelines (AEP 2018).

- **Zinc** - The guideline of 0.03 mg/L is derived from CCME (2008c) guidance summarized in Alberta's surface water quality guidelines (AEP 2018).

3.3 Salts

3.3.1 Human Health

Most salts are not toxic to humans at typical concentrations and rates of contact. In fact, people often add salt to foods (sodium chloride) and bath water (magnesium sulphate). Some members of the population require a sodium-restricted diet due to hypertension or congestive heart failure. Canadian drinking water guidelines for sodium (200 mg/L), chloride (250 mg/L), sulphate (500 mg/L), and TDS (500 mg/L) are based on guarding against unpleasant taste and are aesthetic guidelines (Health Canada 2020). Natural concentrations of TDS in the Horseshoe Canyon Formation (the bedrock aquifer that underlies the former Calmar 09-25 battery site) are typically one to five times the drinking water guideline of 500 mg/L. The highest TDS concentrations are usually associated with sodium chloride type water from the bedrock (Ceroici 1979).

3.3.2 Ecological

Soil salinity affects the uptake of water by vegetation, resulting in impaired plant growth (AENV 2001). Saline conditions impair plant growth by increasing the osmotic pressures that must be overcome to transport water and nutrients to various parts of the plant (Edwards 1987). This phenomenon also affects animals such as earthworms that depend on osmosis for maintaining cellular water balance. In effect, the salts in the soil compete with the plant for the available water. The presence of excessive salts in soils has a similar effect as drought and can cause plants to go into drought stress at a soil moisture level that would normally provide sufficient water to the plants.

To maintain the osmotic differential, plant energy is diverted from growth processes. One of the first growth processes to be affected is cell elongation: leaf tissue cells continue to divide but do not elongate. Plants growing in saline soils may appear stunted and have thickened leaves with a deeper colour than usual (AENV 2001). The occurrence of more cells per unit leaf area accounts for the typical dark green colour of osmotically stressed plants (Bohn et al. 1985). Plants are most severely affected by salinity in the early stages of growth, and salinity tolerance varies by plant species (McKenzie and Najda 1994; McKenzie et al. 1994).

Chloride toxicity is especially a concern for woody species and legumes; sodium toxicity is less widespread but can be a problem for cereal crops. Following uptake, chloride is easily carried to the extremities of the plant (Edwards 1987). Excessive accumulations in tissues near the end of the plant transpiration stream lead to necrosis, burn of leaf tips and margins, and eventual death (Bohn et al. 1985). Many conifers, including Colorado spruce, white spruce, black spruce, and balsam fir, develop chlorosis initially, become pink, and finally develop a reddish brown tint of the needles, beginning at the tip and progressing toward the base. Deciduous species are reported to be generally more tolerant to soil salinity than conifers. The annual leaf fall cycle may serve a cleansing function and play a role in increased salinity tolerance of deciduous species (Edwards 1987).

Sodium toxicity is not considered as significant as chloride toxicity. However, the potential for plant uptake of sodium is increased if sulphate is also present (Edwards 1987). The chief adverse effects of sodium on plants are the stresses brought on by osmotic effects (Edwards 1987) and the deterioration of soil structure which results when sodium replaces calcium and magnesium on the soil exchange complex. Soil sodicity can affect the soil structure to a degree that results in poor drainage, excess moisture, and inadequate aeration, conditions that are detrimental to plant growth (AENV 2001). In the presence of high exchangeable sodium concentrations, clay particles disperse and cause the soil to swell that can cause crusting at the soil surface that reduces seedling emergence. In addition, high exchangeable sodium decreases hydraulic conductivity of the soil, retards infiltration, and can cause ponding and increased surface runoff which lessens the amount of water available for plants.

Alberta's surface water guideline for chloride is 120 mg/L (AEP 2018). This value was obtained from the CCME and is based on protecting a variety freshwater aquatic species from continuous contact to chloride associated with sodium. The 5th percentile value of pooled toxicity tests was used to define the guideline.

4 EXPOSURE ASSESSMENT AND RISK CHARACTERIZATION

To-date there have been no observed adverse effects of impacts. Based on the use of much of the area as a sports field, potential vegetation stress would have been difficult to attribute to shallow salt impacts versus active use of the field. Shallow salts have now been addressed by the 2016 remedial excavation (Matrix 2017a).

None of the CoPC are expected to be transported in vapour-phase, therefore soil vapour management is not considered necessary. Despite the presence of a DUA, onsite groundwater flow is calculated to be less than 2 m/year and while semi-connected sand lenses have been identified, delineation of impacts more than 40 years after site operations ceased confirms that impact migration is slow.

4.1 Soil Risk Characterization

4.1.1 Human Direct Soil Contact, Vapour Inhalation, and Management Limit

The chief risks arising from soil quality are ecological rather than human health-based. Following the 2016 remedial excavation, the only remaining area exceeding the guidelines based on human health was at the wellhead (wellbore M12-02; lead and PHCs F2 and F3 in subsoil at 6.1 m). Vapour inhalation guidelines were exceeded by PHC F2 near the well centre (wellbore M12-02); the Tier 1 Management Limit was exceeded by concentrations of PHCs F2 and F3 at this location as well.

4.1.2 Ecological Direct Soil Contact

Testing has shown that salinity and sodicity in the subsoil (>3 m) exceed SCAR guidelines. Prior to the 2016 excavation, the area impacted by soil salinity was estimated at 14,800 m^2; the excavation of salinity impacts based on confirmatory samples covered 16,683 m^2. Beyond salinity, the 2016 remedial excavation addressed the majority of impacts exceeding ecological contact guidelines; selected hydrocarbons and barium in a localized area near the wellhead (M12-02) and boron in the former flare pit (13-B3, 13-B16, and 13-B21) are the remaining parameters that exceed guidelines for this exposure pathway, as summarized in Table C. As indicated in the hazard identification (Section 3), salts are of particular concern for plants and, to a lesser extent, terrestrial organisms.

The intended land use for the trailer park and developer area is single-family residential housing; plants grown for this land use are likely to include lawn grasses, vegetable gardens, fruit trees, and ornamental trees, and shrubs. The intended land use for the Town of Calmar recreational area is sports fields; plants, are likely to comprise turf grasses across the broad area with possible trees or shrubs at the perimeter. To successfully establish and maintain vegetative cover, salinity and sodicity levels within the rooting zone must be within a range that can be tolerated by the plant species.

Alberta's SCAR guidelines acknowledge that a site-specific risk assessment approach may be used: *"Remediation to the generic guideline levels is expected for topsoil and subsoil, to a depth sufficient to prevent impact on the rooting zone, or to a depth at which similar levels of naturally occurring salts occur in the control soils. Efforts should also be made to remediate soil below this depth to generic guideline levels. If remediation of soil at depth is not feasible, a risk assessment approach is necessary."* The risk assessment approach includes an assessment of the site-specific rooting depth, background salinity levels, the salt tolerance of potential vegetation, and the potential for introduced salts to migrate into the soil profile.

4.1.2.1 Rooting Depth and Distribution

Soil salinity can determine where roots will grow within a soil, and will limit the efficiency of water uptake by vegetation. A consideration of the natural distribution of roots and the maximum rooting depth at a site is therefore required to determine the probable effect of soil salinity on plant growth.

Rooting depth and distribution of roots in the soil profile are influenced by several factors including nutrient availability, soil porosity, aeration, toxicity, and soil moisture content (Gregory 1988). Few plants have roots extending beyond 1.8 m (Hausenbuiller 1985). Grasses can root to approximately 1.2 to 1.5 m if they are left uncut. Turf grasses root more shallowly, with root depths determined by the nature and frequency of cutting: the effective root depth of turf grass is typically two to three times the height at which it is cut (McKenzie 2000, Pers. Comm.). The effective root depths of trees and shrubs are typically within 60 cm of the ground surface (McKenzie 2001, Pers. Comm.). However, there are deeper-rooting species: the root depth of spruce is approximately 60 to 80 cm, but for caragana the root depth could be as much as 3 m (McKenzie 2001, Pers. Comm.). A depth of 1.5 m has been used as the rooting depth to assess soil salinity in Alberta (AEP 2020), and Alberta Agriculture and Rural Development (AARD) provide salinity ratings for vegetation to a depth of 1.2 m (Wentz 2001).

Plants selectively use the upper portion of their rooting zone in preference to the lower portion and, if they can obtain sufficient water and nutrients from the upper zone, may be unaffected by poorer soil quality at depth (McKenzie 2001, Pers. Comm.). The greatest density of plant roots occurs in topsoil (A horizons) and upper subsoil (B horizons) where soil structure allows for extensive root growth throughout the soil. As plants grow, moisture is rapidly extracted from these horizons, creating a gradient that draws upward moisture from deeper in the profile. If roots grow deeper in response to desiccation near surface, these deeper roots will be increasingly relied upon to meet a plant's water requirements.

The natural soil at the former Calmar 09-25 battery site is likely Malmo, an Eluviated Black Chernozemic soil, or a similar Black Chernozemic soil (AARD 2013). Malmo soil is developed on slightly saline lacustrine parent material, with glacial till near the surface, and with sand layers common immediately above the till. Topsoil depth (Ah and Ae horizons) is generally 35 cm with an underlying Bt horizon extending to the C horizon, beginning at about 1 m bgs (Bowser et al. 1962). This description is consistent with the stratigraphy identified during the historical Phase 2 ESAs at the site (Matrix 2015b, 2013).

Most of the rooting mass of non-impacted soil at this site would be expected from surface to 1 m bgs, corresponding to the A and B horizons. In addition, the high moisture content of the soil above the shallow water table (approximately 2 m bgs) would likely limit aeration and thereby restrict the extent of maximum root penetration to 1.5 to 2 m bgs.

4.1.2.2 Natural Salinity and Sodicity

The SCAR guidelines provide a rating of soil salinity and sodicity (Table D) and allow for comparison of salinity impacts relative to natural, background values. Comparison to natural soil conditions provides a means for determining equivalent land capability that is more appropriate than fixed criteria.

TABLE D Soil Quality Guidelines for Unrestricted Land Use

Parameter		Rating Category			
		Good	Fair	Poor	Unsuitable
Topsoil	EC (salinity; dS/m)	<2	2 to 4	4 to 8	>8
	SAR (sodicity)	<4	4 to 8	8 to 12	>12
Subsoil	EC (salinity; dS/m)	<3	3 to 5	5 to 10	>10
	SAR (sodicity)	<4	4 to 8	8 to 12	>12

Source: AENV 2001

The A and B horizons of Malmo soil have low salinity due to leaching of soluble salts and carbonates downward into the C horizon; a "good" rating is not likely to be exceeded within these horizons. The C horizon of a Malmo soil is characterized by greyish brown clay that may contain salts (0.3 mol/L soluble cations; Bowser et al. 1962) that could exceed the EC limit (3 dS/m) for a "good" subsoil rating according to the applicable Tier 1 guidelines (AENV 2001). The Phase 2 ESA results for the site found the maximum background salinity value to be 2.88 dS/m, which is within the "good" rating for subsoil. This level of salinity is approaching the "fair" category and could limit growth of sensitive plants.

Sodicity values for the A and B horizons of a Malmo soil would be low; however, the sodicity of the C horizon is likely to be elevated to a rating of "fair," as indicated by the exchangeable sodium percentages (11%; Bowser et al. 1962). The historical ESA results also support these sodicity ratings for the site.

4.1.2.3 Sensitivity of Plants Within the Land Use Scenario

Plants grown in a residential setting are likely to include lawn grasses, vegetable gardens, fruit trees, and ornamental trees and shrubs. Introduced chloride salts affect plant growth almost exclusively through their effect on salinity and osmotic potential (Section 3.3.2). Plants vary in tolerance/sensitivity to soil salinity according to species.

AARD has compiled a list of plants including field crops, forages, vegetables, and trees and shrubs, and has rated them according to salt tolerance (Wentz 2001). The soil salinity ratings used (Table E) are slightly different than those used in the Tier 1 guidelines (Table D).

TABLE E Alberta Agriculture and Rural Development Soil Salinity Ratings

Soil Depth	Non-saline	Weakly Saline	Moderately Saline	Strongly Saline	Very Strongly Saline
0 to 60 cm	<2 dS/m*	2 to 4 dS/m	4 to 8 dS/m	8 to 16 dS/m	>16 dS/m
60 to 120 cm	<4 dS/m	4 to 8 dS/m	8 to16 dS/m	16to 24 dS/m	>24 dS/m

Source: Wentz 2001

Sensitivity to salinity depends on the type of vegetation:

- Grasses for lawns and turf are relatively shallow-rooted and would be minimally affected by salinity below the topsoil.

- Garden plants vary in sensitivity. Carrots, onions, strawberries, peas, and beans are listed as having the lowest salt tolerance (Wentz 2001). The effect of soil salinity on plants is greatest during periods of drought. Gardens would tend to be less sensitive than agricultural crops because they are typically watered regularly.

- Ornamental trees and shrubs likewise have a range of tolerance to soil salinity; however, some common ornamental shrubs (e.g., dogwood and spirea) are more sensitive than vegetables (Wentz 2001) and as perennials have the potential of rooting deeper.

For introduced salts, the most sensitive plant receptors under the existing and proposed future residential/parkland land use appear to be non-tolerant trees and shrubs that homeowners may plant.

4.1.2.4 Potential for Salt Migration

Dissolved salts move with soil water and can therefore move downward due to precipitation, upward by capillary rise, or laterally with groundwater below the water table. The former Calmar 09-25 battery site is within a recharge area and groundwater monitoring results indicate a downward gradient of 0.21 to 0.63 m/m (Matrix 2019). The effect of this net downward movement would prevent salts from accumulating within the rooting zone.

Periods during which a lack of precipitation might allow upward migration of groundwater into the lower portion of the rooting zone are possible in some areas of the prairie provinces, and in these places soil and groundwater immediately below the rooting zone could accumulate excessive concentrations of salts. However, numerical modelling using Calmar-area weather and site soil characteristics determined that while plant root transpiration does incite upward gradients during dry spells, they are not strong enough to cause significant upward migration of salts or concentration of chloride in the rooting zone.

Long term, residual salinity is expected to decrease as introduced salts are leached down to the water table.

4.1.2.5 Site-specific Soil Salinity and Sodicity Criteria

Considering site-specific conditions, along with guidance available regarding soil salinity in Alberta, criteria (Table F) that are intended to provide protection of vegetation within a residential/parkland land use scenario were developed for the site. Rationale for the criteria is based on applicable guidelines and relevant soil processes.

TABLE F Site-specific Soil Salinity Criteria and Rationale According to Depth

Parameter	Depth	Criteria	Rationale
EC (salinity; dS/m)	0 to 0.6 m	<2 dS/m	This is consistent with the low level of natural salinity in the topsoil and upper subsoil of Malmo soil, and corresponds to the AARD "non-saline" category.
	0.6 to 1.0 m	<3 dS/m	This is consistent with the low level of natural salinity in the upper subsoil of Malmo soil and with the AARD "non-saline" category. It also corresponds to the "good" category for subsoil.
	1.0 to 1.5 m	<4 dS/m	This is consistent with the potential for a "fair" rating for the C horizon of Malmo soils. In addition, the AARD uses <4 dS/m in the 0.6 to 1.2 m depth as an indication of "non-saline" soil.
	1.5 to 2.0 m	<5 dS/m	This is consistent with the SCAR guidelines and the potential for a "fair" rating in the C horizon of Malmo soils. Because of the depth, root mass, and activity within this depth range are expected to be minimal.
	2.0 to 3.0 m	<10 dS/m	This depth is far enough below the rooting zone that salts are unlikely to migrate up into the rooting zone. This value is less than the "unsuitable" rating; therefore, tolerant plants could extract moisture and other plants are unlikely to be affected, provided that the criteria for the shallower depths are not exceeded.
	>3.0 m	<65 dS/m	This depth is far enough below the rooting zone that salts are unlikely to migrate up into the rooting zone. The value is classified as "unsuitable;" however, with clean soil above 3 m and a confirmed downward gradient, moisture available for plants should not be restricted.
SAR (sodicity)	0 to 0.6 m	<4	This is consistent with the low natural sodicity in the topsoil and upper subsoil of Malmo soil and a SCAR rating category of "good."
	0.6 to 1.0 m	<8	This is consistent with potentially elevated natural sodicity in the C horizon of Malmo soil to a rating of "fair" for subsoil.
	>1.0 m	<12	Rooting below 1 m (C horizon) would be limited, and there is no soil structure below this depth; therefore, there would be no impact on soil structure and minimal impact on plant growth.

AARD - Alberta Agriculture and Rural Development
EC - electrical conductivity
SAR - sodium adsorption ratio

4.2 Groundwater Risk Characterization

Numerical modelling was conducted to assess the potential risk to both of the groundwater receptors indicated in Table C:

- a potential DUA within bedrock below the site
- FAL in surface water downstream of the site

The modelling report is provided in Appendix C. The problem to be solved by the numerical model prior to the 2016 remedial excavation was framed as follows:

1. If none of the soil that exceeds Tier 1/SCAR guidelines is removed from the site, what is the risk to the potential bedrock DUA?

2. If none of the soil that exceeds Tier 1/SCAR guidelines is removed from the site, what is the risk to the nearest surface water that is or could be habitat for FAL?

3. To ensure that both the potential bedrock DUA and surface water do not exceed Tier 1 guidelines indefinitely, what is the volume of soil that would have to be removed from the site?

As indicated in Table C, groundwater beneath the former Calmar 09-25 battery site exceeds Tier 1 guidelines for a number of constituents including salts, metals, and hydrocarbons. Chloride is a conservative constituent as it does not degrade, volatilize, or participate in soil reactions; hence, chloride transport modelling can be used to estimate and understand the maximum extent of impacted groundwater and soil. For this site chloride concentrations were modelled to estimate the spatial extent and peak chloride concentrations in the potential bedrock DUA and at the closest surface water, and to give an indication of the minimum amount of hydrodynamic dispersion that would be experienced by the other, less conservative constituents.

Two models were developed to represent fate and transport in the unsaturated and saturated zones as follows:

- A one-dimensional HYDRUS model was developed to simulate flow and solute transport downward through the unsaturated zone and estimate chloride loading to the water table.

- A three-dimensional numerical model was developed and calibrated in FEFLOW to simulate groundwater flow and chloride transport vertically and horizontally in the saturated zone.

Transient model simulations were conducted to assess peak chloride concentrations at the defined receptors under various uncertainty realizations and excavation/remediation scenarios.

4.2.1 Potable Groundwater

Hydraulic conductivity and pumping tests in the 2014 Phase 2 ESA confirmed the absence of a DUA in the unconsolidated sediments beneath the site (Matrix 2015b). However, the strong downward gradients at several nested piezometers indicate that shallow groundwater is recharging a deeper groundwater system. As discussed in Section 2.1, bedrock beneath the site is interpreted to belong to the Horseshoe Canyon Formation. Although a significant water-bearing zone was not encountered during Matrix's drilling programs, it is known that sandstone within the Horseshoe Canyon Formation is used as aquifers. For the purposes of the model, it was assumed that the deep groundwater system may comprise a single aquifer, located immediately below the depths drilled by Matrix. This has been termed the "potential bedrock DUA." In actuality, any aquifers within the Horseshoe Canyon Formation may be deeper than have been modelled, so in this manner, modelling a potential bedrock DUA at this depth represents a conservative assumption.

In constructing the numerical model, it was observed that:

- Migration of the chloride plume has been less than 80 m from the well centre in the 50 years since the battery was in operation. The electromagnetic (EM) survey (Figure 8) indicates that the leading edge of the plume has travelled only 80 m over 50 years, although it has also moved downward, and beneath the depth of the EM survey using a Geonics EM31 instrument. Consequently, dispersion of the plume as it travels downgradient is expected to reduce concentrations and lower peak chloride concentrations at potential receptors.

- Soil sampling and analysis indicates that most of the chloride has migrated below the root zone. Measured vertical gradients suggest strong downward flow, meaning that concentrations in the root zone are likely to continue to decrease.

If none of the soil exceeding Tier 1/SCAR guidelines had been excavated and replaced with clean soil, the modelling indicated a peak chloride concentration in the potential bedrock DUA of 7,880 mg/L; this was not predicted to occur for another 30 years and after reaching this peak, concentrations would begin to subside as dispersion of the chloride continues.

Under this scenario, the areal extent of the chloride plume that exceeds the drinking water guideline of 250 mg/L would peak approximately 135 years from now, encompassing an area of about 11,000 m^2 centred northeast of the existing trailer park; before and after this, the area of the groundwater plume would be less.

Excavation per the determined remedial action plan (Matrix 2015a) was simulated in the model. Assuming removal and replacement of 32,400 m^3 targeted soils, the modelling indicates a peak chloride concentration in the potential bedrock DUA of 2,652 mg/L. The actual 2016 remedial excavation removed 38,300 m^3 from the area. Increasing soil excavation volumes were modelled, and it was determined that removing even the most impacted 100,000 m^3 of soil would not result in peak chloride concentrations

meeting the drinking water guideline within the potential bedrock DUA. The peak concentration would be approximately three times the drinking water guideline.

4.2.2 Freshwater Aquatic Life

The nearest fish-bearing surface water body is relatively distant: Conjuring Creek is 1 km west of the site (Figure 3). However, approximately 270 m to the northwest of the site lies a stormwater containment pond that can be released directly to the creek during high water periods. Because of this potential, migration to the stormwater pond was modelled rather than migration to the more distant creek.

The modelling showed that there is such a strong downward gradient that horizontal migration of the plume is not a cause for concern. This aligns with the observation that the leading edge of the plume has advanced only 80 m in approximately 50 years since the battery was in operation. Under the no-excavation and remedial action plan scenarios, concentrations at the FAL receptor location remained constant, at a background concentration of 20 mg/L, far less than the FAL guideline of 120 mg/L. Thus, there is no risk to the nearest FAL.

4.2.3 Constituents Other Than Chloride

As a conservative constituent, chloride will move farther than other constituents that degrade, volatilize, or participate in soil reactions. Therefore, the transport distance (extent) of other constituents that are subject to additional processes (e.g., sorption and degradation) will be equal to or less than that estimated for chloride and will undergo proportional reductions in peak concentrations due to hydrodynamic dispersion.

With or without the 2016 remedial excavation, concentrations of sodium, TDS, sulphate, aluminum, arsenic, iron, manganese, selenium, and uranium were projected to possibly exceed drinking water guidelines in the potential DUA. Most of these are naturally occurring in the shallow groundwater, and sorption and reaction processes as they migrate toward the bedrock DUA are likely to attenuate these faster than simple proportional analysis predicts.

The 2016 remedial excavation is expected to result in concentrations of barium, boron, cadmium, chromium, copper, zinc, benzene, ethylbenzene, PHCs F1 and F2, and naphthalene to meet the respective drinking water guidelines in the potential DUA.

Manganese exists naturally at high background concentrations in the unconsolidated sediments. In surface water only, manganese is projected to exceed criteria for FAL, attributable to these naturally high background concentrations. Additional manganese originating from the former battery operations is predicted to remain within the site boundaries and not contribute to elevated manganese at more distant freshwater aquatic receptors.

5 RISK MANAGEMENT PLAN

Impacts were identified and fully delineated by intrusive investigations between 2012 and 2016. Site-specific guidelines were developed in 2014 (Matrix 2015a) and a 2016 remedial excavation was completed in accordance with the site-specific guidelines. The Town of Calmar was informed of the risk management strategy and design and implementation of the excavation plan. Several trailers in the trailer park were temporarily moved to allow excavation of highly impacted flare pit material. Soil was excavated in the flare pit and production areas to between 1 and 3 m to address salinity impacts, and to 3.5 m in the production area to address hydrocarbons. Soil was excavated in the wellhead area to between 0.6 and 2.75 m; during the excavation two drilling sump cells were discovered and all sump material was fully excavated (Matrix 2017a).

The 2016 excavation addressed all soil impacts required per the RMP, and 3 years of follow-up groundwater sampling were completed to provide confidence that the excavation met the expected outcomes predicted by the site-specific numerical model. Vegetation assessment will confirm if equivalent land capability has been met following the excavation. Long-term administrative management is required by the town to ensure that development does not disrupt impacts remaining at depth.

5.1 Risk Management Strategy

Strategies for managing remaining risks are summarized in Table G along with proposed timelines.

TABLE G Risk Management Strategy Table

Receptor/Exposure Pathway	Strategy	Time Line
Human ingestion of drinking water	Town of Calmar sources water from City of Edmonton; no drinking water wells should be in use in proximity to the site. The numerical model confirms migration of impacts in the DUA is not predicted to exceed 140 m in 200 years (Appendix C).	Completed. Site was monitored for 3 years (4 sampling events) and observations were consistent with model predictions – no further groundwater monitoring is recommended.
Protection of freshwater aquatic life	The nearest surface water receptor is 270 m northwest of the site. Model predictions confirm aquatic life receptors are not at risk (Appendix C).	Completed.
Direct soil contact: eco	Site-specific guidelines were developed to be protective of this pathway for EC and SAR and per the site-specific guidelines, impacts were excavated to 1 to 3 m. Regarding PHC impacts, per Directive 079 (AER 2014), development is not permitted within 5 m of an abandoned wellhead. These impacts should therefore remain undisturbed.	Ongoing - Long-term exposure control required by limiting development in the parkland.

Receptor/Exposure Pathway	Strategy	Time Line
Direct Soil Contact: human	Per Directive 079 (AER 2014), development is not permitted within 5 m of an abandoned wellhead. These impacts should therefore remain undisturbed.	Ongoing - long-term exposure control required by limiting development in the parkland.
Management Limit	Per Directive 079, development is not permitted within 5 m of an abandoned wellhead. These impacts should therefore remain undisturbed.	Ongoing - long-term exposure control required by limiting development in the parkland.
Vapour Inhalation (slab)	Impacts are within 5 m of the wellhead – per Directive 079, no development is permitted here.	Ongoing - long-term exposure control required by limiting development in the parkland.
Vapour Inhalation (basement)	Impacts are within 5 m of the wellhead – per Directive 079, no development is permitted here.	Ongoing - long-term exposure control required by limiting development per Directive 079.

DUA - domestic use aquifer
EC - electrical conductivity
PHC - petroleum hydrocarbon

5.2 Obligations for Long-term Care and Control

Remediation was completed to the site-specific criteria described in Section 4.1.2.5. While impacts and exposure pathways associated with potential human health risks were remediated, chloride, PHC, and metals impacts remain.

In the parkland areas, particularly around the wellhead, constituents remaining between 0.6 and 6.1 m will be managed through administrative exposure controls so that buildings and/or water wells will not be established on the affected portions of parkland. Deep soils on the residential properties (up to 3 m deep as appropriate) were remediated to preclude the need for any exposure controls from a soil quality perspective.

The Town of Calmar sources its water supply from the City of Edmonton. Shallow groundwater and bedrock groundwater in the Calmar area are typically of poor quality, so it is unlikely that local aquifers will be exploited. Residents of existing and proposed residential properties will receive Municipally supplied water from Edmonton's water treatment plant. Thus, administrative controls on water usage are moot and preventing groundwater usage will not create hardship.

5.3 Monitoring Plan

Following the 2016 remediation program, groundwater monitoring was completed annually from 2017 through 2019 to ensure that soil remediation would also address groundwater impacts. Results from the monitoring programs were compared with the site-specific model predictions to confirm that chloride concentrations were decreasing at predicted rates. Since 2017, chloride concentrations in well 17-12a, installed directly in the former flare pit, have decreased by over 70%; this aligns with model predictions (Matrix 2019). The model also predicted concentrations at well 14-11a would decrease to background,

which had not yet occurred in 2019, but concentrations had decreased to below Tier 1 guidelines. Dissolved hydrocarbon concentrations met Tier 1 guidelines during the first post-remediation sampling event in 2017 and have continued to meet guidelines.

Based on the groundwater sampling since the 2016 excavation, and the general alignment of predicted to observed concentrations, groundwater monitoring has been discontinued and no additional monitoring is planned.

Vegetation monitoring is required to verify that equivalent land capability has been established following the 2016 remedial excavation. In 2018, scentless chamomile, a noxious weed, was observed near the trailer park fenceline on the west side of the site. Noxious weeds are not related to residual impacts in soil but to physical disturbances during excavation activities. Weed control measures should be implemented and a detailed site assessment completed to confirm that vegetation established on the site is sustainable and suitable for the intended land use.

5.4 Contingency Plan

Canadian Natural may elect to retain long-term responsibility for the contingency plan or may consider contracting the responsibility to the Town of Calmar or another stakeholder.

The result of remediation to the site-specific criteria is expected to provide protection to plants typically grown in a residential setting, within the limits of the particular soil type and climate of this site. Should there be any indication that plants are or could be impacted unacceptably by salinity, the following contingency plan would be implemented:

- characterizing and determining the extent of any soil that is adversely affecting vegetation
- reviewing whether affected vegetation could be replaced by more salinity tolerant species (which offer the side benefit of also being more drought tolerant)
- implementing targeted remediation that could include additional soil removal and/or groundwater treatment depending on the results of the soil characterization
- continue monitoring plants, which could include regular assessments of plant health and/or plant tissue analyses

5.5 Communication Plan

Prior to the 2016 remedial excavation, stakeholder engagement was led by Canadian Natural and supported by Matrix. Key stakeholders include the trailer park owner and residents, the developer, the Town of Calmar and applicable regulators (likely Alberta Environment and Parks since this is within a developed urban setting). The RMP, developed prior to remediation, was presented to all applicable landowners and accepted as described. A written agreement between Canadian Natural and the Town of Calmar will document the requirement for administrative management and controls of remaining PHC, PAH, and lead impacts around the wellhead.

6 REFERENCES

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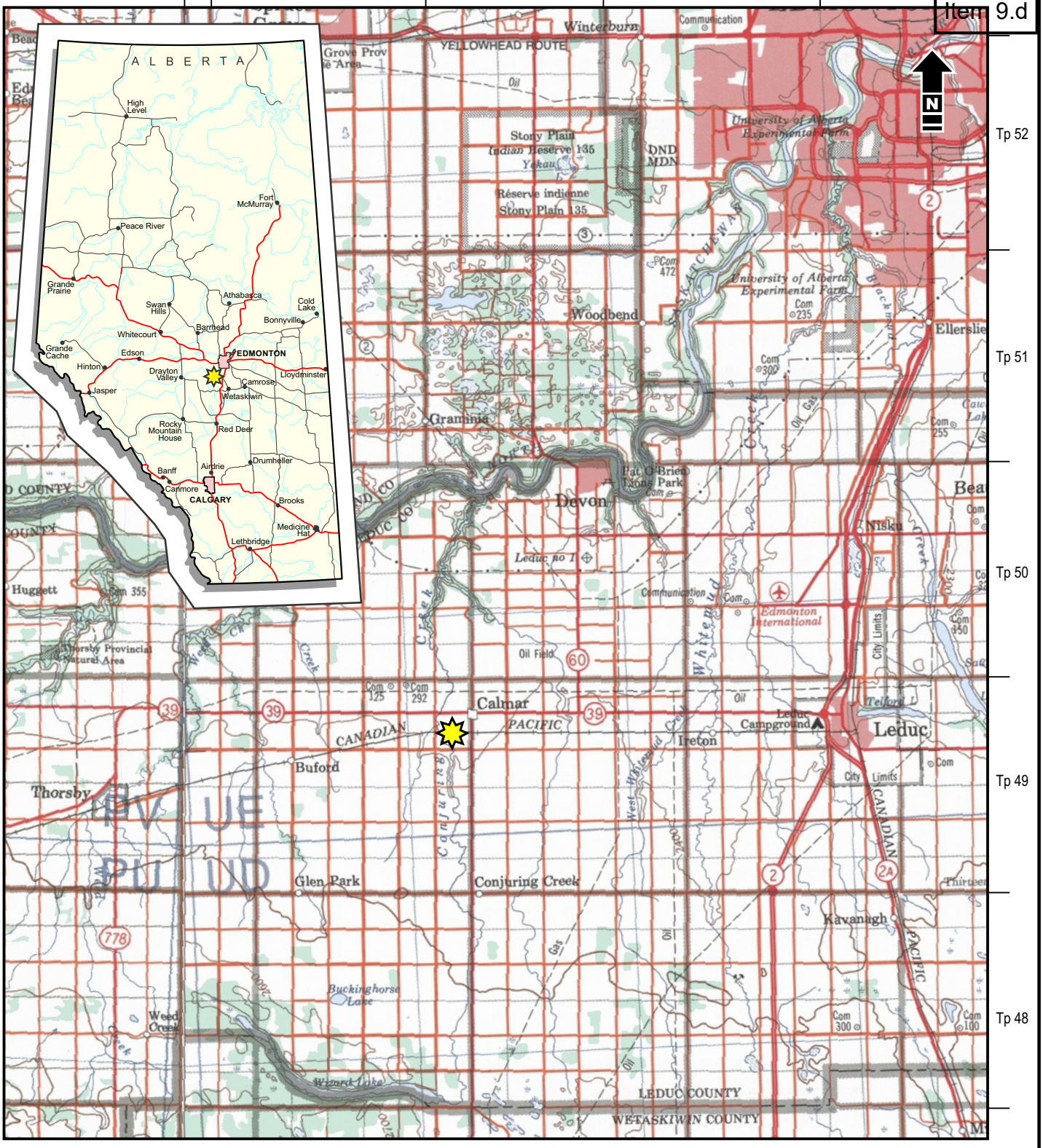

Site Location

Reference:
83G (Edmonton), Edition 4, UTM Zone 12, NAD83
83H (Wabmun Lake), Edition 3, UTM Zone 11, NAD83
The Canada Centre For Mapping, Department of Energy, Mines and Resources.

1:250,000 metres
2,500 0 2,500 5,000

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09-25-049-27 W4M

Site Location Map

Date:	Project:	Technical:	Reviewer:
March 2021	17295-LP-20	S. Brown	M. Allan

Figure 1

F:\17295\Drafting\2020\17295-LP-20.cdr

Plot 1:1 = Tabloid (L)

Easting (m)

312240 312270 312300 312330 312360 312390 312420 312450 312480 312510 312540 312570 312600 312630 312660 312690 312720 312750 312780

Northing (m)

5905080 5905050 5905020 5904990 5904960 5904930 5904900 5904870 5904840 5904810

N

47th Avenue

Owner: Calmar Southbridge Developments Inc.

Owner: Canadian Natural Resources Ltd.

Owner: Town of Calmar

Owner: Kutny Construction Ltd.

14–8c
14–8a
14–8d
M12–15
14–9d
14–9a
14–9c
14–10c
17–10a
14–11c
14–11a
17–2
13–2
13–4
17–4
17–12c
14–12c
M12–18
17–13a
17–13c
17–12a
14–12a
13–1
Former Flare Pit
13–6b
M12–19
M12–17b
M12–17a
Approximate Lease Boundary
Former Process Buildings
M12–16
13–5
13–3
M12–12
Approx. Flowline
00/09–25
Former Tank
13–7
46th Avenue
51st Street

- Wellhead - Abandoned
- Monitoring Well
- Abandoned Well
- Damaged Well
- Abandoned Well*
- Flare Pit Investigation Area
- Production Area
- Well Centre Area
- Property Boundary

* Abandoned following August 2016 Groundwater Monitoring Program for 2016 Excavation Program.

Reference:
Aerial imagery (September 28, 2017) obtained from Valtus © (2021) used under license.
Nichols Environmental Ltd.; Project #:12-380-TOC dated December 2012.

1:1500 metres
15 0 15 30
NAD 1983 UTM Zone 12N

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09-25-049-27 W4M

Site Plan

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-SP-20	S. Brown	M. Allan

Figure 2

F:\17295\Drafting\2020\17295-SP-20.dwg - Site - March 22, 2021 1:04:25 PM - Gary Evenson

Plot 1:1 = Tabloid (L)

Item 9.d

Easting (m)

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Northing (m)

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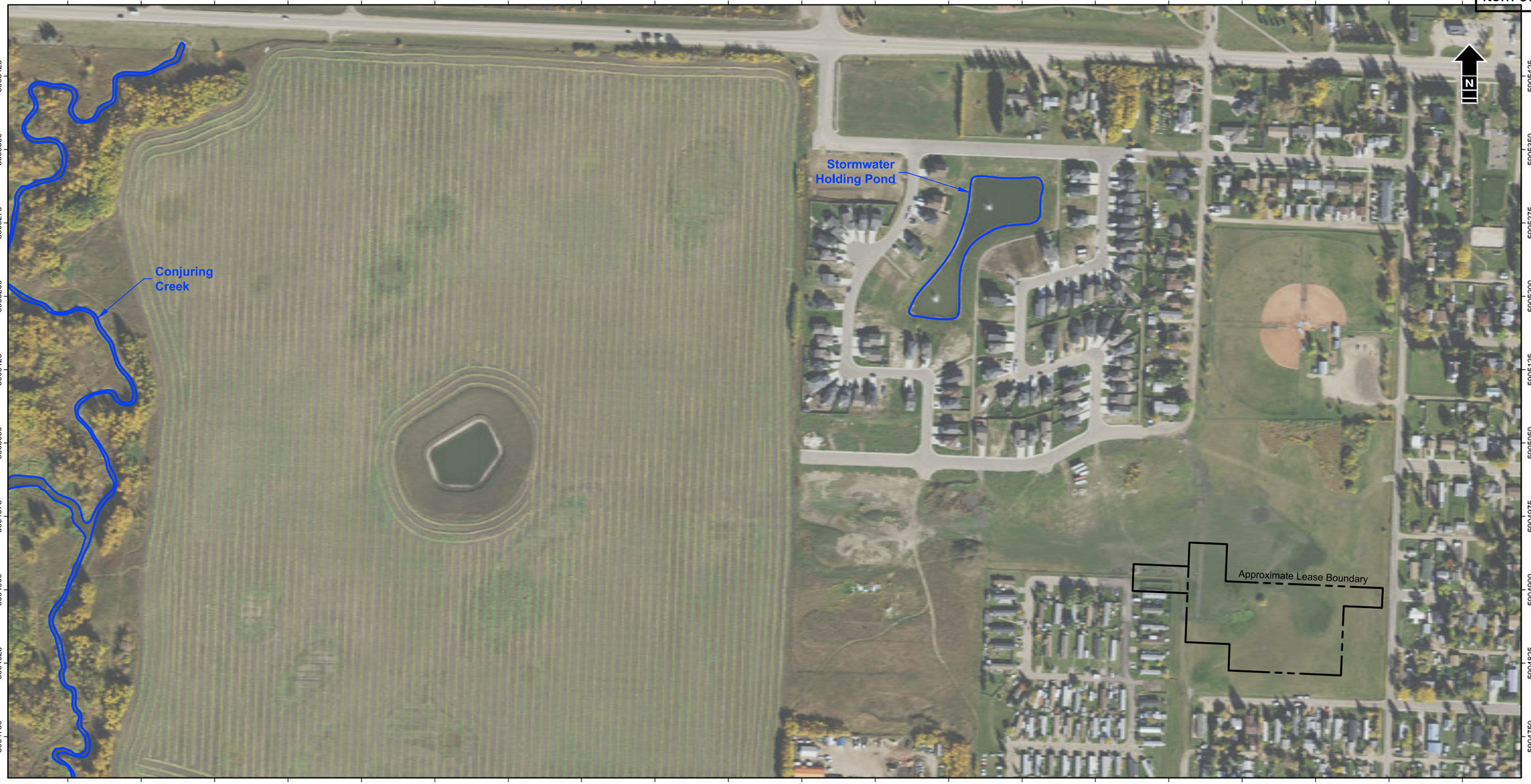

Surface Water Receptor

Reference:
Aerial imagery (September 28, 2017) obtained from Vaitus © (2021) used under license.

1:4000 metres
40 0 40 80
NAD 1983 UTM Zone 12N

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Surface Water Receptors

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-SP-20	S. Brown	M. Allan

Figure 3

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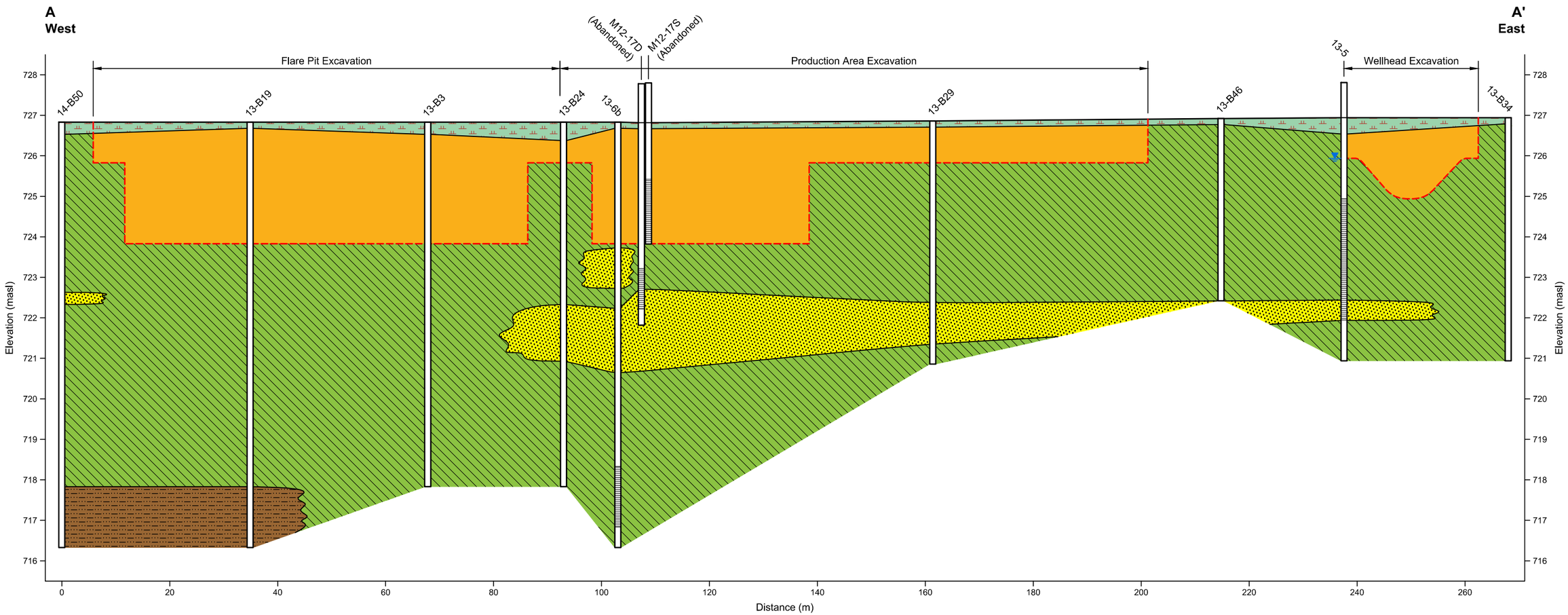
Item 9.d



Topsoil
Clay Fill
Clay
Sand
Siltstone
Excavation

Borehole / Monitoring Well
Solid Pipe
Groundwater Elevation - October 21, 2019
Screened Interval

Reference:

1:100 metres
1 0 1 2
Vertical Scale

1:750 metres
7.5 0 7.5 15
Horizontal Scale

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09-25-049-27 W4M

West - East
Cross-section A-A'

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-XS-20	S. Brown	M. Allan

Figure 4

Plot 1:1 = Tabloid (L)

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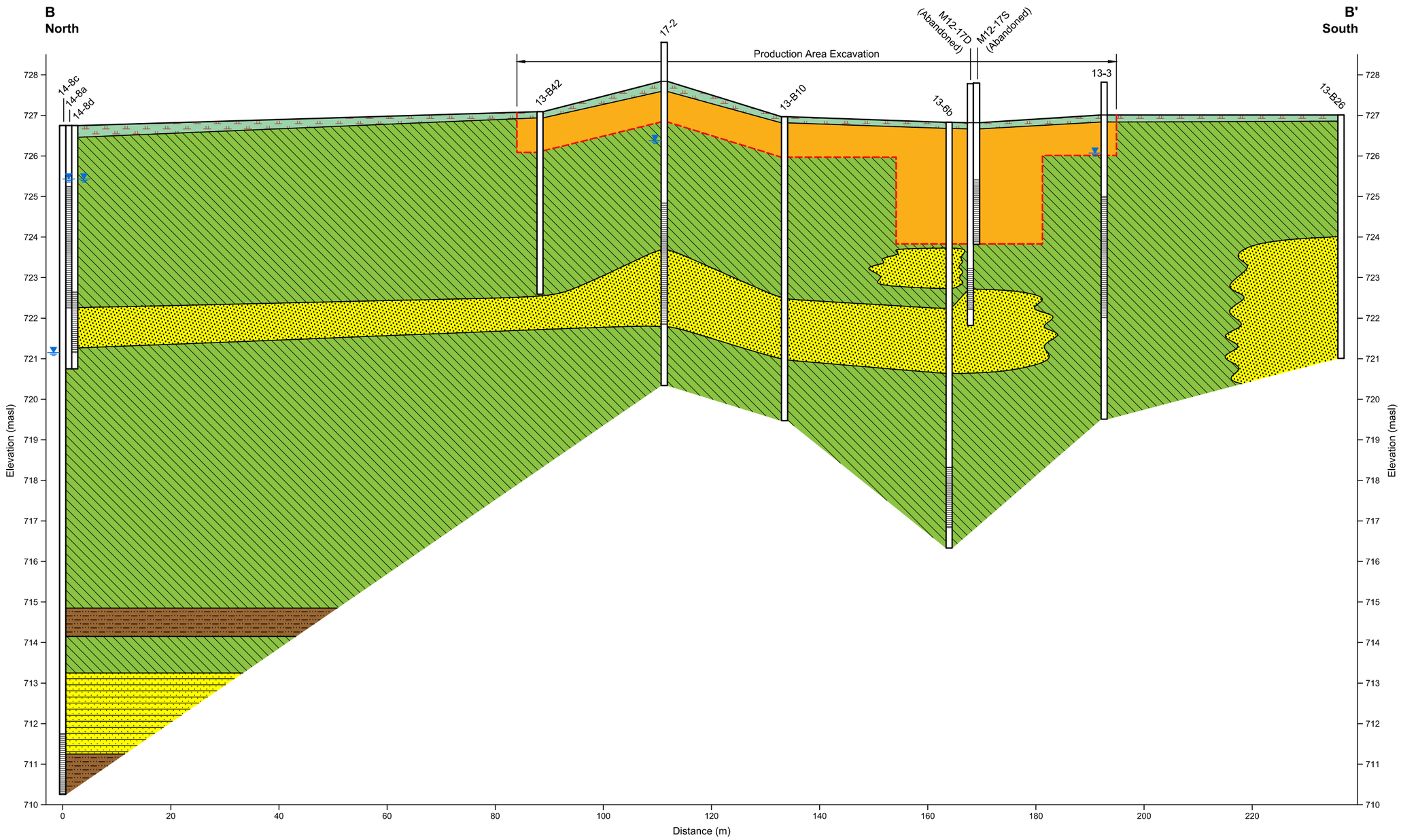
Item 9.d



Topsoil
Clay Fill
Clay
Sand
Siltstone
Sandstone
Excavation

Borehole / Monitoring Well
Solid Pipe
Groundwater Elevation - October 21, 2019
Screened Interval

Reference:

1:100 metres
1 0 1 2
Vertical Scale

1:750 metres
7.5 0 7.5 15
Horizontal Scale

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09-25-049-27 W4M

North - South Cross-section B-B'

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-XS-20	S. Brown	M. Allan

Figure 5

Plot 1:1 = Tabloid (L)

Easting (m)

312240 312270 312300 312330 312360 312390 312420 312450 312480 312510 312540 312570 312600 312630 312660 312690 312720 312750 312780

Northing (m)

5905080 5905050 5905020 5904990 5904960 5904930 5904900 5904870 5904840 5904810

N

47th Avenue

46th Avenue

51st Street

Boron Impacted
from 3.0 to 5.5 m
Area = ~1,280 m²
Volume = 3,200 m²

Boron Impacted
from 0.0 to 0.3 m
Area = ~270 m²
Volume = 81 m²

Remaining EC & SAR above Tier 1 Guidelines Contained in 2016 Excavation Area (16,683 m²) between 3 m and maximum of 10 m, 16,7000 to 38,200 m³

Wellhead Impacts
(see Figure 6 for details)

Approximate Former Process Buildings

Former Flare Pit

Approx. Flowline

Former Tank

A A'

B B'

14–8c 14–8a 14–8d
14–9d 14–9a 14–9c
14–10c 17–10a 14–10a
14–11c 14–11a
M12–15
M12–14
M12–20
M12–18
M12–19
M12–17D M12–17S
M12–16
M12–12 M12–11 M12–10
M12–09
M12–08
M12–07
M12–06
M12–05
14–12c 14–12a
17–12c 17–12a
17–13a 17–13c
13–6b
17–2 13–2
17–4 13–4
00/09–25–2–03
M11M12-02
13–1 13–2 13–3 13–4 13–5 13–7
13–B1 13–B2 13–B3 13–B4 13–B5 13–B6 13–B7 13–B8 13–B9 13–B10 13–B11 13–B12 13–B13 13–B14 13–B15 13–B16 13–B17 13–B18 13–B19 13–B20 13–B21 13–B22 13–B23 13–B24 13–B25 13–B26 13–B27 13–B28 13–B29 13–B31 13–B33 13–B34 13–B35 13–B36 13–B37 13–B38 13–B39 13–B40 13–B41 13–B42 13–B43 13–B44 13–B45 13–B46 13–B47 13–B48 13–B49 13–B50 13–B51 13–B52
16–B53 16–B54 16–B55 16–B56 16–B57 16–B58 16–B59 16–B60 16–B61 16–B62 16–B63 16–B64 16–B65 16–B66 16–B67 16–B68 16–B69 16–B70 16–B71 16–B72 16–B73 16–B74 16–B75 16–B76 16–B77 16–B78 16–B79 16–B80 16–B81 16–B82 16–B83 16–B84 16–B85 16–B86 16–B87 16–B88 16–B89 16–B90 16–B91
16–H1 16–H2 16–H3 16–H4 16–H5 16–H6 16–H7 16–H8 16–H9 16–H10
16–LF1 16–LF2 16–LF3 16–LF4 16–LF5 16–LF6

Wellhead - Abandoned
Monitoring Well
Abandoned Well
Damaged Well
Abandoned Well*
Borehole
Hand Auger
Cross-section Location

Buried Gas Line and Power Cable
Buried Pipeline
Buried Water and Sewer Line
Power Line
Flare Pit Investigation Area
Production Area
Well Centre Area
Final Excavation Extent

Boron Impacted Area

* Abandoned following August 2016 Groundwater Monitoring Program for 2016 Excavation Program.

Reference:
Aerial imagery (September 28, 2017) obtained from Valtus © (2021) used under license.
Nichols Environmental Ltd.; Project #:12-380-TOC dated December 2012.

1:1500 metres
15 0 15 30
NAD 1983 UTM Zone 12N

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Canadian Natural Resources Limited
09-25-049-27 W4M

Historical Investigations

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-SP-20	S. Brown	M. Allan

Figure 6a

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Plot 1:1 = Tabloid (L)

Easting (m)

312550 312555 312560 312565 312570 312575 312580 312585 312590 312595 312600 312605 312610 312615 312620 312625 312630 312635 312640

Northing (m)

5904895 5904890 5904885 5904880 5904875 5904870 5904865 5904860 5904855 5904850

N

M12–05

13–5

16–X111 16–X112 16–X113 16–X90

1

13–B40

North Sump

16–X110 16–X109 16–X108 16–X107 16–X88

16–X87

13–B37

M12–07

13–B39

16–X73a

16–X89

16–X72

16–X69

16–X70

F1, F2, F3 Impacts
Cumulative Area ≈ 115 m²
Depth ≈ 1.0 - 2.5 m
Volume ≈ 170 m³

South Sump

13–B34

16–X71

16–X76

M12–01

16–X75

16–X74

M12–02

00/09–25

13–B33

13–B38

13–B31

13–B30

M12–04

16–X38

16–X37

16–X33

16–X32

M12–03

16–X36

16–X39

Benzene, F1, F2, F3, PAHs, Lead, Barium Impacts
Area ≈ 935 m²
Depth ≈ 3.0 - 6.1 m
Volume ≈ 2,900 m³

13–B47

13–B35

13–B32

13–B36

- Wellhead - Abandoned
- Monitoring Well
- Abandoned Well*
- Borehole
- Hand Auger
- Excavation Sample
- Final Excavation Boundary
- 1 Excavation Depth Contour (m)
- Locations with Shallow (1 - 2.5 m) Remaining Impacts
- Locations and Estimated Area with Deeps (3 - 6.1 m) Remaining Impacts

* Abandoned following August 2016 Groundwater Monitoring Program for 2016 Excavation Program.

Reference:
Aerial imagery (September 28, 2017) obtained from Valtus © (2021) used under license.
Nichols Environmental Ltd.; Project #:12-380-TOC dated December 2012.

1:250 metres
2,5 0 2,5 5
NAD 1983 UTM Zone 12N

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Canadian Natural Resources Limited
09-25-049-27 W4M

Wellhead - Remaining Impacts

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-SP-20	S. Brown	M. Allan

Figure 6b

F:\17295\Drafting\2020\17295-SP-20.dwg - WCExc - March 23, 2021 9:18:23 AM - Gary Evenson

Plot 1:1 = Tabloid (L)

Easting (m)

312240 312270 312300 312330 312360 312390 312420 312450 312480 312510 312540 312570 312600 312630 312660 312690 312720 312750 312780

Northing (m)

5905080 5905050 5905020 5904990 5904960 5904930 5904900 5904870 5904840 5904810

N

47th Avenue

47th Avenue

46th Avenue

51st Street

Approximate Lease Boundary

14–8c
14–8d
14–8a
33.8

M12–15
21.6

14–9d
14–9a
14–9c
12.5

14–10c
3.6
17–10a

14–11c
14–11a
101

100

1000

10000

17–2
4190

17–4
2320

166
17–13a
17–13c

17–12c
17–12d
12800

13–1
44.9

13–3
196

M12–12
119

13–5
62

00/09–25

13–7
143

Wellhead - Abandoned
Monitoring Well
Flare Pit Investigation Area
Production Area
Well Centre Area

196 Groundwater Chloride Concentration (mg/L)
1000 Groundwater Chloride Concentration Contour (mg/L)
Groundwater Chloride Concentration Contour Inferred

Reference: May 9 - July 3, 2013 aerial photograph obtained from Valtus Imagery Services. Nichols Environmental Ltd.; Project #:12-380-TOC dated December 2012.

1:1500 metres
15 0 15 30
NAD 1983 UTM Zone 12N

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Canadian Natural Resources Limited
09-25-049-27 W4M

Shallow Groundwater Chloride Map
October 21, 2019

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-SP-20	S. Brown	M. Allan

Figure 7

F:\17295\Drafting\2020\17295-SP-20.dwg - C191021 - March 19, 2021 3:37:41 PM - Gary Evenson

Plot 1:1 = Tabloid (L)

Easting (m)

312240 312270 312300 312330 312360 312390 312420 312450 312480 312510 312540 312570 312600 312630 312660 312690 312720 312750 312780

Northing (m)

5905080 5905050 5905020 5904990 5904960 5904930 5904900 5904870 5904840 5904810

47th Avenue

47th Avenue

Approximate Lease Boundary

46th Avenue

51st Street

00/09-25

N

Wellhead - Abandoned

Final Excavation Extent

* Abandoned following August 2016 Groundwater Monitoring Program for 2016 Excavation Program.

Reference:
Aerial imagery (September 28, 2017) obtained from Valtus © (2021) used under license.
Nichols Environmental Ltd.; Project #:12-380-TOC dated December 2012.

60 80 100 120 140 160 180 200 220 240
APPARENT CONDUCTIVITY (mS/m)

1:1500 metres
15 0 15 30
NAD 1983 UTM Zone 12N

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

Canadian Natural Resources Limited
09-25-049-27 W4M

Final 2016 Remediation Extents Overlain on 2013 EM31 Survey

Date:	Project:	Submitter:	Reviewer:
March 2021	17295-SP-20	S. Brown	M. Allan

Figure 8

F:\17295\Drafting\2020\17295-SP-20.dwg - RemEx - March 19, 2021 3:42:37 PM - Gary Evenson

TABLE 1

Water Wells Within a 1 km Radius of 09-25-049-27 W4M

Canadian Natural Resources Limited

09-25-049-27 W4M

Water Well Number	Well ID*	Location	Well Owner	Direction From Site	Distance From Site km**	Total Depth m	Top of Screen m	Bottom of Screen m	Top of Perforation m	Bottom of Perforation m	Bottom of Casing m	Depth to Water m	Bedrock Depth m	Date of Information	Proposed Use For Well	Type of Work
1	283129	9-25-49-27-W4M	Calmar, Town Of #Rink	NW	0.01	---	---	---	---	---	---	---	---	1967/09/05	Domestic	Chemistry
2	283126	NE-25-49-27-W4M	Calmar, Town Of	NW	0.29	62.79	---	---	---	---	24.38	10.97	17.07	1957/12/04	Municipal	Well Inventory
3	283130	NE-25-49-27-W4M	Calmar, Town Of	NW	0.29	---	---	---	---	---	---	---	---	---	---	Unknown
4	283128	NE-25-49-27-W4M	Calmar, Town Of #Well	NW	0.29	67.67	52.43	56.08	---	---	52.43	---	15.85	1967/05/16	Municipal	New Well
5	283123	NE-25-49-27-W4M	Nystrom, Glen	NW	0.29	28.96	---	---	---	---	---	9.14	---	1974/08/09	Domestic	Chemistry
6	283122	NE-25-49-27-W4M	Calmar, Town Of	NW	0.29	61.27	---	---	---	---	---	---	11.58	1964/04/28	Municipal	New Well
7	283125	NE-25-49-27-W4M	Calmar, Town Of	NW	0.29	73.15	---	---	---	---	---	---	---	1966/01/01	Municipal	New Well
8	283127	NE-25-49-27-W4M	Calmar, Town Of	NW	0.29	73.15	---	---	---	---	---	---	5.49	1966/06/29	Municipal	New Well
9	281060	NE-25-49-27-W4M	Calmar, Town Of #6	NW	0.29	54.86	---	---	30.48	54.86	---	5.64	20.73	1960/09/01	Municipal	New Well
10	283131	NE-25-49-27-W4M	Calmar, Town Of #Well	NW	0.29	64.01	---	---	---	---	---	---	20.42	1964/04/29	Municipal	New Well
11	283118	8-25-49-27-W4M	Calmar, Town Of	S	0.40	54.86	---	---	24.38	54.86	---	15.85	15.24	1972/11/09	Municipal	New Well
12	283133	16-25-49-27-W4M	Calmar Creamery	N	0.41	54.86	---	---	---	---	---	---	---	1931/01/01	Domestic	Federal Well Survey
13	283132	16-25-49-27-W4M	Calmar, Town Of #Well	N	0.41	---	---	---	---	---	---	---	---	1968/09/20	Municipal	Chemistry
14	283124	15-25-49-27-W4M	Calmar, Town Of	NW	0.58	54.86	---	---	24.38	54.86	---	15.85	15.24	1972/11/09	Municipal	New Well
15	283119	SE-25-49-27-W4M	Petersen, Dona	S-SW	0.63	---	---	---	---	---	---			1985/06/05	Domestic	Chemistry
16	283120	SE-25-49-27-W4M	Krenke, Ron	S-SW	0.63	---	---	---	---	---	---	---	---	---	---	Unknown
17	100346	SE-25-49-27-W4M	Calmar, Town Of	S-SW	0.63	65.53	---	---	---	---	19.20	11.58	18.29	1968/05/28	Municipal	New Well
18	100347	SE-25-49-27-W4M	Calmar, Town Of	S-SW	0.63	60.96	---	---	---	---	19.20	10.36	16.76	1968/06/18	Municipal	New Well
19	283116	SE-25-49-27-W4M	Manchak, R.	S-SW	0.63	42.67	---	---	---	---	17.98	9.75	17.07	1979/06/28	Domestic	New Well
20	283117	SE-25-49-27-W4M	Kiseloff, A.	S-SW	0.63	28.96	---	---	---	---	20.12	9.75	15.85	1967/10/17	Domestic	New Well
21	1120195	SE-25-49-27-W4M	Zoltenko, Mr & Mrs Len	S-SW	0.65	35.05	---	---	32.00	35.05	20.12	6.44	14.02	2003/08/14	Domestic & Stock	New Well
22	282831	NW-30-49-26-W4M	Calmar, Town Of	E-NE	0.65	---	---	---	---	---	---	---	---	---	Domestic	Chemistry
23	283201	1-36-49-27-W4M	Calmar Lumber Co	N	0.81	43.89	---	---	---	---	---	---	---	---	Domestic	Federal Well Survey
24	283121	2-25-49-27-W4M	Borys, William	S-SW	0.90	39.62	---	---	---	---	---	24.38	---	1965/06/08	Domestic	Chemistry
25	281059	4-30-49-26-W4M	Calmar, Town Of #73-2	S-SE	0.91	74.07	---	---	---	---	19.51	---	15.24	1973/03/20	Municipal	New Well
26	282832	14-30-49-26-W4M	Frederickson, Teckla	E-NE	0.92	53.34	---	---	---	---	---	---	---	---	Domestic	Chemistry

Notes:

--- - not available

* - Alberta Environment and Parks (AEP). 2021. Alberta Water Well Information. Provided to Matrix Solutions Inc. by the Groundwater Information Centre (GIC) March 2021. Uploaded to Prometheus Matrix Field Data Portal. Accessed on March 9, 2021.

** - When no specific project location available, site location is the centre of the LSD or the centre of the quarter section when LSD is not specified.
- the presence and location of these wells were not field verified by Matrix personnel.

APPENDIX A
Proponent and Consultant Contact Information

APPENDIX A

CONTACT INFORMATION

Company	Contact Name	Address	Phone Number	Email
Matrix Solutions Inc.	Lindsay Oiffer	Suite 200, 5083 Windermere Bldvd. SW Edmonton, Alberta T6W 0J5	780.989.8347	LOiffer@matrix-solutions.com
Canadian Natural Resources Limited	Ryan Okada	Suite 2500, 855 - 2 Street SW Calgary, Alberta T2P 4J8	403.386.5617	Ryan.okada@cnrl.com

APPENDIX B
Previous Investigations

TABLE B1

Historical Groundwater Quality Results - General and Inorganic Parameters

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2-N+NO_3-N mg/L	T-Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
Flare Pit																	
Trailer Park																	
13-1	27-Aug-13	17295130827015	7.96	2210	357	71.9	59.1	2.64	63.1	***857***	<0.05	<0.05	<0.071	425	518	1190	***1670***
13-1	11-Sep-14	17295140911005	7.6	2320	404	77.7	55.1	3.01	42.3	***953***	<0.02	<0.05	<0.054	442	539	1330	***1800***
13-1	29-Jul-15	17295150729013	7.5	2390	406	76.9	53.3	3.23	67.6	***1040***	<0.020	<0.040	<0.045	337	411	1330	***1850***
13-1	02-Nov-15	17295151102026	7.94	3410	554	154	148	7.02	15.3	***1850***	<0.050	<0.10	<0.11	390	476	2020	***2960***
13-1	24-Aug-16	17295160824025	7.65	2610	427	96	89	4.85	25.1	***1300***	<0.020	<0.040	<0.045	358	437	1460	***2160***
13-1	28-Jul-17	17295170728013	8.19	2050	317	69	72.8	2.43	53.6	***789***	<0.020	<0.040	<0.045	402	490	1080	***1570***
13-1	03-Nov-17	17295171103011	8.11	3310	558	149	146	6.91	18.4	***1850***	0.052	<0.10	<0.11	297	362	2010	***2930***
13-1	19-Oct-18	17295181019012	8.05	2780	549	96.8	80.3	4.75	44.3	***1480***	<0.050	1.95	1.95	355	433	1770	***2480***
13-1	21-Oct-19	17295191021011	7.67	1670	416	85.5	68.2	2.84	44.9	***1030***	<0.020	0.059	0.059	410	500	1390	***1890***
13-3	27-Aug-13	17295130827001	7.43	3590	614	91.4	94	3.52	***394***	***1200***	<0.5	<0.5	<0.71	584	713	1910	***2750***
13-3	13-Feb-14	17295140213024	7.58	3420	610	87.8	84.5	3.16	***288***	***1030***	<0.05	<0.05	<0.071	617	753	1880	***2470***
13-3	11-Sep-14	17295140911008	7.4	3400	602	93.3	94	3.77	***311***	***1120***	<0.02	<0.05	<0.054	579	706	1890	***2570***
13-3	29-Jul-15	17295150729006	7.57	3150	572	85.4	83.2	3.67	***235***	***1080***	<0.050	<0.10	<0.11	534	652	1780	***2380***
13-3	02-Nov-15	17295151102022	7.76	3270	575	100	90.3	3.9	***234***	***1140***	<0.050	<0.10	<0.11	575	702	1850	***2490***
13-3	24-Aug-16	17295160824007	7.53	3210	574	95.5	103	3.92	***318***	***1200***	<0.050	<0.10	<0.11	499	609	1830	***2590***
13-3	28-Jul-17	17295170728008	7.74	2950	461	80.6	86.8	3.54	***267***	***988***	<0.020	<0.040	<0.045	454	554	1480	***2180***
13-3	03-Nov-17	17295171103009	7.73	2920	580	88.3	90.3	3.57	***261***	***1150***	<0.050	<0.10	<0.11	286	349	1810	***2370***
13-3	19-Oct-18	17295181019011	7.84	3220	578	94	95.7	3.59	***269***	***1260***	<0.050	<0.10	<0.11	465	567	1830	***2580***
13-3	21-Oct-19	17295191021010	7.6	2200	621	99.1	120	3.71	***196***	***1540***	<0.050	0.46	0.46	463	565	1960	***2860***
Developer																	
14-9a	12-Feb-14	17295140212004	7.34	1830	244	64	77.4	3.34	16	***704***	<0.05	<0.05	<0.071	361	441	873	***1330***
14-9a	11-Sep-14	17295140911004	7.48	1310	183	45.8	50.1	4.74	15.7	393	<0.02	<0.05	<0.054	326	398	646	***888***
14-9a	29-Jul-15	17295150729016	7.84	1170	157	39.7	41.5	3.78	10.6	340	<0.010	0.028	0.028	282	344	556	***762***
14-9a	02-Nov-15	17295151102006	8.06	1190	161	44.8	50.3	4.1	10.5	341	<0.010	<0.020	<0.022	315	384	587	***801***
14-9a	24-Aug-16	17295160824020	7.68	1300	174	44.4	52	3.49	10.9	373	<0.010	<0.020	<0.022	382	466	617	***887***
14-9a	28-Jul-17	17295170728016	8.17	1100	140	36.6	37.6	7.18	28.5	291	<0.010	<0.020	<0.022	294	359	500	***739***
14-9a	03-Nov-17	17295171103018	8.41	1240	172	42.4	45.4	7.22	26.4	309	0.037	0.047	0.084	346	404	604	***834***
14-9a	19-Oct-18	17295181019022	8.24	773	97	30	24.9	2.9	35.4	68.4	<0.010	0.058	0.058	312	380	366	446
14-9a	21-Oct-19	17295191021018	7.72	704	117	29.7	25.4	6.47	12.5	123	<0.010	0.076	0.076	331	404	414	***513***
14-9c	12-Feb-14	17295140212006	8.1	2310	41.6	10.3	***521***	2.53	5.23	***497***	<0.05	<0.05	<0.071	723	883	146	***1510***
14-9c	11-Sep-14	17295140911025	***8.71***	1620	16.7	3.55	***396***	2.54	12.8	***253***	<0.02	<0.05	<0.054	568	635	56.3	***1030***
14-9c	29-Jul-15	17295150729017	7.46	2350	18.7	3.98	***504***	2.28	15.1	***518***	<0.020	1.81	1.81	663	809	63.1	***1470***
14-9c	02-Nov-15	17295151102007	***8.51***	2310	17.9	4.13	***527***	2.35	5.5	***443***	***0.075***	0.092	0.167	741	867	61.7	***1450***
14-9c	24-Aug-16	17295160824022	8.47	2150	14.1	2.99	***502***	1.93	3.6	***421***	<0.020	<0.040	<0.045	709	830	47.5	***1370***
14-9c	28-Jul-17	17295170728022	***8.71***	2120	14.4	3.18	***513***	3.15	4.2	***380***	<0.020	<0.040	<0.045	756	862	49.1	***1380***
14-9c	03-Nov-17	17295171103017	***8.82***	2300	13.7	3.01	***527***	2.98	4.8	***432***	<0.050	0.22	0.22	795	884	46.6	***1470***
14-9c	19-Oct-18	17295181019023	8.48	2750	41.9	8.9	***598***	3.46	<2.5	***783***	<0.050	<0.10	<0.11	713	832	141	***1860***
14-9c	21-Oct-19	17295191021016	***8.61***	1610	15.9	3.08	***433***	3.32	1.7	***301***	<0.020	0.048	0.048	675	781	52.4	***1160***
Alberta Tier 1 - Residential/Parkland*			**6.5-8.5^{P}**	**NS**	**NS**	**NS**	**200^{P,AO}**	**NS**	**120^{A}**	**H^{LAP,***}**	**Cl^{A,***}**	**3^{A}**	**NS**	**NS**	**NS**	**NS**	**500^{P,AO}**
Canadian Drinking Water Guidelines**			**7.0-10.5**	**NS**	**NS**	**NS**	**200^{AO,T}**	**NS**	**250^{AO}**	**500^{AO}**	**1^{MAC}**	**10^{MAC}**	**NS**	**NS**	**NS**	**NS**	**500^{AO}**

TABLE B1

Historical Groundwater Quality Results - General and Inorganic Parameters

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2-N+NO_3-N mg/L	T-Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
Flare Pit																	
Developer																	
14-9d	12-Feb-14	17295140212005	7.56	2150	199	51.3	***238***	6.75	6.91	***675***	<0.05	0.054	<0.071	541	660	708	***1500***
14-9d	11-Sep-14	17295140911001	7.42	947	107	23.5	59.8	17.6	25.6	128	<0.02	<0.05	<0.054	348	425	364	***570***
14-9d	29-Jul-15	17295150729019	8.15	996	105	22.6	75.8	13.3	22	133	<0.010	0.027	0.027	360	439	355	***588***
14-9d	02-Nov-15	17295151102005	8.04	1030	102	22.2	79	13.3	21.5	125	<0.010	<0.020	<0.022	406	495	346	***607***
14-9d	24-Aug-16	17295160824021	7.72	1020	109	23.5	83.2	10.8	20	135	<0.010	<0.020	<0.022	407	496	369	***626***
14-9d	28-Jul-17	17295170728019	8.12	836	99.4	20.2	40	17.7	12.1	129	<0.010	<0.020	<0.022	305	372	331	***536***
14-9d	03-Nov-17	17295171103019	8.48	887	113	23.5	31	24	15.1	76	0.028	0.062	0.09	400	460	379	***557***
14-9d	19-Oct-18	17295181019021	8.19	946	99.5	27.1	74.9	5.79	18.9	145	<0.010	0.107	0.107	370	451	360	***594***
14-9d	21-Oct-19	17295191021017	7.76	678	101	22.6	36.2	21.8	12.5	11.5	0.017	0.062	0.079	407	497	345	450
14-10a	12-Feb-14	17295140212007	7.49	3070	538	113	106	7.54	16.5	***1700***	<0.5	<0.5	<0.71	283	345	1810	***2650***
14-10a	11-Sep-14	17295140911003	7.36	3060	549	108	108	6.6	6.49	***1680***	<0.02	<0.05	<0.054	321	391	1820	***2650***
14-10a	24-Aug-16	17295160824023	7.65	2660	485	88.7	88.8	5.22	2.9	***1450***	<0.020	<0.040	<0.045	298	363	1580	***2300***
17-10a	28-Jul-17	17295170728020	8.02	1670	234	42.5	74.6	3.89	6.1	***617***	<0.020	<0.040	<0.045	341	416	759	***1200***
17-10a	03-Nov-17	17295171103016	8.06	2940	506	93.8	126	6.4	5.1	***1610***	<0.050	<0.10	<0.11	271	331	1650	***2540***
17-10a	19-Oct-18	17295181019013	7.95	3520	569	126	***233***	7.61	2.9	***2000***	<0.050	<0.10	<0.11	377	460	1940	***3160***
17-10a	21-Oct-19	17295191021012	7.49	1830	467	90.3	107	7.78	3.6	***1290***	<0.020	0.125	0.125	368	449	1540	***2190***
14-10c	12-Feb-14	17295140212008	8.12	1130	17.1	4.13	***236***	1.45	0.55	186	<0.05	<0.05	<0.071	407	496	59.7	***689***
14-10c	11-Sep-14	17295140911022	***8.72***	1110	15.7	3.73	***239***	1.16	1.17	163	<0.02	<0.05	<0.054	420	470	54.6	***676***
14-10c	29-Jul-15	17295150729028	8.44	1150	23.3	5.34	***221***	1.83	<0.50	189	<0.010	<0.020	<0.022	359	417	80.2	***656***
14-10c	02-Nov-15	17295151102004	8.44	1110	26.1	6.63	***220***	1.46	<0.50	180	<0.010	<0.020	<0.022	399	471	92.5	***674***
14-10c	24-Aug-16	17295160824024	8.19	1090	18.7	4.7	***225***	1.22	<0.50	185	<0.010	<0.020	<0.022	372	453	66	***658***
14-10c	28-Jul-17	17295170728006	***8.52***	1090	19.5	4.88	***229***	1.2	0.54	187	<0.010	<0.020	<0.022	397	466	68.8	***694***
14-10c	03-Nov-17	17295171103015	***8.64***	1180	25.5	6.87	***234***	1.57	<1.0	194	***0.027***	<0.040	<0.045	420	481	92	***727***
14-10c	19-Oct-18	17295181019014	8.42	1160	21.2	5.35	***231***	1.79	0.96	194	***0.053***	0.249	0.301	414	489	75	***704***
14-10c	21-Oct-19	17295191021013	8.31	972	18.5	5.03	***240***	1.34	<0.50	186	<0.010	0.064	0.064	421	508	66.9	***704***
14-11a	12-Feb-14	17295140212009	7.51	2260	313	85.4	95.6	7.11	52.8	***803***	<0.05	0.11	0.11	478	583	1130	***1640***
14-11a	11-Sep-14	17295140911019	8.28	1450	204	56.5	44.6	4.17	118	263	<0.02	<0.05	<0.054	343	419	742	***896***
14-11a	31-Aug-16	17295160831001	7.5	1640	223	66.9	52.4	4.28	***132***	318	<0.010	<0.020	<0.022	442	540	832	***1060***
14-11a	28-Jul-17	17295170728021	8.18	1680	213	59.3	57.7	3.58	116	357	<0.020	<0.040	<0.045	425	519	776	***1080***
14-11a	03-Nov-17	17295171103012	8.24	1630	223	66.7	52.6	4.12	***129***	342	<0.050	<0.10	<0.11	385	469	832	***1070***
14-11a	19-Oct-18	17295181019007	7.91	1240	159	44.5	44.3	4.06	78.1	205	<0.010	0.998	0.998	384	468	580	***770***
14-11a	21-Oct-19	17295191021006	7.47	1110	195	56.1	37.6	3.94	101	207	0.013	0.227	0.24	391	477	718	***837***
14-11c	12-Feb-14	17295140212010	7.64	4080	289	81.3	***445***	5.79	***739***	***690***	<0.5	<0.5	<0.71	409	499	1060	***2500***
14-11c	11-Sep-14	17295140911012	8.11	5240	475	131	***493***	6.47	***1170***	***687***	<0.10	<0.25	<0.27	334	407	1730	***3160***
14-11c	31-Aug-16	17295160831002	7.63	4050	336	102	***489***	5.93	***833***	***701***	<0.050	<0.10	<0.11	415	506	1260	***2720***
14-11c	28-Jul-17	17295170728017	8.17	3870	293	83.6	***438***	5.96	***663***	***655***	<0.020	<0.040	<0.045	411	501	1080	***2400***
14-11c	03-Nov-17	17295171103013	8.09	4300	339	99.5	***447***	5.92	***821***	***716***	0.059	0.11	0.17	289	352	1260	***2620***
14-11c	19-Oct-18	17295181019015	8.04	3720	261	75.8	***415***	5.32	***628***	***701***	<0.050	0.28	0.28	420	513	964	***2340***
14-11c	21-Oct-19	17295191021014	7.73	2780	324	92.8	***429***	6.17	***757***	***689***	<0.050	0.11	<0.11	435	530	1190	***2560***
Alberta Tier 1 - Residential/Parkland*			**6.5-8.5^{P}**	**NS**	**NS**	**NS**	**200^{P,AO}**	**NS**	**120^{A}**	**H^{LAP,***}**	**Cl^{A,***}**	**3^{A}**	**NS**	**NS**	**NS**	**NS**	**500^{P,AO}**
Canadian Drinking Water Guidelines**			**7.0-10.5**	**NS**	**NS**	**NS**	**200^{AO,T}**	**NS**	**250^{AO}**	**500^{AO}**	**1^{MAC}**	**10^{MAC}**	**NS**	**NS**	**NS**	**NS**	**500^{AO}**

TABLE B1

Historical Groundwater Quality Results - General and Inorganic Parameters

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2-N+NO_3-N mg/L	T-Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
Flare Pit																	
Developer																	
14-12a	12-Feb-14	17295140212011	***6.49***	169000	9890	2210	***43300***	1530	***96200***	***1300***	<5	<5	<7.1	220	268	33800	***155000***
14-12a	11-Sep-14	17295140911002	***6.5***	133000	4830	1020	***25000***	1040	***64500***	***925***	<0.80	<2.0	<2.2	476	581	16300	***97600***
14-12a	29-Jul-15	17295150729003	7.22	91300	4310	901	***20000***	962	***39700***	***511***	<0.50	<1.0	<1.1	247	301	14500	***66500***
14-12a	02-Nov-15	17295151102025	7.08	135000	7240	1570	***32100***	1480	***75400***	***926***	<0.50	<1.0	<1.1	275	335	24500	***119000***
14-12a	24-Aug-16	17295160824026	7.27	31600	943	227	***6050***	316	***16700***	354	<0.20	0.75	0.75	337	412	3290	***24800***
17-12a	28-Jul-17	17295170728014	7.35	92700	5140	1170	***14000***	330	***42300***	***1360***	<0.20	<0.40	<0.45	268	327	17700	***64500***
17-12a	03-Nov-17	17295171103003	7.57	54900	3870	890	***8430***	135	***21000***	***1380***	<0.20	<0.40	<0.45	186	226	13300	***35800***
17-12a	19-Oct-18	17295181019006	7.57	40300	3250	653	***5780***	106	***16100***	***1340***	<1.0	<2.0	<2.2	317	386	10800	***27400***
17-12a	21-Oct-19	17295191021004	***6.99***	29500	2580	619	***6200***	181	***12800***	***1790***	<0.20	<0.40	<0.45	313	381	8990	***24400***
14-12c	12-Feb-14	17295140212012	8.13	2100	54.1	12	***387***	2.94	76.8	419	<0.05	<0.05	<0.071	541	660	185	***1280***
14-12c	11-Sep-14	17295140911006	7.82	2720	88.6	12.7	***532***	5.08	***328***	398	<0.02	<0.05	<0.054	539	658	274	***1690***
14-12c	29-Jul-15	17295150729012	7.81	3380	131	14.8	***540***	6.09	***588***	402	<0.050	<0.10	<0.11	395	482	388	***1920***
14-12c	02-Nov-15	17295151102024	8.04	4590	211	19.5	***744***	8.16	***956***	411	<0.050	<0.10	<0.11	471	574	607	***2630***
14-12c	24-Aug-16	17295160824027	7.99	3930	219	30.5	***628***	5.98	***849***	391	<0.050	<0.10	<0.11	517	630	672	***2430***
17-12c	28-Jul-17	17295170728018	8.16	3050	73.2	17.6	***552***	15	***375***	***511***	<0.020	<0.040	<0.045	459	560	255	***1830***
17-12c	03-Nov-17	17295171103010	8.38	3770	110	23.6	***742***	12.6	***556***	***645***	<0.050	<0.10	<0.11	413	491	372	***2350***
17-12c	19-Oct-18	17295181019005	7.88	10100	358	24	***1790***	44.2	***3030***	469	<0.10	<0.20	<0.22	419	511	993	***5970***
17-12c	21-Oct-19	17295191021005	7.89	2670	96.2	15.2	***680***	12	***486***	466	<0.050	<0.10	<0.11	538	656	303	***2080***
Production Area																	
Town of Calmar																	
M12-02	23-Oct-12	Nichols Environmental	7.2	1600	176	46.2	105	3.8	117	109	<0.005	<0.01	<0.01	645	786	629	***943***
M12-12	23-Oct-12	Nichols Environmental	7.39	1900	228	56.2	83.4	4.5	***152***	428	<0.005	0.02	0.02	441	538	801	***1220***
M12-12	27-Aug-13	17295130827005	7.6	1890	244	55	95.2	4.77	***146***	458	<0.05	<0.05	<0.071	440	536	836	***1270***
M12-12	13-Feb-14	17295140213022	7.57	2180	246	53.7	83.8	3.94	***130***	***635***	<0.05	<0.05	<0.071	410	500	835	***1400***
M12-12	11-Sep-14	17295140911009	7.68	2040	257	61.9	107	4.98	***150***	***532***	<0.02	<0.05	<0.054	417	509	897	***1360***
M12-12	29-Jul-15	17295150729005	7.82	1950	253	57.8	95.6	4.68	***149***	***536***	<0.020	<0.040	<0.045	328	400	870	***1290***
M12-12	02-Nov-15	17295151102023	7.92	1950	252	62.9	107	4.92	***136***	475	<0.020	<0.040	<0.045	407	497	888	***1280***
M12-12	24-Aug-16	17295160824006	7.57	1920	251	62.5	93.4	4.79	***163***	457	<0.020	<0.040	<0.045	412	502	884	***1280***
M12-12	28-Jul-17	17295170728005	7.86	1880	235	58	92.2	4.49	***146***	431	<0.020	<0.040	<0.045	395	482	826	***1230***
M12-12	03-Nov-17	17295171103008	8.11	1700	237	57.7	101	4.7	***140***	446	<0.050	<0.10	<0.11	266	325	829	***1170***
M12-12	19-Oct-18	17295181019009	7.97	1670	215	54.4	84.6	4.11	***138***	358	<0.010	<0.020	<0.022	397	484	761	***1090***
M12-12	21-Oct-19	17295191021009	7.73	1410	246	61.6	84.5	4.62	119	388	0.036	0.086	0.122	414	505	868	***1150***
Alberta Tier 1 - Residential/Parkland*			**6.5-8.5^{P}**	**NS**	**NS**	**NS**	**200^{P,AO}**	**NS**	**120^{A}**	**H^{LAP,***}**	**Cl^{A,***}**	**3^{A}**	**NS**	**NS**	**NS**	**NS**	**500^{P,AO}**
Canadian Drinking Water Guidelines**			**7.0-10.5**	**NS**	**NS**	**NS**	**200^{AO,T}**	**NS**	**250^{AO}**	**500^{AO}**	**1^{MAC}**	**10^{MAC}**	**NS**	**NS**	**NS**	**NS**	**500^{AO}**

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Historical Groundwater Quality Results - General and Inorganic Parameters

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2-N+NO_3-N mg/L	T-Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
Production Area																	
Town of Calmar																	
M12-15	23-Oct-12	Nichols Environmental	7.48	1650	234	65.9	39.6	4.2	22.2	***576***	<0.005	0.08	0.08	375	457	855	***1170***
M12-15	27-Aug-13	17295130827009	7.71	1430	210	57.2	22.5	2.87	21.2	477	<0.05	<0.05	<0.071	360	439	760	***1010***
M12-15	13-Feb-14	17295140213014	7.66	1440	234	60.2	22.1	2.7	19.5	458	<0.05	<0.05	<0.071	340	414	832	***1000***
M12-15	11-Sep-14	17295140911020	8.12	1360	231	62.5	23.9	3.09	17.5	460	<0.02	<0.05	<0.054	265	323	834	***957***
M12-15	29-Jul-15	17295150729001	7.83	1380	219	57.9	22.3	2.9	18.7	478	<0.010	<0.020	<0.022	282	344	785	***968***
M12-15	02-Nov-15	17295151102010	8.06	1480	226	64.3	24.1	3.08	17.7	478	<0.020	<0.040	<0.045	319	389	829	***1000***
M12-15	24-Aug-16	17295160824003	7.66	1400	217	58.9	23.2	2.81	21.1	471	<0.010	<0.020	<0.022	340	415	784	***998***
M12-15	28-Jul-17	17295170728012	7.95	1360	194	58	23.3	2.59	23.3	464	<0.010	<0.020	<0.022	330	402	723	***985***
M12-15	03-Nov-17	17295171103006	7.93	1370	225	66.6	27.1	3.05	25.4	472	0.033	<0.040	<0.045	255	310	836	***995***
M12-15	19-Oct-18	17295181019024	8.07	1480	220	66.4	25.8	2.89	22.7	479	<0.010	<0.020	<0.022	361	440	823	***1030***
M12-15	21-Oct-19	17295191021022	7.73	1150	226	66.3	24.5	2.97	21.6	484	<0.010	0.035	0.035	363	442	837	***1040***
M12-16	23-Oct-12	Nichols Environmental	7.45	2840	419	102	130	7.1	***295***	***799***	<0.02	0.13	0.13	434	529	1460	***2010***
M12-16	27-Aug-13	17295130827006	7.6	2330	322	69.8	81.7	4.33	***326***	458	<0.05	<0.05	<0.071	423	516	1090	***1520***
M12-16	13-Feb-14	17295140213023	7.6	2320	339	66.6	71.3	3.52	***284***	452	<0.05	<0.05	<0.071	435	531	1120	***1480***
M12-16	11-Sep-14	17295140911021	7.99	2180	326	71.7	80.3	4.44	***254***	455	<0.02	<0.05	<0.054	352	430	1110	***1400***
M12-16	29-Jul-15	17295150729007	7.64	2050	271	59.4	70.3	3.76	***245***	459	<0.020	<0.040	<0.045	302	368	921	***1290***
M12-16	02-Nov-15	17295151102020	7.98	2140	313	73	77.3	4.14	***246***	449	<0.020	<0.040	<0.045	364	444	1080	***1380***
M12-16	24-Aug-16	17295160824008	7.64	2060	284	61.1	76.7	3.6	***263***	426	<0.020	0.7	0.7	356	435	961	***1330***
M12-17s	23-Oct-12	Nichols Environmental	7.41	5510	584	156	***516***	10	***1240***	***525***	<0.05	<0.1	<0.1	716	873	2100	***3460***
M12-17s	27-Aug-13	17295130827003	7.38	4080	330	73.1	***483***	4.04	***633***	***597***	<0.5	<0.5	<0.71	832	1020	1130	***2620***
M12-17s	13-Feb-14	17295140213025	7.44	4300	380	85.2	***431***	4.2	***709***	***536***	<0.05	<0.05	<0.071	756	922	1300	***2600***
M12-17s	11-Sep-14	17295140911026	8.01	3930	313	75.4	***498***	4.02	***579***	***550***	<0.10	<0.25	<0.27	695	848	1090	***2440***
M12-17s	29-Jul-15	17295150729011	7.38	4020	314	71.8	***460***	3.86	***640***	***587***	<0.050	<0.10	<0.11	635	775	1080	***2460***
M12-17s	02-Nov-15	17295151102017	7.71	4210	341	82.2	***491***	3.95	***626***	***592***	<0.050	<0.10	<0.11	795	970	1190	***2610***
M12-17s	24-Aug-16	17295160824011	7.51	3450	282	69.7	***469***	3.97	***540***	***549***	<0.050	<0.10	<0.11	703	857	991	***2340***
M12-17d	23-Oct-12	Nichols Environmental	7.14	7480	810	290	***270***	9.5	***2010***	371	<0.05	<0.1	<0.1	421	513	3220	***4010***
M12-17d	27-Aug-13	17295130827002	7.14	6970	734	235	***240***	7.85	***2150***	365	<0.5	<0.5	<0.71	416	507	2800	***3980***
M12-17d	13-Feb-14	17295140213026	7.4	5760	621	187	***243***	7	***1480***	348	<0.05	<0.05	<0.071	432	527	2320	***3150***
M12-17d	11-Sep-14	17295140911028	7.85	5850	659	218	***254***	7.66	***1540***	353	<0.10	<0.25	<0.27	323	393	2540	***3230***
M12-17d	29-Jul-15	17295150729009	7.32	3970	357	121	***227***	6.24	***895***	396	<0.050	<0.10	<0.11	376	459	1390	***2230***
M12-17d	02-Nov-15	17295151102018	7.72	4070	392	138	***253***	6.84	***877***	375	<0.050	<0.10	<0.11	497	607	1550	***2340***
M12-17d	24-Aug-16	17295160824010	7.45	3840	381	130	***238***	6.37	***939***	369	<0.050	<0.10	<0.11	481	587	1490	***2350***
M12-18	23-Oct-12	Nichols Environmental	***6.97***	20700	1860	523	***2070***	33	***7210***	110	<0.1	<0.2	<0.3	580	707	6798	***12200***
M12-18	27-Aug-13	17295130827004	***6.94***	13800	865	234	***1640***	15.9	***4820***	238	<1	<1	<1.4	438	534	3120	***8080***
M12-18	13-Feb-14	17295140213017	7.02	16000	1180	325	***1680***	18.1	***5340***	50.4	<0.5	<0.5	<0.71	455	555	4280	***8870***
M12-18	11-Sep-14	17295140911014	7.74	15700	1050	318	***1750***	18.2	***5200***	124	<0.20	<0.50	<0.54	316	386	3930	***8650***
M12-18	29-Jul-15	17295150729010	7.59	15700	1070	275	***1590***	18.4	***5260***	62.2	<0.10	<0.20	<0.22	342	417	3800	***8480***
M12-18	02-Nov-15	17295151102014	7.52	12800	791	228	***1660***	12.9	***4250***	31.1	<0.10	<0.20	<0.22	366	447	2910	***7190***
M12-18	24-Aug-16	17295160824012	7.02	11300	714	186	***1430***	13.6	***4440***	226	<0.10	<0.20	<0.22	475	580	2550	***7290***
Alberta Tier 1 - Residential/Parkland*			**6.5-8.5^{P}**	**NS**	**NS**	**NS**	**200^{P,AO}**	**NS**	**120^{A}**	**H^{LAP,***}**	**Cl^{A,***}**	**3^{A}**	**NS**	**NS**	**NS**	**NS**	**500^{P,AO}**
Canadian Drinking Water Guidelines**			**7.0-10.5**	**NS**	**NS**	**NS**	**200^{AO,T}**	**NS**	**250^{AO}**	**500^{AO}**	**1^{MAC}**	**10^{MAC}**	**NS**	**NS**	**NS**	**NS**	**500^{AO}**

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Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2-N+NO_3-N mg/L	T-Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
Production Area																	
Town of Calmar																	
M12-19	23-Oct-12	Nichols Environmental	7.55	2050	77.2	15	***352***	3.8	***187***	85.6	<0.005	0.01	<0.01	762	928	255	***1180***
M12-19	27-Aug-13	17295130827007	7.67	2230	118	20.5	***341***	3.17	***198***	222	<0.05	<0.05	<0.071	748	912	379	***1350***
M12-19	13-Feb-14	17295140213019	7.63	2210	110	20	***340***	2.6	***186***	191	<0.05	<0.05	<0.071	720	879	357	***1280***
M12-19	11-Sep-14	17295140911010	8.14	2400	142	24.5	***380***	2.93	***197***	314	<0.02	<0.05	<0.054	669	816	455	***1460***
M12-19	29-Jul-15	17295150729023	7.45	2470	133	22.7	***346***	2.22	***224***	354	<0.020	<0.040	<0.045	594	725	426	***1440***
M12-19	02-Nov-15	17295151102019	8.02	2330	132	25.8	***374***	2.74	***194***	234	<0.050	<0.10	<0.11	726	886	436	***1400***
M12-19	24-Aug-16	17295160824014	7.58	2280	146	25.3	***360***	2.86	***192***	332	<0.020	<0.040	<0.045	649	792	469	***1450***
13-2	27-Aug-13	17295130827008	7.38	10300	1350	245	***459***	8	***3480***	***655***	<0.5	<0.5	<0.71	231	282	4380	***6340***
13-2	13-Feb-14	17295140213016	7.42	10500	1540	260	***386***	7.6	***3910***	***594***	<0.5	<0.5	<0.71	217	265	4920	***6830***
13-2	11-Sep-14	17295140911023	7.84	8010	1020	239	***371***	9.5	***2240***	***746***	<0.20	<0.50	<0.54	174	212	3530	***4730***
13-2	29-Jul-15	17295150729014	7.33	7210	802	199	***297***	9.34	***1970***	***843***	<0.050	<0.10	<0.11	198	241	2820	***4240***
13-2	02-Nov-15	17295151102008	7.73	8680	1120	278	***347***	10.2	***2530***	***734***	<0.10	<0.20	<0.22	272	332	3940	***5180***
13-2	24-Aug-16	17295160824016	7.44	8440	1210	252	***340***	8.7	***2970***	***668***	<0.050	0.18	0.18	216	263	4060	***5580***
17-2	28-Jul-17	17295170728010	7.65	11600	1600	371	***278***	13.1	***3620***	***962***	<0.020	<0.040	<0.045	271	331	5520	***7030***
17-2	03-Nov-17	17295171103005	7.72	14000	1900	428	***296***	13.5	***4500***	***1190***	<0.20	<0.40	<0.45	154	188	6510	***8440***
17-2	19-Oct-18	17295181019017	7.62	13100	1780	406	***298***	12.2	***4280***	***989***	<0.10	<0.20	<0.22	280	341	6120	***7930***
17-2	21-Oct-19	17295191021023	7.39	6260	1940	438	***251***	13.9	***4190***	***1130***	<0.10	<0.20	<0.22	283	345	6650	***8130***
13-4	27-Aug-13	17295130827011	7.44	5730	645	157	***203***	8.98	***1710***	343	<0.5	<0.5	<0.71	322	393	2260	***3260***
13-4	13-Feb-14	17295140213015	7.47	5620	692	167	196	7.6	***1580***	329	<0.5	<0.5	<0.71	307	374	2420	***3160***
13-4	11-Sep-14	17295140911017	7.87	5350	643	162	***209***	8.83	***1440***	315	<0.10	<0.25	<0.27	263	321	2270	***2940***
13-4	29-Jul-15	17295150729002	7.59	4870	574	144	***212***	7.79	***1300***	336	<0.050	<0.10	<0.11	250	305	2030	***2720***
13-4	02-Nov-15	17295151102013	7.8	5130	587	153	196	8.73	***1370***	340	<0.050	<0.10	<0.11	335	409	2100	***2860***
13-4	24-Aug-16	17295160824004	7.5	4470	552	138	***212***	8.14	***1260***	345	<0.050	<0.10	<0.11	362	442	1950	***2730***
17-4	28-Jul-17	17295170728015	7.62	8120	1010	265	***208***	12.2	***2530***	360	<0.050	<0.10	<0.11	210	257	3610	***4530***
17-4	03-Nov-17	17295171103007	7.57	8690	1070	274	***208***	12.2	***2680***	***534***	<0.10	<0.20	<0.22	143	175	3800	***4880***
17-4	19-Oct-18	17295181019010	7.8	5980	658	156	***378***	8.11	***1670***	424	<0.050	<0.10	<0.11	437	533	2290	***3560***
17-4	21-Oct-19	17295191021024	7.55	4260	965	254	***229***	12.1	***2320***	425	<0.10	<0.20	<0.22	289	353	3460	***4380***
13-6b	27-Aug-13	17295130827014	7.89	4590	283	70.9	***613***	7.63	***803***	***951***	<0.5	<0.5	<0.71	476	580	999	***3010***
13-6b	13-Feb-14	17295140213018	7.55	4350	244	59.1	***676***	7.57	***297***	***1450***	<0.5	<0.5	<0.71	530	647	853	***3050***
13-6b	11-Sep-14	17295140911027	8.24	4190	228	53.5	***740***	7.37	***226***	***1400***	<0.10	<0.25	<0.27	449	547	790	***2920***
13-6b	29-Jul-15	17295150729008	7.99	4170	226	58	***702***	7.08	***260***	***1450***	<0.050	<0.10	<0.11	416	508	803	***2950***
13-6b	02-Nov-15	17295151102015	8.11	4100	207	48.3	***709***	7.21	***239***	***1410***	<0.050	<0.10	<0.11	497	606	716	***2920***
13-6b	24-Aug-16	17295160824009	7.61	3860	240	58.6	***606***	7.62	***377***	***1280***	<0.050	<0.10	<0.11	446	544	841	***2840***
Alberta Tier 1 - Residential/Parkland*			**6.5-8.5^{P}**	**NS**	**NS**	**NS**	**200^{P,AO}**	**NS**	**120^{A}**	**H^{LAP,***}**	**Cl^{A,***}**	**3^{A}**	**NS**	**NS**	**NS**	**NS**	**500^{P,AO}**
Canadian Drinking Water Guidelines**			**7.0-10.5**	**NS**	**NS**	**NS**	**200^{AO,T}**	**NS**	**250^{AO}**	**500^{AO}**	**1^{MAC}**	**10^{MAC}**	**NS**	**NS**	**NS**	**NS**	**500^{AO}**

TABLE B1

Historical Groundwater Quality Results - General and Inorganic Parameters

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2-N+NO_3-N mg/L	T-Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
Production Area																	
Town of Calmar																	
14-8a	12-Feb-14	17295140212001	7.69	941	103	30.3	28	3.66	38.9	144	<0.05	<0.05	<0.071	308	375	382	***533***
14-8a	11-Sep-14	17295140911030	***8.53***	724	93.1	26.2	23.3	3.14	31.9	62.1	<0.02	<0.05	<0.054	279	318	340	407
14-8a	29-Jul-15	17295150729020	8.27	707	90.8	25.2	22.7	3.31	30.2	63.6	<0.010	0.043	0.043	259	316	331	392
14-8a	02-Nov-15	17295151102001	8.05	775	94.3	28.5	24.7	3.48	31.6	72.1	<0.010	0.025	0.025	297	363	353	433
14-8a	24-Aug-16	17295160824017	7.83	731	85.9	25.1	22.7	3.87	30.6	69.2	<0.010	<0.020	<0.022	278	339	318	404
14-8a	28-Jul-17	17295170728002	8.25	736	81.8	26.1	24.7	3.3	31.1	69.9	<0.010	<0.020	<0.022	290	354	312	431
14-8a	03-Nov-17	17295171103020	8.37	902	115	36.2	44.9	4.09	30	126	0.015	<0.020	<0.022	328	389	436	***575***
14-8a	19-Oct-18	17295181019018	8.11	913	133	30	28.3	9.03	24.1	153	<0.010	<0.020	<0.022	332	405	456	***577***
14-8a	21-Oct-19	17295191021020	7.9	708	101	31.8	31.5	3.41	33.8	82.7	<0.010	<0.020	<0.022	307	374	383	469
14-8c	12-Feb-14	17295140212003	8.12	2210	52.7	13.9	***481***	4.27	7.17	393	<0.05	<0.05	<0.071	806	983	189	***1440***
14-8c	11-Sep-14	17295140911024	***8.52***	1750	48.7	10.8	***351***	3.72	12	***370***	<0.02	<0.05	<0.054	512	595	166	***1100***
14-8c	29-Jul-15	17295150729021	8.49	2130	25.4	5.1	***428***	2.85	7.6	***407***	<0.020	0.06	0.06	678	780	84.4	***1280***
14-8c	02-Nov-15	17295151102002	8.49	2160	24.4	5.11	***477***	2.79	4.4	***367***	<0.020	0.041	<0.045	786	922	82	***1350***
14-8c	24-Aug-16	17295160824018	8.38	1790	22.9	4.44	***377***	3	2.5	***423***	<0.020	0.075	0.075	505	602	75.5	***1140***
14-8c	28-Jul-17	17295170728011	8.3	918	59.4	13	***205***	3.38	9.65	216	<0.010	<0.020	<0.022	256	311	202	***675***
14-8c	03-Nov-17	17295171103021	***8.61***	2660	44.6	9.72	***587***	3.59	4	***734***	<0.050	0.18	0.18	662	760	151	***1800***
14-8c	19-Oct-18	17295181019019	8.07	932	116	24.9	34.9	25.1	22.3	26.4	<0.010	0.125	0.125	481	587	392	***539***
14-8c	21-Oct-19	17295191021019	8.2	2310	55.3	12.8	***554***	4.4	2.4	***759***	<0.020	0.103	0.103	607	740	191	***1750***
14-8d	12-Feb-14	17295140212002	7.3	2040	221	58.6	162	5.71	15.4	***758***	<0.05	0.109	0.109	390	476	793	***1460***
14-8d	11-Sep-14	17295140911029	8.43	791	98.6	22.8	38.1	6.71	14	110	<0.02	<0.05	<0.054	294	343	340	467
14-8d	29-Jul-15	17295150729022	8.17	835	89.4	22.7	49.3	5.96	18.1	129	<0.010	<0.020	<0.022	284	346	317	485
14-8d	02-Nov-15	17295151102003	8.1	942	107	28.3	61.3	6.85	18.1	148	<0.010	0.048	0.048	313	382	384	***558***
14-8d	24-Aug-16	17295160824019	7.78	482	46.6	11.8	30.5	6.09	9.31	54.4	<0.010	<0.020	<0.022	182	222	165	268
14-8d	28-Jul-17	17295170728004	8.13	491	43	12	36.7	4.29	7.25	51.8	<0.010	<0.020	<0.022	200	244	157	293
14-8d	03-Nov-17	17295171103023	8.47	891	88.1	25.1	68.9	5.41	16	121	0.03	<0.020	0.03	342	396	323	***553***
14-8d	19-Oct-18	17295181019020	***8.6***	2190	11.6	2.46	***507***	2	1.76	***415***	<0.010	0.039	0.039	794	912	39.1	***1420***
14-8d	21-Oct-19	17295191021021	7.91	649	79.8	22.4	51.3	5.1	12.3	84.3	<0.010	0.057	0.057	302	368	292	437
17-13a	28-Jul-17	17295170728001	7.95	3950	568	157	***409***	9.57	***810***	***565***	<0.020	<0.040	<0.045	318	388	2060	***2740***
17-13a	03-Nov-17	17295171103002	7.84	5910	657	159	***409***	8.59	***1310***	***918***	<0.050	<0.10	<0.11	178	217	2300	***3590***
17-13a	19-Oct-18	17295181019004	8.06	705	43.2	1.49	94.7	4.73	35.3	195	0.027	<0.020	0.027	75.1	91.6	114	421
17-13a	21-Oct-19	17295191021001	8.07	1430	187	36.7	155	4.92	***166***	***541***	<0.010	<0.020	<0.022	185	225	618	***1200***
17-13c	28-Jul-17	17295170728003	8.44	2620	34.6	8.52	***555***	13.3	41.8	***795***	<0.020	<0.040	<0.045	481	570	121	***1760***
17-13c	03-Nov-17	17295171103004	***8.59***	3240	38.6	10.8	***675***	8.21	57.8	***1060***	0.062	<0.10	<0.11	476	548	141	***2160***
17-13c	19-Oct-18	17295181019001	8.35	2720	51.3	13.1	***606***	5.28	16.2	***823***	<0.050	<0.10	<0.11	671	804	182	***1920***
17-13c	21-Oct-19	17295191021002	8.02	2230	56.3	13.1	***563***	3.82	6.4	***775***	<0.050	<0.10	<0.11	631	770	195	***1800***
Alberta Tier 1 - Residential/Parkland*			**6.5-8.5^{P}**	**NS**	**NS**	**NS**	**200^{P,AO}**	**NS**	**120^{A}**	**H^{LAP,***}**	**Cl^{A,***}**	**3^{A}**	**NS**	**NS**	**NS**	**NS**	**500^{P,AO}**
Canadian Drinking Water Guidelines**			**7.0-10.5**	**NS**	**NS**	**NS**	**200^{AO,T}**	**NS**	**250^{AO}**	**500^{AO}**	**1^{MAC}**	**10^{MAC}**	**NS**	**NS**	**NS**	**NS**	**500^{AO}**

TABLE B1

Historical Groundwater Quality Results - General and Inorganic Parameters

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Lab pH	Lab EC µS/cm	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_2-N mg/L	NO_3-N mg/L	NO_2-N+NO_3-N mg/L	T-Alkalinity mg/L	HCO_3 mg/L	Hardness mg/L	TDS mg/L
Well Centre Area																	
Town of Calmar																	
13-5	27-Aug-13	17295130827010	7.66	1950	239	57	115	3.51	62	***534***	<0.05	<0.05	<0.071	583	711	832	***1360***
13-5	13-Feb-14	17295140213020	7.62	1970	260	63.1	102	3.7	63.1	***507***	<0.05	<0.05	<0.071	551	672	909	***1330***
13-5	11-Sep-14	17295140911016	8.02	1950	260	65.5	122	4.15	58.2	***524***	<0.02	<0.05	<0.054	514	627	919	***1340***
13-5	29-Jul-15	17295150729004	8.06	1930	237	58.9	116	3.82	55.2	***558***	<0.020	<0.040	<0.045	423	516	834	***1280***
13-5	02-Nov-15	17295151102011	8.01	2080	281	74.1	117	4.4	56.8	***609***	<0.020	<0.040	<0.045	528	644	1010	***1460***
13-5	24-Aug-16	17295160824005	7.7	1720	221	53.1	119	3.15	41.4	***528***	<0.020	<0.040	<0.045	431	526	771	***1220***
13-5	28-Jul-17	17295170728009	8.1	1650	199	51.8	112	3.03	46.8	***509***	<0.010	<0.020	<0.022	406	495	710	***1190***
13-5	03-Nov-17	17295171103001	7.85	1880	244	68	124	4.19	53.7	***580***	<0.020	<0.040	<0.045	419	511	889	***1350***
13-5	19-Oct-18	17295181019003	7.97	1910	249	65.2	125	4.05	60.8	***614***	<0.010	0.035	0.035	432	527	890	***1380***
13-5	21-Oct-19	17295191021007	7.87	1440	227	59.9	120	3.74	62	***533***	<0.010	0.068	0.068	409	499	813	***1250***
13-7	27-Aug-13	17295130827012	7.84	1530	213	42.8	41.4	2.77	***128***	269	<0.05	<0.05	<0.071	446	545	708	***965***
13-7	13-Feb-14	17295140213021	7.79	1480	228	42.6	40.4	2.63	117	215	<0.05	<0.05	<0.071	426	520	745	***901***
13-7	11-Sep-14	17295140911018	8.1	1400	220	44.2	44.4	3	***125***	200	<0.02	<0.05	<0.054	361	440	731	***853***
13-7	29-Jul-15	17295150729015	7.95	1320	167	35.8	64.1	2.74	111	237	<0.010	0.208	0.208	296	361	564	***797***
13-7	02-Nov-15	17295151102012	8.11	1400	196	43.5	48.9	2.93	***129***	175	<0.020	<0.040	<0.045	389	475	669	***829***
13-7	24-Aug-16	17295160824028	7.87	1440	194	39.6	54.7	2.95	***129***	220	<0.010	<0.020	<0.022	407	496	647	***885***
13-7	28-Jul-17	17295170728007	8.06	1390	160	38.7	59.1	2.75	***131***	218	<0.010	<0.020	<0.022	374	456	559	***856***
13-7	19-Oct-18	17295181019025	8.17	1430	189	40.9	50.4	3.08	***138***	204	<0.010	0.025	0.025	392	478	640	***861***
13-7	21-Oct-19	17295191021025	7.99	1190	205	45.7	70.1	3.24	***143***	242	<0.010	0.108	0.108	403	492	700	***952***
Alberta Tier 1 - Residential/Parkland*			**6.5-8.5^{P}**	**NS**	**NS**	**NS**	**200^{P,AO}**	**NS**	**120^{A}**	**H^{LAP,***}**	**Cl^{A,***}**	**3^{A}**	**NS**	**NS**	**NS**	**NS**	**500^{P,AO}**
Canadian Drinking Water Guidelines**			**7.0-10.5**	**NS**	**NS**	**NS**	**200^{AO,T}**	**NS**	**250^{AO}**	**500^{AO}**	**1^{MAC}**	**10^{MAC}**	**NS**	**NS**	**NS**	**NS**	**500^{AO}**

Notes:

--- - not analyzed

NS - not specified

A - indicates guideline for Aquatic Life exposure pathway

AO - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)

Cl - dependent on chloride value

H - dependent on hardness value

LAP - lowest of Aquatic Life and Potable Groundwater exposure pathways

MAC - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)

P - indicates guideline for Potable Groundwater exposure pathway

T - indicates guideline is for total sodium

* - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)

** - *Guidelines for Canadian Drinking Water Quality-Summary Table* (Health Canada 2020)

Italics - indicates values do not meet applicable guidelines

TABLE B2

Historical Groundwater Quality Results - Dissolved Metals

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
Flare Pit																											
Trailer Park																											
13-1	27-Aug-13	17295130827015	<0.01	<0.0004	0.00042	0.0279	<0.001	0.112	0.00014	<0.0004	0.00372	0.00105	<0.02	<0.0001	---	***0.832***	<0.0001	0.00266	0.0121	0.00078	<0.0002	1.59	<0.0001	<0.0002	<0.0006	***0.0239***	<0.0002	0.0243
13-1	11-Sep-14	17295140911005	***0.0692***	<0.00020	0.00061	0.0566	<0.0005	0.122	0.00011	0.00023	0.00111	0.00116	0.132	0.00014	0.114	***0.278***	<0.0000050	0.00065	0.005	<0.00020	<0.000020	1.78	<0.000050	<0.00020	0.00229	***0.0314***	0.00047	***0.0748***
13-1	29-Jul-15	17295150729013	<0.0020	<0.00020	0.0004	0.0339	<0.00020	0.106	0.00013	<0.00020	0.00124	0.00101	<0.030	<0.00010	0.119	***0.541***	<0.0000050	0.00077	0.0058	0.00021	<0.000020	1.77	0.000032	<0.00020	<0.00060	***0.0318***	<0.001	***0.0595***
13-1	28-Jul-17	17295170728013	<0.0050	<0.00050	0.00056	0.0837	<0.00050	0.095	0.00010	<0.00050	<0.00050	0.0016	<0.050	<0.00025	0.103	0.00117	<0.0000050	0.00123	0.0041	0.0008	<0.000050	1.54	<0.000050	<0.00050	<0.0015	***0.03***	<0.0025	***0.457***
13-3	27-Aug-13	17295130827001	0.011	<0.0005	<0.0005	0.032	<0.0025	0.123	0.00020	<0.0005	0.00166	0.00172	<0.05	<0.00025	---	***0.224***	<0.0001	0.00398	0.0157	0.00061	<0.0002	2.97	<0.00025	<0.0005	<0.0015	***0.0382***	<0.0005	***0.0377***
13-3	13-Feb-14	17295140213024	<0.005	<0.0005	<0.0005	0.0308	<0.0025	0.111	0.00027	<0.0005	0.00221	0.00165	<0.05	<0.00025	---	***0.406***	<0.00002	0.00079	0.0115	<0.0005	<0.00005	2.92	<0.00025	<0.0005	<0.0015	***0.0361***	<0.0005	0.008
13-3	11-Sep-14	17295140911008	0.01	<0.0005	<0.0005	0.0299	<0.0005	0.138	0.00012	0.00086	<0.0005	0.00102	<0.050	<0.00025	0.13	***0.0788***	<0.0000050	0.00049	0.00596	<0.0005	<0.000050	2.81	<0.000050	<0.0005	<0.0015	***0.0352***	<0.0005	***0.0411***
13-3	29-Jul-15	17295150729006	0.0067	<0.0005	<0.0005	0.0251	<0.0005	0.134	0.00009	<0.0005	<0.0005	0.0013	<0.050	<0.00025	0.126	***0.0651***	<0.0000050	0.00029	0.0067	<0.00025	<0.000050	2.74	<0.000050	<0.0005	<0.0015	***0.0346***	<0.0025	<0.0050
13-3	28-Jul-17	17295170728008	<0.0050	<0.00050	<0.00050	0.0204	<0.00050	0.117	<0.000025	<0.00050	<0.00050	<0.0010	<0.050	<0.00025	0.121	0.00214	<0.0000050	0.00035	0.0044	<0.00025	<0.000050	2.5	<0.000050	<0.00050	<0.0015	***0.0249***	<0.0025	<0.0050
Developer																											
14-9a	12-Feb-14	17295140212004	0.0121	<0.0004	0.00046	0.0247	<0.001	0.116	***0.00051***	<0.0004	0.0152	0.00165	<0.02	<0.0001	---	***3***	<0.00002	0.00065	0.0525	0.0006	<0.00002	0.721	<0.0001	0.00161	<0.0006	0.00727	<0.0002	0.0103
14-9a	11-Sep-14	17295140911004	0.0072	0.00015	0.00232	0.0379	<0.0005	0.101	0.00013	<0.00010	0.00383	0.00132	***0.419***	0.000052	0.0531	***1.81***	***0.0000054***	0.00121	0.00843	0.00049	<0.000010	0.727	0.000054	<0.00010	0.00035	0.00975	0.00196	0.0101
14-9a	29-Jul-15	17295150729016	0.0031	0.00015	0.00179	0.0508	<0.00010	0.082	0.00001	<0.00010	0.00257	0.00057	***0.737***	<0.000050	0.053	***1.35***	<0.0000050	0.000877	0.00514	0.00018	<0.000010	0.669	<0.000010	<0.00010	<0.00030	0.00964	0.00154	0.0105
14-9a	28-Jul-17	17295170728016	<0.0050	<0.00050	0.00099	0.0499	<0.00050	0.075	0.00014	<0.00050	<0.00050	0.0034	<0.050	<0.00025	0.0596	0.00422	<0.0000050	0.0013	0.0047	<0.00025	<0.000050	0.647	0.000051	<0.00050	<0.0015	0.0106	<0.0025	***0.151***
14-9c	12-Feb-14	17295140212006	0.0034	<0.0004	0.00072	0.0235	<0.001	0.214	<0.0001	<0.0004	0.00045	<0.0006	<0.02	<0.0001	---	***0.273***	<0.00002	0.00454	0.0014	<0.0004	<0.00002	0.341	<0.0001	<0.0002	<0.0006	0.00245	<0.0002	0.0026
14-9c	11-Sep-14	17295140911025	0.0231	<0.00020	0.00182	0.0207	<0.0005	0.18	<0.000020	0.00024	0.00039	0.00125	0.072	0.00011	0.0949	***0.0808***	<0.0000050	0.0091	0.00284	<0.00020	<0.000020	0.158	<0.000050	0.00025	0.00139	0.00317	0.00108	0.0195
14-9c	29-Jul-15	17295150729017	0.0077	<0.00020	0.00281	0.032	<0.00020	0.211	<0.000010	<0.00020	0.00035	0.00051	<0.030	<0.00010	0.124	***0.105***	<0.0000050	0.0127	0.0026	0.00011	<0.000020	0.199	<0.000020	<0.00020	<0.00060	0.00609	<0.001	0.0044
14-9c	28-Jul-17	17295170728022	0.0115	0.00088	0.00309	0.0233	<0.00050	0.225	<0.000025	<0.00050	0.00098	0.0011	<0.050	<0.00025	0.126	***0.102***	<0.0000050	0.00973	0.0039	0.00041	<0.000050	0.18	<0.000050	<0.00050	<0.0015	0.005	<0.0025	***0.15***
14-9d	12-Feb-14	17295140212005	0.0024	<0.0004	0.0005	0.047	<0.001	0.18	<0.0001	<0.0004	0.00384	<0.0006	<0.02	<0.0001	---	***1.81***	<0.00002	0.00085	0.00875	0.0005	<0.00002	0.931	<0.0001	0.00036	<0.0006	0.0118	<0.0002	0.0051
14-9d	11-Sep-14	17295140911001	0.0163	<0.00010	***0.0058***	0.0545	<0.0005	0.074	0.00002	0.00039	0.0054	0.00109	***1.23***	0.000115	0.0842	***2.2***	***0.0000064***	0.00122	0.0168	0.00027	0.000011	0.469	<0.000050	0.00014	0.001	0.00673	0.00172	0.0096
14-9d	29-Jul-15	17295150729019	0.009	<0.00010	***0.00579***	0.0781	<0.00010	0.091	0.00001	0.00026	0.00511	0.00056	***3.16***	0.000059	0.0861	***2.7***	***0.0000079***	0.00153	0.0138	0.000152	<0.000010	0.487	<0.000010	<0.00010	0.00067	0.00934	0.00162	0.0137
14-9d	02-Nov-15	17295151102005	0.008	<0.00010	***0.00617***	0.0968	<0.00010	0.088	0.00001	0.00013	0.00509	0.0005	***3.72***	<0.000050	0.0801	***2.81***	***0.0000059***	0.00134	0.0127	0.00011	<0.000010	0.492	<0.000010	0.00025	0.00046	0.00568	0.00129	0.0041
14-9d	24-Aug-16	17295160824021	0.0048	<0.00010	***0.00694***	0.158	<0.00010	0.116	<0.0000050	0.00016	0.00546	0.00026	***3.64***	<0.000050	0.0689	***2.8***	***0.0000065***	0.00122	0.0137	0.000134	<0.000010	0.571	<0.000010	<0.00010	0.00032	0.00722	0.00121	0.0087
14-9d	28-Jul-17	17295170728019	0.0156	<0.00050	0.00384	0.0775	<0.00050	<0.050	0.00003	<0.00050	0.00138	0.0028	***1.47***	0.00066	0.0383	***0.77***	***0.0000058***	0.00222	0.0122	<0.00025	<0.000050	0.432	<0.000050	<0.00050	0.0025	0.00326	<0.0025	***0.359***
14-10a	12-Feb-14	17295140212007	0.0083	<0.0005	0.00062	0.0921	<0.0025	0.127	***0.00039***	0.00076	0.00743	0.00189	<0.05	<0.00025	---	***2.16***	<0.00002	0.00059	0.0493	0.00071	<0.00005	1.83	<0.00025	0.00145	<0.0015	***0.0196***	<0.0005	0.0088
14-10a	11-Sep-14	17295140911003	0.0073	<0.0005	0.00146	0.111	<0.0005	0.167	<0.000050	<0.0005	0.0101	<0.0005	***0.371***	<0.00025	0.122	***7.37***	<0.0000050	0.00073	0.0223	<0.0005	<0.000050	2.3	<0.000050	<0.0005	<0.0015	***0.0204***	0.00059	***0.0785***
17-10a	28-Jul-17	17295170728020	<0.0050	<0.00050	0.0009	0.0517	<0.00050	0.125	<0.000025	<0.00050	<0.00050	0.0012	<0.050	<0.00025	0.0793	0.00123	<0.0000050	0.00231	<0.0025	***0.00297***	<0.000050	1.19	<0.000050	<0.00050	<0.0015	***0.0185***	<0.0025	<0.0050
14-10c	12-Feb-14	17295140212008	0.0022	<0.0004	0.00062	0.0238	<0.0005	0.152	<0.0001	<0.0004	0.00044	<0.0006	<0.01	0.00013	---	***0.121***	<0.00002	0.00246	0.00056	<0.0004	<0.00001	0.118	<0.00005	<0.0002	<0.0003	0.00063	0.0002	0.0021
14-10c	11-Sep-14	17295140911022	0.0017	<0.00010	0.00044	0.0159	<0.0005	0.16	<0.000010	<0.00010	0.00038	0.00035	0.088	<0.000050	0.113	***0.123***	<0.0000050	0.00121	0.00036	<0.00010	<0.000010	0.109	<0.000050	<0.00010	<0.00030	0.000136	0.00012	0.0243
14-10c	29-Jul-15	17295150729028	0.0081	<0.00010	0.00185	0.0399	<0.00010	0.157	<0.0000050	<0.00010	0.00083	0.00042	0.16	<0.000050	0.116	***0.312***	<0.0000050	0.00166	0.00249	0.000066	<0.000010	0.12	<0.000010	<0.00010	<0.00030	0.000888	0.00128	0.0058
14-10c	28-Jul-17	17295170728006	<0.0050	<0.00050	0.00052	0.0232	<0.00050	0.158	<0.000025	<0.00050	<0.00050	<0.0010	<0.050	<0.00025	0.117	***0.0696***	<0.0000050	0.00112	<0.0025	<0.00025	<0.000050	0.117	<0.000050	<0.00050	<0.0015	0.000165	<0.0025	0.0134
14-11a	12-Feb-14	17295140212009	0.0068	<0.0004	0.00065	0.082	<0.001	0.122	0.00018	<0.0004	0.00265	0.00165	<0.02	<0.0001	---	***2.12***	<0.00002	0.00059	0.0146	0.00094	<0.00002	1.22	<0.0001	0.00541	<0.0006	***0.0216***	0.00024	0.0046
14-11a	11-Sep-14	17295140911019	0.0037	<0.00010	0.00114	0.0914	<0.0005	0.099	0.00004	<0.00010	0.00387	0.0003	0.206	<0.000050	0.055	***2.84***	<0.0000050	0.00061	0.0102	0.00043	<0.000010	0.925	<0.000050	0.00014	<0.00030	0.00931	0.00056	0.0105
14-11a	28-Jul-17	17295170728021	<0.0050	<0.00050	0.00085	0.0788	<0.00050	0.088	0.00035	<0.00050	<0.00050	0.0026	<0.050	<0.00025	0.0682	***0.962***	<0.0000050	0.00069	0.0093	0.00028	<0.000050	1.07	0.00005	<0.00050	<0.0015	***0.0205***	<0.0025	***0.28***
14-11c	12-Feb-14	17295140212010	<0.005	<0.0005	0.00232	0.0623	<0.0025	0.188	<0.0001	<0.0005	0.0061	<0.0006	***9.68***	<0.00025	---	***2.32***	<0.00002	0.00263	0.00889	<0.0005	<0.00005	1.94	<0.00025	<0.0005	<0.0015	0.00584	<0.0005	<0.005
14-11c	11-Sep-14	17295140911012	<0.010	<0.001	0.0034	0.0296	<0.001	0.28	<0.00010	<0.001	0.0059	0.0015	***17.6***	<0.0005	0.328	***2.35***	<0.0000050	0.00116	0.0049	<0.001	<0.00010	3.31	<0.00010	<0.001	<0.0030	0.00548	<0.001	0.018
14-11c	28-Jul-17	17295170728017	<0.010	<0.0010	<0.0010	0.0268	<0.0010	0.22	<0.000050	<0.0010	0.0022	<0.0020	<0.10	<0.00050	0.31	***1.36***	<0.0000050	0.00121	<0.0050	<0.00050	<0.00010	2.23	<0.00010	<0.0010	<0.0030	0.00443	<0.0050	***0.042***
14-12a	12-Feb-14	17295140212011	***0.29***	<0.01	<0.01	***1.59***	<0.05	***48.2***	***0.04000***	<0.01	0.21	***0.039***	<1	***0.0117***	---	***112***	<0.00002	<0.005	0.328	<0.01	***0.0015***	274	0.0051	<0.01	<0.03	***0.0492***	<0.01	***0.23***
14-12a	11-Sep-14	17295140911002	<0.10	<0.010	<0.010	***1.31***	<0.010	***41.7***	***0.00680***	<0.010	0.113	***0.01***	***2.6***	<0.0050	19.9	***62.8***	***0.0000076***	0.005	0.16	<0.010	<0.001	133	<0.001	<0.010	<0.030	***0.0348***	<0.010	***0.19***
14-12a	29-Jul-15	17295150729003	***0.25***	<0.020	<0.020	0.989	<0.020	***32.5***	***0.00190***	<0.020	0.122	<0.040	***4***	<0.010	19.4	***55.4***	<0.0000050	<0.010	0.13	<0.010	<0.0020	117	<0.0020	<0.020	<0.060	***0.038***	<0.10	<0.20
14-12a	02-Nov-15	17295151102025	<0.050	<0.0050	<0.0050	0.807	<0.0050	***51***	***0.00824***	<0.0050	0.157	<0.010	***2.19***	0.0066	32.3	***82.3***	<0.0000050	<0.0025	0.156	<0.0025	<0.0005	222	0.00093	<0.0050	<0.015	***0.0533***	<0.025	***0.148***
14-12a	24-Aug-16	17295160824026	<0.10	<0.010	<0.010	0.625	<0.010	***15.5***	***0.00095***	<0.010	0.014	<0.020	<1.0	<0.0050	3.67	***7.49***	***0.0000075***	<0.0050	<0.050	<0.0050	<0.0010	32.2	<0.0010	<0.010	<0.030	***0.0285***	<0.050	***0.2***
17-12a	28-Jul-17	17295170728014	<0.10	<0.010	<0.010	0.902	<0.010	***18.3***	***0.00764***	<0.010	0.033	<0.020	<1.0	<0.0050	16.4	***24.3***	<0.0000050	<0.0050	<0.050	<0.0050	<0.0010	102	0.0013	<0.010	<0.030	***0.0573***	<0.050	<0.10
14-12c	12-Feb-14	17295140212012	0.0024	<0.0004	<0.0004	0.0135	<0.001	0.225	<0.0001	0.00067	0.00181	<0.0006	***0.37***	<0.0001	---	***0.434***	<0.00002	0.00162	0.00354	<0.0004	<0.00002	0.383	<0.0001	0.00129	<0.0006	0.00043	<0.0002	0.0025
14-12c	11-Sep-14	17295140911006	<0.0050	<0.0005	0.00144	0.0206	<0.0005	0.232	<0.000050	<0.0005	0.00114	<0.0005	***1.55***	<0.00025	0.253	***0.652***	<0.0000050	0.00223	0.00116	<0.0005	<0.000050	0.961	<0.000050	<0.0005	<0.0015	0.00183	<0.0005	0.0082
14-12c	29-Jul-15	17295150729012	0.0058	<0.0005	0.00066	0.0201	<0.0005	0.226	<0.000025	<0.0005	0.00062	<0.001	***0.875***	<0.00025	0.327	***0.394***	<0.0000050	0.00112	<0.0025	<0.00025	<0.000050	1.57	<0.000050	<0.0005	<0.0015	0.000781	<0.0025	0.0127
14-12c	02-Nov-15	17295151102024	<0.0050	<0.0005	0.00061	0.0272	<0.0005	0.224	<0.000025	<0.0005	0.00099	<0.001	<0.050	<0.00025	0.416	***0.527***	<0.0000050	0.00111	<0.0025	<0.00025	<0.000050	2.62	<0.000050	<0.0005	<0.0015	0.00188	<0.0025	0.0066
14-12c	24-Aug-16	17295160824027	<0.0050	<0.00050	0.00057	0.0221	<0.00050	0.324	<0.000025	<0.00050	0.00057	<0.0010	***0.66***	<0.00025	0.372	***0.436***	<0.0000050	0.00107	<0.0025	<0.00025	<0.000050	2.93	<0.000050	<0.00050	<0.0015	0.00105	<0.0025	0.0051
17-12c	28-Jul-17	17295170728018	0.0055	<0.00050	0.00091	0.0309	<0.00050	0.199	<0.000025	<0.00050	<0.00050	<0.0010	<0.050	<0.00025	0.242	<0.00050	<0.0000050	0.0129	<0.0025	0.00036	<0.000050	0.72	<0.000050	<0.00050	<0.0015	0.00464	<0.0025	<0.0050
Alberta Tier 1 - Residential/Parkland*			**Al[A,***]**	**0.006[P]**	**0.005[A]**	**1[P]**	**NS**	**1.5[A]**	**H[A,***]**	**0.05[P]**	**NS**	**0.007[A]**	**0.3[A,P]**	**H[A,***]**	**NS**	**0.05[P]**	**0.000005[A]**	**NS**	**H[A,***]**	**0.002[A]**	**0.0001[A]**	**NS**	**NS**	**NS**	**NS**	**0.015[A]**	**NS**	**0.03[A]**
Canadian Drinking Water Guidelines**			**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS**	**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS**	**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS**	**NS[TM]**	**NS[TM]**	**NS**	**NS**	**NS[TM]**	**NS**	**NS[TM]**	**NS**	**NS**	**NS**	**NS[TM]**	**NS**	**NS[TM]**

TABLE B2

Historical Groundwater Quality Results - Dissolved Metals

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
Production Area																											
Town of Calmar																											
M12-02	23-Oct-12	Nichols Environmental	<0.002	0.0004	***0.0056***	0.472	---	0.151	<0.00001	<0.0005	---	<0.001	0.08	0.0005	---	***3.04***	<0.0001	---	0.0094	<0.0002	<0.00001	---	---	---	---	0.013	---	0.002
M12-12	23-Oct-12	Nichols Environmental	<0.002	<0.0002	0.0004	0.059	---	0.129	0.00011	<0.0005	---	0.002	<0.01	<0.0001	---	***0.434***	<0.0001	---	<0.0005	<0.0002	<0.00001	---	---	---	---	0.0148	---	0.002
M12-12	27-Aug-13	17295130827005	<0.01	<0.0004	<0.0004	0.0476	<0.001	0.129	0.00012	<0.0004	0.00024	0.00089	<0.02	<0.0001	---	***0.37***	<0.0001	0.00334	0.00346	<0.0004	<0.0002	1.29	<0.0001	0.00024	<0.0006	0.0144	<0.0002	0.0059
M12-12	13-Feb-14	17295140213022	<0.002	<0.0004	<0.0004	0.0445	<0.001	0.103	<0.0001	<0.0004	<0.0002	0.00107	<0.02	<0.0001	---	***0.0505***	<0.00002	0.00047	0.00215	<0.0004	<0.00002	1.27	<0.0001	<0.0002	<0.0006	0.0137	<0.0002	0.0061
M12-12	11-Sep-14	17295140911009	0.0026	<0.00020	0.00023	0.053	<0.0005	0.125	0.00010	<0.00020	<0.00020	0.00054	<0.030	<0.00010	0.0968	***0.182***	<0.0000050	0.00055	0.0025	<0.00020	<0.000020	1.43	<0.000050	<0.00020	<0.00060	***0.0166***	<0.00020	<0.0050
M12-12	29-Jul-15	17295150729005	0.0021	<0.00020	0.00023	0.0495	<0.00020	0.115	0.00008	<0.00020	<0.00020	0.0009	<0.030	<0.00010	0.102	***0.162***	<0.0000050	0.00051	0.0022	0.00016	<0.000020	1.38	<0.000020	<0.00020	<0.00060	***0.0166***	<0.001	0.0028
M12-12	28-Jul-17	17295170728005	<0.0050	<0.00050	<0.00050	0.0494	<0.00050	0.108	0.00004	<0.00050	<0.00050	0.0011	<0.050	<0.00025	0.0992	<0.00050	<0.0000050	0.00041	<0.0025	<0.00025	<0.000050	1.34	<0.000050	<0.00050	<0.0015	***0.0151***	<0.0025	0.0068
M12-15	23-Oct-12	Nichols Environmental	<0.002	<0.0002	0.0005	0.047	---	0.107	0.00008	0.0005	---	0.002	<0.01	<0.0001	---	***0.436***	<0.0001	---	<0.0005	0.0007	<0.00001	---	---	---	---	0.0149	---	0.002
M12-15	27-Aug-13	17295130827009	<0.01	<0.0004	<0.0004	0.0261	<0.0005	0.0812	<0.0001	<0.0004	0.00025	0.00069	<0.01	<0.0001	---	***0.0974***	<0.0001	0.00352	0.00276	<0.0004	<0.0002	1.25	<0.00005	<0.0002	<0.0003	0.0146	0.00015	0.0054
M12-15	13-Feb-14	17295140213014	<0.001	<0.0004	<0.0004	0.0235	<0.0005	0.0733	<0.0001	<0.0004	<0.0001	0.00088	<0.01	<0.0001	---	0.025	<0.00002	0.00032	0.00246	<0.0004	<0.00001	1.31	<0.00005	<0.0002	<0.0003	0.0139	<0.0001	0.0017
M12-15	11-Sep-14	17295140911020	<0.001	<0.00010	0.00028	0.0229	<0.0005	0.083	0.00010	<0.00010	0.00013	0.00065	<0.030	<0.000050	0.0927	***0.0775***	<0.0000050	0.000313	0.0027	0.00015	<0.000010	1.39	<0.000050	<0.00010	<0.00030	***0.0152***	0.00011	<0.0050
M12-15	29-Jul-15	17295150729001	0.0015	<0.00010	0.00024	0.0209	<0.00010	0.071	0.00009	<0.00010	0.00017	0.00104	<0.030	<0.000050	0.0932	***0.104***	<0.0000050	0.000281	0.00271	0.000117	<0.000010	1.27	0.000021	<0.00010	<0.00030	0.0148	<0.0005	0.0035
M12-15	28-Jul-17	17295170728012	<0.0050	<0.00050	<0.00050	0.0199	<0.00050	0.065	0.00004	<0.00050	<0.00050	<0.0010	<0.050	<0.00025	0.0892	<0.00050	<0.0000050	0.00029	<0.0025	<0.00025	<0.000050	1.26	<0.000050	<0.00050	<0.0015	0.014	<0.0025	<0.0050
M12-16	23-Oct-12	Nichols Environmental	<0.004	<0.0004	0.0009	0.087	---	0.12	0.00020	<0.001	---	0.003	<0.02	<0.0002	---	***0.656***	<0.0001	---	<0.001	<0.0004	<0.00002	---	---	---	---	***0.02***	---	0.005
M12-16	27-Aug-13	17295130827006	<0.01	<0.0004	<0.0004	0.0673	<0.001	0.0947	0.00012	<0.0004	<0.0002	0.00082	<0.02	<0.0001	---	***0.0722***	<0.0001	0.00325	0.00238	<0.0004	<0.0002	1.74	<0.0001	<0.0002	<0.0006	***0.0176***	<0.0002	0.0063
M12-16	13-Feb-14	17295140213023	0.0021	<0.0004	<0.0004	0.061	<0.001	0.0806	<0.0001	<0.0004	<0.0002	0.00137	<0.02	<0.0001	---	0.0168	<0.00002	0.0003	0.00181	<0.0004	<0.00002	1.82	<0.0001	<0.0002	<0.0006	***0.0171***	<0.0002	0.0039
M12-16	11-Sep-14	17295140911021	<0.0020	<0.00020	0.00029	0.066	<0.0005	0.104	0.00009	<0.00020	<0.00020	0.00081	<0.030	<0.00010	0.0828	***0.0564***	<0.0000050	0.00025	0.00229	0.00025	<0.000020	1.88	<0.000050	<0.00020	<0.00060	***0.0193***	<0.00020	<0.0050
M12-16	29-Jul-15	17295150729007	<0.0020	<0.00020	0.00021	0.0593	<0.00020	0.083	0.00005	<0.00020	<0.00020	0.00106	<0.030	<0.00010	0.0752	0.0142	<0.0000050	0.00024	0.0017	0.00021	<0.000020	1.5	<0.000020	<0.00020	<0.00060	***0.0163***	<0.001	0.0036
M12-17s	23-Oct-12	Nichols Environmental	<0.01	<0.001	0.003	0.19	---	0.18	***0.00040***	0.0097	---	<0.005	<0.05	<0.0005	---	***1.26***	<0.0001	---	<0.002	<0.001	<0.00005	---	---	---	---	***0.023***	---	<0.005
M12-17s	27-Aug-13	17295130827003	<0.01	<0.0005	0.00077	0.0778	<0.0025	0.433	***0.00044***	<0.0005	0.00181	0.00254	<0.05	<0.00025	---	***1.55***	<0.0001	0.00352	0.0107	<0.0005	<0.0002	1.83	<0.00025	<0.0005	<0.0015	***0.0299***	0.00067	0.009
M12-17s	13-Feb-14	17295140213025	<0.005	<0.0005	0.0006	0.0782	<0.0025	0.282	***0.00049***	<0.0005	0.00305	0.00297	0.14	<0.00025	---	***1.86***	<0.00002	0.0005	0.0115	<0.0005	<0.00005	1.86	<0.00025	<0.0005	<0.0015	***0.0241***	0.00058	0.0146
M12-17s	11-Sep-14	17295140911026	<0.0050	<0.0005	<0.0005	0.0651	<0.0005	0.377	***0.00046***	<0.0005	0.00118	0.00318	<0.050	<0.00025	0.211	***1.2***	<0.0000050	0.00064	0.0107	<0.0005	<0.000050	1.73	0.000061	<0.0005	<0.0015	***0.0253***	<0.0005	0.0109
M12-17s	29-Jul-15	17295150729011	<0.0050	<0.0005	<0.0005	0.0654	<0.0005	0.4	0.00027	<0.0005	0.00149	0.0016	0.053	<0.00025	0.238	***1.15***	<0.0000050	0.00053	0.0103	<0.00025	<0.000050	1.65	0.000064	<0.0005	<0.0015	***0.0302***	<0.0025	0.0092
M12-17d	23-Oct-12	Nichols Environmental	<0.01	<0.001	***0.0064***	0.14	---	0.11	0.00008	0.0051	---	<0.005	0.27	<0.0005	---	***10.9***	<0.0001	---	<0.0025	<0.001	<0.00005	---	---	---	---	***0.019***	---	0.006
M12-17d	27-Aug-13	17295130827002	<0.01	<0.001	<0.001	0.129	<0.005	0.109	0.00013	<0.001	0.0161	<0.001	***0.85***	<0.0005	---	***10.4***	<0.0001	0.00175	0.014	<0.001	<0.0002	4.13	<0.0005	<0.001	<0.003	***0.0179***	<0.001	0.013
M12-17d	13-Feb-14	17295140213026	<0.005	<0.0005	<0.0005	0.101	<0.0025	0.109	0.00013	<0.0005	0.0128	<0.0006	0.098	<0.00025	---	***8.69***	<0.00002	0.00041	0.0128	<0.0005	<0.00005	3.44	<0.00025	<0.0005	<0.0015	***0.0173***	<0.0005	0.0071
M12-17d	11-Sep-14	17295140911028	<0.010	<0.001	<0.001	0.0876	<0.001	0.15	<0.00010	<0.001	0.0118	0.0023	***0.55***	<0.0005	0.181	***9.33***	<0.0000050	<0.0005	0.0123	<0.001	<0.00010	3.75	<0.00010	<0.001	<0.0030	***0.0211***	<0.001	***0.138***
M12-17d	29-Jul-15	17295150729009	<0.0050	<0.0005	<0.0005	0.0624	<0.0005	0.094	0.00010	<0.0005	0.00706	<0.001	0.07	<0.00025	0.153	***5.21***	<0.0000050	0.00033	0.0086	<0.00025	<0.000050	2.06	<0.000050	<0.0005	<0.0015	***0.0205***	<0.0025	***0.0719***
M12-18	23-Oct-12	Nichols Environmental	<0.02	<0.002	***0.022***	0.92	---	0.28	***0.00440***	0.012	---	<0.01	<0.1	<0.001	---	***24.2***	<0.0001	---	<0.005	<0.002	<0.0001	---	---	---	---	***0.022***	---	0.02
M12-18	27-Aug-13	17295130827004	<0.1	<0.01	<0.01	***1.15***	<0.05	0.63	<0.001	<0.01	0.039	<0.01	***25.1***	<0.005	---	***21.3***	<0.0001	<0.005	0.032	<0.01	<0.001	5.45	<0.005	<0.01	<0.03	0.0119	<0.01	***0.48***
M12-18	13-Feb-14	17295140213017	<0.02	<0.002	<0.002	***1.25***	<0.01	0.384	***0.00156***	<0.002	0.0321	<0.002	***5.65***	<0.001	---	***23.1***	<0.00002	<0.001	0.0394	<0.002	<0.0002	6.85	<0.001	0.0103	<0.0060	0.0134	<0.002	<0.02
M12-18	11-Sep-14	17295140911014	<0.10	<0.010	<0.010	***1.38***	<0.010	<1.0	<0.001	<0.010	0.036	<0.010	***16.9***	<0.0050	0.49	***24.7***	<0.0000050	<0.0050	0.043	<0.010	***0.0019***	6.9	<0.001	<0.010	<0.030	0.0147	<0.010	***0.25***
M12-18	29-Jul-15	17295150729010	<0.050	<0.0050	<0.0050	***1.12***	<0.0050	<0.50	0.00027	<0.0050	0.033	<0.010	***13.8***	<0.0025	0.693	***21.8***	<0.0000050	<0.0025	0.036	<0.0025	<0.0005	6.35	<0.0005	<0.0050	<0.015	0.0148	<0.025	***0.075***
M12-18	02-Nov-15	17295151102014	<0.050	<0.0050	<0.0050	***1.4***	<0.0050	0.57	<0.00025	<0.0050	0.0149	<0.010	***23.6***	<0.0025	0.489	***14.2***	<0.0000050	<0.0025	<0.025	<0.0025	<0.0005	5.6	<0.0005	<0.0050	<0.015	0.00813	<0.025	***0.225***
M12-18	24-Aug-16	17295160824012	<0.050	<0.0050	<0.0050	0.275	<0.0050	0.53	<0.00025	<0.0050	0.0193	<0.010	***18.8***	<0.0025	0.32	***13.9***	***0.0000159***	<0.0025	<0.025	<0.0025	<0.00050	4.87	<0.00050	<0.0050	<0.015	0.0113	<0.025	<0.050
M12-19	23-Oct-12	Nichols Environmental	<0.002	<0.0002	0.004	0.239	---	0.379	0.00008	<0.0005	---	0.001	0.02	<0.0001	---	***0.838***	<0.0001	---	0.011	0.0007	<0.00001	---	---	---	---	0.006	---	0.002
M12-19	27-Aug-13	17295130827007	<0.01	<0.0004	***0.00619***	0.162	<0.001	0.362	0.00019	<0.0004	0.00433	0.00071	***3.76***	0.00017	---	***1.84***	<0.0001	0.00421	0.00724	0.00051	<0.0002	1.17	<0.0001	<0.0002	0.00321	0.00685	0.00064	0.0257
M12-19	13-Feb-14	17295140213019	<0.002	<0.0004	0.002	0.149	<0.001	0.313	0.00012	<0.0004	0.00346	0.00135	***1.05***	<0.0001	---	***1.78***	<0.00002	0.00169	0.00727	0.00071	<0.00002	1.03	<0.0001	0.00035	<0.0006	0.0072	0.00046	0.0039
M12-19	11-Sep-14	17295140911010	0.0027	<0.00020	0.00329	0.196	<0.0005	0.345	0.00024	<0.00020	0.00269	0.00174	***1.28***	<0.00010	0.127	***1.6***	***0.0000099***	0.00146	0.00633	0.0007	<0.000020	1.38	<0.000050	<0.00020	<0.00060	0.00651	0.00055	<0.0050
M12-19	29-Jul-15	17295150729023	0.0026	<0.00020	0.00441	0.236	<0.00020	0.311	0.00005	<0.00020	0.00278	0.00069	***6.16***	<0.00010	0.13	***1.33***	<0.0000050	0.00134	0.0055	0.00035	<0.000020	1.23	<0.000020	<0.00020	<0.00060	0.00534	<0.001	0.0031
13-2	27-Aug-13	17295130827008	<0.1	<0.01	<0.01	0.0896	<0.05	0.46	<0.001	<0.01	<0.01	<0.01	<1	<0.005	---	***0.332***	<0.0001	0.0154	<0.01	<0.01	<0.001	7.2	<0.005	<0.01	<0.03	***0.0301***	<0.01	<0.1
13-2	13-Feb-14	17295140213016	<0.01	<0.001	<0.001	0.0773	<0.005	0.107	***0.00056***	<0.001	0.0012	0.0016	<0.1	<0.0005	---	***0.879***	<0.00002	0.00327	0.0087	0.002	<0.0001	8.05	<0.0005	<0.001	<0.0030	***0.0284***	<0.001	<0.01
13-2	11-Sep-14	17295140911023	<0.020	<0.0020	<0.0020	0.0584	<0.0020	0.3	***0.00069***	<0.0020	<0.0020	0.0036	<0.20	<0.001	0.239	***0.734***	<0.0000050	0.0022	0.0105	<0.0020	<0.00020	6.21	<0.00020	0.0039	<0.0060	***0.0231***	<0.0020	<0.020
13-2	29-Jul-15	17295150729014	<0.010	<0.001	<0.001	0.0433	<0.001	0.17	0.00025	<0.001	0.0023	<0.0020	<0.10	<0.0005	0.267	***1.48***	<0.0000050	0.00153	0.0106	<0.0005	<0.00010	5.15	<0.00010	<0.001	<0.0030	***0.0188***	<0.0050	<0.010
17-2	28-Jul-17	17295170728010	<0.0050	<0.00050	0.00052	0.0981	<0.00050	0.17	***0.00090***	<0.00050	0.00343	0.0011	<0.050	<0.00025	0.366	***8.82***	<0.0000050	0.0006	0.0176	<0.00025	<0.000050	8.93	0.000146	<0.00050	<0.0015	***0.0413***	<0.0025	<0.0050
13-4	27-Aug-13	17295130827011	<0.01	<0.001	<0.001	0.0978	<0.005	0.106	***0.00060***	<0.001	0.0026	<0.001	<0.1	<0.0005	---	***0.656***	<0.0001	0.00143	0.0155	<0.001	<0.0002	3.11	<0.0005	<0.001	<0.003	***0.0165***	<0.001	***0.038***
13-4	13-Feb-14	17295140213015	<0.005	<0.0005	<0.0005	0.084	<0.0025	0.09	***0.00049***	<0.0005	0.00308	0.00125	<0.05	<0.00025	---	***0.877***	<0.00002	0.0008	0.0141	<0.0005	<0.00005	3.25	<0.00025	<0.0005	<0.0015	***0.0162***	<0.0005	<0.005
13-4	11-Sep-14	17295140911017	0.014	<0.001	<0.001	0.0973	<0.001	0.11	0.00034	<0.001	0.0013	<0.001	<0.10	<0.0005	0.15	***0.651***	<0.0000050	<0.0005	0.0122	<0.001	<0.00010	3.14	0.00011	<0.001	<0.0030	***0.0173***	<0.001	0.018
13-4	29-Jul-15	17295150729002	<0.0050	<0.0005	<0.0005	0.0804	<0.0005	0.102	0.00031	<0.0005	0.00053	0.0013	<0.050	<0.00025	0.176	***0.485***	<0.0000050	0.00041	0.0094	<0.00025	<0.0000050	2.73	<0.000050	<0.0005	<0.0015	***0.0184***	<0.0025	0.0105
17-4	28-Jul-17	17295170728015	<0.020	<0.0020	<0.0020	0.15	<0.0020	<0.20	***0.00075***	<0.0020	<0.0020	<0.0040	<0.20	<0.0010	0.216	***0.463***	<0.0000050	<0.0010	<0.010	<0.0010	<0.00020	5.04	<0.00020	<0.0020	<0.0060	***0.0163***	<0.010	<0.020
Alberta Tier 1 - Residential/Parkland*			Al[A,***]	0.006[P]	0.005[A]	1[P]	NS	1.5[A]	H[A,***]	0.05[P]	NS	0.007[A]	0.3[A,P]	H[A,***]	NS	0.05[P]	0.000005[A]	NS	H[A,***]	0.002[A]	0.0001[A]	NS	NS	NS	NS	0.015[A]	NS	0.03[A]
Canadian Drinking Water Guidelines**			NS[TM]	NS[TM]	NS[TM]	NS[TM]	NS	NS[TM]	NS[TM]	NS[TM]	NS	NS[TM]	NS[TM]	NS[TM]	NS	NS[TM]	NS[TM]	NS	NS	NS[TM]	NS	NS[TM]	NS	NS	NS	NS[TM]	NS	NS[TM]

TABLE B2

Historical Groundwater Quality Results - Dissolved Metals

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	B mg/L	Cd mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	Se mg/L	Ag mg/L	Sr mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L
Production Area																											
Town of Calmar																											
13-6b	27-Aug-13	17295130827014	<0.01	<0.0005	0.00179	0.062	<0.0025	0.233	0.00016	<0.0005	0.0259	0.00101	***1.89***	<0.00025	---	***6.43***	<0.0001	0.00753	0.0425	<0.0005	<0.0002	1.64	<0.00025	<0.0005	<0.0015	0.0147	0.00067	0.0131
13-6b	13-Feb-14	17295140213018	<0.005	<0.0005	***0.00574***	0.0583	<0.0025	0.31	<0.0001	<0.0005	0.0166	<0.0006	***9.57***	<0.00025	---	***6.8***	<0.00002	0.00448	0.0168	<0.0005	<0.00005	1.86	<0.00025	<0.0005	<0.0015	0.0137	<0.0005	<0.005
13-6b	11-Sep-14	17295140911027	0.0051	<0.0005	***0.00679***	0.051	<0.0005	0.318	<0.000050	<0.0005	0.012	0.00191	***10.5***	<0.00025	0.246	***4.93***	<0.0000050	0.00491	0.0142	<0.0005	<0.000050	1.96	<0.000050	0.00113	<0.0015	0.0121	<0.0005	0.0063
13-6b	29-Jul-15	17295150729008	0.0161	<0.0005	***0.00603***	0.044	<0.0005	0.371	<0.000025	<0.0005	0.00931	<0.001	***9.18***	<0.00025	0.305	***3.33***	<0.0000050	0.0041	0.0111	<0.00025	<0.000050	1.9	<0.000050	<0.0005	<0.0015	0.0101	<0.0025	0.0101
13-6b	02-Nov-15	17295151102015	<0.0050	<0.0005	0.00269	0.0425	<0.0005	0.316	<0.000025	<0.0005	0.00802	<0.001	***1.49***	<0.00025	0.267	***3.02***	<0.0000050	0.00319	0.0101	<0.00025	<0.000050	1.83	<0.000050	<0.0005	<0.0015	0.00971	<0.0025	0.009
13-6b	24-Aug-16	17295160824009	<0.0050	<0.00050	***0.00648***	0.0423	<0.00050	0.511	0.00007	<0.00050	0.00648	<0.0010	***5.64***	<0.00025	0.236	***1.73***	<0.0000050	0.0033	0.0079	<0.00025	<0.000050	2.25	0.000055	<0.00050	<0.0015	0.00644	<0.0025	<0.0050
14-8a	12-Feb-14	17295140212001	0.0033	<0.0004	<0.0004	0.0501	<0.0005	0.0493	<0.0001	<0.0004	0.00056	0.00114	<0.01	<0.0001	---	***0.151***	<0.00002	0.00048	0.00461	<0.0004	<0.00001	0.355	<0.00005	0.00044	<0.0003	0.00431	0.00013	0.004
14-8a	11-Sep-14	17295140911030	0.0088	<0.00010	0.00049	0.103	<0.0005	0.057	<0.000010	<0.00010	0.00058	0.00076	<0.030	<0.000050	0.0467	***0.213***	<0.0000050	0.000751	0.00229	0.00015	<0.000010	0.445	<0.000050	<0.00010	<0.00030	0.00373	0.00146	0.0176
14-8a	29-Jul-15	17295150729020	0.0012	<0.00010	0.00033	0.0867	<0.00010	0.056	0.00001	<0.00010	0.00043	0.00087	<0.030	<0.000050	0.0498	***0.176***	<0.0000050	0.000692	0.00204	0.000106	<0.000010	0.443	0.000016	<0.00010	<0.00030	0.00423	0.00114	***0.0341***
14-8a	28-Jul-17	17295170728002	<0.0050	<0.00050	<0.00050	0.0859	<0.00050	<0.050	0.00003	<0.00050	<0.00050	<0.0010	<0.050	<0.00025	0.052	0.00072	<0.0000050	0.00064	<0.0025	<0.00025	<0.000050	0.42	<0.000050	<0.00050	<0.0015	0.00362	<0.0025	***0.232***
14-8c	12-Feb-14	17295140212003	0.0045	<0.0004	0.00269	0.0194	<0.001	0.202	<0.0001	<0.0004	0.00117	0.00068	<0.02	<0.0001	---	***0.375***	<0.00002	0.0138	0.00258	<0.0004	<0.00002	0.453	<0.0001	0.00777	<0.0006	0.00623	0.00034	0.0103
14-8c	11-Sep-14	17295140911024	0.0147	<0.00020	0.0047	0.107	<0.0005	0.134	<0.000020	0.00032	0.00196	0.00073	0.112	<0.00010	0.0752	***0.426***	<0.0000050	0.0123	0.0101	0.00026	<0.000020	0.372	<0.000050	0.00062	0.00154	0.00872	0.00192	<0.0050
14-8c	29-Jul-15	17295150729021	0.0066	<0.00020	0.00439	0.0523	<0.00020	0.178	<0.000010	<0.00020	0.00093	<0.00040	0.039	<0.00010	0.104	***0.196***	<0.0000050	0.0106	0.0061	0.00012	<0.000020	0.24	<0.000020	<0.00020	<0.00060	0.0058	<0.001	0.0041
14-8c	28-Jul-17	17295170728011	0.01	<0.00050	0.00176	0.0933	<0.00050	0.099	<0.000025	<0.00050	<0.00050	0.0053	<0.050	<0.00025	0.0508	***0.18***	<0.0000050	0.00309	0.005	0.0005	<0.000050	0.42	<0.000050	<0.00050	0.0045	0.00516	<0.0025	***0.139***
14-8d	12-Feb-14	17295140212002	0.0079	<0.0004	0.00098	0.0251	<0.001	0.142	***0.00052***	<0.0004	0.0199	0.00133	0.044	<0.0001	---	***4***	<0.00002	0.00145	0.0541	0.0016	<0.00002	0.793	<0.0001	0.00072	<0.0006	0.00763	<0.0002	0.0142
14-8d	11-Sep-14	17295140911029	0.0045	<0.00010	0.00349	0.0664	<0.0005	0.051	<0.000010	<0.00010	0.00421	0.00047	0.241	<0.000050	0.0247	***2.09***	<0.0000050	0.00185	0.00932	0.00023	<0.000010	0.462	<0.000050	<0.00010	<0.00030	0.0069	0.00066	0.0131
14-8d	29-Jul-15	17295150729022	0.0021	<0.00010	0.00272	0.078	<0.00010	0.059	0.00001	<0.00010	0.00326	0.00046	***0.894***	<0.000050	0.0368	***2.07***	<0.0000050	0.00143	0.00586	0.000111	<0.000010	0.45	<0.000010	<0.00010	<0.00030	0.00827	0.00073	***0.0317***
14-8d	28-Jul-17	17295170728004	0.0072	0.00013	0.00138	0.0629	<0.00010	0.045	0.00022	<0.00010	0.0003	0.00272	0.044	<0.000050	0.03	***0.799***	<0.0000050	0.00127	0.0039	0.000268	<0.000010	0.239	0.000034	<0.00010	0.00286	0.00306	0.00101	***0.141***
17-13a	28-Jul-17	17295170728001	<0.010	<0.0010	<0.0010	0.123	<0.0010	0.18	0.00018	<0.0010	<0.0010	<0.0020	<0.10	<0.00050	0.28	***2.55***	<0.0000050	0.0103	0.0061	<0.00050	<0.00010	2.98	<0.00010	<0.0010	<0.0030	***0.0267***	<0.0050	<0.010
17-13c	28-Jul-17	17295170728003	0.0141	<0.00050	***0.0224***	0.0148	<0.00050	0.255	<0.000025	0.00162	<0.00050	<0.0010	<0.050	<0.00025	0.17	<0.00050	<0.0000050	0.0314	<0.0025	0.00066	<0.000050	0.314	<0.000050	<0.00050	<0.0015	0.00369	0.0031	<0.0050
17-13c	03-Nov-17	17295171103004	0.0299	0.00032	***0.0234***	0.0183	<0.00020	0.278	<0.000010	0.00312	<0.00020	<0.00040	0.023	<0.00010	0.166	***0.177***	<0.0000050	0.0452	0.0017	***0.00343***	<0.000020	0.375	<0.000020	0.00082	0.00086	0.00503	0.004	<0.0020
Well Centre Area																											
Town of Calmar																											
13-5	27-Aug-13	17295130827010	<0.01	<0.0004	0.00042	0.0415	<0.001	0.0853	0.00016	<0.0004	0.00226	0.00146	<0.02	<0.0001	---	***0.446***	<0.0001	0.00289	0.0109	0.00069	<0.0002	1.42	<0.0001	<0.0002	<0.0006	***0.033***	<0.0002	0.0292
13-5	13-Feb-14	17295140213020	<0.002	<0.0004	0.00066	0.0399	<0.001	0.0883	0.00023	<0.0004	0.00328	0.00107	<0.02	<0.0001	---	***1.94***	<0.00002	0.00077	0.0101	<0.0004	<0.00002	1.48	<0.0001	<0.0002	<0.0006	***0.0333***	0.00039	0.0036
13-5	11-Sep-14	17295140911016	0.0033	<0.00020	0.00072	0.0484	<0.0005	0.101	0.00017	<0.00020	0.0021	0.00116	<0.030	<0.00010	0.109	***1.66***	<0.0000050	0.00064	0.00739	0.00051	<0.000020	1.58	<0.000050	<0.00020	<0.00060	***0.0362***	0.00034	<0.0050
13-5	29-Jul-15	17295150729004	0.0035	<0.00020	0.00049	0.0445	<0.00020	0.094	0.00011	<0.00020	0.00113	0.00119	<0.030	<0.00010	0.114	***1.3***	<0.0000050	0.00052	0.0062	0.00022	<0.000020	1.43	0.000037	<0.00020	<0.00060	***0.0347***	<0.001	0.0039
13-5	28-Jul-17	17295170728009	<0.0050	<0.00050	<0.00050	0.0436	<0.00050	0.082	0.00004	0.00067	<0.00050	0.0035	<0.050	<0.00025	0.108	0.00227	<0.0000050	0.00057	<0.0025	0.00198	<0.000050	1.28	<0.000050	<0.00050	<0.0015	***0.0251***	<0.0025	<0.0050
13-7	27-Aug-13	17295130827012	<0.01	<0.0004	<0.0004	0.0441	<0.001	0.0731	<0.0001	<0.0004	0.00089	0.00108	<0.02	<0.0001	---	***0.112***	<0.0001	0.00184	0.00573	***0.00268***	<0.0002	1.22	<0.0001	<0.0002	<0.0006	***0.0224***	<0.0002	0.0053
13-7	13-Feb-14	17295140213021	0.0017	<0.0004	0.00058	0.0412	<0.0005	0.0831	<0.0001	<0.0004	0.00058	0.00096	<0.01	<0.0001	---	***0.122***	<0.00002	0.00115	0.00334	0.00116	<0.00001	1.22	<0.00005	<0.0002	<0.0003	***0.022***	0.00026	0.0029
13-7	11-Sep-14	17295140911018	0.0021	<0.00010	0.0005	0.0493	<0.0005	0.082	0.00004	<0.00010	0.00036	0.00077	<0.030	<0.000050	0.102	0.0347	<0.0000050	0.000784	0.0017	***0.00264***	<0.000010	1.29	<0.000050	<0.00010	<0.00030	***0.0224***	0.0002	<0.0050
13-7	29-Jul-15	17295150729015	0.0011	0.00034	0.0012	0.0827	<0.00010	0.07	0.00003	<0.00010	0.00037	0.00092	<0.030	0.000064	0.0785	***0.12***	<0.0000050	0.00165	0.00315	0.000994	<0.000010	1.04	0.000016	<0.00010	<0.00030	***0.022***	<0.0005	0.0023
13-7	28-Jul-17	17295170728007	<0.0050	<0.00050	0.00052	0.0602	<0.00050	0.069	<0.000025	<0.00050	<0.00050	<0.0010	<0.050	<0.00025	0.0894	<0.00050	<0.0000050	0.00092	<0.0025	***0.00253***	<0.000050	1.07	<0.000050	<0.00050	<0.0015	***0.0185***	<0.0025	<0.0050
Alberta Tier 1 - Residential/Parkland*			**Al[A,***]**	**0.006[P]**	**0.005[A]**	**1[P]**	**NS**	**1.5[A]**	**H[A,***]**	**0.05[P]**	**NS**	**0.007[A]**	**0.3[A,P]**	**H[A,***]**	**NS**	**0.05[P]**	**0.000005[A]**	**NS**	**H[A,***]**	**0.002[A]**	**0.0001[A]**	**NS**	**NS**	**NS**	**NS**	**0.015[A]**	**NS**	**0.03[A]**
Canadian Drinking Water Guidelines**			**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS**	**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS**	**NS[TM]**	**NS[TM]**	**NS[TM]**	**NS**	**NS[TM]**	**NS[TM]**	**NS**	**NS**	**NS[TM]**	**NS**	**NS[TM]**	**NS**	**NS**	**NS**	**NS[TM]**	**NS**	**NS[TM]**

Notes:

--- - not analyzed

NS - not specified

[A] - indicates guideline for Aquatic Life exposure pathway

Al - guideline value is 0.05 mg/L or pH dependent if pH <6.5

H - dependent on hardness value

[P] - indicates guideline for Potable Groundwater exposure pathway

[TM] - total metals guideline available

* - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)

** - *Guidelines for Canadian Drinking Water Quality-Summary Table* (Health Canada 2020)

Italics - indicates values do not meet applicable guidelines

TABLE B3

Historical Groundwater Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	Styrene mg/L	F1 C_6-C_{10} - BTEX mg/L	F2 $C_{>10}$-C_{16} mg/L
Flare Pit									
Trailer Park									
13-1	27-Aug-13	17295130827015	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-1	11-Sep-14	17295140911005	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-3	27-Aug-13	17295130827001	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-3	13-Feb-14	17295140213024	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
Developer									
14-9a	12-Feb-14	17295140212004	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-9a	11-Sep-14	17295140911004	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-9c	12-Feb-14	17295140212006	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-9d	12-Feb-14	17295140212005	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-9d	11-Sep-14	17295140911001	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-10a	12-Feb-14	17295140212007	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-10a	11-Sep-14	17295140911003	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-10c	12-Feb-14	17295140212008	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-11a	12-Feb-14	17295140212009	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-11a	11-Sep-14	17295140911019	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-11a	31-Aug-16	17295160831001	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
14-11a	28-Jul-17	17295170728021	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
14-11a	19-Oct-18	17295181019007	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
14-11a	21-Oct-19	17295191021006	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
14-11c	12-Feb-14	17295140212010	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-11c	11-Sep-14	17295140911012	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-12a	12-Feb-14	17295140212011	***0.0388***	<0.0005	***0.0019***	0.00345	<0.001	<0.1	<0.25
14-12a	11-Sep-14	17295140911002	***0.0495***	<0.0005	0.0013	0.00241	<0.001	<0.1	0.49
14-12a	29-Jul-15	17295150729003	***0.0192***	<0.0005	<0.0005	0.00121	<0.001	<0.10	<0.25
14-12a	02-Nov-15	17295151102025	***0.00856***	<0.0005	<0.0005	<0.00071	<0.001	<0.10	---
14-12a	24-Aug-16	17295160824026	***0.0692***	<0.00050	***0.0072***	0.00812	<0.0010	<0.10	0.1
17-12a	28-Jul-17	17295170728014	0.00309	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-12a	03-Nov-17	17295171103003	0.00086	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-12a	19-Oct-18	17295181019006	0.00114	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
17-12a	21-Oct-19	17295191021004	0.00316	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
Alberta Tier 1 - Coarse-grained Soils - Residential/Parkland*			**$0.005^{P,MAC}$**	**0.021^{A}**	**$0.0016^{P,AO}$**	**$0.02^{P,AO}$**	**0.072^{A}**	**0.81^{In}**	**1.1^{P}**
Canadian Drinking Water Guidelines**			**0.005^{MAC}**	**0.024^{AO}**	**0.0016^{AO}**	**0.02^{AO}**	**NS**	**NS**	**NS**

TABLE B3

Historical Groundwater Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	Styrene mg/L	F1 C_6-C_{10} - BTEX mg/L	F2 $C_{>10}$-C_{16} mg/L
Flare Pit									
Trailer Park									
14-12c	12-Feb-14	17295140212012	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-12c	11-Sep-14	17295140911006	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-12c	29-Jul-15	17295150729012	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.10	<0.25
14-12c	02-Nov-15	17295151102024	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.10	<0.10
14-12c	24-Aug-16	17295160824027	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-12c	28-Jul-17	17295170728018	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-12c	19-Oct-18	17295181019005	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
17-12c	21-Oct-19	17295191021005	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
Production Area									
Town of Calmar									
M12-02	23-Oct-12	Nichols Environmental	***0.012***	<0.001	***0.0600***	***0.131***	---	***2.9***	***7.7***
M12-12	23-Oct-12	Nichols Environmental	<0.001	<0.001	<0.001	<0.001	---	<0.2	<0.1
M12-12	27-Aug-13	17295130827005	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-15	23-Oct-12	Nichols Environmental	0.002	<0.001	<0.001	<0.001	---	<0.2	<0.1
M12-15	27-Aug-13	17295130827009	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-15	13-Feb-14	17295140213014	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-16	23-Oct-12	Nichols Environmental	<0.001	<0.001	<0.001	<0.001	---	<0.2	<0.1
M12-16	27-Aug-13	17295130827006	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-17s	23-Oct-12	Nichols Environmental	0.001	<0.001	<0.001	<0.001	---	<0.2	<0.1
M12-17s	27-Aug-13	17295130827003	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-17s	13-Feb-14	17295140213025	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-17d	23-Oct-12	Nichols Environmental	0.001	<0.001	<0.001	<0.001	---	<0.2	<0.1
M12-17d	27-Aug-13	17295130827002	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-17d	13-Feb-14	17295140213026	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
M12-18	23-Oct-12	Nichols Environmental	0.002	<0.001	<0.001	<0.001	---	<0.2	<0.1
M12-18	27-Aug-13	17295130827004	0.00109	<0.0005	***0.0544***	<0.00071	<0.001	0.16	<0.25
M12-18	13-Feb-14	17295140213017	0.00067	<0.0005	***0.0285***	<0.00071	<0.001	<0.1	0.32
M12-18	11-Sep-14	17295140911014	0.00075	<0.0005	***0.0464***	<0.00071	<0.001	<0.1	0.36
M12-18	29-Jul-15	17295150729010	0.00062	<0.0005	***0.0096***	<0.00071	<0.001	0.11	0.45
M12-18	02-Nov-15	17295151102014	0.00073	<0.0005	***0.0074***	<0.00071	<0.001	<0.10	0.7
M12-18	24-Aug-16	17295160824012	0.00059	<0.00050	<0.00050	<0.00071	<0.0010	0.11	0.28
Alberta Tier 1 - Coarse-grained Soils - Residential/Parkland*			**$0.005^{P,MAC}$**	**0.021^{A}**	**$0.0016^{P,AO}$**	**$0.02^{P,AO}$**	**0.072^{A}**	**0.81^{In}**	**1.1^{P}**
Canadian Drinking Water Guidelines**			**0.005^{MAC}**	**0.024^{AO}**	**0.0016^{AO}**	**0.02^{AO}**	**NS**	**NS**	**NS**

TABLE B3

Historical Groundwater Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	Styrene mg/L	F1 C_6-C_{10} - BTEX mg/L	F2 $C_{>10}$-C_{16} mg/L
Production Area									
Town of Calmar									
M12-19	23-Oct-12	Nichols Environmental	<0.001	<0.001	***0.0020***	<0.001	---	0.2	0.1
M12-19	27-Aug-13	17295130827007	<0.0005	<0.0005	0.0007	<0.00071	<0.001	<0.1	0.6
M12-19	13-Feb-14	17295140213019	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	0.75
M12-19	11-Sep-14	17295140911010	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	0.62
M12-19	29-Jul-15	17295150729023	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	0.1	0.87
M12-19	02-Nov-15	17295151102019	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.10	0.97
M12-19	24-Aug-16	17295160824014	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	0.46
13-2	27-Aug-13	17295130827008	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-2	13-Feb-14	17295140213016	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-4	27-Aug-13	17295130827011	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-4	13-Feb-14	17295140213015	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-6b	27-Aug-13	17295130827014	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-6b	13-Feb-14	17295140213018	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-8a	12-Feb-14	17295140212001	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-8c	12-Feb-14	17295140212003	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
14-8d	12-Feb-14	17295140212002	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
17-13a	28-Jul-17	17295170728001	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-13a	03-Nov-17	17295171103002	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-13a	19-Oct-18	17295181019004	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
17-13a	21-Oct-19	17295191021001	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
17-13c	28-Jul-17	17295170728003	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-13c	03-Nov-17	17295171103004	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
17-13c	19-Oct-18	17295181019001	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
17-13c	21-Oct-19	17295191021002	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
Alberta Tier 1 - Coarse-grained Soils - Residential/Parkland*			**$0.005^{P,MAC}$**	**0.021^{A}**	**$0.0016^{P,AO}$**	**$0.02^{P,AO}$**	**0.072^{A}**	**0.81^{In}**	**1.1^{P}**
Canadian Drinking Water Guidelines**			**0.005^{MAC}**	**0.024^{AO}**	**0.0016^{AO}**	**0.02^{AO}**	**NS**	**NS**	**NS**

TABLE B3

Historical Groundwater Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Benzene mg/L	Toluene mg/L	Ethylbenzene mg/L	Xylenes mg/L	Styrene mg/L	F1 C_6-C_{10} - BTEX mg/L	F2 $C_{>10}$-C_{16} mg/L
Well Centre Area									
Town of Calmar									
13-5	27-Aug-13	17295130827010	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-5	13-Feb-14	17295140213020	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-5	28-Jul-17	17295170728009	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
13-5	03-Nov-17	17295171103001	<0.00050	<0.00050	<0.00050	<0.00071	<0.0010	<0.10	<0.10
13-5	19-Oct-18	17295181019003	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
13-5	21-Oct-19	17295191021007	<0.00050	<0.00050	<0.00050	<0.00071	<0.00050	<0.10	<0.10
13-7	27-Aug-13	17295130827012	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
13-7	13-Feb-14	17295140213021	<0.0005	<0.0005	<0.0005	<0.00071	<0.001	<0.1	<0.25
Alberta Tier 1 - Coarse-grained Soils - Residential/Parkland*			**$0.005^{P,MAC}$**	**0.021^{A}**	**$0.0016^{P,AO}$**	**$0.02^{P,AO}$**	**0.072^{A}**	**0.81^{In}**	**1.1^{P}**
Canadian Drinking Water Guidelines**			**0.005^{MAC}**	**0.024^{AO}**	**0.0016^{AO}**	**0.02^{AO}**	**NS**	**NS**	**NS**

Notes:

--- - not analyzed

NS - guideline not specified

A - indicates guideline for Aquatic Life exposure pathway

AO - aesthetic objective from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)

In - indicates guideline for Inhalation exposure pathway

MAC - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)

P - indicates guideline for Potable Groundwater exposure pathway

* - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)

Italics - indicates values do not meet applicable guidelines

TABLE B4

Historical Groundwater Quality Results - Polycyclic Aromatic Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Monitoring Well	Sample Date	MSI Sample Number	Acenaphthene mg/L	Acenaphthylene mg/L	Anthracene mg/L	Benz[a]anthracene++ mg/L	Benzo[b&j]fluoranthene++ mg/L	Benzo[k]fluoranthene++ mg/L	Benzo[g,h,i]perylene++ mg/L	Benzo[a]pyrene++ mg/L	Chrysene++ mg/L	Dibenz[a,h]anthracene++ mg/L	Fluoranthene mg/L	Fluorene mg/L	Indeno[1,2,3-c,d]pyrene++ mg/L	Naphthalene mg/L	Phenanthrene mg/L	Pyrene mg/L	B[a]P TPE mg/L
Production Area																			
Town of Calmar																			
M12-02	23-Oct-12	Nichols Environmental	<0.1	0.0007	***0.000138***	0.0003	0.0001	<0.0001	0.0003	***0.000162***	0.0016	<0.00005	***0.0001***	***0.0052***	<0.00005	***0.033***	***0.0091***	***0.0006***	***0.00022***
M12-12	23-Oct-12	Nichols Environmental	<0.0001	<0.0001	<0.000005	<0.00001	<0.0001	<0.0001	<0.00005	<0.000008	<0.0001	<0.00005	<0.00001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00001	ND
M12-15	23-Oct-12	Nichols Environmental	<0.0001	<0.0001	<0.000005	<0.00001	<0.0001	<0.0001	<0.00005	<0.000008	<0.0001	<0.00005	<0.00001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00001	ND
M12-16	23-Oct-12	Nichols Environmental	<0.0001	<0.0001	<0.000005	<0.00001	<0.0001	<0.0001	<0.00005	<0.000008	<0.0001	<0.00005	<0.00001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00001	ND
M12-17s	23-Oct-12	Nichols Environmental	<0.0001	<0.0001	<0.000005	<0.00001	<0.0001	<0.0001	<0.00005	<0.000008	<0.0001	<0.00005	<0.00001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00001	ND
M12-17d	23-Oct-12	Nichols Environmental	<0.0001	<0.0001	<0.000005	<0.00001	<0.0001	<0.0001	<0.00005	<0.000008	<0.0001	<0.00005	<0.00001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00001	ND
M12-18	23-Oct-12	Nichols Environmental	<0.0001	<0.0001	<0.000005	<0.00001	<0.0001	<0.0001	<0.00005	<0.000008	<0.0001	<0.00005	<0.00001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00001	ND
M12-19	23-Oct-12	Nichols Environmental	<0.0001	0.0008	<0.000005	<0.00001	<0.0001	<0.0001	<0.00005	<0.000008	<0.0001	<0.00005	<0.00001	<0.0001	<0.00005	<0.0001	<0.0001	<0.00001	ND
AB Tier 1 - Coarse-grained Soils - Residential/Parkland*			**0.0058^{A}**	**NS**	**0.000012^{A}**	**NS**	**NS**	**NS**	**NS**	**0.0018^{ES}**	**NS**	**NS**	**0.000057^{A}**	**0.003^{A}**	**NS**	**0.001^{A}**	**0.0004^{A}**	**0.000092^{A}**	**0.00004^{P}**
Canadian Drinking Water Guidelines**			**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**0.00004^{MAC}**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Notes:

--- - not analyzed

ND - not detected

NS - not specified

^{A} - indicates guideline for Aquatic Life exposure pathway

^{ES} - indicates guideline for Direct Soil Contact (eco) exposure pathway

^{MAC} - maximum acceptable concentration from Guidelines for Canadian Drinking Water Quality-Summary Table (Health Canada 2020)

^{P} - indicates guideline for Potable Groundwater exposure pathway

$^{++}$ - carcinogenic PAH compounds

B[a]P TPE - Benzo[a]pyrene Total Potency Equivalents calculated by Matrix Solutions

* - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)

** - *Guidelines for Canadian Drinking Water Quality-Summary Table* (Health Canada 2020)

Italics - indicates values do not meet applicable guidelines

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Flare Pit																	
Trailer Park																	
13-B1	1.00	1.50	29-Jul-13	17295130729005	7.32	***4.12***	1.72	71.1	132	510	73.8	8.6	423	1220	Subsoil	Fair	Good
13-B1	3.00	3.50	29-Jul-13	17295130729009	7.47	***11***	***4.28***	41	286	556	164	11.1	1490	643	Subsoil	Unsuitable	Fair
13-B1	5.00	5.50	29-Jul-13	17295130729013	7.95	***3.99***	***4.35***	62.3	249	230	102	13.5	256	1130	Subsoil	Fair	Fair
13-B1	6.50	7.00	29-Jul-13	17295130729016	8.34	1.96	***9.31***	72.9	231	38.9	15.4	9.1	<15	547	Subsoil	Good	Poor
13-B2	0.60	1.00	29-Jul-13	17295130729021	7.52	***4.2***	1.12	62.7	79.2	531	45.9	3.2	457	964	Subsoil	Fair	Good
13-B2	4.00	4.50	29-Jul-13	17295130729028	7.58	***16.4***	***4.9***	31.9	356	842	250	11.3	2090	593	Subsoil	Unsuitable	Fair
13-B2	5.50	6.00	29-Jul-13	17295130729031	7.9	***5.61***	3.58	52	220	343	128	14.3	484	1110	Subsoil	Poor	Good
13-B3	1.50	2.00	29-Jul-13	17295130729037	8.04	***3.64***	***26.4***	111	803	46.7	9.8	15.6	816	651	Subsoil	Fair	Unsuitable
13-B3	3.00	3.50	29-Jul-13	17295130729040	7.63	***45.6***	***48.8***	44.9	4000	857	169	104	7380	380	Subsoil	Unsuitable	Unsuitable
13-B3	6.00	6.50	29-Jul-13	17295130729046	8.2	***14.6***	***7.18***	59	712	855	248	28.9	3380	253	Subsoil	Unsuitable	Fair
13-B3	7.50	8.00	29-Jul-13	17295130729049	8.15	***3.91***	***9.53***	60.1	340	113	28.8	11.7	540	327	Subsoil	Fair	Poor
13-B3	8.50	9.00	29-Jul-13	17295130729051	8.58	***3.04***	***12.9***	59.6	340	59.6	17.3	13.9	135	556	Subsoil	Fair	Unsuitable
13-B4	0.30	0.60	29-Jul-13	17295130729054	7.22	***11.6***	***17.6***	64.7	1140	363	77.9	2.2	2500	477	Subsoil	Unsuitable	Unsuitable
13-B4	3.50	4.00	29-Jul-13	17295130729061	7.53	***60.9***	***42.8***	37.1	3970	1320	267	48.4	9060	610	Subsoil	Unsuitable	Unsuitable
13-B4	5.50	6.00	29-Jul-13	17295130729065	8.1	***17.8***	***9***	55.8	939	985	299	25.7	3770	860	Subsoil	Unsuitable	Poor
13-B4	7.00	7.50	29-Jul-13	17295130729068	7.86	***3.07***	***4.98***	52.1	170	112	34.7	11.6	288	386	Subsoil	Fair	Fair
13-B5	0.60	1.00	30-Jul-13	17295130730072	7.04	1.24	0.84	79.5	33	104	25.4	<1.6	95	280	Subsoil	Good	Good
13-B5	3.50	4.00	30-Jul-13	17295130730078	7.44	1.15	2.19	45.8	41.4	38.2	12.6	3.85	18.7	174	Subsoil	Good	Good
13-B6	0.60	1.00	30-Jul-13	17295130730086	7.15	***21.5***	***4.99***	72	743	1660	407	15.2	5450	<430	Subsoil	Unsuitable	Fair
13-B6	3.50	4.00	30-Jul-13	17295130730092	7.5	***5.2***	1.56	44.2	75.5	288	69.5	10.3	380	741	Subsoil	Poor	Good
13-B6	6.50	7.00	30-Jul-13	17295130730098	8.01	2.15	***4.64***	60.3	137	76.9	19.9	11	161	322	Subsoil	Good	Fair
13-B7	0.30	0.60	30-Jul-13	17295130730116	7.41	1.11	0.71	59.8	20.4	73.7	18.4	1.3	32	248	Subsoil	Good	Good
13-B7	2.00	2.50	30-Jul-13	17295130730120	7.56	1.04	0.81	80	29.5	86.3	24.1	5.4	30	303	Subsoil	Good	Good
13-B7	3.00	3.50	30-Jul-13	17295130730122	7.77	1.05	1.35	41.7	24.8	40.6	12.3	3.74	<8.3	169	Subsoil	Good	Good
13-B7	4.00	4.50	30-Jul-13	17295130730124	7.56	0.769	1.83	44.2	26.4	23.3	7.4	3.32	<8.8	112	Subsoil	Good	Good
13-B16	1.00	1.50	01-Aug-13	17295130801291	7.42	1.72	0.95	77.4	45.7	158	39.9	5.5	30	583	Subsoil	Good	Good
13-B16	2.50	3.00	01-Aug-13	17295130801294	7.34	1.16	1.05	41.7	21	52.4	12.3	3.2	14.8	179	Subsoil	Good	Good
13-B16	4.50	5.00	01-Aug-13	17295130801298	7.68	***3.08***	2.71	53.4	116	185	47.3	9.1	21	858	Subsoil	Fair	Good
13-B24	0.30	0.60	02-Aug-13	17295130802446	7.4	***9.08***	***7.35***	70.3	654	596	156	8.5	2380	302	Subsoil	Poor	Fair
13-B24	5.50	5.90	02-Aug-13	17295130802457	8.12	***28.2***	***11.1***	52.9	1380	1540	425	37.7	5850	<320	Subsoil	Unsuitable	Poor
13-B24	7.00	7.50	02-Aug-13	17295130802460	8.04	***3.35***	***7.82***	54.1	271	118	30.4	15.4	396	319	Subsoil	Fair	Fair
13-B24	8.00	8.50	02-Aug-13	17295130802462	8.12	2.32	***12.5***	53.4	209	27.8	7.1	7.2	118	271	Subsoil	Good	Unsuitable
13-B25	1.00	1.50	02-Aug-13	17295130802485	7.4	2.64	0.98	62.8	52.8	255	58.9	8.9	308	466	Subsoil	Good	Good
13-B25	2.50	3.00	02-Aug-13	17295130802488	7.43	1.18	1.31	33.6	21.9	44.4	11.5	3.97	36.3	109	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Flare Pit																	
Trailer Park																	
13-1	0.15	0.30	30-Jul-13	17295130730101	7.52	2.44	1.03	69.1	52.1	210	44.3	<1.4	211	573	Subsoil	Good	Good
13-1	2.50	3.00	30-Jul-13	17295130730107	7.39	***3.12***	0.58	48.3	26.8	267	39.9	8.53	<9.7	961	Subsoil	Fair	Good
13-1	5.00	5.50	30-Jul-13	17295130730112	8.05	***3.82***	2.03	63.2	126	284	109	16.9	36	1470	Subsoil	Fair	Good
13-3	0.60	1.00	02-Aug-13	17295130802467	7.6	2.82	1.42	74.1	93.1	359	47.6	8.8	445	568	Subsoil	Good	Good
13-3	3.00	3.50	02-Aug-13	17295130802472	7.57	***3.42***	1.89	44	86.8	256	64	9.92	29	920	Subsoil	Fair	Good
13-3	6.00	6.50	02-Aug-13	17295130802478	8.41	1.73	***7.96***	83	264	60.5	24.4	15.9	26	585	Subsoil	Good	Fair
16-B51	0.30	0.60	17-Mar-16	17295160317003	7.17	2.59	0.14	66.7	9.2	468	25.1	<3.3	<13	1090	Subsoil	Good	Good
16-B51	1.00	1.50	17-Mar-16	17295160317005	7.09	2.62	0.2	70	14	455	34.7	8.8	<14	1130	Subsoil	Good	Good
16-B51	2.00	2.50	17-Mar-16	17295160317007	7.19	***3.1***	0.61	52.7	33.4	358	41.4	11.9	79	922	Subsoil	Fair	Good
16-B52	0.60	1.00	17-Mar-16	17295160317015	7.39	2.49	1.27	80	84.5	372	28.2	5.8	164	844	Subsoil	Good	Good
16-B52	1.50	2.00	17-Mar-16	17295160317017	7.41	2.83	2.06	51.3	85	207	26.4	9	262	380	Subsoil	Good	Good
16-B52	2.50	3.00	17-Mar-16	17295160317019	7.38	***5.65***	***4.11***	44	190	295	43.6	10.3	704	273	Subsoil	Poor	Fair
16-B52	4.00	4.50	17-Mar-16	17295160317022	7.56	***4.93***	2.11	52	128	386	88.9	16.8	413	960	Subsoil	Fair	Good
16-B53	0.15	0.30	17-Mar-16	17295160317024	7.44	***5.32***	3.62	38	140	220	47.2	5.2	573	172	Subsoil	Poor	Good
16-B53	1.50	2.00	17-Mar-16	17295160317028	7.37	***13.2***	***11.5***	66.7	1050	709	139	22.1	2920	314	Subsoil	Unsuitable	Poor
16-B54	0.30	0.60	17-Mar-16	17295160317036	7.47	2.09	1.09	64.7	48.7	173	37	<3.2	213	358	Subsoil	Good	Good
16-B54	1.00	1.50	17-Mar-16	17295160317038	7.48	1.18	0.92	76.7	36.1	110	25	7.6	71	305	Subsoil	Good	Good
16-B54	2.00	2.50	17-Mar-16	17295160317040	7.51	1.3	0.93	46.7	22.9	70.8	17.3	5.5	78.2	155	Subsoil	Good	Good
16-B55	0.15	0.30	17-Mar-16	17295160317046	7.47	***6.32***	1.16	70.7	111	714	157	<3.5	1150	877	Subsoil	Poor	Good
16-B55	0.60	1.00	17-Mar-16	17295160317048	7.5	2.33	0.64	73.3	35.4	235	49.2	<3.7	434	211	Subsoil	Good	Good
16-B55	1.50	2.00	17-Mar-16	17295160317050	7.46	***3.33***	0.74	83.3	56.5	380	93.2	14.4	814	276	Subsoil	Fair	Good
16-B56	0.30	0.60	17-Mar-16	17295160317058	7.55	1.42	0.65	70	27	140	28	<3.5	97	320	Subsoil	Good	Good
16-B56	1.00	1.50	17-Mar-16	17295160317060	7.6	1.42	0.77	51.3	23.2	98.6	20.7	4.7	65	259	Subsoil	Good	Good
16-B56	2.50	3.00	17-Mar-16	17295160317063	7.5	1.2	0.85	55.3	24.3	83.8	17.4	7.6	57	212	Subsoil	Good	Good
16-B57	0.30	0.60	17-Mar-16	17295160317069	7.52	1.31	1.1	60	36.1	104	19.7	<3.0	81	238	Subsoil	Good	Good
16-B57	2.00	2.50	17-Mar-16	17295160317073	7.5	0.966	0.78	52	19.2	63.2	15.5	6.5	27	178	Subsoil	Good	Good
16-B58	0.00	0.15	18-Mar-16	17295160318075	7.56	*3.61*	1.13	73.3	89	469	106	<3.7	283	1200	Topsoil	Fair	Good
16-B58	0.60	1.00	18-Mar-16	17295160318078	7.59	1.81	1.05	76.7	53.1	186	41.2	4.5	185	410	Subsoil	Good	Good
16-B58	1.50	2.00	18-Mar-16	17295160318080	7.54	1.51	0.9	60	33.1	125	28.8	8.1	88	318	Subsoil	Good	Good
16-B58	2.50	3.00	18-Mar-16	17295160318082	7.53	1.93	0.92	51.3	31.7	129	27.6	7.6	169	241	Subsoil	Good	Good
16-B59	0.15	0.30	18-Mar-16	17295160318087	7.34	***9.27***	2.45	71.3	264	926	187	5.6	2020	458	Subsoil	Poor	Good
16-B59	1.00	1.50	18-Mar-16	17295160318090	7.34	***8***	1.95	80	216	876	170	18.2	1970	369	Subsoil	Poor	Good
16-B59	2.00	2.50	18-Mar-16	17295160318092	7.5	***5.85***	2.04	54.7	130	432	78.2	12.5	897	280	Subsoil	Poor	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Flare Pit																	
Trailer Park																	
16-B60	0.30	0.60	18-Mar-16	17295160318102	7.55	1.63	0.93	64	37.7	145	29.9	<3.2	94	377	Subsoil	Good	Good
16-B60	1.00	1.50	18-Mar-16	17295160318104	7.5	1.73	0.99	76.7	49.1	177	39.7	6.2	118	492	Subsoil	Good	Good
16-B60	2.00	2.50	18-Mar-16	17295160318106	7.52	1.78	1.16	57.3	44.4	137	34.6	6.4	100	375	Subsoil	Good	Good
16-B61	0.60	1.00	18-Mar-16	17295160318114	7.4	1.97	0.81	73.3	41.3	191	46.1	<3.7	299	284	Subsoil	Good	Good
16-B61	1.50	2.00	18-Mar-16	17295160318116	7.48	1.63	0.99	76.7	47.3	158	41.6	6.9	181	338	Subsoil	Good	Good
16-S1	comp	comp	18-Mar-16	17295160318124	7.57	***11.2***	2.59	53.3	231	838	177	20.2	1940	358	Subsoil	Unsuitable	Good
Developer																	
13-B8	0.60	1.00	30-Jul-13	17295130730131	7.29	***3.65***	0.67	76.8	50.7	465	58.4	<1.5	319	1220	Subsoil	Fair	Good
13-B8	2.50	3.00	30-Jul-13	17295130730135	7.46	1.1	0.72	77.2	26.5	93.5	23.4	4.8	26	329	Subsoil	Good	Good
13-B8	4.50	5.00	30-Jul-13	17295130730139	7.78	***3.67***	1.49	54.9	82.8	277	90.2	12.2	<11	1290	Subsoil	Fair	Good
13-B9	1.00	1.50	30-Jul-13	17295130730152	7.42	1.75	0.7	75.5	31.5	142	37.4	5.7	220	297	Subsoil	Good	Good
13-B9	2.50	3.00	30-Jul-13	17295130730155	7.35	2.32	0.52	55.1	20.5	147	41.5	6.5	259	249	Subsoil	Good	Good
13-B9	5.00	5.50	30-Jul-13	17295130730160	8.08	1.17	2.62	55.5	55.6	41.6	12.2	4.8	40	207	Subsoil	Good	Good
13-B9	8.00	8.50	30-Jul-13	17295130730166	8.05	1.46	***4.9***	49.3	88.9	36.1	8.8	6.34	40.2	240	Subsoil	Good	Fair
13-B14	0.60	1.00	31-Jul-13	17295130731253	7.28	1.8	0.62	75.2	29.9	178	35.4	<1.5	120	440	Subsoil	Good	Good
13-B14	2.50	3.00	31-Jul-13	17295130731257	7.19	***10.8***	3.15	83.8	402	1040	258	22.3	3100	330	Subsoil	Unsuitable	Good
13-B14	3.50	4.00	31-Jul-13	17295130731259	7.61	1.45	0.72	42.3	16.1	60.3	17.4	4.53	117	92	Subsoil	Good	Good
13-B15	1.00	1.50	31-Jul-13	17295130731271	7.41	***4.85***	3.42	73.8	223	330	63	6.4	1080	267	Subsoil	Fair	Good
13-B15	3.00	3.50	31-Jul-13	17295130731275	7.4	***7***	3.08	43.5	153	324	64.3	9.53	1030	110	Subsoil	Poor	Good
13-B15	5.50	6.00	31-Jul-13	17295130731280	8.11	2.72	2.07	47.2	71.9	129	39.4	12.3	162	404	Subsoil	Good	Good
13-B17	0.60	1.00	01-Aug-13	17295130801304	7.43	***5.87***	0.96	67.3	78.9	596	99.7	3.3	962	901	Subsoil	Poor	Good
13-B17	2.50	3.00	01-Aug-13	17295130801308	7.13	***11.9***	1.17	61.8	126	1060	226	11.3	2510	661	Subsoil	Unsuitable	Good
13-B17	4.50	5.00	01-Aug-13	17295130801312	7.74	***4.67***	1.94	47.6	98.8	244	104	9.94	311	859	Subsoil	Fair	Good
13-B17	5.50	6.00	01-Aug-13	17295130801314	8.15	***4.09***	1.97	49.8	103	242	102	14.2	166	1010	Subsoil	Fair	Good
13-B17	6.50	7.00	01-Aug-13	17295130801316	7.9	***3.3***	3.24	58.8	164	184	88.2	14.6	131	819	Subsoil	Fair	Good
13-B18	0.00	0.15	01-Aug-13	17295130801318	7.22	*6.35*	0.67	74.6	63	680	127	4.9	1290	687	Topsoil	Poor	Good
13-B18	1.50	2.00	01-Aug-13	17295130801323	7.28	***13.7***	***5.23***	70.7	605	1110	196	12.7	3450	260	Subsoil	Unsuitable	Fair
13-B18	4.00	4.50	01-Aug-13	17295130801328	7.62	2.54	1.07	44.2	33.7	118	32.3	5.51	270	143	Subsoil	Good	Good
13-B19	0.60	1.00	01-Aug-13	17295130801338	7.56	***16.2***	***20.6***	68.8	1750	595	121	8.4	4680	280	Subsoil	Unsuitable	Unsuitable
13-B19	3.00	3.50	01-Aug-13	17295130801343	7.39	***55.1***	***42.9***	46.5	4170	1200	209	22.5	9210	820	Subsoil	Unsuitable	Unsuitable
13-B19	6.50	7.00	01-Aug-13	17295130801350	8.08	2.33	3.56	42.3	86.6	70.8	21.3	9.87	96	320	Subsoil	Good	Good
13-B19	9.50	10.00	01-Aug-13	17295130801356	8.33	2.88	***7.31***	54	186	68.8	13.2	8.2	380	143	Subsoil	Good	Fair
13-B20	0.15	0.30	01-Aug-13	17295130801359	7.41	***8.64***	3.6	63.1	294	593	126	1.5	1870	443	Subsoil	Poor	Good
13-B20	2.00	2.50	01-Aug-13	17295130801364	7.38	***27.6***	***24.2***	81.3	3030	1120	211	22.2	7750	590	Subsoil	Unsuitable	Unsuitable
13-B20	6.00	6.50	01-Aug-13	17295130801372	8.19	1.8	2.23	53.2	63.1	74.4	24.5	10.6	59	321	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Flare Pit																	
Developer																	
13-B21	2.00	2.50	01-Aug-13	17295130801387	7.68	***37.6***	***48.6***	45.1	2760	408	80.7	93	6460	<270	Subsoil	Unsuitable	Unsuitable
13-B21	4.00	4.50	01-Aug-13	17295130801391	7.47	***56.4***	***38.5***	48.5	4270	1390	325	65	11700	<290	Subsoil	Unsuitable	Unsuitable
13-B21	6.50	7.00	01-Aug-13	17295130801396	8.25	***4.12***	***5.34***	54	204	146	35.4	12.7	638	180	Subsoil	Fair	Fair
13-B21	8.00	8.50	01-Aug-13	17295130801399	8.19	1.39	***7.71***	56.7	120	23.3	5.6	6	16	193	Subsoil	Good	Fair
13-B22	0.30	0.60	01-Aug-13	17295130801406	7.8	***4.55***	***6.55***	68.3	327	208	41.5	3.8	874	283	Subsoil	Fair	Fair
13-B22	1.00	1.50	01-Aug-13	17295130801408	7.61	2.3	***5.57***	68.3	228	138	28.6	6.5	571	165	Subsoil	Good	Fair
13-B22	3.50	4.00	01-Aug-13	17295130801413	7.49	***15.7***	***12.8***	45.7	1010	762	163	13.1	3500	641	Subsoil	Unsuitable	Unsuitable
13-B22	5.00	5.50	01-Aug-13	17295130801416	8.19	***3.27***	2.61	53.8	103	137	50	14.8	431	219	Subsoil	Fair	Good
13-B22	6.50	7.00	01-Aug-13	17295130801419	8.21	1.43	3.99	60.6	98.2	49.2	16	12.8	22	284	Subsoil	Good	Good
13-B23	0.60	1.00	02-Aug-13	17295130802427	7.38	***9.25***	***4.55***	68.2	441	748	180	10.7	2160	440	Subsoil	Poor	Fair
13-B23	2.50	3.00	02-Aug-13	17295130802431	7.48	***3.97***	***7.34***	43.8	223	113	28.2	7.19	561	82	Subsoil	Fair	Fair
13-B23	5.50	6.00	02-Aug-13	17295130802437	8.11	***24.1***	***5.74***	38.4	528	1210	282	32	3530	<230	Subsoil	Unsuitable	Fair
13-B23	7.50	8.00	02-Aug-13	17295130802441	8.18	2.9	***7.3***	65.3	274	118	27.4	17.7	492	219	Subsoil	Good	Fair
13-B41	0.60	1.00	03-Aug-13	17295130803739	7.29	1.24	0.47	72.6	19.5	134	27.6	<1.5	42	379	Subsoil	Good	Good
13-B41	2.00	2.50	03-Aug-13	17295130803742	7.43	0.837	0.64	66.2	18.4	66.2	16.4	2.7	29	186	Subsoil	Good	Good
13-B41	3.00	3.50	03-Aug-13	17295130803744	7.53	0.869	1.82	43.5	29	31	8.1	2.52	29	108	Subsoil	Good	Good
14-9c	0.30	0.60	31-Jan-14	17295140131502	7.25	***3.48***	0.82	61.1	53.4	388	85.6	<1.2	26	1240	Subsoil	Fair	Good
14-9c	1.00	1.50	31-Jan-14	17295140131504	7.28	1.61	0.58	66.8	25	157	33	2.7	<13	459	Subsoil	Good	Good
14-9c	3.50	4.00	31-Jan-14	17295140131509	7.48	0.899	1.54	38.2	23.2	30.8	8.6	3.61	<7.6	73	Subsoil	Good	Good
14-9c	9.50	10.00	31-Jan-14	17295140131521	8.3	1.78	***16.7***	59.7	201	12.3	3.8	27.1	32	196	Subsoil	Good	Unsuitable
14-9c	11.00	11.50	31-Jan-14	17295140131524	8.15	***4.38***	***30.5***	47.2	402	17.5	6.3	2.84	<9.4	63.1	Subsoil	Fair	Unsuitable
14-10a	0.60	1.00	31-Jan-14	17295140131018	7.3	0.652	0.49	78	14.7	65	13.4	1.7	<16	80	Subsoil	Good	Good
14-10a	2.00	2.50	31-Jan-14	17295140131021	7.22	1.04	0.48	72.5	17.3	104	19.9	6.6	<14	271	Subsoil	Good	Good
14-10a	5.00	5.50	31-Jan-14	17295140131027	7.46	***3.59***	1.35	32.4	47.3	199	53.8	7.5	<6.5	699	Subsoil	Fair	Good
14-10c	8.00	8.50	31-Jan-14	17295140131529	7.82	2.18	***4.1***	46.5	106	68.4	25	10.6	14	352	Subsoil	Good	Fair
14-10c	11.00	11.50	31-Jan-14	17295140131535	7.61	1.57	***10.6***	38.1	103	12.8	3.6	2	10.5	125	Subsoil	Good	Poor
14-11a	0.30	0.60	31-Jan-14	17295140131032	7.24	1.3	0.71	65.6	26.6	127	22.1	<1.3	44	279	Subsoil	Good	Good
14-11a	1.50	2.00	31-Jan-14	17295140131035	7.16	0.886	0.6	75.5	19.9	77.7	19.3	5.7	48	128	Subsoil	Good	Good
14-11a	5.50	6.00	31-Jan-14	17295140131043	7.61	1.34	1.32	52.2	36.1	74.7	20.1	9.7	<10	229	Subsoil	Good	Good
14-11c	10.00	10.50	01-Feb-14	17295140201105	7.72	2.18	2.97	43.2	76.1	80.6	21	11	107	218	Subsoil	Good	Good
14-11c	11.00	11.50	01-Feb-14	17295140201107	7.78	***10.8***	2.44	46.8	169	540	148	20.6	1800	187	Subsoil	Unsuitable	Good
14-11c	12.00	12.50	01-Feb-14	17295140201109	7.88	2.29	***5.3***	60.6	151	72.3	18	8.1	248	224	Subsoil	Good	Fair
14-11c	13.50	14.00	01-Feb-14	17295140201111	7.91	2.45	***26.5***	51.9	229	8.3	<1.6	5.8	175	100	Subsoil	Good	Unsuitable
14-12a	0.00	0.15	31-Jan-14	17295140131045	7.11	*15.4*	*17*	82.3	2170	1050	267	33.9	3410	1980	Topsoil	Unsuitable	Unsuitable
14-12a	2.00	2.50	31-Jan-14	17295140131050	8.02	***54.4***	***78.9***	47.7	5930	677	135	230	8890	<290	Subsoil	Unsuitable	Unsuitable
14-12a	5.50	6.00	31-Jan-14	17295140131056	7.77	***60.8***	***43***	65.6	7650	2720	574	105	15500	<390	Subsoil	Unsuitable	Unsuitable
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Flare Pit																	
Developer																	
14-12c	6.50	7.00	02-Feb-14	17295140202115	7.8	***5.94***	***4.39***	54.8	230	273	64.1	21.5	994	233	Subsoil	Poor	Fair
14-12c	8.50	9.10	02-Feb-14	17295140202119	8.02	1.82	***9.2***	51.7	147	26.9	6.5	7.3	41	204	Subsoil	Good	Poor
14-12c	9.10	9.50	02-Feb-14	17295140202120	7.58	1.24	***11.7***	62	127	10.3	2.5	4.4	24	139	Subsoil	Good	Poor
14-12c	10.50	11.00	02-Feb-14	17295140202123	7.71	2.16	***15.9***	37.8	147	12.4	3	2.02	43.7	193	Subsoil	Good	Unsuitable
14-B50	0.15	0.30	31-Jan-14	17295140131058	7.22	2.44	1.37	90.5	96.8	326	56.5	3.2	183	651	Subsoil	Good	Good
14-B50	0.60	1.00	31-Jan-14	17295140131060	7.15	1.8	1.03	79.1	53.7	206	31.9	<1.6	100	485	Subsoil	Good	Good
14-B50	2.50	3.00	31-Jan-14	17295140131063	7.24	1.04	0.7	67.5	21.4	77.7	16.3	5.1	44	154	Subsoil	Good	Good
14-B50	7.00	7.50	31-Jan-14	17295140131071	7.81	2.13	2.84	46.3	81.5	83.9	30.8	10.6	15.2	383	Subsoil	Good	Good
14-B50	10.00	10.50	31-Jan-14	17295140131077	7.67	1.09	***4.4***	57.1	77.5	27.5	8.3	4.4	<11	120	Subsoil	Good	Fair
17-12c	3.00	3.50	29-Jun-17	17295170629034	7.79	***39***	***47.7***	46.3	3760	760	155	99	7400	221	Subsoil	Unsuitable	Unsuitable
17-12c	4.00	4.50	29-Jun-17	17295170629036	7.75	***58.5***	***65.4***	49.4	6410	1110	220	152	12500	184	Subsoil	Unsuitable	Unsuitable
17-12c	6.00	6.50	29-Jun-17	17295170629040	8.11	***7.35***	***4.81***	57.8	292	341	86	26.5	1200	263	Subsoil	Poor	Fair
17-12c	7.50	8.00	29-Jun-17	17295170629043	8.16	2.98	***10.3***	55.9	271	64.3	17.4	14.2	210	441	Subsoil	Good	Poor
17-12c	8.50	9.00	29-Jun-17	17295170629045	8.14	1.31	***10.4***	51.5	124	14.5	4	4.9	21	213	Subsoil	Good	Poor
17-12c	9.50	10.00	29-Jun-17	17295170629047	8.1	1.35	***16.6***	48	123	8.7	<2.4	<2.4	34.7	176	Subsoil	Good	Unsuitable
17-12c	11.00	11.50	29-Jun-17	17295170629050	8.12	2.15	***22.4***	88	328	18.4	<8.8	<8.8	460	90	Subsoil	Good	Unsuitable
Production Area																	
Town of Calmar																	
M12-01	1.50	1.50	02-Oct-12	Nichols Environmental	7.8	1.08	0.7	88	95	78	18.8	4	53	94.3	Subsoil	Good	Good
M12-05	3.10	3.10	02-Oct-12	Nichols Environmental	7.7	0.84	0.8	46	15	42.6	11	3	46	30.5	Subsoil	Good	Good
M12-06	1.50	1.50	02-Oct-12	Nichols Environmental	7.8	1.07	***5.9***	90	151	41.4	8.7	4	56	96.3	Subsoil	Good	Fair
M12-07	6.10	6.10	02-Oct-12	Nichols Environmental	7.9	1.06	0.8	60	25	78.9	24.8	0.36	33	121	Subsoil	Good	Good
M12-08	4.60	4.60	02-Oct-12	Nichols Environmental	7.7	0.69	0.3	48	6	47.4	6.7	4	14	35.1	Subsoil	Good	Good
M12-10	1.50	1.50	02-Oct-12	Nichols Environmental	7.6	1.26	1.1	90	58	161	35.6	6	26	185	Subsoil	Good	Good
M12-11	0.80	0.80	02-Oct-12	Nichols Environmental	7.5	1.37	1.2	81	56	154	35.5	<1	98	150	Subsoil	Good	Good
M12-13	1.50	1.50	02-Oct-12	Nichols Environmental	7.8	0.94	3.7	88	103	48.5	11.2	4	88	62.6	Subsoil	Good	Good
M12-14	3.10	3.10	02-Oct-12	Nichols Environmental	7.3	***9.77***	***9.2***	50	595	480	86	10	1750	50	Subsoil	Poor	Poor
M12-16	1.50	1.50	02-Oct-12	Nichols Environmental	7.6	1	0.9	92	40	107	22.8	7	116	72.9	Subsoil	Good	Good
M12-17	0.80	0.80	02-Oct-12	Nichols Environmental	7.9	1.72	***8.5***	70	201	44.1	10	3	153	93.6	Subsoil	Good	Poor
M12-17	3.10	3.10	09-Oct-12	Nichols Environmental	7.4	2.22	2.4	49	76	100	29.2	6	326	27.3	Subsoil	Good	Good
M12-17	5.00	5.00	09-Oct-12	Nichols Environmental	7.8	2.54	2.2	46	78	122	44.8	8	383	29	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					6-8.5[ES]	+	+	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-
Salt Guideline for Topsoil (Good)[+]					NS	2	4	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-
Salt Guideline for Subsoil (Good)[+]					NS	3	4	NS	NS	NS	NS	NS	NS	NS	NS	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Production Area																	
Town of Calmar																	
M12-18	3.80	3.80	09-Oct-12	Nichols Environmental	7.5	***6.86***	***8.5***	48	410	252	65.6	10	1150	8.5	Subsoil	Poor	Poor
M12-18	6.10	6.10	09-Oct-12	Nichols Environmental	7.5	***4.99***	2.8	41	120	220	65.6	13	667	32	Subsoil	Fair	Good
M12-19	1.50	1.50	02-Oct-12	Nichols Environmental	7.9	2.27	***6.1***	87	302	172	23.5	7	73	304	Subsoil	Good	Fair
M12-19	3.80	3.80	09-Oct-12	Nichols Environmental	7.7	2.26	2.9	53	106	149	26.6	7	164	144	Subsoil	Good	Good
M12-20	0.80	0.80	02-Oct-12	Nichols Environmental	7.9	1.33	***17.4***	101	269	12.9	3	5	101	96.5	Subsoil	Good	Unsuitable
M12-20	3.10	3.10	09-Oct-12	Nichols Environmental	7.6	***4.52***	***14***	53	408	87.4	20	6	672	46	Subsoil	Fair	Unsuitable
M12-20	5.30	5.30	09-Oct-12	Nichols Environmental	7.4	***15.1***	***9.2***	40	640	627	182	20	2730	38	Subsoil	Unsuitable	Poor
13-2	1.00	1.50	31-Jul-13	17295130731195	7.47	***4.4***	0.66	78.6	52.3	476	82.9	10.7	759	601	Subsoil	Fair	Good
13-2	3.00	3.50	31-Jul-13	17295130731199	7.4	***4.23***	0.73	44.7	36	297	69.9	8.78	247	742	Subsoil	Fair	Good
13-2	4.00	4.50	31-Jul-13	17295130731201	7.67	***3.13***	1.05	44.2	46.8	227	68.6	12.1	64.6	810	Subsoil	Fair	Good
13-B10	0.30	0.60	31-Jul-13	17295130731173	7.58	***4.93***	2.41	64.9	150	314	82.7	2.3	999	150	Subsoil	Fair	Good
13-B10	2.00	2.50	31-Jul-13	17295130731177	7.54	***5.05***	3.66	40.8	136	183	44	5.98	654	82	Subsoil	Poor	Good
13-B10	5.00	5.50	31-Jul-13	17295130731183	7.85	2.63	2.21	30.2	48.3	78.9	25.1	8.2	153	159	Subsoil	Good	Good
13-B11	0.60	1.00	31-Jul-13	17295130731208	7.54	***7.73***	1.98	65.6	166	595	131	3.3	1710	235	Subsoil	Poor	Good
13-B11	2.50	3.00	31-Jul-13	17295130731212	7.42	***9.95***	***5.58***	46.2	326	415	87.5	10.1	1560	118	Subsoil	Poor	Fair
13-B11	4.50	5.00	31-Jul-13	17295130731216	7.83	***4.26***	1.19	51.5	66.5	317	86.6	14.1	223	929	Subsoil	Fair	Good
13-B11	5.50	6.00	31-Jul-13	17295130731218	8.11	2.48	1.57	60.7	70.5	161	54.6	17	145	535	Subsoil	Good	Good
13-B12	0.15	0.30	31-Jul-13	17295130731223	7.32	***7.94***	0.64	74	68.6	850	203	4.4	1830	652	Subsoil	Poor	Good
13-B12	1.00	1.50	31-Jul-13	17295130731226	7.42	***4.85***	0.47	71.3	33.8	389	104	9.8	1090	214	Subsoil	Fair	Good
13-B12	3.00	3.50	31-Jul-13	17295130731230	7.41	***3.03***	0.49	44.1	16.8	155	31.3	6.74	356	83	Subsoil	Fair	Good
13-B13	0.60	1.00	31-Jul-13	17295130731239	7.4	2.82	0.46	71.1	25.1	242	43.1	6.4	472	246	Subsoil	Good	Good
13-B13	2.50	3.00	31-Jul-13	17295130731243	7.37	1.56	0.64	41.9	14.3	69.2	13.3	4.36	133	88	Subsoil	Good	Good
13-4	0.00	0.15	02-Aug-13	17295130802555	7.01	*7.21*	1.03	98.3	145	1140	242	4.1	2350	800	Topsoil	Poor	Good
13-4	1.00	1.50	02-Aug-13	17295130802559	7.28	***3.34***	2.36	74.1	142	268	61.8	12.4	700	176	Subsoil	Fair	Good
13-4	3.00	3.50	02-Aug-13	17295130802563	7.45	1.79	0.91	44.8	26.3	101	25.1	7.41	157	166	Subsoil	Good	Good
13-B26	0.60	1.00	02-Aug-13	17295130802495	7.29	1.29	0.68	78.8	30.1	137	29.4	8.9	146	230	Subsoil	Good	Good
13-B26	2.50	3.00	02-Aug-13	17295130802499	7.34	0.859	0.69	38.1	11.6	39.5	10.3	4.02	31.9	79	Subsoil	Good	Good
13-B26	4.50	5.00	02-Aug-13	17295130802503	7.39	1.61	3.13	33.2	56.7	52.9	13.2	6.07	9.5	232	Subsoil	Good	Good
13-B27	0.60	1.00	02-Aug-13	17295130802509	7.99	***4.73***	***9.58***	75	502	220	35.6	6.9	1120	228	Subsoil	Fair	Poor
13-B27	5.00	5.50	02-Aug-13	17295130802518	7.82	***52.4***	***30.1***	35.4	2880	1470	302	34.7	8260	<210	Subsoil	Unsuitable	Unsuitable
13-B27	7.00	7.50	02-Aug-13	17295130802522	7.99	***9.81***	***5.55***	50.2	378	464	145	25.4	1810	154	Subsoil	Poor	Fair
13-B27	9.50	10.00	02-Aug-13	17295130802525	8.13	***3.94***	***8.62***	48	267	108	26.7	11.8	547	164	Subsoil	Fair	Poor
13-B27	10.00	10.50	02-Aug-13	17295130802526	8.17	2.78	***8.78***	52.1	200	54	12.9	10.4	314	152	Subsoil	Good	Poor
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Production Area																	
Town of Calmar																	
13-B28	0.00	0.15	02-Aug-13	17295130802527	7.33	*9*	*6.15*	84	679	821	170	7	2700	410	Topsoil	Unsuitable	Fair
13-B28	1.00	1.50	02-Aug-13	17295130802531	7.32	***5.62***	0.77	77.7	73	611	155	15.8	1550	207	Subsoil	Poor	Good
13-B28	3.50	4.00	02-Aug-13	17295130802536	7.5	***3.01***	1.26	46.4	48	161	45.3	10.3	425	46	Subsoil	Fair	Good
13-B29	0.15	0.30	02-Aug-13	17295130802542	7.36	***6.17***	3.41	67.9	272	530	109	4.6	1340	469	Subsoil	Poor	Good
13-B29	2.00	2.50	02-Aug-13	17295130802547	7.37	0.775	0.63	41.8	11.1	40.2	9.9	3.97	39.9	63	Subsoil	Good	Good
13-B49	1.00	1.50	04-Aug-13	17295130804884	7.56	***3.33***	***6.42***	80	327	184	37.7	8.3	523	626	Subsoil	Fair	Fair
13-B49	2.50	3.00	04-Aug-13	17295130804887	7.41	***3.41***	***7.22***	47.4	215	101	25.1	4.91	392	253	Subsoil	Fair	Fair
13-H1	0.00	0.30	05-Aug-13	17295130805890	6.04	0.71	0.4	96	15.3	87	16.2	6	30.4	181	Topsoil	Good	Good
13-H2	0.00	0.30	05-Aug-13	17295130805891	5.82	*2.74*	*4.19*	135	423	429	87.5	<2.7	166	1760	Topsoil	Fair	Fair
13-6	0.30	0.60	03-Aug-13	17295130803782	7.61	1.69	***7.17***	70.7	176	46.8	10.8	2.6	159	259	Subsoil	Good	Fair
13-6	1.50	2.00	03-Aug-13	17295130803785	7.62	1.72	***6.66***	69.7	173	51.9	12.9	4.3	195	196	Subsoil	Good	Fair
13-6	5.50	6.00	03-Aug-13	17295130803793	8.02	2.14	3.32	47.4	84.7	67.4	22.4	7.87	233	120	Subsoil	Good	Good
14-8a	0.15	0.30	31-Jan-14	17295140131002	7.01	0.64	0.57	68.3	14.5	51.5	12.6	<1.4	33	41	Subsoil	Good	Good
14-8a	1.00	1.50	31-Jan-14	17295140131005	7.24	0.783	0.75	81.3	24.9	71.6	19.3	5	22	147	Subsoil	Good	Good
14-8a	4.50	5.00	31-Jan-14	17295140131012	7.5	1.33	***4.14***	35.6	59.9	30.6	8.5	4.97	<7.1	111	Subsoil	Good	Fair
14-8c	7.00	7.50	01-Feb-14	17295140201080	7.67	1.46	***5.01***	38	72.5	29.7	7.3	6.82	<7.6	130	Subsoil	Good	Fair
14-8c	11.90	12.60	01-Feb-14	17295140201090	7.61	1.22	***23.4***	91.9	212	6.8	<2.8	4.2	<18	167	Subsoil	Good	Unsuitable
14-8c	13.50	14.00	01-Feb-14	17295140201093	8.01	1.24	***18.9***	65.9	156	4	2.4	3.8	<13	99	Subsoil	Good	Unsuitable
17-2	3.00	3.50	29-Jun-17	17295170629059	7.77	***4.7***	0.95	41.7	42.4	268	54.8	10.2	520	335	Subsoil	Fair	Good
17-2	4.10	4.50	29-Jun-17	17295170629061	7.78	***9.15***	1.25	27.7	54.1	387	77.9	8.3	730	379	Subsoil	Poor	Good
17-2	5.50	6.00	29-Jun-17	17295170629064	7.99	***3.89***	2.16	36.3	68	135	43.4	9.3	400	149	Subsoil	Fair	Good
17-2	7.00	7.50	29-Jun-17	17295170629067	8.27	1.53	***4.07***	54.7	98.2	50.7	18.2	12.3	46	284	Subsoil	Good	Fair
17-4	2.00	2.50	29-Jun-17	17295170629074	7.56	***3.2***	1.15	48.1	43.8	162	41.7	8.5	446	78.6	Subsoil	Fair	Good
17-4	3.50	4.00	29-Jun-17	17295170629077	7.63	2.05	0.9	46.2	27.6	109	26.4	7.9	200	170	Subsoil	Good	Good
17-4	5.00	5.50	29-Jun-17	17295170629080	8	2.85	1.16	46	48.7	211	46.7	14.6	16.4	799	Subsoil	Good	Good
17-13c	4.00	4.50	29-Jun-17	17295170629011	7.82	1.82	***4.12***	42.8	81.4	46	14	5.3	187	78.9	Subsoil	Good	Fair
17-13c	5.50	5.90	29-Jun-17	17295170629014	8.09	***3.99***	3.45	48.3	134	152	51.4	16.6	570	136	Subsoil	Fair	Good
17-13c	7.50	8.00	29-Jun-17	17295170629018	8.11	1.36	***8.32***	50.7	118	20.1	6.2	6.4	32	199	Subsoil	Good	Poor
17-13c	10.00	10.50	29-Jun-17	17295170629023	8.17	1.2	***17***	56.7	137	8.6	<2.8	3.5	15	185	Subsoil	Good	Unsuitable
17-13c	11.00	11.50	29-Jun-17	17295170629025	8.15	1.22	***19.9***	76.3	191	9.1	<3.8	<3.8	26	244	Subsoil	Good	Unsuitable
Well Centre Area																	
Town of Calmar																	
M12-02	6.10	6.10	02-Oct-12	Nichols Environmental	8	1.93	2.6	83	143	180	52.6	11	245	269	Subsoil	Good	Good
13-B30	1.00	1.50	03-Aug-13	17295130803573	7.28	0.952	0.79	69.1	24.8	83.1	15.4	3.4	81	133	Subsoil	Good	Good
13-B30	3.00	3.50	03-Aug-13	17295130803577	7.33	0.625	0.73	40.4	9.84	25.2	5.7	2.91	33.7	33	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Well Centre Area																	
Town of Calmar																	
13-B31	1.50	2.00	03-Aug-13	17295130803591	7.24	0.516	0.45	52.2	7.5	31.4	5.9	3.7	26	37	Subsoil	Good	Good
13-B31	4.00	4.50	03-Aug-13	17295130803596	7.42	2.88	0.68	44.4	29.5	237	49.2	9.23	20.4	791	Subsoil	Good	Good
13-B32	0.30	0.60	03-Aug-13	17295130803602	7.29	0.43	0.6	56.7	10.2	29	6	<1.1	12	34	Subsoil	Good	Good
13-B33	0.60	1.00	03-Aug-13	17295130803620	7.26	0.957	0.87	62.3	24.1	67.1	16.8	<1.2	38	189	Subsoil	Good	Good
13-B34	0.15	0.30	03-Aug-13	17295130803635	7.35	2.82	0.82	90.4	71.5	457	112	4.7	75	1400	Subsoil	Good	Good
13-B35	1.00	1.50	03-Aug-13	17295130803651	7.37	0.843	0.63	79.8	21.7	81.7	19.1	4.8	30	207	Subsoil	Good	Good
13-B36	2.00	2.50	03-Aug-13	17295130803684	7.42	0.618	0.5	51.8	9.2	38.1	7	3.9	20	75	Subsoil	Good	Good
13-B37	0.15	0.30	03-Aug-13	17295130803662	7.5	2.53	1.89	61.9	96.2	254	38.8	4.8	<12	917	Subsoil	Good	Good
13-B37	1.00	1.50	03-Aug-13	17295130803665	8.04	***3.99***	***13.6***	75.8	569	122	32.9	8.9	85	1620	Subsoil	Fair	Unsuitable
13-B37	2.00	2.50	03-Aug-13	17295130803667	8.27	2.01	***10.4***	52.5	193	34.1	9.4	4.7	106	422	Subsoil	Good	Poor
13-B38	0.30	0.60	03-Aug-13	17295130803691	7.17	0.309	0.4	41.9	4.51	17.2	3.3	<0.84	<8.4	17	Subsoil	Good	Good
13-B39	1.00	1.50	03-Aug-13	17295130803718	7.69	1.33	2.53	83.8	102	111	22.4	6.8	30	448	Subsoil	Good	Good
13-B40	0.60	1.00	03-Aug-13	17295130803728	7.44	2.65	1.52	87.4	115	402	58.3	15.7	<17	1430	Subsoil	Good	Good
13-B42	0.30	0.60	03-Aug-13	17295130803749	7.4	1.47	0.64	65.2	23	107	26.8	1.4	97	271	Subsoil	Good	Good
13-B42	1.50	2.00	03-Aug-13	17295130803752	7.32	0.965	0.36	72.7	12.3	85.7	20.5	5.7	94	139	Subsoil	Good	Good
13-B43	0.00	0.15	03-Aug-13	17295130803758	7.46	1.01	0.45	67.2	15	87.9	23.5	<1.3	44	192	Topsoil	Good	Good
13-B43	1.00	1.50	03-Aug-13	17295130803762	7.5	0.688	0.59	40.6	8.71	26.7	8.2	2.56	24.4	59	Subsoil	Good	Good
13-B43	3.00	3.50	03-Aug-13	17295130803766	7.38	0.871	0.69	62.9	18.7	58	18.4	6.3	16	186	Subsoil	Good	Good
13-B44	0.15	0.30	03-Aug-13	17295130803770	7.18	1.25	0.47	66.2	17.2	108	26	1.7	48	303	Subsoil	Good	Good
13-B44	2.50	3.00	03-Aug-13	17295130803776	7.44	0.897	0.52	37.3	8.69	42	8.7	3.35	14.4	104	Subsoil	Good	Good
13-B46	0.00	0.15	04-Aug-13	17295130804817	7.49	1.49	0.75	69.6	32.1	157	24.9	<1.4	60	388	Topsoil	Good	Good
13-B46	1.00	1.50	04-Aug-13	17295130804821	7.32	0.713	0.79	78.9	22.7	62.1	10.9	6	32	156	Subsoil	Good	Good
13-B46	2.50	3.00	04-Aug-13	17295130804824	7.35	0.621	0.97	54.2	17.3	33.7	6.4	3.7	17	83	Subsoil	Good	Good
13-B47	0.60	1.00	04-Aug-13	17295130804831	7.36	0.627	0.35	67.6	8.9	58.9	9.5	1.6	<14	133	Subsoil	Good	Good
13-B48	1.00	1.50	04-Aug-13	17295130804843	7.38	0.931	0.8	69.1	23.6	71.6	14.1	3.5	55	179	Subsoil	Good	Good
13-B48	4.00	4.50	04-Aug-13	17295130804849	7.22	2.67	0.68	46.6	28.8	228	40.1	9.16	<9.3	772	Subsoil	Good	Good
13-B48	7.00	7.50	04-Aug-13	17295130804855	8	1.49	3.36	47.7	72.3	53.3	12.3	9.14	<9.5	287	Subsoil	Good	Good
13-B48	9.00	9.50	04-Aug-13	17295130804859	8.03	1.5	***4.98***	47	90.9	41.2	7.7	8.27	<9.4	271	Subsoil	Good	Fair
13-B48	12.00	12.50	04-Aug-13	17295130804865	8.12	1.45	***7.36***	47.1	107	27.2	4.3	6.52	<9.4	244	Subsoil	Good	Fair
13-B48	16.50	17.00	04-Aug-13	17295130804873	7.99	1.03	***7.81***	52.8	88.4	14.9	2.1	3.4	<11	184	Subsoil	Good	Fair
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Well Centre Area																	
Town of Calmar																	
13-5	0.30	0.60	03-Aug-13	17295130803702	7.37	0.507	0.64	61.3	12.9	37.2	7.8	<1.2	<12	70	Subsoil	Good	Good
13-5	1.00	1.50	03-Aug-13	17295130803704	7.49	0.714	0.87	67.5	21.8	50.6	11.7	2.7	<13	156	Subsoil	Good	Good
16-B62	1.00	1.50	18-Mar-16	17295160318120	7.74	***3.9***	***20.4***	90	708	73.8	16.7	11.7	735	635	Subsoil	Fair	Unsuitable
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X1	0.60	0.60	07-Sep-16	17295160907001	7.81	***3.37***	0.63	54.8	34.8	367	35.3	<5.5	210	823	Subsoil	Fair	Good
16-X1a	1.00	1.00	12-Sep-16	17295160912100	7.4	2.72	0.5	63.1	30.6	421	22.4	7.9	88	1100	Subsoil	Good	Good
16-X2	0.60	0.60	07-Sep-16	17295160907002	7.7	***3.17***	0.39	57.8	22.1	402	16.6	<5.8	210	803	Subsoil	Fair	Good
16-X2a	1.00	1.00	10-Sep-16	17295160910104	7.71	2.93	0.25	59.1	13.9	377	15.8	<5.9	132	876	Subsoil	Good	Good
16-X3	0.60	0.60	07-Sep-16	17295160907003	7.83	***3.21***	0.86	62.1	45.9	268	50.5	<6.2	550	186	Subsoil	Fair	Good
16-X3a	1.10	1.10	10-Sep-16	17295160910103	7.75	1.2	1.25	50.2	30.2	72.5	9	2.5	73	178	Subsoil	Good	Good
16-X4	0.60	0.60	07-Sep-16	17295160907004	7.88	1.82	2.2	58.5	68.8	99.6	16.8	<2.9	240	145	Subsoil	Good	Good
16-X5	0.60	0.60	07-Sep-16	17295160907005	7.76	***3.35***	0.57	64.9	37.9	471	29.4	<6.5	250	1040	Subsoil	Fair	Good
16-X5a	1.00	1.00	12-Sep-16	17295160912101	7.25	2.83	0.56	77.1	41.4	498	29.1	12.1	123	1300	Subsoil	Good	Good
16-X6	0.30	0.30	07-Sep-16	17295160907006	7.47	2.73	0.58	54.7	25.9	218	35.7	<5.5	320	322	Subsoil	Good	Good
16-X7	0.30	0.30	07-Sep-16	17295160907007	7.84	1.89	***11.8***	58	181	23.5	4.5	<2.9	150	246	Subsoil	Good	Poor
16-X7a	0.40	0.40	20-Sep-16	17295160920007	7.79	0.941	0.87	67	26	76.9	14.9	<3.4	89	138	Subsoil	Good	Good
16-X8	0.30	0.30	07-Sep-16	17295160907008	7.66	1.46	1.39	57.6	44.7	105	18.7	<2.9	38	360	Subsoil	Good	Good
16-X9	0.30	0.30	07-Sep-16	17295160907009	7.74	2.29	0.99	55.1	39.5	168	31.5	<5.5	280	257	Subsoil	Good	Good
16-X10	0.30	0.30	07-Sep-16	17295160907010	7.59	2.82	0.2	55	10.6	362	16.7	<5.5	160	779	Subsoil	Good	Good
16-X11	0.30	0.30	07-Sep-16	17295160907011	7.68	***3.48***	1.06	53.8	57.6	343	43.4	<5.4	220	870	Subsoil	Fair	Good
16-X11a	0.40	0.40	10-Sep-16	17295160910004	7.67	2.82	1.01	66.7	59.4	342	31.1	<6.7	94	1010	Subsoil	Good	Good
16-X12	0.30	0.30	07-Sep-16	17295160907012	7.7	***3.95***	0.87	56.1	51.5	402	43.6	<5.6	360	811	Subsoil	Fair	Good
16-X12a	0.40	0.40	10-Sep-16	17295160910005	7.44	2.88	0.46	61	24.9	300	39	<6.1	135	839	Subsoil	Good	Good
16-X13	0.30	0.30	07-Sep-16	17295160907013	7.08	0.785	0.6	56.5	13	46.8	9.9	<2.8	68	102	Subsoil	Good	Good
16-X14	0.30	0.30	07-Sep-16	17295160907014	7.58	***3***	0.57	59.1	29	252	50.2	<5.9	400	368	Subsoil	Fair	Good
16-X14a	0.30	0.30	10-Sep-16	17295160910011	7.51	1.32	0.47	60	15.4	99	20.6	<3.0	90	248	Subsoil	Good	Good
16-X15	0.30	0.30	07-Sep-16	17295160907015	7.65	***3.21***	0.4	61.4	24.4	338	70.6	<6.1	310	811	Subsoil	Fair	Good
16-X15a	0.30	0.30	10-Sep-16	17295160910010	7.7	1.92	0.44	55.1	16.7	141	34.2	<2.8	161	323	Subsoil	Good	Good
16-X16	0.30	0.30	07-Sep-16	17295160907016	7.74	0.932	0.38	55	9.6	62.4	16.1	<2.8	88	103	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X17	0.30	0.30	07-Sep-16	17295160907017	7.68	***3.01***	0.55	59.4	29.6	291	48.6	<5.9	380	458	Subsoil	Fair	Good
16-X17a	0.40	0.40	10-Sep-16	17295160910001	7.31	0.275	0.65	57.6	8.8	16.7	4.3	<2.9	<12	33.6	Subsoil	Good	Good
16-X18	0.30	0.30	07-Sep-16	17295160907018	7.93	***3.33***	***10.9***	63.1	328	84.5	15.4	<6.3	390	434	Subsoil	Fair	Poor
16-X18a	0.40	0.40	10-Sep-16	17295160910101	7.7	0.522	***7.13***	81	68.1	8.5	<4.1	<4.1	<16	82.8	Subsoil	Good	Fair
16-X18b	0.40	0.40	20-Sep-16	17295160920008	7.71	1.01	0.64	67.7	20.9	90.5	16.6	<3.4	77	167	Subsoil	Good	Good
16-X19	0.30	0.30	07-Sep-16	17295160907019	7.59	1	***4.44***	62.6	90	37.5	7.5	<3.1	50	143	Subsoil	Good	Fair
16-X19a	0.40	0.40	20-Sep-16	17295160920009	7.61	1.84	***16.1***	77.4	277	19.8	5.7	<3.9	220	269	Subsoil	Good	Unsuitable
16-X19b	0.40	0.40	22-Sep-16	17295160922012	7.49	1.98	0.59	65.5	25.2	154	36.5	<3.3	300	241	Subsoil	Good	Good
16-X20	0.30	0.30	07-Sep-16	17295160907020	7.45	***5.13***	***6.43***	60.6	362	304	56.7	<6.1	380	1230	Subsoil	Poor	Fair
16-X20a	0.50	0.50	13-Sep-16	17295160913801	7.23	2.69	0.85	58.2	41.5	230	47.1	<5.8	330	477	Subsoil	Good	Good
16-X21	0.30	0.30	07-Sep-16	17295160907021	7.7	1.99	0.52	57.1	19.6	142	28.9	<2.9	250	206	Subsoil	Good	Good
16-X22	0.60	0.60	07-Sep-16	17295160907022	7.79	***4.74***	1.02	61	65.1	369	80.7	<6.1	850	292	Subsoil	Fair	Good
16-X22a	1.00	1.00	09-Sep-16	17295160909100	7.77	2.85	2.03	69.9	99.4	189	43.1	<7.0	567	168	Subsoil	Good	Good
16-X23	0.60	0.60	07-Sep-16	17295160907023	7.73	2.95	1.51	55.6	65.9	193	40.3	<5.6	420	208	Subsoil	Good	Good
16-X24	0.60	0.60	07-Sep-16	17295160907024	7.36	***3.84***	***13.9***	65.4	437	82.8	19.7	<6.5	580	427	Subsoil	Fair	Unsuitable
16-X24a	1.00	1.00	10-Sep-16	17295160910100	7.85	2.53	***20.3***	69.8	311	25.5	<7.0	<7.0	360	267	Subsoil	Good	Unsuitable
16-X24b	2.00	2.00	20-Sep-16	17295160920010	7.75	1.58	***7.07***	48	112	27.2	7.7	<2.4	136	117	Subsoil	Good	Fair
16-X25	0.60	0.60	07-Sep-16	17295160907025	7.82	***3.82***	***4.56***	62.5	211	200	37.2	<6.2	610	254	Subsoil	Fair	Fair
16-X25a	1.10	1.10	10-Sep-16	17295160910102	7.78	1.27	***8.28***	63.1	124	20.1	4.3	<3.2	106	158	Subsoil	Good	Poor
16-X25b	2.00	2.00	20-Sep-16	17295160920011	7.56	0.808	3.83	76.8	85.4	36.3	7.9	4.7	64	118	Subsoil	Good	Good
16-X26	0.60	0.60	07-Sep-16	17295160907026	7.77	2.03	3.37	60.7	119	116	24.1	<6.1	260	203	Subsoil	Good	Good
16-X27	0.60	0.60	07-Sep-16	17295160907027	7.33	1.19	0.6	60.2	18.1	88.6	16	<3.0	112	164	Subsoil	Good	Good
16-X28	0.60	0.60	07-Sep-16	17295160907028	7.46	2.16	0.52	63	23.6	186	35.4	<6.3	330	202	Subsoil	Good	Good
16-X29	0.60	0.60	07-Sep-16	17295160907029	7.57	1.36	0.44	59.4	14.2	100	19.8	<3.0	170	126	Subsoil	Good	Good
16-X30	0.60	0.60	07-Sep-16	17295160907030	7.74	2.78	0.41	55.9	18.7	212	43.7	<5.6	410	170	Subsoil	Good	Good
16-X31	0.60	0.60	07-Sep-16	17295160907031	7.75	***5.31***	0.45	58.6	30.9	447	97	<5.9	930	323	Subsoil	Poor	Good
16-X31a	1.00	1.00	10-Sep-16	17295160910002	7.78	***3.23***	0.49	58.9	23.2	202	50.4	<5.9	539	141	Subsoil	Fair	Good
16-X44	0.90	0.90	09-Sep-16	17295160909001	7.77	2.55	1.72	38.3	46.2	101	25.5	<3.8	252	139	Subsoil	Good	Good
16-X45	0.90	0.90	09-Sep-16	17295160909002	7.6	1.19	2.07	70.3	65	83	14.3	<3.5	138	160	Subsoil	Good	Good
16-X46	0.90	0.90	09-Sep-16	17295160909003	7.43	2.55	1.95	68.6	86.3	158	34.9	<6.9	445	185	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X47	0.80	0.80	09-Sep-16	17295160909004	7.43	1.8	1.46	63.2	54.2	122	26.4	<3.2	240	224	Subsoil	Good	Good
16-X48	0.80	0.80	09-Sep-16	17295160909005	7.31	2.27	0.86	65.6	39.6	176	41	<6.6	335	311	Subsoil	Good	Good
16-X49	0.90	0.90	09-Sep-16	17295160909006	7.46	2.31	0.73	67.2	35.1	188	42.1	<6.7	320	334	Subsoil	Good	Good
16-X50	0.90	0.90	09-Sep-16	17295160909007	7.4	2.85	0.67	69.6	37.1	252	52.3	<7.0	456	402	Subsoil	Good	Good
16-X51	0.80	0.80	09-Sep-16	17295160909008	7.42	2.39	0.67	64	33	212	45.5	<6.4	136	615	Subsoil	Good	Good
16-X52	0.70	0.70	09-Sep-16	17295160909009	7.43	2.02	0.65	69.1	32.6	198	46.8	<6.9	130	602	Subsoil	Good	Good
16-X53	0.70	0.70	09-Sep-16	17295160909010	6.58	2.05	0.72	64	32.8	175	44.6	<6.4	206	425	Subsoil	Good	Good
16-X54	1.20	1.20	09-Sep-16	17295160909011	7.06	***3.46***	0.41	74	26.3	301	75.7	7.5	649	345	Subsoil	Fair	Good
16-X55	1.20	1.20	09-Sep-16	17295160909012	7.46	1.94	0.57	74.6	28.5	186	42.5	6.3	208	454	Subsoil	Good	Good
16-X56	1.30	1.30	09-Sep-16	17295160909013	6.29	2.35	0.32	76.6	18.7	243	56	7.9	420	350	Subsoil	Good	Good
16-X57	0.70	0.70	09-Sep-16	17295160909014	6.26	***3.28***	0.68	64.8	37	233	68	<6.5	517	313	Subsoil	Fair	Good
16-X57a	0.50	0.50	14-Sep-16	17295160914002	6.86	1.57	0.48	74.2	22.9	159	42.9	5.9	135	270	Subsoil	Good	Good
16-X58	0.70	0.70	09-Sep-16	17295160909015	7.58	1.14	0.71	76.1	24.9	85	23.2	<3.8	196	95.5	Subsoil	Good	Good
16-X59	0.70	0.70	09-Sep-16	17295160909016	7.61	0.72	0.69	47.4	12.4	36.8	8.9	2.5	47.3	68.9	Subsoil	Good	Good
16-X60	0.30	0.30	10-Sep-16	17295160910013	7.68	1.28	0.3	63.6	10.2	93.9	23.9	<3.2	179	121	Subsoil	Good	Good
16-X61	0.30	0.30	10-Sep-16	17295160910012	7.5	1.25	0.62	66.3	21.7	105	21.2	<3.3	65	294	Subsoil	Good	Good
16-X62	0.40	0.40	10-Sep-16	17295160910003	7.58	2.96	0.57	62.2	32.2	337	33.9	<6.2	199	838	Subsoil	Good	Good
16-X63	0.40	0.40	10-Sep-16	17295160910006	7.65	1.98	0.57	63.7	24.8	182	27.8	<3.2	236	340	Subsoil	Good	Good
16-X64	1.00	1.00	10-Sep-16	17295160910007	7.67	1.32	0.54	75.1	21.9	139	16.7	<3.8	104	311	Subsoil	Good	Good
16-X65	1.00	1.00	10-Sep-16	17295160910008	7.57	2.77	0.63	71.4	39.3	371	23.7	<7.1	120	1030	Subsoil	Good	Good
16-X66	1.00	1.00	10-Sep-16	17295160910009	7.65	2.79	0.46	66.7	28.5	375	39.1	<6.7	131	1020	Subsoil	Good	Good
16-X67	0.60	0.60	10-Sep-16	17295160910014	7.66	1.07	0.51	67.2	16.6	82.9	21.7	<3.4	95	180	Subsoil	Good	Good
16-X68	0.60	0.60	10-Sep-16	17295160910015	7.62	1.11	0.77	66	25	87.6	20.5	<3.3	76	231	Subsoil	Good	Good
16-X77	2.20	2.25	11-Sep-16	17295160911014	7.36	0.986	1.18	81.6	42.2	85.7	19.7	7.4	89	205	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X78	0.80	0.80	11-Sep-16	17295160911001	7.44	1.26	1.17	77.7	46.8	113	25	6.6	129	254	Subsoil	Good	Good
16-X79	0.80	0.80	11-Sep-16	17295160911003	7.46	0.92	1.39	72	39.7	64.1	13.5	4.3	83	140	Subsoil	Good	Good
16-X81	0.80	0.80	11-Sep-16	17295160911007	7.51	0.612	1.2	75	29.1	46.4	7.9	3.8	34	118	Subsoil	Good	Good
16-X82	0.80	0.80	11-Sep-16	17295160911009	7.5	1.18	0.89	90	38.4	119	23.8	8	149	249	Subsoil	Good	Good
16-X83	3.00	3.00	11-Sep-16	17295160911011	7.43	1.05	1.15	41.5	20.8	43.2	10.2	3.3	58	99.5	Subsoil	Good	Good
16-X85	3.00	3.00	11-Sep-16	17295160911013	7.4	1.04	1.03	48.4	23	52.5	15.4	5	60	123	Subsoil	Good	Good
16-X86	0.80	0.80	11-Sep-16	17295160911015	7.43	1.25	2.88	68	81.6	65.7	14.5	4.4	104	189	Subsoil	Good	Good
16-X91	0.80	0.80	12-Sep-16	17295160912011	7.44	2.16	0.55	66.4	28.4	280	13	<6.6	220	455	Subsoil	Good	Good
16-X92	1.00	1.00	12-Sep-16	17295160912012	7.43	***3.31***	0.72	69	50.5	445	56	<6.9	250	1100	Subsoil	Fair	Good
16-X93	1.00	1.00	12-Sep-16	17295160912013	7.37	1.38	0.92	88.1	41.2	130	25	7.1	250	172	Subsoil	Good	Good
16-X94	0.80	0.80	12-Sep-16	17295160912014	7.47	1.51	3.3	58	87.4	67.7	14.3	4.5	140	196	Subsoil	Good	Good
16-X95	2.00	2.00	13-Sep-16	17295160913101	7.48	2.15	***4.7***	74.3	180	106	26.7	<7.4	390	226	Subsoil	Good	Fair
16-X96	2.00	2.00	13-Sep-16	17295160913102	7.63	2.35	1.14	25.9	23	88.3	18.4	3.2	76	218	Subsoil	Good	Good
16-X97	3.00	3.00	13-Sep-16	17295160913103	7.67	1.34	1.11	41.7	25.7	72.3	15.6	4.5	19.6	236	Subsoil	Good	Good
16-X98	3.00	3.00	13-Sep-16	17295160913104	7.39	1.96	0.88	56.3	35.6	174	28.4	7.7	71	486	Subsoil	Good	Good
16-X99	0.50	0.50	13-Sep-16	17295160913105	7.57	1.16	0.98	70.2	33.9	101	17	4.4	102	207	Subsoil	Good	Good
16-X100	1.50	1.50	13-Sep-16	17295160913106	7.52	1.21	1.07	88.7	47.7	143	17	7.9	123	327	Subsoil	Good	Good
16-X101	0.80	0.80	13-Sep-16	17295160913107	7.43	2.92	0.88	59.3	48.9	330	42	<5.9	69	1000	Subsoil	Good	Good
16-X102	1.80	1.80	13-Sep-16	17295160913108	7.45	1.53	0.86	50.2	26.5	115	17.5	5.3	19	349	Subsoil	Good	Good
16-X103	0.80	0.80	13-Sep-16	17295160913109	7.44	2.51	0.12	61.6	6.8	376	18.4	<6.2	<12	992	Subsoil	Good	Good
16-X104	1.80	1.80	13-Sep-16	17295160913110	7.55	2.85	0.88	69.7	57.5	394	43.2	9.5	14	1260	Subsoil	Good	Good
16-X105	0.80	0.80	13-Sep-16	17295160913111	7.43	2.45	0.2	58.2	10.1	298	23	<5.8	<12	828	Subsoil	Good	Good
16-X106	1.80	1.80	13-Sep-16	17295160913112	7.55	***3.45***	1.78	62.4	111	397	42.3	9.4	115	1220	Subsoil	Fair	Good
16-X114	2.00	2.00	13-Sep-16	17295160913002	7.46	***4.42***	***4.97***	92.6	367	352	57.4	17.2	1210	304	Subsoil	Fair	Fair
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X115	1.00	1.00	13-Sep-16	17295160913003	7.45	1.84	1.53	74.3	65.8	141	29.3	5	340	159	Subsoil	Good	Good
16-X116	1.00	1.00	13-Sep-16	17295160913004	7.32	***4.95***	1.06	81.7	101	622	131	14.4	970	1010	Subsoil	Fair	Good
16-X117	1.00	1.00	14-Sep-16	17295160914003	7.43	2.93	0.45	80.1	30	314	64.4	9	560	351	Subsoil	Good	Good
16-X118	1.25	1.25	14-Sep-16	17295160914004	7.42	***3.93***	0.44	81.5	35.5	456	94.9	13.7	910	388	Subsoil	Fair	Good
16-X119	1.50	1.50	14-Sep-16	17295160914005	7.37	***4.12***	0.44	77.3	35.7	468	112	10.9	950	396	Subsoil	Fair	Good
16-X120	1.50	1.50	14-Sep-16	17295160914006	7.55	***5.27***	0.57	70.3	45	491	115	11.5	1130	294	Subsoil	Poor	Good
16-X120a	2.50	2.50	20-Sep-16	17295160920001	7.39	***6.22***	0.98	53.4	63	428	97	12	1050	203	Subsoil	Poor	Good
16-X120b	2.75	2.80	23-Sep-16	17295160923004	7.47	***5.85***	0.85	45.3	41.8	293	67.5	9.2	820	171	Subsoil	Poor	Good
16-X120c	3.00	3.00	26-Sep-16	17295160926001	7.57	***5.95***	0.76	47.7	45.7	403	99.6	11.2	950	226	Subsoil	Poor	Good
16-X121	3.00	3.00	15-Sep-16	17295160915001	7.49	***7.95***	2.33	64.7	195	602	131	<13	1650	216	Subsoil	Poor	Good
16-X122	3.00	3.00	15-Sep-16	17295160915002	7.89	***4.28***	0.82	40.8	32.6	201	55.5	7.4	520	98.1	Subsoil	Fair	Good
16-X123	3.00	3.00	15-Sep-16	17295160915003	7.70	***6.38***	2.00	42	99.1	306	82.4	<8.4	860	137	Subsoil	Poor	Good
16-X124	3.00	3.00	15-Sep-16	17295160915004	7.54	***6.96***	***4.36***	99.5	470	618	162	<20	2250	275	Subsoil	Poor	Fair
16-X125	2.25	2.25	15-Sep-16	17295160915005	7.55	2.86	0.75	64.7	37.5	212	49.3	<6.5	510	157	Subsoil	Good	Good
16-X126	2.25	2.25	15-Sep-16	17295160915006	7.54	***5.22***	0.67	55.9	41.1	345	96.3	8.1	910	174	Subsoil	Poor	Good
16-X127	2.25	2.25	15-Sep-16	17295160915007	7.49	***12.1***	***4.94***	75.3	564	948	223	<15	2980	315	Subsoil	Unsuitable	Fair
16-X128	2.25	2.25	15-Sep-16	17295160915008	7.59	2.98	0.61	77.9	39.7	282	76.2	8.8	610	283	Subsoil	Good	Good
16-X129	0.50	0.50	16-Sep-16	17295160916001	6.56	1.94	0.42	68	22.6	226	56.8	5.9	170	562	Subsoil	Good	Good
16-X130	1.00	1.00	16-Sep-16	17295160916002	6.31	2.75	0.43	68.1	25.8	273	73.9	<6.8	500	387	Subsoil	Good	Good
16-X131	1.00	1.00	16-Sep-16	17295160916003	7.24	***5.25***	0.67	67.7	49.9	441	113	9.5	1090	283	Subsoil	Poor	Good
16-X131a	1.50	1.50	20-Sep-16	17295160920002	7.51	***3.56***	1.02	47.2	41.7	197	42.2	7.7	550	96.1	Subsoil	Fair	Good
16-X132	1.00	1.00	16-Sep-16	17295160916004	7.61	***5.38***	0.67	70.8	55.5	589	85.2	9.2	1100	615	Subsoil	Poor	Good
16-X132a	1.50	1.50	20-Sep-16	17295160920003	7.53	***3.78***	0.82	50.1	36.9	256	32.2	9	570	148	Subsoil	Fair	Good
16-X133	1.50	1.50	16-Sep-16	17295160916005	7.36	***5.78***	0.68	67.2	54.3	492	137	<6.7	1260	202	Subsoil	Poor	Good
16-X133a	2.00	2.00	20-Sep-16	17295160920004	7.57	***4.31***	0.6	87.5	51	446	110	13.9	1220	192	Subsoil	Fair	Good
16-X136	3.00	3.00	16-Sep-16	17295160916008	7.63	***10.9***	***9.45***	47.7	563	419	88.5	<9.5	1760	134	Subsoil	Unsuitable	Poor
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X137	2.00	2.00	16-Sep-16	17295160916009	7.72	***5.08***	0.66	36.8	25.5	222	53.9	5.2	600	69.6	Subsoil	Poor	Good
16-X137a	2.00	2.00	20-Sep-16	17295160920005	7.56	2.52	0.62	45.1	20.6	136	31.2	6.5	336	61	Subsoil	Good	Good
16-X138	2.00	2.00	16-Sep-16	17295160916010	7.76	***4.58***	0.9	82.1	75.7	441	127	12.9	1310	118	Subsoil	Fair	Good
16-X139	2.00	2.00	16-Sep-16	17295160916011	7.52	***4.18***	0.64	79.2	51.1	402	124	<7.9	1130	170	Subsoil	Fair	Good
16-X140	3.00	3.00	16-Sep-16	17295160916012	7.61	***8.19***	***4.28***	48.6	251	387	89.4	<9.7	1400	97	Subsoil	Poor	Fair
16-X141	1.00	1.00	17-Sep-16	17295160917001	7.54	0.694	0.53	72.1	15.5	63.5	15.7	3.9	35	152	Subsoil	Good	Good
16-X142	2.25	2.25	17-Sep-16	17295160917002	7.67	0.932	0.64	71.7	20.4	75.6	20	4.3	84	148	Subsoil	Good	Good
16-X143	2.25	2.25	17-Sep-16	17295160917003	7.65	0.858	0.5	71.2	15.5	71.3	19	4.4	43	191	Subsoil	Good	Good
16-X144	3.00	3.00	17-Sep-16	17295160917004	7.55	***11.1***	***7.31***	47.3	464	476	104	10.5	1910	104	Subsoil	Unsuitable	Fair
16-X145	2.50	2.50	17-Sep-16	17295160917005	***9.54***	***5.12***	1.41	81.7	125	532	119	16.2	1390	189	Subsoil	Poor	Good
16-X145a	2.80	2.80	20-Sep-16	17295160920006	7.53	***4.01***	1.44	55.8	73.1	255	57.4	10.7	740	118	Subsoil	Fair	Good
16-X146	2.00	2.00	19-Sep-16	17295160919001	7.51	***6***	3.48	47	177	317	59.8	<9.4	910	145	Subsoil	Poor	Good
16-X146a	2.50	2.50	22-Sep-16	17295160922002	7.57	***5.46***	2.91	48.8	146	308	51.8	9.8	840	177	Subsoil	Poor	Good
16-X146b	3.00	3.00	24-Sep-16	17295160924002	7.4	***6.15***	1.91	48.1	117	467	70.8	12.1	840	633	Subsoil	Poor	Good
16-X147	1.50	1.50	19-Sep-16	17295160919002	7.71	***7.7***	0.91	29.5	37.3	339	58.6	<5.9	780	151	Subsoil	Poor	Good
16-X147a	2.25	2.25	22-Sep-16	17295160922003	7.71	***8.65***	0.94	27.3	36	326	52.2	<5.5	780	142	Subsoil	Poor	Good
16-X147b	3.00	3.00	24-Sep-16	17295160924003	7.41	***4.98***	0.99	43.8	48.5	322	58.8	10.2	730	187	Subsoil	Fair	Good
16-X148	1.00	1.00	19-Sep-16	17295160919003	7.61	***4.5***	0.58	53.8	35.5	409	69.8	6.5	690	412	Subsoil	Fair	Good
16-X149	0.40	0.40	19-Sep-16	17295160919004	7.59	1.11	***6.39***	64.7	113	24.4	7.6	<3.2	57	149	Subsoil	Good	Fair
16-X149a	0.40	0.40	20-Sep-16	17295160920014	7.75	2.29	***5.38***	73.9	232	145	27.9	<7.4	200	647	Subsoil	Good	Fair
16-X149b	0.50	0.50	28-Sep-16	17295160928008	7.56	0.943	0.91	62	26	75.6	14.7	<3.1	57	157	Subsoil	Good	Good
16-X150	1.00	1.00	19-Sep-16	17295160919005	7.65	0.914	3.56	42	48.1	23.1	6	<2.1	56	65.5	Subsoil	Good	Good
16-X151	3.00	3.00	19-Sep-16	17295160919006	7.59	***3.94***	1.83	46.2	76	180	61.9	4.8	540	180	Subsoil	Fair	Good
16-X152	3.00	3.00	19-Sep-16	17295160919007	7.58	1.86	***7.63***	37.6	110	27.8	8.4	2.5	173	57	Subsoil	Good	Fair
16-X153	3.00	3.00	19-Sep-16	17295160919008	7.57	***3.95***	***10.3***	43	292	109	20.5	4.4	417	293	Subsoil	Fair	Poor
16-X154	0.80	0.80	19-Sep-16	17295160919009	7.63	2.67	1.33	70.5	80.5	339	34.6	<7.0	200	841	Subsoil	Good	Good
16-X155	0.80	0.80	21-Sep-16	17295160921001	7.73	1.4	0.45	72.9	18.4	125	28.9	<3.6	180	226	Subsoil	Good	Good
16-X156	0.80	0.80	21-Sep-16	17295160921002	7.66	1.93	0.5	79.7	24.9	181	35.2	5.7	380	179	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X157	1.00	1.00	21-Sep-16	17295160921003	7.55	2.44	1.39	80.9	77.8	214	47.9	<8.1	550	158	Subsoil	Good	Good
16-X158	1.00	1.00	21-Sep-16	17295160921004	7.44	2.96	1.95	77	107	214	50.9	8	650	153	Subsoil	Good	Good
16-X159	1.50	1.50	21-Sep-16	17295160921005	7.41	***3.68***	0.47	71	31	329	79.6	10.5	810	119	Subsoil	Fair	Good
16-X160	1.25	1.25	21-Sep-16	17295160921006	7.58	1.53	0.5	83.6	22.8	134	33.9	5.7	300	144	Subsoil	Good	Good
16-X161	1.75	1.75	21-Sep-16	17295160921007	7.57	2.4	0.52	82.3	32.4	251	64.8	10.7	570	142	Subsoil	Good	Good
16-X162	1.50	1.50	21-Sep-16	17295160921008	7.64	2.38	0.6	78	36.2	247	63.5	9.8	530	157	Subsoil	Good	Good
16-X163	2.00	2.00	21-Sep-16	17295160921009	7.73	***3.89***	2.15	43.8	83.2	192	40.7	4.7	490	158	Subsoil	Fair	Good
16-X164	2.00	2.00	21-Sep-16	17295160921010	7.67	***4.48***	1.96	47.2	86.2	235	44.9	6.7	670	106	Subsoil	Fair	Good
16-X165	2.00	2.00	21-Sep-16	17295160921011	7.62	***5.38***	***4.9***	53.8	260	284	67.8	8.3	930	106	Subsoil	Poor	Fair
16-X165a	3.00	3.00	23-Sep-16	17295160923002	7.61	***5.96***	***4.32***	43.9	183	230	47.7	8.1	880	45.5	Subsoil	Poor	Fair
16-X166	2.00	2.00	22-Sep-16	17295160922001	7.47	***5.64***	1.39	53.8	91.9	503	70.9	10.2	770	775	Subsoil	Poor	Good
16-X166a	2.50	2.50	24-Sep-16	17295160924001	7.46	***4.44***	1.55	47.3	72.4	279	43.8	9.2	690	150	Subsoil	Fair	Good
16-X167	3.00	3.00	22-Sep-16	17295160922004	8.02	***6.27***	3.19	49.7	162	290	64.6	9.9	1070	23	Subsoil	Poor	Good
16-X168	3.00	3.00	22-Sep-16	17295160922005	7.85	***12.9***	***18.7***	50.5	1020	332	69	<10	2100	149	Subsoil	Unsuitable	Unsuitable
16-X169	3.00	3.00	22-Sep-16	17295160922006	7.62	***12.3***	2.85	46.5	224	743	162	11.6	1990	164	Subsoil	Unsuitable	Good
16-X170	3.00	3.00	22-Sep-16	17295160922007	7.55	***14.6***	***6.99***	95.6	1010	1240	246	<19	5000	280	Subsoil	Unsuitable	Fair
16-X171	3.00	3.00	22-Sep-16	17295160922008	7.73	***12.7***	***6.38***	42.6	406	530	116	<8.5	1860	154	Subsoil	Unsuitable	Fair
16-X172	3.00	3.00	22-Sep-16	17295160922009	7.8	***20.4***	***12.4***	43.9	997	842	166	10.8	3230	201	Subsoil	Unsuitable	Unsuitable
16-X173	3.00	3.00	22-Sep-16	17295160922010	7.96	***30.3***	***19.5***	42.9	1790	1100	233	13.2	5500	189	Subsoil	Unsuitable	Unsuitable
16-X174	3.00	3.00	22-Sep-16	17295160922011	7.39	***25.5***	***10.6***	92.8	2140	2500	518	24	8800	342	Subsoil	Unsuitable	Poor
16-X175	2.00	2.00	22-Sep-16	17295160922013	7.68	***5.54***	3.92	41.6	155	207	46.5	6.7	710	176	Subsoil	Poor	Good
16-X175a	3.00	3.00	24-Sep-16	17295160924004	7.38	***4.63***	0.85	41.9	43.5	364	63.1	10.4	398	638	Subsoil	Fair	Good
16-X176	1.50	1.50	22-Sep-16	17295160922014	7.66	***4.54***	0.66	60.8	46	516	56.8	<6.1	570	901	Subsoil	Fair	Good
16-X177	3.50	3.50	24-Sep-16	17295160924008	7.77	***7.92***	***9.92***	43.9	424	232	51	9.4	1270	<11	Subsoil	Poor	Poor
16-X178	2.00	2.00	23-Sep-16	17295160923003	7.58	***5.23***	***8.09***	40.3	259	143	30.2	7.4	660	126	Subsoil	Poor	Poor
16-X178a	2.50	2.50	26-Sep-16	17295160926002	7.59	***3.54***	2.59	61.8	125	205	48.2	10.2	670	164	Subsoil	Fair	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X179	1.50	1.50	23-Sep-16	17295160923005	7.51	***3.91***	0.98	61.3	57.9	310	74.5	11.8	760	171	Subsoil	Fair	Good
16-X180	1.50	1.50	23-Sep-16	17295160923006	7.54	2.55	1.56	43.5	48.1	115	30.9	5.8	308	104	Subsoil	Good	Good
16-X181	1.50	1.50	23-Sep-16	17295160923007	7.63	***3.31***	2.53	76.3	154	266	64.1	10.9	730	221	Subsoil	Fair	Good
16-X182	1.50	1.50	23-Sep-16	17295160923008	7.57	2.38	3.34	101	201	191	50	13	600	249	Subsoil	Good	Good
16-X183	1.50	1.50	24-Sep-16	17295160924005	7.5	***3.15***	***5.25***	45.7	162	115	26.8	7.8	450	104	Subsoil	Fair	Fair
16-X184	1.50	1.50	24-Sep-16	17295160924006	7.61	***4.44***	***7.61***	42.5	238	125	29.6	7.2	630	74.5	Subsoil	Fair	Fair
16-X185	2.25	2.25	24-Sep-16	17295160924007	7.49	***6.75***	***6.49***	44.4	292	252	56.5	9.7	1080	48	Subsoil	Poor	Fair
16-X185a	3.00	3.00	28-Sep-16	17295160928001	7.66	***10.7***	***11.7***	48.4	724	453	92.2	11.9	1790	50	Subsoil	Unsuitable	Poor
16-X186	3.00	3.00	24-Sep-16	17295160924009	7.89	***12.1***	***24.6***	44.4	987	209	40.6	<8.9	2020	113	Subsoil	Unsuitable	Unsuitable
16-X187	3.00	3.00	24-Sep-16	17295160924010	7.5	***9.36***	***7.19***	44.2	388	377	75	10.4	1520	100	Subsoil	Poor	Fair
16-X188	1.50	1.50	24-Sep-16	17295160924011	7.4	2.65	3.32	106	224	235	54	15	830	160	Subsoil	Good	Good
16-X189	3.00	3.00	24-Sep-16	17295160924012	7.73	***10.9***	***27.9***	50.2	1050	172	26	17	1890	189	Subsoil	Unsuitable	Unsuitable
16-X192	2.00	2.00	26-Sep-16	17295160926004	7.86	2.95	3.91	37.8	95.8	86.4	20.6	4.7	317	92.9	Subsoil	Good	Good
16-X193	3.00	3.00	26-Sep-16	17295160926005	7.65	***21.7***	***20.1***	43.1	1290	525	121	<43	3640	<52	Subsoil	Unsuitable	Unsuitable
16-X194	3.00	3.00	26-Sep-16	17295160926006	7.93	***14.8***	***30***	45.8	1210	205	39.7	<9.2	2540	130	Subsoil	Unsuitable	Unsuitable
16-X195	3.00	3.00	26-Sep-16	17295160926007	7.77	***11.5***	***17.7***	44.9	777	260	41.2	<9.0	1910	130	Subsoil	Unsuitable	Unsuitable
16-X196	0.75	0.75	26-Sep-16	17295160926008	7.89	1.89	0.68	71.6	30.3	149	37.8	<3.6	360	143	Subsoil	Good	Good
16-X197	2.25	2.25	26-Sep-16	17295160926009	7.55	1.91	0.61	74.3	28.3	166	31.1	8.1	350	174	Subsoil	Good	Good
16-X198	2.00	2.00	26-Sep-16	17295160926010	7.5	***5.94***	0.93	57.3	63.9	437	110	10.4	1200	115	Subsoil	Poor	Good
16-X198a	3.00	3.00	07-Oct-16	17295161007005	7.46	***5.85***	2.61	43.6	125	285	68	9.8	860	105	Subsoil	Poor	Good
16-X199	2.00	2.00	26-Sep-16	17295160926011	7.7	***5.33***	***9.48***	47.4	342	158	30.7	6.5	850	109	Subsoil	Poor	Poor
16-X199a	3.00	3.00	07-Oct-16	17295161007006	7.51	***9.15***	***8.99***	42.9	430	310	57	9.1	1220	122	Subsoil	Poor	Poor
16-X200	3.00	3.00	26-Sep-16	17295160926012	7.58	***13.2***	***10***	77.7	1150	969	195	<16	4100	345	Subsoil	Unsuitable	Poor
16-X201	3.00	3.00	26-Sep-16	17295160926013	7.5	***19.5***	***11.4***	88.2	1930	1850	377	<44	7200	403	Subsoil	Unsuitable	Poor
16-X202	0.75	0.75	26-Sep-16	17295160926003	7.84	2.05	2.12	61.7	79.1	128	26	<6.2	330	150	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X203	2.75	2.75	27-Sep-16	17295160927101	7.43	***3.31***	2.35	75.4	154	322	65.1	<7.5	610	420	Subsoil	Fair	Good
16-X204	0.75	0.75	27-Sep-16	17295160927102	7.54	1.06	1.84	72.8	58.4	76.8	17.4	<3.6	69	227	Subsoil	Good	Good
16-X205	1.00	1.00	27-Sep-16	17295160927103	7.53	2.6	***6.44***	69.3	240	109	25.9	7.9	470	169	Subsoil	Good	Fair
16-X206	0.50	0.50	27-Sep-16	17295160927104	7.65	1.66	3.07	75	117	109	22.3	<3.8	250	211	Subsoil	Good	Good
16-X207	2.00	2.00	27-Sep-16	17295160927105	7.57	***3.58***	***12.4***	52.4	328	70.7	18.6	5.9	560	106	Subsoil	Fair	Unsuitable
16-X207a	3.00	3.00	30-Sep-16	17295160930008	8.25	***9.75***	***22.5***	44.4	780	149	33.8	11.5	1500	49	Subsoil	Poor	Unsuitable
16-X208	2.50	2.50	27-Sep-16	17295160927106	7.69	***5.82***	***25.3***	45.1	556	57.8	14	5.3	830	44.7	Subsoil	Poor	Unsuitable
16-X208a	3.00	3.00	30-Sep-16	17295160930009	7.69	***5.81***	***12.8***	41.2	360	106	24.2	6.5	770	73.7	Subsoil	Poor	Unsuitable
16-X209	2.00	2.00	27-Sep-16	17295160927107	7.45	2.55	2.53	77.6	133	188	48.6	8.1	510	221	Subsoil	Good	Good
16-X210	2.50	2.50	27-Sep-16	17295160927108	7.47	***3.36***	3.47	47.5	128	151	39.7	5.1	408	223	Subsoil	Fair	Good
16-X211	2.50	2.50	27-Sep-16	17295160927109	7.64	1.86	***17.5***	95.1	354	21.4	6.8	<4.8	370	151	Subsoil	Good	Unsuitable
16-X211a	3.00	3.00	29-Sep-16	17295160929016	7.7	2.63	***9.19***	42.5	169	41.5	11.3	<4.3	301	67.1	Subsoil	Good	Poor
16-X212	1.75	1.75	28-Sep-16	17295160928003	7.61	2.43	***4.8***	67.8	200	144	30.6	9.7	430	246	Subsoil	Good	Fair
16-X213	1.75	1.75	28-Sep-16	17295160928004	7.59	***3.81***	2.99	81.5	199	303	65.4	13.1	930	188	Subsoil	Fair	Good
16-X216	2.50	2.50	28-Sep-16	17295160928009	7.55	***4.43***	***4.31***	45.2	176	198	48.9	9.3	670	98	Subsoil	Fair	Fair
16-X217	1.00	1.00	28-Sep-16	17295160928010	7.89	***3.22***	3.66	41.1	112	126	29.3	<4.1	378	119	Subsoil	Fair	Good
16-X218	1.25	1.25	28-Sep-16	17295160928011	7.74	2.1	2.66	56	86.6	107	22.1	<5.6	310	113	Subsoil	Good	Good
16-X218a	3.00	3.00	13-Oct-16	17295161013001	7.39	***8.07***	***11.9***	41.4	438	184	40.1	9.2	1160	66.1	Subsoil	Poor	Poor
16-X219	3.00	3.00	28-Sep-16	17295160928012	7.6	***42.4***	***30.2***	44.3	3130	1390	274	<44	7800	173	Subsoil	Unsuitable	Unsuitable
16-X220	3.00	3.00	28-Sep-16	17295160928013	7.72	***14.8***	***9.19***	46	681	680	138	11.8	2330	128	Subsoil	Unsuitable	Poor
16-X221	3.00	3.00	28-Sep-16	17295160928014	7.66	***14.1***	***7.82***	42.4	529	604	130	9.9	2040	146	Subsoil	Unsuitable	Fair
16-X222	3.00	3.00	28-Sep-16	17295160928015	7.77	***14***	***28.8***	57.8	1530	276	57	22	2770	267	Subsoil	Unsuitable	Unsuitable
16-X223	3.00	3.00	28-Sep-16	17295160928016	7.7	***22***	***14***	42.3	1120	860	172	12.1	3360	180	Subsoil	Unsuitable	Unsuitable
16-X224	3.00	3.00	28-Sep-16	17295160928017	7.48	***37***	***17.6***	46.9	2110	1730	367	<47	7300	212	Subsoil	Unsuitable	Unsuitable
16-X225	3.00	3.00	28-Sep-16	17295160928018	7.38	***19.1***	***8.19***	84.5	1370	1900	368	20	6000	367	Subsoil	Unsuitable	Poor
16-X226	3.00	3.00	28-Sep-16	17295160928019	7.77	***12.8***	1.76	40.8	133	728	205	10.5	1850	177	Subsoil	Unsuitable	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X227	3.00	3.00	28-Sep-16	17295160928020	7.41	***14.1***	***6.03***	94.1	1010	1740	321	32	5200	335	Subsoil	Unsuitable	Fair
16-X228	2.75	2.75	28-Sep-16	17295160928021	7.8	***13.5***	***25.6***	60	1500	324	66	13	2730	213	Subsoil	Unsuitable	Unsuitable
16-X229	2.75	2.75	28-Sep-16	17295160928022	7.7	***37.8***	***57.5***	47.5	4050	602	115	99	7600	359	Subsoil	Unsuitable	Unsuitable
16-X230	2.75	2.75	29-Sep-16	17295160929001	7.69	***3.73***	***12.9***	59.5	357	72	15.9	6.3	640	143	Subsoil	Fair	Unsuitable
16-X231	2.75	2.75	29-Sep-16	17295160929002	7.67	***6.41***	***17.8***	44.4	464	86.4	17.5	9	860	77	Subsoil	Poor	Unsuitable
16-X232	2.75	2.75	29-Sep-16	17295160929003	7.77	***3.84***	3.93	48.9	157	194	31.5	<4.9	480	217	Subsoil	Fair	Good
16-X233	0.80	0.80	29-Sep-16	17295160929004	7.72	***3.6***	1.26	77.9	91.4	381	81.5	<7.8	680	497	Subsoil	Fair	Good
16-X233a	0.90	0.90	05-Oct-16	17295161005005	7.54	***3.08***	1.32	48.4	51.4	179	36.4	5.1	354	230	Subsoil	Fair	Good
16-X233b	0.90	0.90	07-Oct-16	17295161007001	7.51	1.81	1.21	64.3	49.5	146	30.8	<3.2	170	312	Subsoil	Good	Good
16-X234	2.00	2.00	29-Sep-16	17295160929005	7.52	2.94	1.06	87.1	77.5	329	82.3	9.3	630	428	Subsoil	Good	Good
16-X235	0.80	0.80	29-Sep-16	17295160929006	7.71	2.07	0.7	59.8	28.6	151	36.9	<6.0	290	174	Subsoil	Good	Good
16-X236	2.20	2.20	29-Sep-16	17295160929007	7.55	***4.26***	0.66	78.4	53.1	436	112	8.9	1040	221	Subsoil	Fair	Good
16-X237	3.00	3.00	29-Sep-16	17295160929008	7.87	***4.96***	1.12	42.4	52.1	261	78.2	7.2	650	144	Subsoil	Fair	Good
16-X238	3.00	3.00	29-Sep-16	17295160929009	7.69	***10***	***9.31***	47	519	367	80.6	10.3	1580	145	Subsoil	Poor	Poor
16-X239	3.00	3.00	29-Sep-16	17295160929010	7.73	***9.47***	***5.22***	50.8	345	482	104	12	1650	185	Subsoil	Poor	Fair
16-X240	3.00	3.00	29-Sep-16	17295160929011	7.75	***13.7***	***12.1***	42.2	714	483	88.8	8.7	1940	193	Subsoil	Unsuitable	Unsuitable
16-X241	2.60	2.60	29-Sep-16	17295160929012	8	1.52	***20.5***	56.2	146	6.8	<2.8	<2.8	140	98.2	Subsoil	Good	Unsuitable
16-X241a	3.00	3.00	04-Oct-16	17295161004007	7.87	***12.1***	***37.7***	56.5	1290	113	26	11	2160	217	Subsoil	Unsuitable	Unsuitable
16-X242	3.00	3.00	29-Sep-16	17295160929013	8.06	***6.44***	***47.6***	55	636	25	<11	16	1000	176	Subsoil	Poor	Unsuitable
16-X243	3.00	3.00	29-Sep-16	17295160929014	7.92	***28.2***	***53.2***	58.8	3460	410	83	108	5600	219	Subsoil	Unsuitable	Unsuitable
16-X244	3.00	3.00	29-Sep-16	17295160929015	7.73	***21.4***	***16.8***	53.6	1570	901	201	19	4100	269	Subsoil	Unsuitable	Unsuitable
16-X245	0.85	0.85	30-Sep-16	17295160930014	7.51	0.735	0.51	69.9	14.6	66.6	13.6	<3.5	25	144	Subsoil	Good	Good
16-X246	2.25	2.25	30-Sep-16	17295160930015	7.46	***3.08***	0.66	83.9	48.5	349	83.4	11.8	600	468	Subsoil	Fair	Good
16-X247	0.85	0.85	30-Sep-16	17295160930016	7.41	***4.05***	0.77	60.7	51.7	482	53.4	<6.1	460	875	Subsoil	Fair	Good
16-X247a	0.90	0.90	06-Oct-16	17295161006015	7.59	1.46	0.93	69.9	36.3	134	18.4	<3.5	55	362	Subsoil	Good	Good
16-X248	2.50	2.50	03-Oct-16	17295161003002	7.45	1.1	***4.91***	27.7	39.9	12.6	3.4	<1.4	47	32.1	Subsoil	Good	Fair
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X249	3.00	3.00	03-Oct-16	17295161003003	7.51	1.81	0.73	40.9	18	81.6	18.5	4.4	158	94.8	Subsoil	Good	Good
16-X250	2.50	2.50	03-Oct-16	17295161003004	7.47	2.71	1.16	44.9	39.5	141	33	6.1	341	67.6	Subsoil	Good	Good
16-X251	2.00	2.00	03-Oct-16	17295161003005	7.2	0.476	0.33	72.8	7.6	38.9	9.6	3.9	23	77.1	Subsoil	Good	Good
16-X252	0.60	0.60	04-Oct-16	17295161004001	7.38	0.455	0.46	68.4	9.6	37	7.1	<3.4	19	48.5	Subsoil	Good	Good
16-X253	1.50	1.50	04-Oct-16	17295161004002	7.55	1.42	0.74	79.1	31.5	129	27.6	7.1	270	102	Subsoil	Good	Good
16-X254	3.00	3.00	04-Oct-16	17295161004003	7.49	***5.38***	0.67	42.5	36.1	387	79.4	8.3	520	634	Subsoil	Poor	Good
16-X255	3.00	3.00	04-Oct-16	17295161004004	7.57	***9.98***	***8.41***	44.7	456	387	67.7	9.1	1460	115	Subsoil	Poor	Poor
16-X256	2.00	2.00	04-Oct-16	17295161004005	7.52	***5.45***	2.18	43	98.4	265	58.1	7.4	750	80.3	Subsoil	Poor	Good
16-X256a	3.00	3.00	06-Oct-16	17295161006021	7.48	***6.09***	1.58	46.5	82.9	320	77.8	11.2	850	96	Subsoil	Poor	Good
16-X257	3.00	3.00	04-Oct-16	17295161004006	7.55	***5.52***	1.75	45.9	86.1	295	63.5	9.5	770	139	Subsoil	Poor	Good
16-X258	2.50	2.50	04-Oct-16	17295161004008	7.71	2.35	***15.6***	43.8	191	16.2	5.9	<4.4	182	131	Subsoil	Good	Unsuitable
16-X258a	3.00	3.00	06-Oct-16	17295161006020	7.91	***7.85***	***46***	49.7	762	41.9	<9.9	11.5	1090	156	Subsoil	Poor	Unsuitable
16-X259	2.00	2.00	04-Oct-16	17295161004009	7.5	2.35	2.85	74.2	128	136	42.2	7.5	450	155	Subsoil	Good	Good
16-X260	2.20	2.20	04-Oct-16	17295161004010	7.56	2.31	***4.97***	54.4	137	70.2	21.7	<5.4	310	110	Subsoil	Good	Fair
16-X261	2.20	2.20	04-Oct-16	17295161004011	7.6	***6.99***	***10.5***	45.9	406	172	44.9	<9.2	1020	94	Subsoil	Poor	Poor
16-X261a	3.00	3.00	06-Oct-16	17295161006019	7.57	***8.11***	***9.84***	45.7	428	222	55.8	<9.1	1310	96	Subsoil	Poor	Poor
16-X262	2.00	2.00	04-Oct-16	17295161004012	7.52	***4.27***	***6.5***	45.1	206	116	31.7	5.2	580	73.5	Subsoil	Fair	Fair
16-X263	2.00	2.00	04-Oct-16	17295161004013	7.85	***19.8***	***54.1***	51.9	2200	182	37	23	3300	399	Subsoil	Unsuitable	Unsuitable
16-X264	2.50	2.50	05-Oct-16	17295161005001	7.38	***3***	1.04	46.5	37.7	152	38.4	6.5	385	89.7	Subsoil	Fair	Good
16-X265	2.00	2.00	05-Oct-16	17295161005002	7.47	2.86	0.51	49.8	20.5	174	44.7	5.8	410	79.2	Subsoil	Good	Good
16-X266	2.00	2.00	05-Oct-16	17295161005003	7.41	2.42	0.82	46.1	27.7	133	33.1	5.4	308	90.9	Subsoil	Good	Good
16-X267	3.00	3.00	05-Oct-16	17295161005004	7.71	***21.2***	***36***	51.3	2060	418	40.1	76.9	2900	1710	Subsoil	Unsuitable	Unsuitable
16-X268	3.00	3.00	05-Oct-16	17295161005006	7.42	***5.31***	***4.3***	43.8	173	195	52	7.6	720	84.7	Subsoil	Poor	Fair
16-X269	2.50	2.50	05-Oct-16	17295161005007	7.44	***3.99***	3.07	43.1	108	146	44	6.1	520	68.6	Subsoil	Fair	Good
16-X270	3.00	3.00	05-Oct-16	17295161005008	7.46	0.905	2.16	46.9	33.3	25.5	7.8	2.5	51	60.2	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X271	2.50	2.50	05-Oct-16	17295161005009	7.41	1.74	3.33	46.7	72.6	52.2	15.1	3.5	184	87.3	Subsoil	Good	Good
16-X272	3.50	3.50	05-Oct-16	17295161005010	7.66	***4.87***	***10.7***	44.3	287	85.4	23.2	5.3	660	21.7	Subsoil	Fair	Poor
16-X273	3.00	3.00	05-Oct-16	17295161005011	7.95	2.58	***6.17***	30.2	91.6	38.5	10.2	<3.0	206	57.2	Subsoil	Good	Fair
16-X274	3.00	3.00	05-Oct-16	17295161005012	7.67	***46.5***	***49.7***	44.5	4040	843	172	79	8900	211	Subsoil	Unsuitable	Unsuitable
16-X275	3.00	3.00	05-Oct-16	17295161005013	8.05	***25***	***83.1***	52.7	2730	155	<53	56	4400	444	Subsoil	Unsuitable	Unsuitable
16-X276	3.00	3.00	05-Oct-16	17295161005014	7.92	***30.5***	***65.9***	48.5	3570	347	68	92	7000	394	Subsoil	Unsuitable	Unsuitable
16-X277	3.00	3.00	05-Oct-16	17295161005015	7.89	***55***	***65***	33.7	3730	530	129	120	7700	<40	Subsoil	Unsuitable	Unsuitable
16-X277a	3.50	3.50	07-Oct-16	17295161007003	7.67	***63***	***63***	44.6	6350	1290	267	174	12400	164	Subsoil	Unsuitable	Unsuitable
16-X278	3.00	3.00	05-Oct-16	17295161005016	8.05	***19.8***	***55.5***	62.4	2610	203	40	85	3800	890	Subsoil	Unsuitable	Unsuitable
16-X278a	3.50	3.50	07-Oct-16	17295161007004	7.85	***42.2***	***65.3***	45	4500	610	116	168	7700	429	Subsoil	Unsuitable	Unsuitable
16-X279	3.00	3.00	05-Oct-16	17295161005017	7.73	***31.1***	***45.5***	53.8	3260	532	117	66	6400	407	Subsoil	Unsuitable	Unsuitable
16-X280	3.00	3.00	05-Oct-16	17295161005018	7.72	***58.6***	***51***	45.5	5080	1210	268	131	11600	298	Subsoil	Unsuitable	Unsuitable
16-X281	3.00	3.00	05-Oct-16	17295161005019	7.51	***21.4***	***9.77***	43.3	835	930	211	10.9	3230	201	Subsoil	Unsuitable	Poor
16-X282	3.00	3.00	05-Oct-16	17295161005020	7.98	***5.69***	1.5	44	75.2	299	82.2	7	800	175	Subsoil	Poor	Good
16-X283	3.00	3.00	05-Oct-16	17295161005021	7.54	***5.83***	1.32	43	64.9	303	76.3	8.4	760	173	Subsoil	Poor	Good
16-X284	3.00	3.00	05-Oct-16	17295161005022	7.32	***3.02***	1.14	69.1	66.7	263	66.3	9.6	510	285	Subsoil	Fair	Good
16-X285	0.80	0.80	05-Oct-16	17295161005023	7.44	2.65	0.77	63.3	41.7	261	57.4	<6.3	290	496	Subsoil	Good	Good
16-X286	2.00	2.00	05-Oct-16	17295161005024	7.43	*6*	1.01	39.3	47.6	298	80.4	7.6	740	113	Subsoil	Poor	Good
16-X286a	2.00	2.00	07-Oct-16	17295161007002	7.41	2.03	0.94	43.1	27.9	108	28.2	5.5	204	148	Subsoil	Good	Good
16-X287	0.80	0.80	06-Oct-16	17295161006001	7.56	1.14	0.74	71.7	27.8	110	24	<3.6	31	324	Subsoil	Good	Good
16-X288	2.00	2.00	06-Oct-16	17295161006002	7.41	***3.61***	0.71	44.5	29.1	209	48	7.9	470	162	Subsoil	Fair	Good
16-X289	0.80	0.80	06-Oct-16	17295161006003	7.45	1.18	0.7	67	25.1	107	24.3	7.1	50	305	Subsoil	Good	Good
16-X290	2.00	2.00	06-Oct-16	17295161006004	7.43	1.26	0.69	83.2	30.5	127	31.1	9.1	96	341	Subsoil	Good	Good
16-X291	0.80	0.80	06-Oct-16	17295161006005	7.56	1.48	0.83	71.9	38.2	160	37	8.4	109	347	Subsoil	Good	Good
16-X292	2.00	2.00	06-Oct-16	17295161006006	7.4	1.95	0.73	78	41.1	253	34.1	11.1	111	664	Subsoil	Good	Good
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines[+]		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X293	0.80	0.80	06-Oct-16	17295161006007	7.43	2.55	0.76	67.8	44.6	328	37.5	<6.8	140	821	Subsoil	Good	Good
16-X294	3.00	3.00	06-Oct-16	17295161006008	7.59	***13.3***	2.3	40.7	175	810	163	10.2	1930	520	Subsoil	Unsuitable	Good
16-X295	3.00	3.00	06-Oct-16	17295161006009	7.33	***6.03***	0.83	64.2	70	624	136	14	1000	940	Subsoil	Poor	Good
16-X296	3.00	3.00	06-Oct-16	17295161006010	7.38	***11.7***	1.39	53.2	130	945	186	16	2400	300	Subsoil	Unsuitable	Good
16-X297	3.00	3.00	06-Oct-16	17295161006011	8.12	***42.4***	***58***	41.1	3480	504	96.4	96.7	6900	374	Subsoil	Unsuitable	Unsuitable
16-X298	3.00	3.00	06-Oct-16	17295161006012	7.8	***48.9***	***41.4***	38.6	3360	965	199	<39	8400	259	Subsoil	Unsuitable	Unsuitable
16-X299	3.00	3.00	06-Oct-16	17295161006013	7.72	***52.2***	***50.2***	45.6	4850	1150	245	79	10700	257	Subsoil	Unsuitable	Unsuitable
16-X300	3.00	3.00	06-Oct-16	17295161006014	7.72	***29.8***	***34.1***	49.8	2290	515	105	<50	5800	207	Subsoil	Unsuitable	Unsuitable
16-X301	3.00	3.00	06-Oct-16	17295161006016	7.68	***28***	***14.3***	43.7	1320	1100	240	<44	4350	166	Subsoil	Unsuitable	Unsuitable
16-X302	3.00	3.00	06-Oct-16	17295161006017	7.4	2.45	3.7	53	113	96.5	21.6	<5.3	330	81.2	Subsoil	Good	Good
16-X303	3.00	3.00	06-Oct-16	17295161006018	7.78	***18.5***	***30.7***	54.5	1770	345	72	39	3500	393	Subsoil	Unsuitable	Unsuitable
16-X304	3.50	3.50	07-Oct-16	17295161007007	7.55	***5.58***	***8.85***	49.4	360	191	38.9	5.3	820	258	Subsoil	Poor	Poor
16-X305	3.50	3.50	07-Oct-16	17295161007008	7.61	2.75	***9.1***	38.7	135	30	7.9	4	206	117	Subsoil	Good	Poor
16-X306	3.50	3.50	07-Oct-16	17295161007009	7.52	***5.62***	***17.7***	40	350	51.9	13.6	7.2	610	107	Subsoil	Poor	Unsuitable
16-X307	3.00	3.00	08-Oct-16	17295161008001	7.57	***8.81***	***6.42***	51.9	403	427	90	<10	1520	187	Subsoil	Poor	Fair
16-X308	3.00	3.00	08-Oct-16	17295161008002	7.55	***8.41***	***6.28***	39.5	290	311	58.9	<7.9	1120	97.9	Subsoil	Poor	Fair
16-X309	3.00	3.00	08-Oct-16	17295161008003	7.52	***7.85***	***10.5***	45.2	443	230	43.1	<9.0	1160	109	Subsoil	Poor	Poor
16-X310	3.75	3.75	08-Oct-16	17295161008004	8.09	***19.2***	***47.3***	43.5	1620	157	29	43	2770	88	Subsoil	Unsuitable	Unsuitable
16-X311	3.25	3.25	08-Oct-16	17295161008005	7.85	***24.4***	***55.3***	46.8	2540	262	47	84	4000	242	Subsoil	Unsuitable	Unsuitable
16-X312	3.00	3.00	11-Oct-16	17295161011009	7.59	***21.7***	***15.1***	44.9	1090	689	114	<45	3040	613	Subsoil	Unsuitable	Unsuitable
16-X313	3.00	3.00	11-Oct-16	17295161011010	7.76	***12.3***	***32***	72.7	1540	188	32	<15	2800	243	Subsoil	Unsuitable	Unsuitable
16-X314	3.00	3.00	11-Oct-16	17295161011011	7.58	***30.8***	***27.1***	64.9	2680	847	180	<65	6500	267	Subsoil	Unsuitable	Unsuitable
16-X315	3.00	3.00	11-Oct-16	17295161011012	7.77	***51.5***	***61.1***	48.1	4830	750	144	<48	10200	237	Subsoil	Unsuitable	Unsuitable
16-X316	3.00	3.00	11-Oct-16	17295161011013	7.64	***35.1***	***20.9***	45	1840	998	188	<45	6400	122	Subsoil	Unsuitable	Unsuitable
Alberta Tier 1 - Residential / Parkland[+]					**6-8.5[ES]**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Topsoil (Good)[+]					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-
Salt Guideline for Subsoil (Good)[+]					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	-	-	-

TABLE B5

Historical Soil Quality Results - Detailed Salinity

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Lab pH	Lab EC dS/m	SAR	Saturation %	Soluble Ions						Salt Remediation Guidelines+		
									Na mg/kg	Ca mg/kg	Mg mg/kg	K mg/kg	Cl mg/kg	SO_4 mg/kg	Soil Horizon	Salinity Rating	Sodicity Rating
Former Flare Pit and Production Area Excavation Confirmatory Samples																	
16-X317	3.00	3.00	11-Oct-16	17295161011014	8.03	***23***	***4.83***	45.8	473	1210	230	<46	3580	372	Subsoil	Unsuitable	Fair
16-X318	3.00	3.00	11-Oct-16	17295161011015	7.48	***24.6***	***7.3***	60.3	883	1370	281	<60	5100	131	Subsoil	Unsuitable	Fair
16-X319	3.20	3.20	11-Oct-16	17295161011016	7.54	***39.8***	***16.1***	52	2020	1810	304	<52	8400	476	Subsoil	Unsuitable	Unsuitable
16-X320	3.00	3.00	13-Oct-16	17295161013002	7.45	2.22	0.75	66.6	35.5	190	38.4	7	419	156	Subsoil	Good	Good
16-X321	3.00	3.00	13-Oct-16	17295161013003	7.42	***3.53***	0.65	42.8	25.7	196	46.7	7.3	499	86.2	Subsoil	Fair	Good
Alberta Tier 1 - Residential / Parkland+					**6-8.5ES**	**+**	**+**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Topsoil (Good)+					**NS**	**2**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**
Salt Guideline for Subsoil (Good)+					**NS**	**3**	**4**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**-**	**-**	**-**

Notes:

--- - not analyzed

NS - not specified

Bold - EC and/or SAR values do not meet the "good" subsoil rating category (AEP 2019)

Good topsoil - EC <2 dS/m; SAR <4

Fair topsoil - EC 2 to 4 dS/m; SAR 4 to 8

Poor topsoil - EC 4 to 8 dS/m; SAR 8 to 12

Unsuitable topsoil - EC >8 dS/m; SAR >12

Good subsoil - EC <3 dS/m; SAR <4

Fair subsoil - EC 3 to 5 dS/m; SAR 4 to 8

Poor subsoil - EC 5 to 10 dS/m; SAR 8 to 12

Unsuitable subsoil - EC >10 dS/m; SAR >12

TABLE B6

Historical Soil Quality Results - Metals

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Sb mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	B^{SAT} mg/L	Cd mg/kg	Cr mg/kg	Co mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Mo mg/kg	Ni mg/kg	Se mg/kg	Ag mg/kg	Tl mg/kg	Sn mg/kg	U mg/kg	V mg/kg	Zn mg/kg
Flare Pit																								
Trailer Park																								
13-B1	0.30	0.60	29-Jul-13	17295130729003	0.5	9.19	226	<1	0.79	<0.5	21.3	8.9	22.2	11.2	0.051	1.2	24.9	<0.5	<1	<0.5	<2.0	<2.0	37.4	61
13-B2	0.15	0.30	29-Jul-13	17295130729019	0.28	7.06	195	<1	1.03	<0.5	22.7	9	17.8	9.9	<0.05	<1	24.2	0.66	<1	<0.5	<2.0	<2.0	36.7	65
13-B3	0.15	0.30	29-Jul-13	17295130729033	0.45	***18.3***	97.7	<1	***15***	<0.5	12.2	4.9	17.3	7.1	<0.05	1.1	15.9	0.57	<1	<0.5	<2.0	15.8	18.6	49
13-B3	3.50	4.00	29-Jul-13	17295130729041	0.33	6.4	127	<1	***7.15***	<0.5	18	6.7	14.1	7.2	<0.05	<1	19.7	0.58	<1	<0.5	<2.0	<2.0	23	49
13-B3	5.00	5.50	29-Jul-13	17295130729044	0.49	5.44	205	<1	0.68	<0.5	17.1	10	19.3	9.7	<0.05	<1	26.1	<0.5	<1	<0.5	<2.0	<2.0	27.1	70
13-B4	0.00	0.15	29-Jul-13	17295130729052	0.32	7.33	153	<1	3.01	<0.5	16.2	6.9	18.9	9.1	<0.05	1.1	19.6	0.66	<1	<0.5	<2.0	12.8	25.1	64
13-B4	1.00	1.50	29-Jul-13	17295130729056	0.61	16	251	<1	***6.9***	<0.5	23.8	19.4	36.7	19.7	0.085	1.9	43.6	<0.5	<1	<0.5	<2.0	<2.0	41.4	95
13-B4	4.00	4.50	29-Jul-13	17295130729062	0.29	5.78	117	<1	1.79	<0.5	14.2	6.8	12.2	6.5	<0.05	<1	18.4	<0.5	<1	<0.5	<2.0	<2.0	21.4	47
13-B5	0.15	0.30	30-Jul-13	17295130730070	---	---	---	---	0.42	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13-B6	0.15	0.30	30-Jul-13	17295130730084	0.45	9.99	223	<1	0.29	<0.5	21.1	10.1	17.1	9.7	<0.05	<1	28.1	<0.5	<1	<0.5	<2.0	<2.0	37.5	58
13-B7	0.15	0.30	30-Jul-13	17295130730115	---	---	---	---	0.74	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13-B16	0.15	0.30	01-Aug-13	17295130801288	0.33	7.04	226	<1	***4.6***	<0.5	18.8	8.4	19.4	11.6	<0.05	<1	22.3	<0.5	<1	<0.5	<2.0	5.3	33.2	60
13-B16	0.60	1.00	01-Aug-13	17295130801290	---	---	---	---	0.42	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13-B24	0.15	0.30	02-Aug-13	17295130802445	0.63	10.9	273	<1	0.51	<0.5	25.8	10.3	27.8	12.1	0.067	1.1	32	<0.5	<1	<0.5	<2.0	<2.0	45.2	74
13-B25	0.15	0.30	02-Aug-13	17295130802482	0.27	8.49	296	<1	0.74	<0.5	24.4	11.8	20.6	11.3	<0.05	<1	27.7	<0.5	<1	<0.5	<2.0	<2.0	43.7	66
13-3	0.00	0.15	02-Aug-13	17295130802464	0.28	6.02	257	<1	0.7	<0.5	21.8	8.3	20.7	10.1	<0.05	<1	24.7	<0.5	<1	<0.5	<2.0	<2.0	36.1	71
Developer																								
13-B17	0.15	0.30	01-Aug-13	17295130801302	0.33	10.6	208	<1	1.07	<0.5	21.2	9	16.8	10.9	<0.05	<1	25	<0.5	<1	<0.5	<2.0	<2.0	41	60
13-B19	0.30	0.60	01-Aug-13	17295130801337	---	---	---	---	0.31	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13-B20	0.15	0.30	01-Aug-13	17295130801359	---	---	---	---	0.52	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13-B21	0.00	0.15	01-Aug-13	17295130801381	0.21	6.02	230	<1	***5.49***	<0.5	20.5	6.9	22.2	11	<0.05	<1	24.6	<0.5	<1	<0.5	<2.0	2.5	32.4	67
13-B21	4.00	4.50	01-Aug-13	17295130801391	0.36	5.99	141	<1	***4.92***	<0.5	12.6	6.9	16.1	7.7	<0.05	<1	19.3	0.86	<1	<0.5	<2.0	<2.0	21.2	48
13-B21	5.00	5.50	01-Aug-13	17295130801393	---	---	---	---	2.69	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13-B22	0.15	0.30	01-Aug-13	17295130801405	---	---	---	---	0.68	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
13-B23	0.30	0.60	02-Aug-13	17295130802426	---	---	---	---	0.54	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Production Area																								
Town of Calmar																								
M12-01	2.30	2.30	02-Oct-12	Nichols Environmental	<0.2	4.9	187	0.5	0.36	0.26	13.3	9	21	9.2	0.05	<1	25.2	0.3	0.5	0.31	1	1.1	23.9	53
M12-07	1.50	1.50	02-Oct-12	Nichols Environmental	<0.2	6.8	268	0.7	0.47	0.24	19.9	11.8	28	12.4	0.05	<1	31.3	0.4	0.5	0.34	<1	1	35.2	63
M12-09	3.10	3.10	02-Oct-12	Nichols Environmental	<0.2	4.4	292	0.6	0.25	0.23	16.3	10.4	29	9.9	0.05	<1	24.2	0.4	0.4	0.3	1	1	26.1	56
Alberta Tier 1 - Residential / Parkland+					**20ES**	**17ES**	**500ES**	**5ES**	**3.3ES**	**10ES**	**64ES**	**20ES**	**63ES**	**140HS**	**6.6HS**	**4ES**	**45ES**	**1ES**	**20ES**	**1HS**	**5ES**	**23HS**	**130ES**	**250ES**

TABLE B6

Historical Soil Quality Results - Metals

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Sb mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	B^{SAT} mg/L	Cd mg/kg	Cr mg/kg	Co mg/kg	Cu mg/kg	Pb mg/kg	Hg mg/kg	Mo mg/kg	Ni mg/kg	Se mg/kg	Ag mg/kg	Tl mg/kg	Sn mg/kg	U mg/kg	V mg/kg	Zn mg/kg
Production Area																								
Town of Calmar																								
M12-12	1.50	1.50	02-Oct-12	Nichols Environmental	<0.2	8.7	299	0.7	0.4	0.24	19.2	12.9	33	13.4	0.07	<1	36.1	0.4	0.4	0.41	1	1	33.4	78
M12-17	3.10	3.10	09-Oct-12	Nichols Environmental	<0.2	5.2	146	0.4	0.29	0.19	11.6	7.9	14	6..9	0.04	<1	19.4	0.5	0.5	0.24	1	0.9	19.6	40
M12-18	0.80	0.80	09-Oct-12	Nichols Environmental	<0.2	7.8	280	0.6	3	0.1	19.2	11.7	26	12.5	0.07	<1	29	<0.3	0.4	0.36	1	0.9	35.4	59
M12-19	2.30	2.30	09-Oct-12	Nichols Environmental	<0.2	3.8	129	0.3	0.64	0.19	9.6	6.3	12	6.1	0.03	<1	16	<0.3	0.5	0.22	1	0.8	15.9	37
Well Centre Area																								
Town of Calmar																								
M12-02	1.50	1.50	02-Oct-12	Nichols Environmental	<0.2	6.3	221	0.6	1	0.17	16.5	9.1	21	19.5	0.06	<1	23.3	0.4	0.5	0.25	1	1.7	30.2	57
M12-02	5.30	5.30	02-Oct-12	Nichols Environmental	<0.2	9.9	***516***	0.6	1.7	0.34	20.2	12.6	28	***202***	0.04	3	30.8	0.8	0.5	0.32	1	1.9	34.3	70
13-B30	0.15	0.30	03-Aug-13	17295130803570	0.46	7.6	343	<1	0.81	<0.5	17.2	9.3	23.8	26.8	<0.05	<1	21.4	0.59	<1	<0.5	2.1	<2.0	29.6	77
13-B30	5.00	5.50	03-Aug-13	17295130803581	0.39	7.22	159	<1	0.72	<0.5	13.4	7	14.4	7.2	<0.05	<1	19.3	<0.5	<1	<0.5	<2.0	<2.0	23.2	54
13-B32	5.00	5.50	03-Aug-13	17295130803612	0.38	6.15	151	<1	0.83	<0.5	15.6	7.5	15.2	6.8	<0.05	<1	19.8	0.52	<1	<0.5	<2.0	<2.0	26.3	52
13-B33	0.00	0.15	03-Aug-13	17295130803617	<0.20	7.06	221	<1	0.66	<0.5	19.4	7.1	17	11.6	<0.05	<1	18.9	0.7	<1	<0.5	<2.0	5.2	35.8	73
13-B33	5.00	5.50	03-Aug-13	17295130803629	0.39	7.16	131	<1	0.76	<0.5	12.1	6	12.7	6.4	<0.05	1	17.2	<0.5	<1	<0.5	<2.0	<2.0	21.4	48
13-B37	0.00	0.15	03-Aug-13	17295130803661	0.45	11.6	276	<1	0.53	<0.5	18.7	12.7	20.9	15.4	<0.05	1.1	26.6	0.52	<1	<0.5	<2.0	<2.0	34.8	67
13-B37	5.50	6.00	03-Aug-13	17295130803674	0.42	6.9	175	<1	0.94	<0.5	17.4	7.7	17.1	7.8	<0.05	<1	20.8	0.51	<1	<0.5	<2.0	<2.0	29.7	60
Alberta Tier 1 - Residential / Parkland[+]					**20^{ES}**	**17^{ES}**	**500^{ES}**	**5^{ES}**	**3.3^{ES}**	**10^{ES}**	**64^{ES}**	**20^{ES}**	**63^{ES}**	**140^{HS}**	**6.6^{HS}**	**4^{ES}**	**45^{ES}**	**1^{ES}**	**20^{ES}**	**1^{HS}**	**5^{ES}**	**23^{HS}**	**130^{ES}**	**250^{ES}**

Notes:

--- - not analyzed

ES - indicates guideline for Direct Soil Contact (ecological) exposure pathway

HS - indicates guideline for Direct Soil Contact (human) exposure pathway

+ - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)

Italics - indicates values do not meet applicable guidelines

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Flare Pit													
Trailer Park													
13-B1	3.50	4.00	29-Jul-13	17295130729010	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	22	21
13-B1	5.00	5.50	29-Jul-13	17295130729013	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B2	3.00	3.50	29-Jul-13	17295130729026	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B2	5.00	5.50	29-Jul-13	17295130729030	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	27	<20
13-B3	1.00	1.50	29-Jul-13	17295130729036	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B3	3.50	4.00	29-Jul-13	17295130729041	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B3	6.00	6.50	29-Jul-13	17295130729046	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	32	<20
13-B4	0.30	0.60	29-Jul-13	17295130729054	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B4	3.50	4.00	29-Jul-13	17295130729061	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B4	5.50	6.00	29-Jul-13	17295130729065	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B5	3.00	3.50	30-Jul-13	17295130730077	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B6	3.00	3.50	30-Jul-13	17295130730091	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B6	4.00	4.50	30-Jul-13	17295130730093	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	39	<20
13-B7	3.00	3.50	30-Jul-13	17295130730122	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B7	4.50	5.00	30-Jul-13	17295130730125	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	41	<20
13-B16	3.00	3.50	01-Aug-13	17295130801295	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B24	2.50	3.00	02-Aug-13	17295130802451	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B24	3.50	4.00	02-Aug-13	17295130802453	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B25	0.60	1.00	02-Aug-13	17295130802484	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-1	3.50	4.00	30-Jul-13	17295130730109	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	22	<20
13-3	3.50	4.00	02-Aug-13	17295130802473	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	21	<20
Developer													
13-B8	3.50	4.00	30-Jul-13	17295130730137	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B8	5.00	5.50	30-Jul-13	17295130730140	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	32	<20
13-B9	3.00	3.50	30-Jul-13	17295130730156	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	48	<20
13-B9	5.50	5.70	30-Jul-13	17295130730161	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	60	<20
13-B9	7.50	8.00	30-Jul-13	17295130730165	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	122	52
13-B14	0.30	0.60	31-Jul-13	17295130731252	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Flare Pit													
Developer													
13-B15	5.00	5.50	31-Jul-13	17295130731279	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B17	4.50	5.00	01-Aug-13	17295130801312	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	25	<20
13-B18	3.00	3.50	01-Aug-13	17295130801326	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B18	5.00	5.50	01-Aug-13	17295130801330	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	73	35
13-B19	4.50	5.00	01-Aug-13	17295130801346	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	97	43
13-B19	9.50	10.00	01-Aug-13	17295130801356	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B20	2.00	2.50	01-Aug-13	17295130801364	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B20	10.00	10.50	01-Aug-13	17295130801380	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B21	3.50	4.00	01-Aug-13	17295130801390	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	26	<20
13-B22	6.00	6.50	01-Aug-13	17295130801418	<0.005	<0.05	<0.015	<0.1	<0.05	<10	26	307	165
13-B23	2.00	2.50	02-Aug-13	17295130802430	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B23	5.50	6.00	02-Aug-13	17295130802437	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
14-12a	0.00	0.15	31-Jan-14	17295140131045	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	183	710
14-12a	0.30	0.60	31-Jan-14	17295140131046	***0.822***	***0.133***	***0.63***	1.39	<0.05	***178***	***1940***	***19000***	***45800***
14-12a	1.00	1.50	31-Jan-14	17295140131048	***0.811***	<0.05	***3.32***	0.88	<0.05	***241***	***382***	***984***	341
14-12a	2.00	2.50	31-Jan-14	17295140131050	***0.576***	<0.05	***0.714***	1.56	<0.05	***143***	***159***	***320***	95
Production Area													
Town of Calmar													
M12-01	3.80	3.80	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-01	4.60	4.60	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-03	3.10	3.10	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-04	3.10	3.10	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	30	60	89	<100
M12-04	3.80	3.80	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-05	1.50	1.50	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-06	2.30	2.30	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-07	0.80	0.80	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-08	3.10	3.10	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Production Area													
Town of Calmar													
M12-09	1.50	1.50	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-10	0.80	0.80	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-11	5.30	5.30	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-12	5.30	5.30	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-13	2.30	2.30	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-14	3.80	3.80	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-15	3.80	3.80	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	52	<100
M12-17	1.50	1.50	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	59	<100
M12-17	3.10	3.10	09-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-18	2.30	2.30	02-Oct-12	Nichols Environmental	<0.005	<0.02	***2.35***	<0.03	---	***175***	***365***	***683***	225
M12-18	6.10	6.10	09-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-19	1.50	1.50	02-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	***101***	***350***	***699***	236
M12-19	3.10	3.10	09-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
M12-20	5.30	-	09-Oct-12	Nichols Environmental	<0.005	<0.02	<0.01	<0.03	---	<10	<50	<50	<100
13-2	3.50	4.00	31-Jul-13	17295130731200	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	22	<20
13-B10	3.00	3.50	31-Jul-13	17295130731179	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B11	2.00	2.50	31-Jul-13	17295130731211	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B12	3.50	4.00	31-Jul-13	17295130731231	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	24	<20
13-B13	0.60	1.00	31-Jul-13	17295130731239	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	48	22
13-4	2.50	3.00	02-Aug-13	17295130802562	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B26	3.00	3.50	02-Aug-13	17295130802500	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B27	0.30	0.60	02-Aug-13	17295130802508	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B27	1.50	2.00	02-Aug-13	17295130802511	<0.005	<0.05	<0.015	<0.1	<0.05	17	24	55	<20
13-B27	2.50	3.00	02-Aug-13	17295130802513	***0.139***	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Production Area													
Town of Calmar													
13-B28	1.50	2.00	02-Aug-13	17295130802532	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B28	3.00	3.50	02-Aug-13	17295130802535	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B29	1.50	2.00	02-Aug-13	17295130802546	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B49	2.00	2.50	04-Aug-13	17295130804886	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B49	2.50	3.00	04-Aug-13	17295130804887	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-6	0.30	0.60	03-Aug-13	17295130803782	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-6	2.00	2.50	03-Aug-13	17295130803786	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-6	4.50	5.00	03-Aug-13	17295130803791	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
Obs 2	1.75	2.25	04-Aug-13	17295130804889	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
Obs 3	1.75	2.25	04-Aug-13	17295130804888	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<25	<50	<50
16-B62	0.30	0.60	18-Mar-16	17295160318119	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<25	166	54
16-B62	3.00	3.50	18-Mar-16	17295160318122	<0.0050	<0.050	0.015	<0.10	<0.050	<10	<25	<50	<50
Well Centre Area													
Town of Calmar													
M12-02	6.10	6.10	02-Oct-12	Nichols Environmental	***0.112***	<0.02	***1.22***	***2.1***	---	***544***	***7790***	***17000***	5370
M12-02	6.80	6.80	02-Oct-12	Nichols Environmental	0.005	<0.02	<0.01	<0.03	---	<10	73	293	124
13-B30	0.30	0.60	03-Aug-13	17295130803571	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	***893***	***3030***
13-B30	1.50	2.00	03-Aug-13	17295130803574	<0.005	<0.05	***0.255***	<0.1	<0.05	***275***	***416***	***794***	223
13-B30	3.50	4.00	03-Aug-13	17295130803578	0.0051	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B30	5.50	6.00	03-Aug-13	17295130803582	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	81	33
13-B31	2.00	2.50	03-Aug-13	17295130803592	<0.005	<0.05	<0.015	<0.1	<0.05	<10	25	106	31
13-B31	3.00	3.50	03-Aug-13	17295130803594	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B32	1.50	2.00	03-Aug-13	17295130803605	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B32	4.50	5.00	03-Aug-13	17295130803611	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	117	53
13-B32	6.00	6.50	03-Aug-13	17295130803614	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	78	28
13-B33	2.00	2.50	03-Aug-13	17295130803623	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B33	3.50	4.00	03-Aug-13	17295130803626	<0.005	<0.05	***0.193***	<0.1	<0.05	***53***	103	224	61
13-B33	4.50	5.00	03-Aug-13	17295130803628	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	72	34
13-B34	2.00	2.50	03-Aug-13	17295130803640	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B34	3.50	4.00	03-Aug-13	17295130803643	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	24	<20
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Well Centre Area													
Town of Calmar													
13-B35	1.00	1.50	03-Aug-13	17295130803651	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B35	3.00	3.50	03-Aug-13	17295130803655	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B36	2.00	2.50	03-Aug-13	17295130803684	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B37	0.60	1.00	03-Aug-13	17295130803664	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	110	38
13-B37	1.50	2.00	03-Aug-13	17295130803666	<0.005	<0.05	<0.015	<0.1	<0.05	***215***	***629***	***1320***	1740
13-B37	3.00	3.50	03-Aug-13	17295130803669	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	24	<20
13-B37	5.00	5.50	03-Aug-13	17295130803673	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	47	<20
13-B38	1.50	2.00	03-Aug-13	17295130803694	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B39	1.00	1.50	03-Aug-13	17295130803718	<0.005	<0.05	<0.015	<0.1	<0.05	***25***	68	***987***	1740
13-B39	2.50	3.00	03-Aug-13	17295130803721	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B39	4.00	4.50	03-Aug-13	17295130803724	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-B40	1.50	2.00	03-Aug-13	17295130803730	<0.005	<0.05	<0.015	<0.1	<0.05	<10	27	175	72
13-B45	4.50	5.00	04-Aug-13	17295130804814	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	47	26
13-B47	2.50	3.00	04-Aug-13	17295130804835	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-5	1.50	2.00	03-Aug-13	17295130803705	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
13-5	3.50	4.00	03-Aug-13	17295130803709	<0.005	<0.05	<0.015	<0.1	<0.05	<10	<20	<20	<20
Former Flare Pit and Production Area Excavation Confirmatory Samples													
16-X78	0.80	0.80	11-Sep-16	17295160911001	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X79	2.50	2.50	11-Sep-16	17295160911004	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X80	0.80	0.80	11-Sep-16	17295160911005	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	107	80
16-X81	2.50	2.50	11-Sep-16	17295160911008	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X82	0.80	0.80	11-Sep-16	17295160911009	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	29	23
16-X83	3.00	3.00	11-Sep-16	17295160911011	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X84	3.00	3.00	11-Sep-16	17295160911012	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X85	3.00	3.00	11-Sep-16	17295160911013	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X95	2.00	2.00	13-Sep-16	17295160913101	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	29	21
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Former Flare Pit and Production Area Excavation Confirmatory Samples													
16-X134	3.50	3.50	16-Sep-16	17295160916006	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X135	3.00	3.00	16-Sep-16	17295160916007	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X177	3.50	3.50	24-Sep-16	17295160924008	*5.52*	<0.050	***0.032***	<0.10	<0.050	<10	<20	***50***	***29***
16-X177a	4.50	4.50	28-Sep-16	17295160928002	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***73***	***47***
16-X185	2.25	2.25	24-Sep-16	17295160924007	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	34	22
16-X188	1.50	1.50	24-Sep-16	17295160924011	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	97	60
16-X189	3.00	3.00	24-Sep-16	17295160924012	***0.0072***	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X190	2.00	2.00	24-Sep-16	17295160924013	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	34	22
16-X191	2.00	2.00	24-Sep-16	17295160924014	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X193	3.00	3.00	26-Sep-16	17295160926005	*5.36*	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X193a	4.00	4.00	28-Sep-16	17295160928005	*0.657*	<0.050	<0.015	<0.10	<0.050	<10	<20	***48***	***28***
16-X193b	4.50	4.50	30-Sep-16	17295160930007	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***24***	<20
16-X194	3.00	3.00	26-Sep-16	17295160926006	***0.0057***	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X199	2.00	2.00	26-Sep-16	17295160926011	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X207a	3.00	3.00	30-Sep-16	17295160930008	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***24***	<20
16-TP207	4.00	4.00	30-Sep-16	17295160930010	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***60***	***30***
16-TP207	5.00	5.00	30-Sep-16	17295160930011	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X208a	3.00	3.00	30-Sep-16	17295160930009	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-TP208	4.00	4.00	30-Sep-16	17295160930012	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***64***	***31***
16-TP208	5.00	5.00	30-Sep-16	17295160930013	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***22***	<20
16-X212	1.75	1.75	30-Sep-16	17295160930005	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X214	3.75	3.75	28-Sep-16	17295160928006	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***53***	***35***
16-X215	4.50	4.50	28-Sep-16	17295160928007	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***84***	***51***
16-X216	2.50	2.50	30-Sep-16	17295160930006	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X248	2.50	2.50	03-Oct-16	17295161003002	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X259	2.00	2.00	04-Oct-16	17295161004009	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Former Flare Pit and Production Area Excavation Confirmatory Samples													
16-X267	3.00	3.00	05-Oct-16	17295161005004	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X269	2.50	2.50	05-Oct-16	17295161005007	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X270	3.00	3.00	05-Oct-16	17295161005008	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X271	2.50	2.50	05-Oct-16	17295161005009	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X272	3.50	3.50	05-Oct-16	17295161005010	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X273	3.00	3.00	05-Oct-16	17295161005011	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X274	3.00	3.00	05-Oct-16	17295161005012	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X275	3.00	3.00	05-Oct-16	17295161005013	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X276	3.00	3.00	05-Oct-16	17295161005014	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X277	3.00	3.00	05-Oct-16	17295161005015	*0.134*	<0.050	***0.044***	***0.45***	<0.050	<10	<20	<20	<20
16-X277a	3.50	3.50	07-Oct-16	17295161007003	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***20***	<20
16-X278	3.00	3.00	05-Oct-16	17295161005016	*0.132*	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X278a	3.50	3.50	07-Oct-16	17295161007004	***0.019***	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X279	3.00	3.00	05-Oct-16	17295161005017	***0.0057***	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X280	3.00	3.00	05-Oct-16	17295161005018	***0.0112***	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X297	3.00	3.00	06-Oct-16	17295161006011	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X299	3.00	3.00	06-Oct-16	17295161006013	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X300	3.00	3.00	06-Oct-16	17295161006014	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***34***	***25***
16-X303	3.00	3.00	06-Oct-16	17295161006018	***0.0184***	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X304	3.50	3.50	07-Oct-16	17295161007007	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X305	3.50	3.50	07-Oct-16	17295161007008	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X306	3.50	3.50	07-Oct-16	17295161007009	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X310	3.75	3.75	08-Oct-16	17295161008004	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***86***	***25***
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Former Flare Pit and Production Area Excavation Confirmatory Samples													
16-X311	3.25	3.25	08-Oct-16	17295161008005	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***47***	<20
16-X312	3.00	3.00	11-Oct-16	17295161011009	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	***41***	***21***
16-X313	3.00	3.00	11-Oct-16	17295161011010	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
Well Center Confirmatory Samples													
16-TP1	1.00	1.00	08-Sep-16	17295160908901	***0.448***	0.068	***5.63***	***20.4***	<0.050	***983***	***6230***	***12100***	***15400***
16-TP1	2.50	2.50	08-Sep-16	17295160908902	0.0099	<0.050	0.048	<0.10	<0.050	***343***	***348***	607	202
16-TP2	1.00	1.00	08-Sep-16	17295160908012	***0.307***	<0.050	***0.142***	0.33	<0.050	***214***	***5750***	***16200***	***24800***
16-TP2	2.50	2.50	08-Sep-16	17295160908013	0.0113	<0.050	***0.277***	0.12	<0.050	***260***	***232***	439	149
16-X32	0.60	0.60	08-Sep-16	17295160908001	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X33	0.30	0.30	08-Sep-16	17295160908002	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	32	22
16-X34	0.60	0.60	08-Sep-16	17295160908003	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	377	1370
16-X35	0.30	0.30	08-Sep-16	17295160908004	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	63	52
16-X36	0.60	0.60	08-Sep-16	17295160908005	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	103	107
16-X37	0.60	0.60	08-Sep-16	17295160908006	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X38	0.30	0.30	08-Sep-16	17295160908007	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	147	130
16-X39	0.30	0.30	08-Sep-16	17295160908008	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X40	0.60	0.60	08-Sep-16	17295160908009	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X41	0.30	0.30	08-Sep-16	17295160908010	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	124	87
16-X42	0.30	0.30	08-Sep-16	17295160908011	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	42	***2260***	***6610***
16-X43	0.30	0.30	08-Sep-16	17295160908014	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	81	52
16-X69	2.50	2.50	11-Sep-16	17295160911901	<0.0050	<0.050	<0.015	<0.10	<0.050	19	36	74	21
16-X70	2.50	2.50	11-Sep-16	17295160911902	<0.0050	<0.050	<0.015	<0.10	<0.050	33	22	34	<20
16-X71	1.50	1.50	11-Sep-16	17295160911903	<0.0050	<0.050	<0.015	<0.10	<0.050	111	144	237	69
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Well Center Confirmatory Samples													
16-X72	2.50	2.50	11-Sep-16	17295160911904	<0.0050	<0.050	0.029	<0.10	<0.050	35	233	551	183
16-X73	1.50	1.50	11-Sep-16	17295160911905	<0.0050	<0.050	*3.36*	0.19	<0.050	*442*	*1350*	*2210*	710
16-X73a	1.50	1.50	13-Sep-16	17295160913001	<0.0050	<0.050	0.766	<0.10	<0.050	307	673	1160	379
16-X74	1.50	1.50	11-Sep-16	17295160911906	<0.0050	<0.050	0.504	<0.10	<0.050	276	463	828	281
16-X75	1.50	1.50	11-Sep-16	17295160911907	<0.0050	<0.050	<0.015	<0.10	<0.050	144	147	278	100
16-X76	1.50	1.50	11-Sep-16	17295160911908	<0.0050	<0.050	0.74	<0.10	<0.050	168	282	499	171
16-X87	1.00	1.00	12-Sep-16	17295160912601	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	235	156
16-X88	2.00	2.00	12-Sep-16	17295160912602	<0.0050	<0.050	<0.015	<0.10	<0.050	219	139	270	81
16-X89	1.00	1.00	12-Sep-16	17295160912603	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X90	1.00	1.00	12-Sep-16	17295160912604	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X107	2.00	2.00	13-Sep-16	17295160913201	<0.0050	<0.050	<0.015	<0.10	<0.050	183	93	181	63
16-X108	2.50	2.50	13-Sep-16	17295160913202	<0.0050	<0.050	<0.015	<0.10	<0.050	99	106	250	93
16-X109	2.75	2.75	13-Sep-16	17295160913203	<0.0050	<0.050	<0.015	<0.10	<0.050	55	132	311	116
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

TABLE B7

Historical Soil Quality Results - Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Benzene mg/kg	Toluene mg/kg	Ethylbenzene mg/kg	Xylenes mg/kg	Styrene mg/kg	F1 C_6-C_{10} - BTEX mg/kg	F2 $C_{>10}$-C_{16} mg/kg	F3 $C_{>16}$-C_{34} mg/kg	F4 $C_{>34}$ mg/kg
Well Center Confirmatory Samples													
16-X110	1.25	1.25	13-Sep-16	17295160913204	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	<20	<20	<20
16-X111	1.25	1.25	13-Sep-16	17295160913205	<0.0050	<0.050	<0.015	<0.10	<0.050	43	108	306	111
16-X112	1.25	1.25	13-Sep-16	17295160913206	<0.0050	<0.050	<0.015	<0.10	<0.050	<10	160	481	186
16-X113	1.00	1.00	13-Sep-16	17295160913207	<0.0050	<0.050	<0.015	<0.10	<0.050	127	98	398	181
Alberta Tier 1 - Coarse-grained Surface Soils - Residential / Parkland+					**0.073^{HVS}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**24^{HVS}**	**130^{HVS}**	**300ES**	**2800ES**
Alberta Tier 1 - Coarse-grained Subsoils (below 3 m) - Residential / Parkland+					**0.078^{HD}**	**0.12^{EA}**	**0.14^{HD}**	**1.9^{HD}**	**0.8^{EA}**	**30^{HVB}**	**160^{HVB}**	**2500^{ML}**	**10000^{ML}**

Notes:

--- - not analyzed

EA - indicates guideline for Protection of Freshwater Aquatic Life exposure pathway

ES - indicates guideline for Direct Soil Contact (ecological) exposure pathway

HD - indicates guideline for Protection of Domestic Use Aquifer exposure pathway

HVB - indicates guideline for Vapour Inhalation (basement) exposure pathway

HVS - indicates guideline for Vapour Inhalation (slab) exposure pathway

ML - indicates guideline for Management Limit exposure pathway

+ - *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (AEP 2019)

F4 - F4 fraction shown represents either extractable, gravimetric or post-silica gel gravimetric petroleum hydrocarbons (PHC)

Italics - indicates values do not meet applicable guidelines

TABLE B8

Historical Soil Quality Results - Polycyclic Aromatic Hydrocarbons

Canadian Natural Resources Limited

09-25-049-27 W4M

Sample Point	Start Depth m	End Depth m	Sample Date	MSI Sample Number	Acenaphthene mg/kg	Acenaphthylene mg/kg	Anthracene mg/kg	Benz[a]anthracene++ mg/kg	Benzo[b&j]fluoranthene++ mg/kg	Benzo[k]fluoranthene++ mg/kg	Benzo[g,h,i]perylene++ mg/kg	Benzo[a]pyrene++ mg/kg	Chrysene ++ mg/kg	Dibenz[a,h]anthracene++ mg/kg	Fluoranthene mg/kg	Fluorene mg/kg	Indeno[1,2,3-cd]pyrene++ mg/kg	Naphthalene mg/kg	Phenanthrene mg/kg	Pyrene mg/kg	IACR - Coarse-grained soils	IACR -Fine-grained soils	B[a]P TPE mg/kg
Flare Pit																							
Trailer Park																							
13-B1	3.00	3.50	29-Jul-13	17295130729009	<0.01	<0.01	<0.0040	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	ND	ND
13-B3	3.00	3.50	29-Jul-13	17295130729040	<0.01	<0.01	<0.0040	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	ND	ND	ND
Production Area																							
Town of Calmar																							
M12-18	3.10	3.10	09-Oct-12	Nichols Environmental	<0.05	<0.05	<0.003	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	0.1	<0.05	***0.183***	***0.12***	0.01	ND	ND	ND
M12-19	2.30	2.30	09-Oct-12	Nichols Environmental	<0.05	<0.05	<0.003	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	0.12	<0.05	***0.069***	***0.18***	0.02	ND	ND	ND
M12-19	5.30	5.30	09-Oct-12	Nichols Environmental	<0.05	<0.05	<0.003	<0.01	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.05	<0.05	<0.01	<0.01	0.01	ND	ND	ND
Well Centre Area																							
Town of Calmar																							
M12-02	5.30	5.30	02-Oct-12	Nichols Environmental	***18.9***	<0.5	***0.506***	0.34	<0.5	<0.5	0.36	0.17	2.75	<0.5	***0.17***	***7.67***	<0.5	***18.9***	***12.4***	***1.26***	0.077173	0.14893	0.2351
13-B30	5.50	6.00	03-Aug-13	17295130803582	<0.01	<0.01	<0.0040	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	ND	ND	ND
13-B32	4.50	5.00	03-Aug-13	17295130803611	<0.01	<0.01	<0.0040	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	ND	ND	ND
13-B33	5.50	6.00	03-Aug-13	17295130803630	<0.01	<0.01	<0.0040	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	ND	ND	ND
13-B37	5.00	5.50	03-Aug-13	17295130803673	<0.01	<0.01	<0.0040	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.02	<0.01	ND	ND	ND
Alberta Tier 1 - Coarse-grained Soils - Residential / Parkland[+]					**0.38[EA]**	**NS**	**0.0056[EA]**	**NS**	**NS**	**NS**	**NS**	**20[ES]**	**NS**	**NS**	**0.055[EA]**	**0.34[EA]**	**NS**	**0.017[EA]**	**0.061[EA]**	**0.15[EA]**	**1.0[HD]**	**NA**	**5.3[HS]**

Notes:

--- - not analyzed

IACR - Index of Additive Cancer Risk for Human Health calculated by Matrix Solutions

B[a]P TPE - Benzo[a]pyrene Total Potency Equivalents calculated by Matrix Solutions

ND - not detected

APPENDIX C
Modelling in Support of Tier 2 Guideline Development

Item 9.d

Matrix Solutions Inc.
ENVIRONMENT & ENGINEERING

APPENDIX E
GROUNDWATER MODELLING SUPPORTING RISK ASSESSMENT
CALMAR FORMER BATTERY
09-25-049-27 W4M

Report Prepared for:
CANADIAN NATURAL RESOURCES LIMITED

Prepared by:
MATRIX SOLUTIONS INC.

June 2014
Calgary, Alberta

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GROUNDWATER MODELLING SUPPORTING RISK ASSESSMENT

CALMAR FORMER BATTERY

09-25-049-27 W4M

Report prepared for Canadian Natural Resources Limited, June 2014

Gaelen Merritt, B.A.Sc.
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1 INTRODUCTION

Canadian Natural Resources Limited retained Matrix Solutions Inc. to conduct a site-specific risk assessment associated with a historical release of saline water at the Calmar Former Battery (the "site") located at 09-25-049-27 W4M (Figure 1). The site is primarily situated on undeveloped land proposed for use as sports fields by the Town of Calmar. A trailer park partially overlaps the former lease area to the west, and permanent housing lies to the north, south, and east of the site. The Calmar Former Battery has been decommissioned since the 1960s, and a reclamation certificate was issued in 1975. However, Phase 1 and Phase 2 environmental site assessments (ESAs) conducted by the Town of Calmar showed that the site contained petroleum hydrocarbons, polycyclic aromatic hydrocarbons, heavy metals, and salinity exceeding regulatory criteria in both the soil and groundwater underlying the former areas of site operation. In June 2013, Matrix conducted a supplemental Phase 2 ESA (Matrix 2014a) to fill data gaps identified following the previous Phase 2 ESA (Nichols 2012). An electromagnetic survey indicated two primary areas of elevated conductivity: one near the former flare pit, and another at the former production area. The survey delineated elevated conductivity to extend approximately 80 m northwest of the former flare pit and 60 m northeast of the former production area.

The results of the 2013 supplemental Phase 2 ESA suggested that chloride impacts exceeding *Alberta Tier 1 Soil and Groundwater Remediation Guidelines* (Tier 1; AENV 2010) were limited to soil and subsoil areas local to the former production areas and had not migrated to any freshwater aquatic life receptors or offsite drinking water sources. A Tier 2C Site-specific Risk Assessment was initiated in fall 2013 to further evaluate the risk to receptors and develop site-specific remediation criteria to protect all receptors. Additional field investigations were completed in February 2014 to address data gaps identified in the conceptual site model (CSM) and to update the understanding risk to receptors.

Numerical modelling was initiated in December 2013 to support the Tier 2C Site-specific Risk Assessment. The modelling provided additional context and insight for the data gap analysis, supported the updated CSM, represented the updated CSM numerically enabling simulation of potential future peak chloride concentrations at receptors under existing and potential remediation scenarios.

1.1 Background

The results of the 2013 Phase 2 ESA and 2014 supplement Phase 2 ESA indicated the following site-specific conditions related to sources, pathways and receptors:

1. The site investigation indicated that chloride concentrations in the root zone exceeded Tier 1 guidelines. The majority of chloride mass has migrated below the root zone and observed vertical gradients suggest concentrations in the root zone are unlikely to increase with time.

2. Excavation of impacted soils from the shallow subsurface is likely to meet Tier 1 guidelines for metal and hydrocarbon contamination in the former operation areas. As part of the excavation some chloride mass will be removed, thereby reducing the amount of chloride that could potentially reach receptors.

3. The chloride plume has migrated about 80 m laterally in over 50 years since the decommissioning of the site, which is less than the 200 m that would be predicted assuming the sand units are laterally continuous and the dominant groundwater flow direction is horizontal.

4. The chloride plume has migrated vertically under strong downward gradients and is present in upper bedrock.

5. No domestic use aquifer (DUA) is present within the overburden units. Current understanding of the underlying bedrock suggests a potential for DUA to exist within the Horseshoe Canyon Formation below the site. However, this potential aquifer unit is not known to be used as a drinking water source within the town limits as the drinking water is supplied by the City of Edmonton.

6. The nearest fresh water aquatic life receptor (surface water body), Conjuring Creek, is 1 km west of the site. Chloride impacts are limited to the town site, trailer park and developer's land; they have not migrated outside of the town limits.

7. Groundwater velocities and historical rate of plume movement and dispersion suggest concentrations at this receptor will remain at background levels.

1.2 Scope of Work

Numerical modelling was undertaken to simulate the peak chloride concentrations at identified receptors, evaluate the efficacy of alternative remediation and risk management scenarios, and determine the excavation volumes for each alternative to support the risk assessment for the site. Regional and site-specific data supporting the CSM were reviewed and compiled into GIS software; these data were represented in the numerical models to simulate flow and transport of chloride in the subsurface. The scope of the modelling work supporting the risk assessment included:

- developing and applying a site-specific Versatile Soil Moisture Budget model (Hayashi et al. 2012) to estimate the root zone water balance including soil infiltration and groundwater recharge below the root zone

- developing and applying a site-specific 1D HYDRUS model to simulate flow and solute transport through the unsaturated zone below the root zone and estimate chloride loading to the water table over time

- developing and applying a site-specific 3D FEFLOW model to simulate three-dimensional (3D) groundwater flow and chloride transport in the saturated zone and estimate peak chloride concentrations at receptors under a variety of excavation/remediation and risk management scenarios

- documenting the updated understanding of groundwater flow and chloride transport derived from model simulations and features of the system

- developing and simulating alternative remediation options based on the site-specific conditions, to minimize remedial excavation volumes

- preparing a report quantifying the existing and peak future chloride concentration in groundwater at each receptor under each remediation scenario to support the risk assessment

2 CONCEPTUAL SITE MODEL SUMMARY

The updated CSM is presented in the 2014 supplemental Phase 2 ESA (Matrix 2014a). This section provides additional context and interpretation of the regional and site conditions used to refine the CSM and enable representation of the CSM in a numerical model.

The topography of the site is flat to undulating; with elevations ranging from 733 m above sea level (m asl) in the southeast to 719 m asl in the northwest over a distance of approximately 2.5 km. Regional topography slopes north towards the North Saskatchewan River. Shallow soils at the site consist primarily of clay till with some discontinuous fine-grained sand units to an approximate depth of 15 m below ground surface (bgs). The underlying bedrock unit is identified as the Horseshoe Canyon Formation, which is characterized as a mix of siltstone and sandstone units with highly variable transmissivity. Sandstone and coal lenses in the Horseshoe Canyon represent aquifers capable of yielding between 4.5 and 23 L/min of water. Aquifer tests performed near Calmar, Alberta, indicated that the discontinuous Millet Member of the Horseshoe Canyon Formation is capable of yielding 110 to 450 L/min of groundwater. However, the Millet Member is not mapped to underlie the Calmar Former Battery site (Ceroici 1979).

A low conductivity siltstone of the Horseshoe Canyon Formation was intersected in boreholes drilled into the upper few metres of bedrock in the 2014 supplemental Phase 2 ESA (Matrix 2014a). The Horseshoe Canyon Formation is regionally known to comprise sequences of more permeable sandstones and there is the potential a transmissive sandstone unit exists deeper than the depth of drilling at the site. A strong downward hydraulic gradient is observed at the site consistent with regional observations of downward hydraulic gradients to and within the Horseshoe Canyon Formation (HCL 1999). The presence of more transmissive sandstone units underlying the lower permeability overburden and siltstone in the upper bedrock may in part explain the strong downward gradients observed on site. A pumping test conducted for the Town of Calmar by MLM Ground-Water Engineering

Ltd. (MLM 1980), found an underlying bedrock unit with a transmissivity of approximately 85 m^2/day further supporting the potential for a conductive sandstone to underlie this site.

The extent of the chloride impacts in soil and groundwater associated with the Former Calmar Battery is documented in the supplemental Phase 2 ESA (Matrix 2013) and the risk assessment report (Matrix 2014b). A total of 109 boreholes and 26 monitoring wells were completed to support characterization of the site.

The soil- and groundwater-impacted subsurface (above Tier 1 criteria) covers an area of 16 000 m^2 and extends up to 80 m from former operation areas. The in situ volume of soil exceeding Tier 1 guidelines is estimated to be 78,000 m^3. Deeper groundwater quality in the upper bedrock underlying the site was generally comparable to background and regional quality, with the exception of elevated chloride and total dissolved solids (TDS) concentrations at 14-11c, located at the north edge of the former flare pit investigation area. Chloride concentrations in groundwater from monitoring wells ranged from 7 to 96,200 mg/L on site.

The 26 monitoring wells installed at the site by Matrix or Nichols Environmental (Canada) Ltd. (Matrix 2014b) provide detailed site-specific information on the chloride-impacted areas, background conditions and the hydrogeologic conditions (flow) contributing to transport of chloride in the subsurface. Many of these monitoring well locations are completed as nests at two or three depths in the same location to measure water levels, vertical hydraulic gradients, and variations in water quality. Most wells are screened in more permeable horizons of the clay till unit and sand lenses and/or the upper bedrock.

The depth to groundwater at the site is generally 2 m bgs. Groundwater flow at the site is observed to be northwestward towards Conjuring Creek, tributary of the North Saskatchewan River, and north-northeast to the North Saskatchewan River. Drilling results indicated that the locally continuous units of fine- to medium-grained sand were encountered at the northern edge and in the northwest areas of the site within the saturated zone. Deeper groundwater quality in the upper bedrock underlying the site was generally comparable to background and regional quality, with the exception of elevated chloride and TDS concentrations at 14-11c, located at the north edge of the former flare pit investigation area.

With a maximum chloride concentration in groundwater of 96,200 mg/L (14-12a), there is some potential for density-driven groundwater flow/chloride transport to occur on site. This may influence the local downward transport of chloride from the shallow source at the flare pit (14-12a) to the upper bedrock at 14-11c to the northwest. Density variability is potentially only a factor over a small portion of the model and is thus ignored.

Elevated chloride in groundwater in the upper bedrock indicates the potential for elevated chloride concentrations in deeper bedrock beneath the site. Due to the dominant downward gradients there is

no interpreted pathway from groundwater to shallow soils in the unsaturated zone above the water table except potentially by capillary uptake action onsite. Freshwater aquatic life receptors are currently located offsite (e.g., Conjuring Creek) beyond the extent of elevated chloride in groundwater.

Modelling was employed to represent the CSM and evaluate the future transport of chloride and estimate the maximum future chloride concentrations at the following receptors:

- potential bedrock DUA below the site
- potential bedrock DUA outside Calmar city limits
- Conjuring Creek, tributary of the North Saskatchewan River

3 METHODS

3.1 Unsaturated Zone Modeling

A 1D numerical model of unsaturated groundwater flow and transport was developed for the site using the Versatile Soil Moisture Budget (VSMB) and HYDRUS-1D. The purpose of the unsaturated zone groundwater flow and transport modeling was to simulate chloride transport in the unsaturated zone, including the mass loading to the saturated zone.

The numerical modelling of unsaturated groundwater flow and transport was completed as follows:

1. Matrix inputted 30 years of weather data into the VSMB to simulate the portion of infiltration that moves below the root zone. The main advantage of employing VSMB to estimate infiltration is its ability to simulate transpiration and snowmelt rates through rooting zone depths and crop stages under actual conditions, demonstrated in Hayashi et al. (2010) in prairie grassland.

2. The portion of infiltration that moves below the root zone was input to HYDRUS to simulate one-dimensional unsaturated mass transport to the water table. Three different chloride transport simulations were run: one for the highest impact area located directly at the flare pit; one for the medium impact area located within the backfilled northwest excavation; and one for the less impacted area surrounding these two areas. This is described in detail in Section 3.1.1.

This approach assumes that net transpiration and capillary action are insufficient to create upward transport of chloride. The evidence for this is based on the following:

1. Water table is at 2 m bgs, capillary height for a clay loam is approximately 0.3 m assuming no root channels. Root zone depth is 1.5 m bgs; therefore, there is low potential for water and chloride to move upwards by capillary action and the dominant flow directions is downward.

2. Downward gradients in the saturated zone were observed on site at all multi-screened wells, often showing in excess of 3 to 4 m of head loss over 12 m of overburden. This is the strongest driving force for vertical movement of water and chloride.

3. Approximately 50% of grass cover on site is dormant or dead. This vastly lowers the amount of potential transpiration that could cause an upward gradient on site. This highlights the low driving force for upward migration into the root zone.

4. Most of the chloride mass in the system is already below the root zone, and the assumption of no upward flux in the unsaturated zone maximizes conservatism at downgradient receptors in the saturated zone. This suggests chloride has been migrating downward from the root zone since the cessation of site operations.

5. Excavation of the root zone is already planned due to other constituents of concern so future predictions are based on flow and transport from below the root zone.

3.1.1 Unsaturated Zone Soil Column (HYDRUS)

The lithology of the unsaturated zone was represented as a homogeneous clay loam. The length of the soil column in the numerical model was simulated to be 2 m, which corresponds to the approximate depth to the water table at the site. The unsaturated soil hydraulic property (van Genuchten parameters) values assigned in the numerical model were taken from the Rosetta Lite database in HYDRUS (Šimůnek et al. 2013) based on the average soil textural analysis and bulk density measurements (1,200 kg/m^3) from soil samples collected at the site. The van Genuchten parameter values assigned in the numerical model are included in Table 1.

Table 1 Clay Loam van Genuchten Parameters

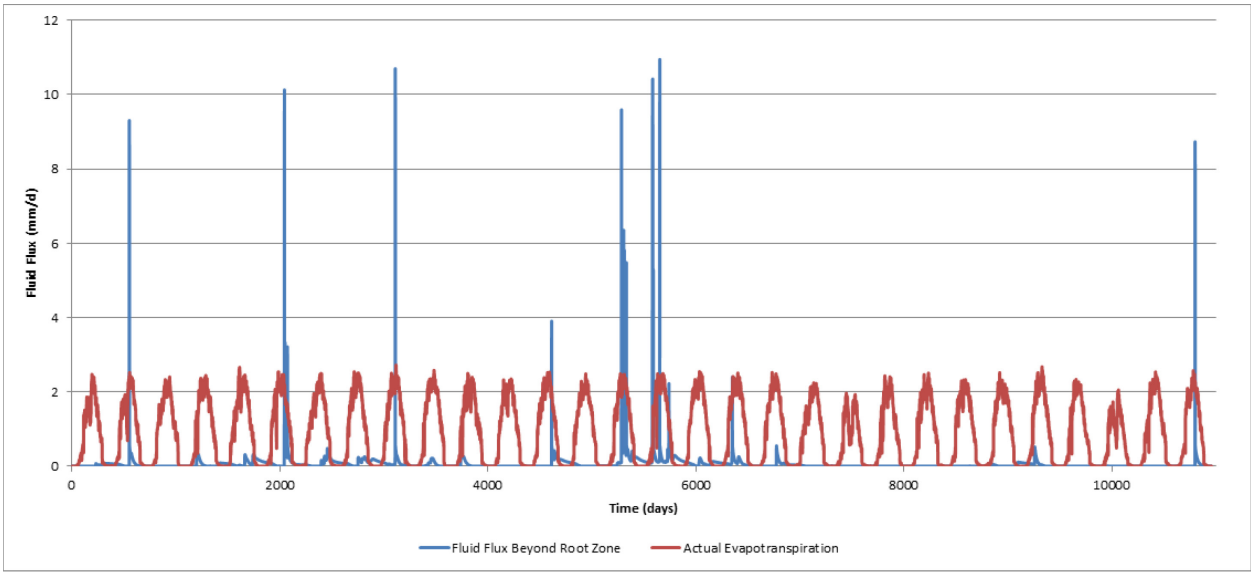
Parameter	Symbol	Value
Residual Soil Water Content [-]	θ_r	0.07
Saturated Soil Water Content [-]	θ_s	0.5
Saturated Hydraulic Conductivity	K_s	5.5×10^{-7} m/s
Inverse of the air-entry value	α	0.5 m^{-1}
Pore size distribution [-]	N	1.09
Pore connectivity parameter [-]	L	0.5

3.1.2 Boundary Conditions

The top flow boundary condition of the HYDRUS model was assigned to be a time-variable flux boundary that was calculated using VSMB. The VSMB model used 1982-2011 site-specific daily climate data obtained from Environment Canada's Edmonton International Airport Weather Station (Government of Canada 2014). The climate data was input into the VSMB water balance model and the output of this

model (the infiltration term) was used in HYDRUS as the top inflow boundary condition, representing infiltration beyond the root zone (Figure 1).

Figure 1 Versatile Soil Moisture Budget Model Fluid Flux beyond Root Zone and Actual Evapotranspiration in the Root Zone for 30 years



The top transport boundary condition of the numerical model was assigned a constant chloride concentration of 0 mg/L, representing infiltrating rainwater. The bottom flow boundary condition of the numerical model was represented by the water table at a depth of 2 m and was assigned a constant pressure head equal to atmospheric air pressure (i.e., static water table). The bottom transport boundary condition of the numerical model was assigned to be a second type (Neumann) boundary condition, which becomes a zero concentration gradient boundary condition at the outflow boundary.

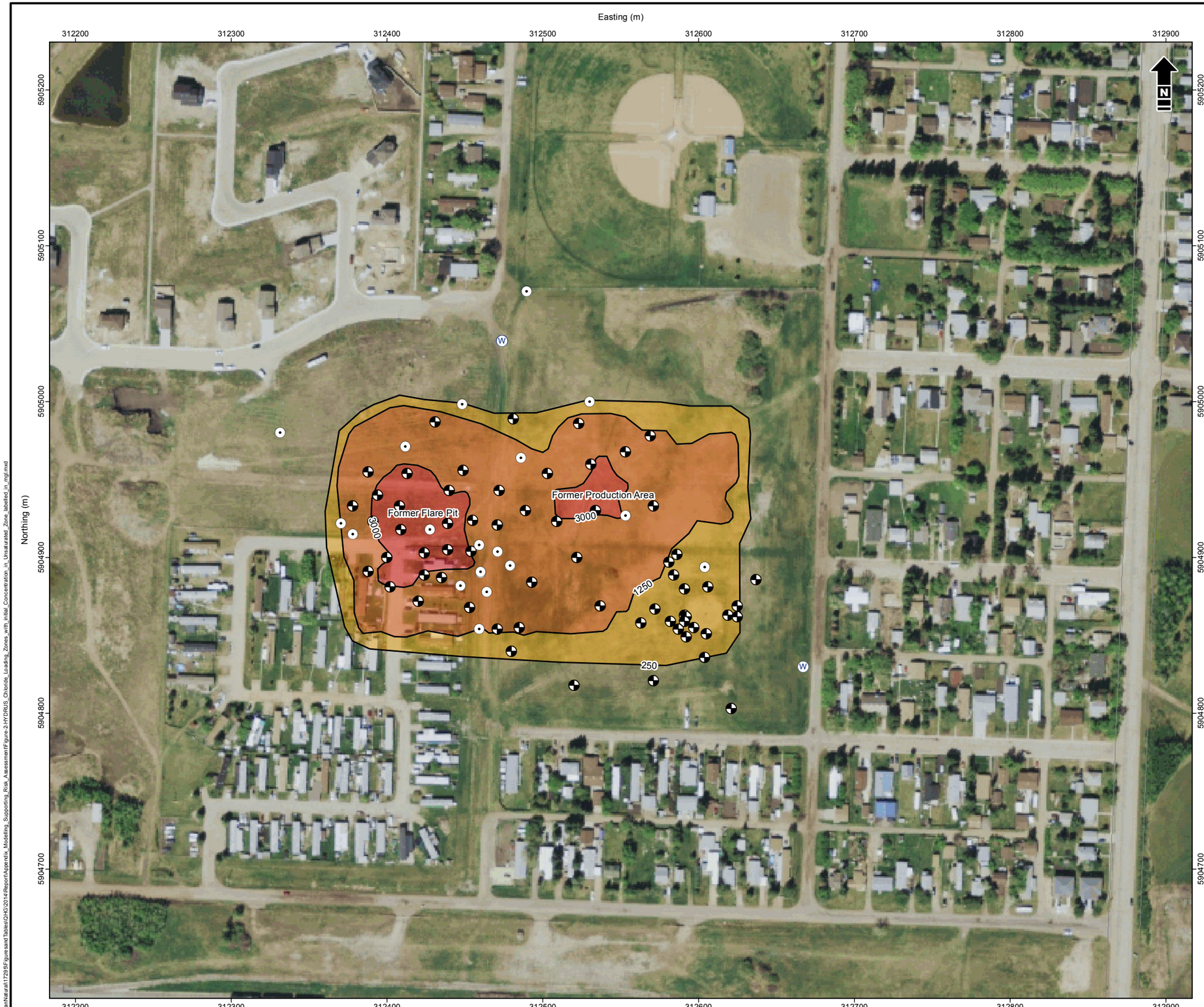
3.1.3 Initial Conditions

A transient flow simulation (i.e., no solute transport) was run with an initial estimate of initial moisture content, obtained from borehole logs in the supplemental Phase 2 ESA (Matrix 2014a) for the 30-year simulation period (from 1982 to 2011), and the moisture content profile on the final simulation day (December 31, 2011) was re-input as the initial moisture content profile on the first simulation day (January 1, 1982). Model output under these initial conditions were stable (i.e., no excessive drainage occurred in the early time steps) and were used for the subsequent solute transport simulations.

Borehole logs were used to identify the maximum soil chloride concentration in the unsaturated zone any depth at each location. The results of this analysis are contoured on Figure 2. From this map, the chloride-impacted areas in the unsaturated zone were divided into three zones: the high impact area (centered on the former flare pit and former production area [soli = 3,000 mg/L]); the medium impact area (soil = 1,250 mg/L); and the low impact area (soil = 250 mg/L; the remainder of the site where soil chloride concentrations greater than 100 mg/kg were measured). A HYDRUS simulation was

developed for each of these three impacts areas where the initial chloride concentrations were approximately 3,000, 1,250 and 250 mg/L for the high, medium and low impact areas, respectively.

Item 9.d



Chloride Concentration Contour (mg/L)
Borehole
GIC Water Well
Monitoring Well

3000 mg/l = High Concentration Loading Zone
1250 mg/l = Medium Concentration Loading Zone
250 mg/l = Low Concentration Loading Zone

1:2,500
m
25 0 25 50
NAD 1983 UTM Zone 12N

Reference: Imagery (2013) obtained from Valtus © (2014) used under license.

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HYDRUS Chloride Loading Zones, with Initial Concentration in Unsaturated Zone Labelled in mg/l

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Figure 2

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3.1.4 HYDRUS Modelling Results

The flow conditions for each of the three HYDRUS models were identical and utilized the output from VSMB as the boundary condition at the top of the unsaturated zone (Figure 3) shows the simulated groundwater recharge at the water table (bottom of HYDRUS model) for 100-plus-year model simulation. Simulated average annual fluid flux to the water table (recharge) is approximately 23 mm/year, and varies year to year was simulated.

Figure 4 shows the simulated chloride mass loading to the water table for each scenario. The VSMB recharge output was cycled four times through the model (approximately 120 years) for all chloride mass to leave the model through the bottom boundary.

Figure 3 Fluid Flux to Water Table (HYDRUS Model)

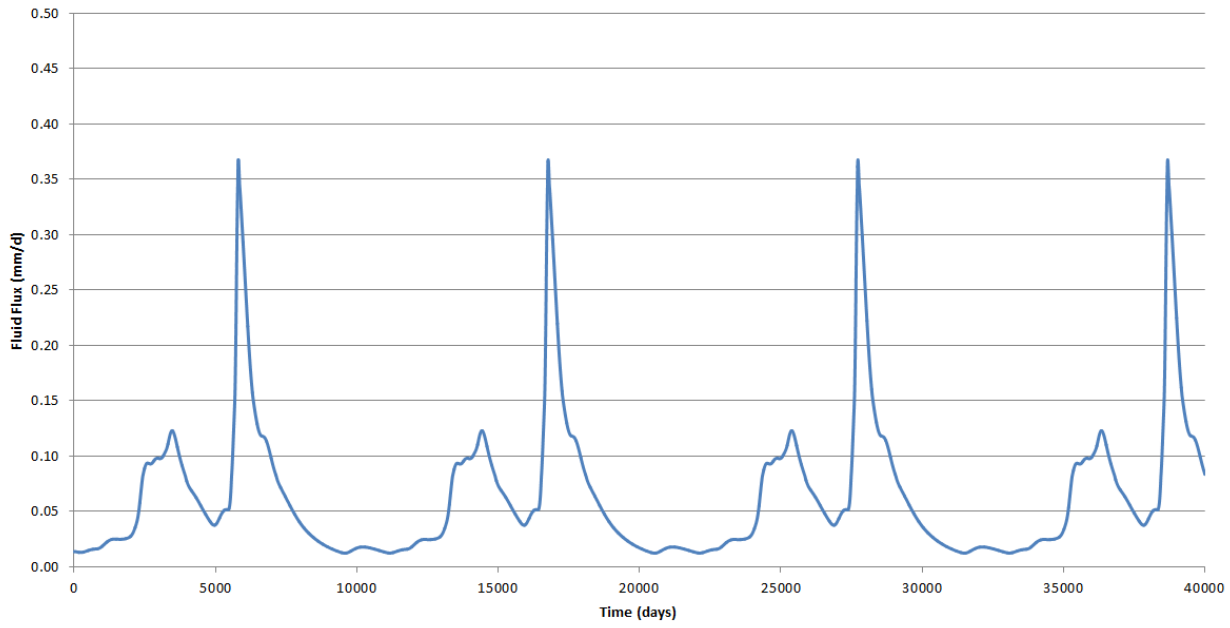
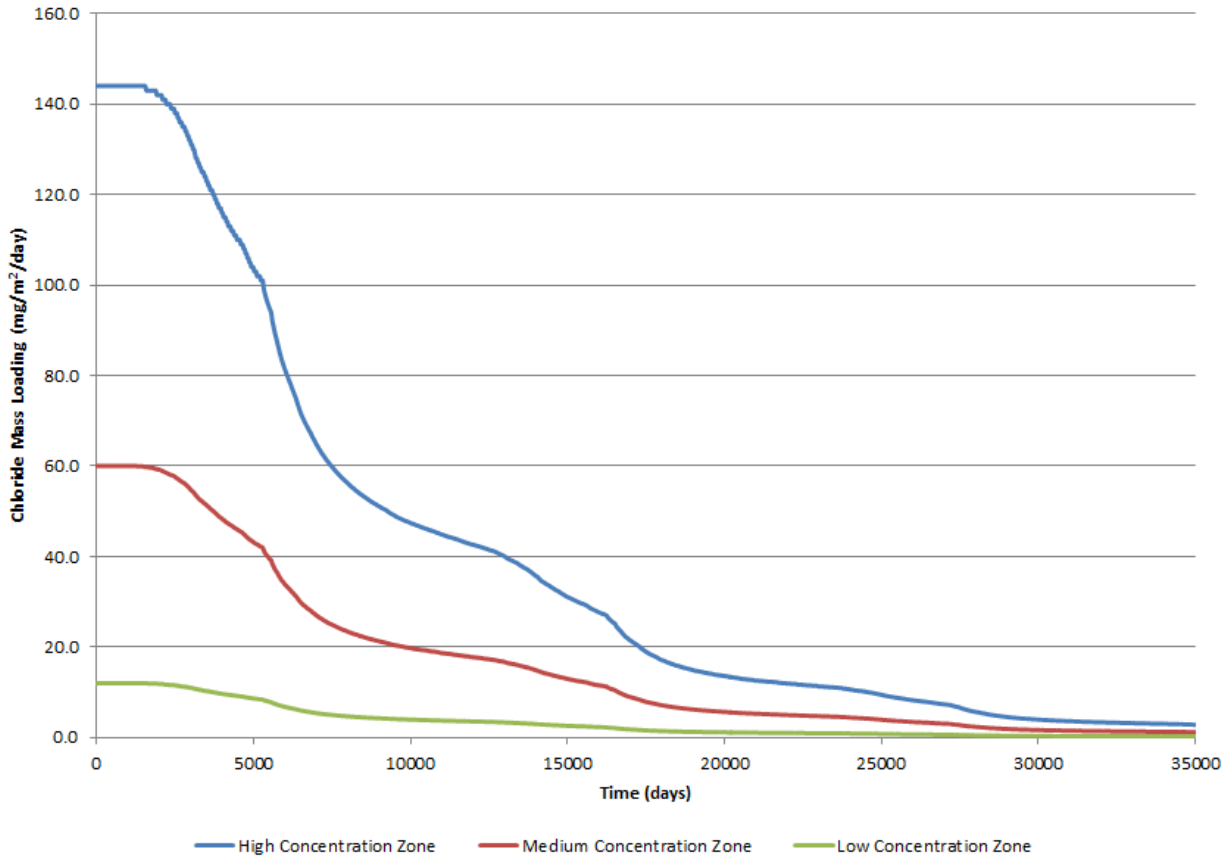


Figure 4 Chloride Mass Loading at the Water Table as modelled in HYDRUS

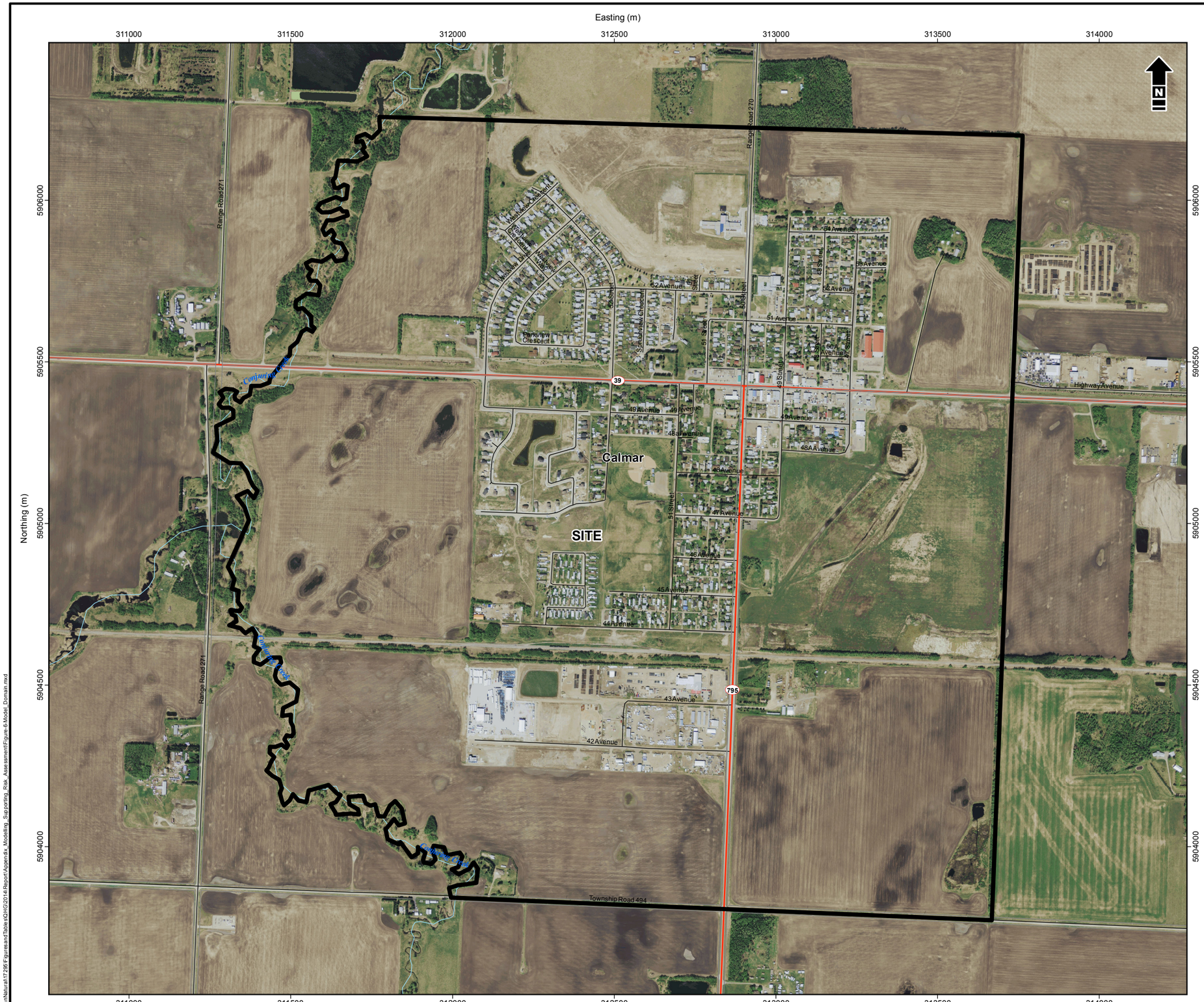


3.2 Saturated Zone Flow and Transport Modeling

A 3D numerical model of saturated groundwater flow and transport was developed for the site using FEFLOW. The purpose of the saturated zone groundwater flow and transport modeling was to simulate the future peak chloride concentration at downgradient receptors including Conjuring Creek and the potential sandstone/bedrock unit based on current chloride distribution in the saturated zone and inputs from the unsaturated zone over time.

3.2.1 Model Structure

The model domain was designed to include the site and the areas and receptors that may comprise the groundwater flow pathways to and from the site. The model domain is approximately 5 km^2 in area and is bounded by Conjuring Creek on the west, Township Road 500 to the north, Regional Road 265 to the east, and Township Road 494 on the south (Figure 5). The model area is 1,800 m (north-south) by 2,200 m (west-east).



Model Domain
Watercourse
Highway
Road

1:12,000
m
120 0 120 240
NAD 1983 UTM Zone 12N

Reference: Data obtained from GeoBase® (2013) used under license. Imagery (2013) obtained from Valtus © (2014) used under license.

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Model Domain

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Figure 5

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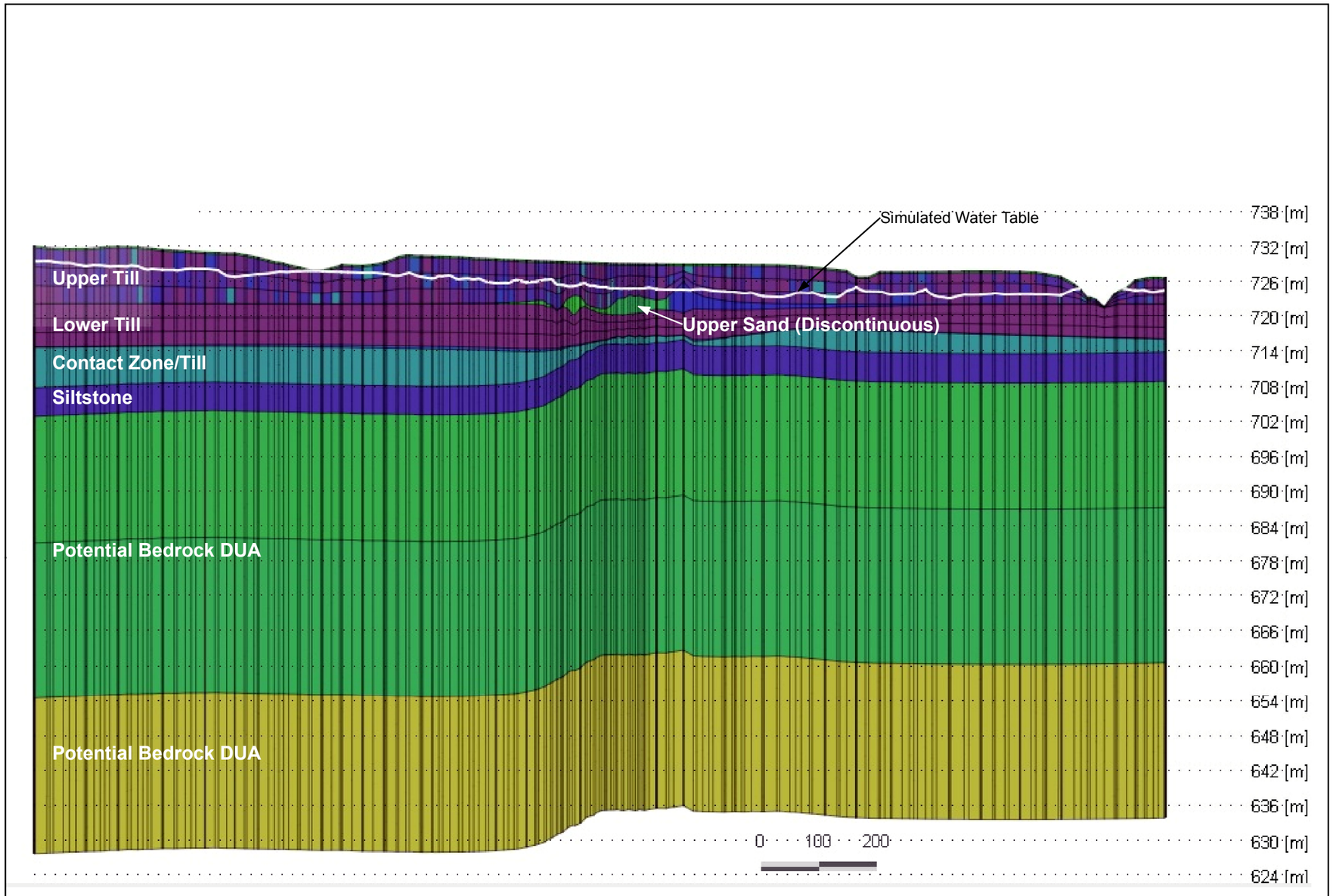

Conductivity Kx (m/s)
- 0.001
- 0.0001
- $1e^{-05}$
- $1e^{-06}$
- $1e^{-07}$
- $1e^{-08}$

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Model Layer Structure

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Figure 6

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The model comprised 17 layers and has a maximum thickness of 105 m representing the hydrostratigraphy based on the CSM (Matrix 2013, 2014; Figure 6). The top 11 layers represent overburden units, and the remaining 6 layers represent bedrock units of Horseshoe Canyon Formation (Table 2).

Table 2 Model Layer Structure

Conceptual Model Layer	FEFLOW Layer(s)	Thickness (m)	Unit Description
Topsoil	1	0.3	Thin, permeable organic layer
Clay Till	2-4	3-7	Clay till of variable conductivity, borehole logs indicate variable sand/silt content
Sand	5	0-3	Discontinuous upper sand unit (non-DUA)
Clay Till	6-8	4-8	Clay till
Sand	9	0-0.5	Thin, highly discontinuous sand unit present in some boreholes (non-DUA)
Clay Till	10	0.5-6	Clay till unit and contact zone with bedrock
Siltstone	11	5	Confining, low permeability bedrock unit as observed in shallow bedrock boreholes.
Sandstone	12-17	75	Transmissive bedrock unit based on regional hydrogeology (MLM 1980). Potential for existence of DUA within these layers.

The water table is observed approximately 2 m bgs on site. The two upper clay till layers were subdivided into three layers each to increase vertical refinement to better represent the source zone/initial chloride concentration and increase numerical stability. The bedrock was also subdivided into multiple layers to increase numerical model stability and enable evaluation of layering effects on chloride transport.

3.2.2 Initial Hydraulic Conductivity

Initial horizontal hydraulic conductivities for overburden units were based on lithology, slug tests, and the pumping tests conducted by Matrix (2013, 2014; Nichols 2012), which suggest a conductivity range of 1 x 10^{-7} to 1.1 x 10^{-6} m/s for till units, and 1.1e-6 m/s for the upper sand unit. The initial conductivity for the uppermost bedrock unit was based on available slug tests conducted on site by Matrix (2013), which ranged between 5 x 10^{-9} and 1 x 10^{-8} m/s.

Initial conductivities for the lower bedrock units were based on the regional data, which indicates a transmissivity of up to 85 m^2/day in sandstone within the Horseshoe Canyon Formation (MLM 1980). At a 75 m average thickness this transmissivity translates to an initial bulk conductivity estimate of

1.3 x 10^{-5} m/s for this unit. An anisotropy ratio of 10 was applied to all units within the model (Kx = 10*Kz) to represent the stratified conditions.

3.2.3 Boundary Conditions

3.2.3.1 Groundwater Flow Boundaries

Topography in the model is represented by a 10 m × 10 m Digital Elevation Model (DEM), which shows ground surface elevations ranging from 736 m asl in the southeast to 716 m asl at the northwestern extent of Conjuring Creek (AltaLIS 2014).

The western edge of the model is bounded by Conjuring Creek, which is represented by a series of constant head boundary conditions set equal to the stream elevation as defined by the DEM (Figure 5). Other surface water bodies (e.g., small ponds), all located off site and more distant than the creek, were identified through satellite imagery and were represented with constant head boundaries set at the ground surface elevation.

The water table on site is observed at approximately 2 m bgs. This was maintained at the model's northern, eastern, and southern boundaries as a Type I boundary condition. Downward gradients with a vertical head difference between the water table and the bedrock of 5 m are observed on site and regionally (HCL 1999) and were represented on the model borders using depth variable Type I boundary conditions between Slice 1 and Slice 12 (top of bedrock). Below slice 12 no vertical gradient boundary was represented as flow is expected to be near horizontal.

Recharge was initially applied to the top of the model (layer 1) as 15 mm/year, the lower end of VSMB/HYDRUS estimate of average annual groundwater recharge. This value was varied during calibration through the range of estimated values of average annual recharge from VSMB/HYDRUS.

3.2.4 Flow Model Calibration

The objective of model calibration is to evaluate the ability of the numerical model to represent observed average annual (steady state) flow conditions. This is typically achieved by adjusting input parameters (e.g., hydraulic conductivity, recharge) within reasonable bounds until an adequate match to observations is simulated. The degree to which these parameters can be adjusted is defined primarily through observations concerning those parameters (e.g., lithology, slug tests, precipitation, evapotranspiration, and literature values).

The model was calibrated using available site data and observations. These observations included water levels measured by Matrix (2013, 2014) and Nichols (2012). Additional qualitative calibration targets included:

- simulated a water table elevation consistent with the observed depth of 2 to 3 m bgs

- simulated downward gradient as observed onsite, represent vertical head differences
- simulated equipotential contours consistent with previous interpretations of observed water level data

Table 3 defines the set of model parameters that provide the best match to observed conditions.

Table 3 Calibrated Model Parameters

Model Parameter	FEFLOW Layer(s)	Calibrated Value(s) (m/s)	Estimated Range	Parameter Description
Recharge	1	30 (mm/yr)	5-30 (mm/yr)	Portion of precipitation over the model domain that contributes to the groundwater flow system, estimated range based on VSMB modelling- VSMB average recharge of 23 mm/yr
Topsoil Conductivity	1	1e-5	5e-7 to 1e-5	Thin, unconsolidated organic layer
Clay Till Conductivity	2-4, 6-8	3.4e-7 to 1 e-8	1e-8 to 1e-6	Clay till of variable conductivity, borehole logs suggest variable sand/silt content in till units
Upper Sand Conductivity	5	1e-5 to 1e-8	5e-8 to 1e-5	Upper sand unit found to be discontinuousness through pump test and borehole interpretation (Matrix 2014a). Pump test excludes this unit from DUA status, lower conductivity to the west of the site, and higher conductivity to the north were found to provide best model fit.
Lower Sand Conductivity	9	7.8e-7	5e-8 to 1e-5	Thin, highly discontinuous sand/silt unit present in some boreholes
Clay Till/Contact Zone Conductivity	10	2.1e-7	1e-8 to 1e-6	Clay till unit and contact zone with upper bedrock, slightly higher permeability than other clay till units found to provide optimal model fit.
Siltstone	11	3.6e-8	1e-9 to 5e-8	Confining bedrock unit as observed in shallow bedrock boreholes.
Sandstone	12-17	2.4e-6 to 1e-4	1e-6 to 1e-4	Transmissive bedrock unit interpreted to be sandstone based on regional geology and observed downward gradient, potential bedrock DUA.

Note Calibrated ranges indicate variable conductivity in model layer.

Figure 7 and Figure 8 show simulated plan view equipotential contours for overburden and bedrock units respectively. These indicate that the prevailing horizontal flow direction is northwestward in the overburden, and predominately northward in the bedrock. These flow directions are consistent with interpreted flow directions based on observed water level data (Matrix 2014a)

Item 9.d

Simulated Head Contour (0.5m)
Borehole
GIC Water Well
Monitoring Well

1:2,500
m
25 0 25 50
NAD 1983 UTM Zone 12N

Reference: Imagery (2013) obtained from Valtus © (2014) used under license.

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Simulated Head Contours in Upper Overburden Units

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Figure 7

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Item 9.d

- Simulated Head Contour (0.25m)
- Borehole
- GIC Water Well
- Monitoring Well

1:2,500
m
25 0 25 50
NAD 1983 UTM Zone 12N

Reference: Imagery (2013) obtained from Valtus © (2014) used under license.

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Simulated Head Contours in Potential Bedrock DUA

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Figure 8

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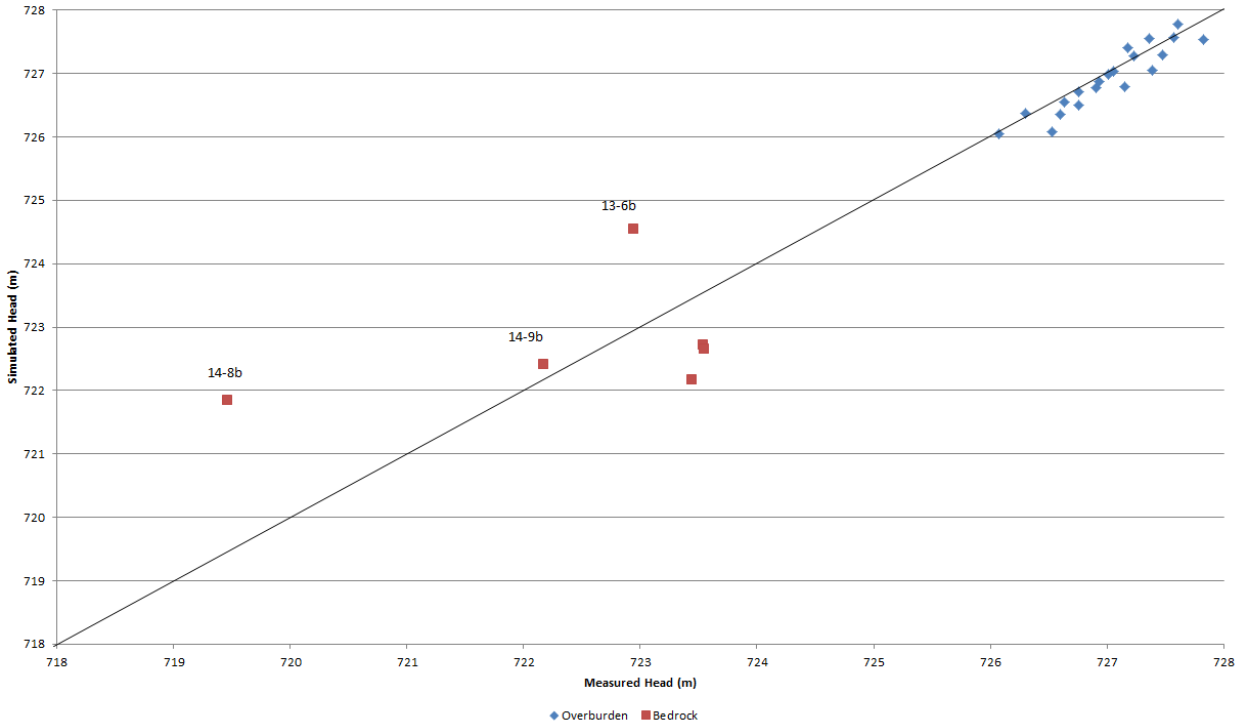
Table 4 summarizes calibration statistics for the numerical model. These statistics are used to judge the goodness of fit between simulated and observed values. These statistics are also used to identify trends in residuals and evaluate the plausibility of a given conceptual model. A model residual is defined as the difference between the simulated water level and the observed water level.

Table 4 Summary of Model Calibration Statistics

Calibration Statistic	Statistic Description	Overburden Observations	Bedrock Observations	All Observations
Mean Residual (m)	The sum of all model residuals divided by the total number of observations. (Negative value = model simulate value is greater than observed value on average)	0.09	-0.20	.02
Mean Absolute Residual (m)	The sum of the absolute value of residuals divided by the number of observations.	0.16	1.20	0.40
Maximum Residual (m)	Simulated water level with the greatest deviation from observed.	0.45 (Well 14-9s)	-2.38 (Well 14-8b)	-2.38 (Well 14-8b)
Root Mean Squared Error (m)	The square root of the sum of all squared residuals (places emphasis on observations with high residuals)	0.21	1.37	0.69
Normalized Root Mean Squared Error (m/m as %)	The root mean squared error divided by the total range of observed water levels. For overburden the total range of observed water levels is 2.56 m and for bedrock the total range is 5.7 m. Range of observed water levels for entire model domain is 9.6 m.	0.12	0.34	0.08

A comparison of simulated and observed water levels can be viewed graphically in a scatterplot (Figure 9). A good model fit was achieved within overburden units. Simulated bedrock water levels have larger residuals than the overburden units, reflecting additional small-scale heterogeneities within the upper bedrock.

Figure 9 Scatterplot of Model Fit



The downward gradient observed on site is represented in the flow simulation using the calibrated parameter values. Table 5 summarizes the model's ability to simulate the observed vertical gradients on site and shows a good representation of vertical head differences.

Table 5 Summary of Model Fit to Observed Vertical Head Differences

Multi-Screened Well	Observed Water Level in Overburden (m asl)	Observed Water Level in Bedrock (m asl)	Observed Head Difference (m)	Simulated Head Difference (m)	Residual (m)
14-8 (a-b)	726.90	719.47	7.44	4.93	-2.51
14-9 (a-b)	726.75	722.17	4.58	4.29	-0.30
14-10 (a-b)	726.08	723.55	2.53	3.40	0.88
14-11(a-b)	726.30	723.45	2.86	4.20	1.35
14-12(a-b)	726.94	723.54	3.40	4.17	0.77
M12-17(s-d both screens in overburden)	727.18	727.15	0.03	0.61	0.58

The flow model calibration indicates that the model is capable of representing observed flow conditions, as evidenced by the following:

- Calibrated parameters are consistent with field and literature values.
- Water table depth is simulated between 2 and 4 m bgs, consistent with observations of 2 to 3 m.

- Water level residuals are in the range of measurement error and consistent with the well-scale heterogeneity for the system.

- Simulated equipotential contours are consistent with observed equipotentials (Matrix 2014a), showing predominant flow directions northwest and north in the overburden and bedrock, respectively.

- Simulated horizontal and vertical gradients are consistent with observed, with the simulated vertical gradients being slightly overestimated within the chloride-impacted areas.

3.2.5 Mass Transport

Mass transport in the saturated zone is simulated in 3D using the FEFLOW model. The velocity field derived from simulated steady-state groundwater flow field is used to simulate the transport of chloride through time (transient simulation) accounting for the effects of dispersion and diffusion.

3.2.5.1 Transport Input Parameters

Table 6 shows the mass transport parameters assigned to the hydrostratigraphic units and dissolved chloride within the 3D model.

Table 6 Calibrated Mass Transport Parameters

Parameter	Value	Description
Porosity	0.3 (Overburden) & 0.1 (Bedrock)	Consistent with material porosities outlined in Freeze and Cherry (1979)
K (Henry constant)	0	No sorption occurs in transport as chloride is a conservative tracer.
Molecular diffusion	1×10^{-9} m^2/s	Value consistent with literature value for chloride (Millington and Quirk 1961)
Longitudinal dispersivity	20 m	Scaled to ensure Peclet criteria is approximately 2 to maintain model stability at the extents of the plume, values consistent with (Zheng and Bennett 1995)
Transverse dispersivity	2 m	
Background concentration	20 mg/L	Observed.
Decay-rate constant	0	No decay as chloride is a conservative solute and does not degrade into other constituents.
Fluid density	1.00 g/cm^3	Density variability is potentially only a factor over a small portion of the model and is thus ignored.

3.2.5.2 Initial Chloride Concentrations in Saturated Zone

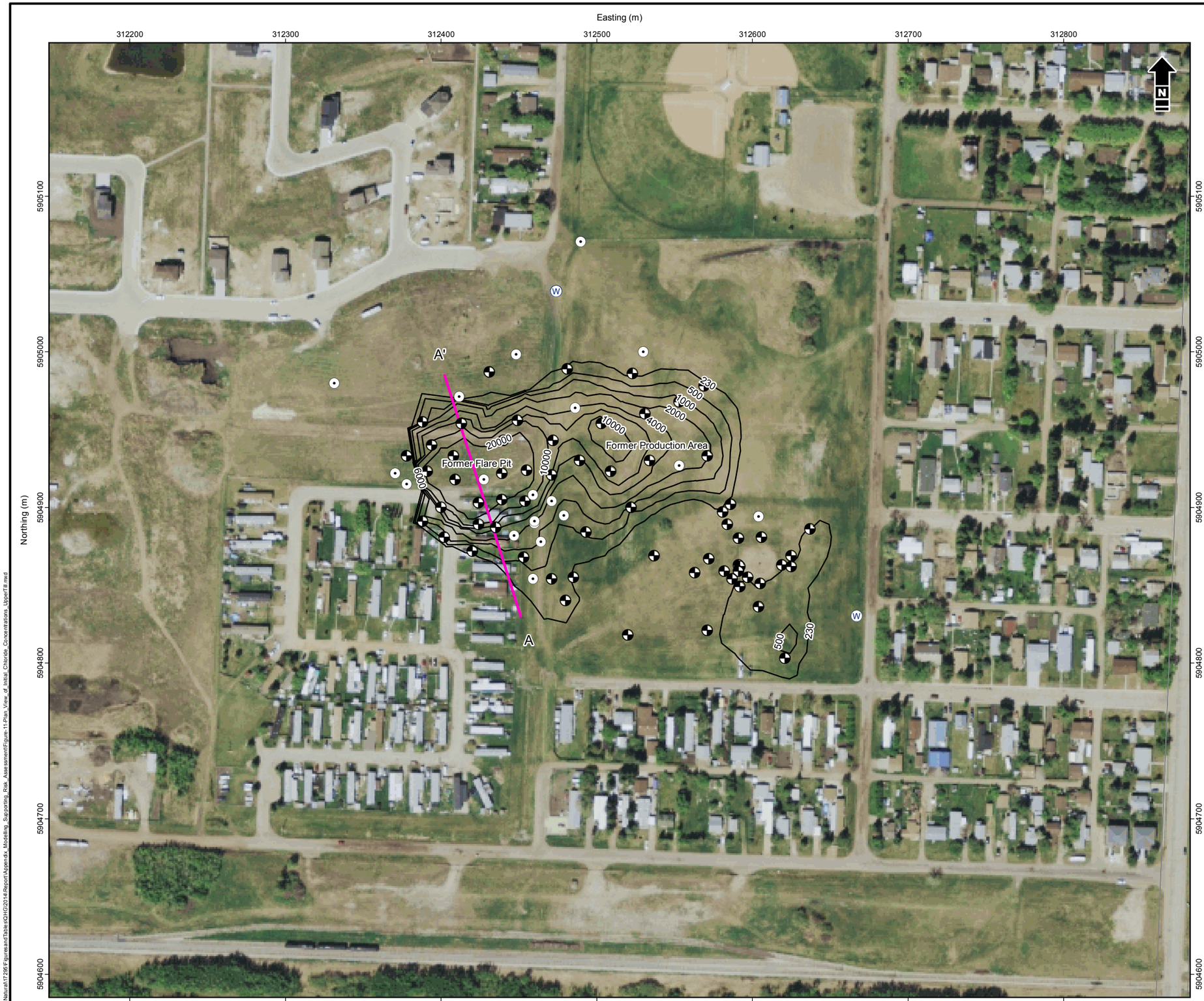
Chloride concentrations in both soil and groundwater samples were collected by Nichols (2012), and Matrix (2013, 2014). Data obtained from all three sample sets were used to delineate the concentration distribution of chloride in the numerical model.

On site, groundwater samples yielded chloride concentrations ranging from 7 mg/L at well 14-8a to 96,200 mg/L at well 14-12a. Soil samples at the same locations were found to range in concentration from 0 at well 14-8a to 24,200 mg/L at well 14-12a. Background chloride concentration in groundwater is 20 mg/L. Empirical analysis (Matrix 2014a) found groundwater concentrations from monitoring wells to be up to five times the soil estimates.

The large number of soil samples provide the best understanding of the spatial extent of chloride impacts in the subsurface. Groundwater samples, while fewer in number, provide the best estimate of maximum dissolved concentrations in groundwater. To represent the spatial extent of the chloride plume as accurately as possible in the numerical model, an initial chloride distribution was delineated using soil samples that are scaled based on groundwater samples.

A 3D interpolation of soil chloride concentration was generated using all available soil sample concentration data points. The highest chloride concentrations were measured in well 14-12a, where the groundwater concentration was approximately 5 times the measured soil concentration. To ensure this peak concentration was represented in the model, all soil sample-derived concentration values generated from the 3D plume interpolation were multiplied by a factor of 5. This approach is conservative in that it captures both the peak chloride concentration and ensures the spatial extent of the plume is properly defined using all available data. The interpolated and scaled distributions are shown on FIGURE 10 and FIGURE 11.

Item 9.d



- Initial Soil Concentration in Upper Till
- Cross Section Location
- Borehole
- GIC Water Well
- Monitoring Well

1:2,500 (25 0 25 50 m)

NAD 1983 UTM Zone 12N

Reference: Imagery (2013) obtained from Valtus © (2014) used under license.

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Canadian Natural Resources Limited
Modelling Supporting Risk Assessment - Calmar Former Battery

Plan View of Initial Chloride Concentrations (Upper Till)

Date:	Project:	Technical:	Reviewer:	Drawn:
09 May 2014	17295-508	G. Merritt	D. Abbey	C. Curry

Figure 10

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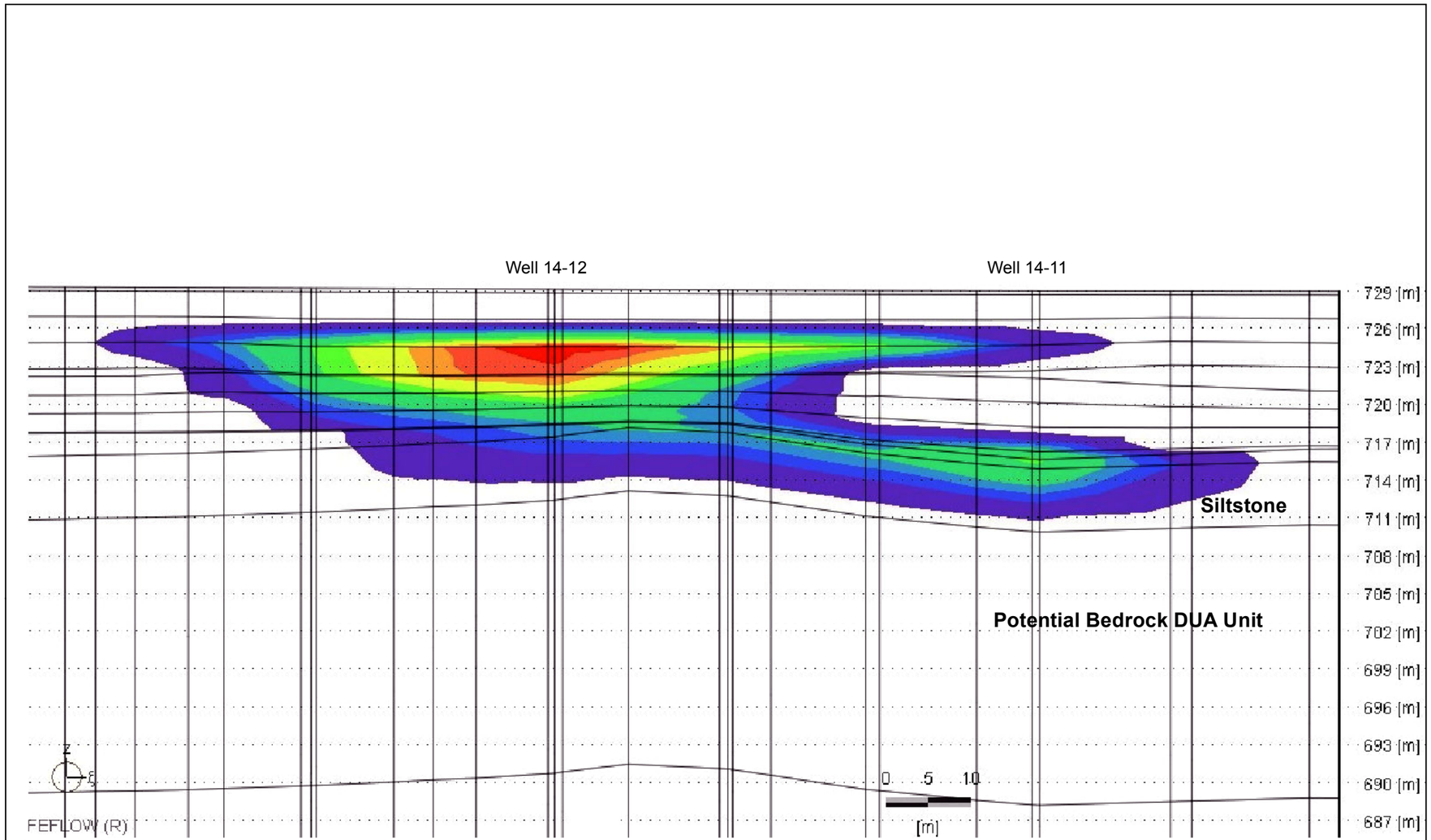

Mass Concentration (mg/L)

- 75000 - 100000
- 50000 - 100230
- 30000 - 50000
- 10000 - 30000
- 5000 - 10000
- 500 - 1000
- 230 - 500
- 50 - 230

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A-A' Cross Section View of Initial Chloride Concentration

Date:	Project:	Technical:	Reviewer:	Drawn:
10 Jun 2014	17295-508	G. Merritt	D. Abbey	C. Curry

Figure 11

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3.2.5.3 Mass Transport Boundaries

A constant mass concentration boundary of 20 mg/L was applied along the upgradient model boundaries to represent background chloride concentrations. Recharge in the model is assumed to have a chloride concentration of zero.

The mass flux of chloride from the unsaturated zone simulated with HYDRUS was represented in the FEFLOW model using a set of transient mass flux boundary conditions (Type II) assigned at the top of the simulated water table for the high, medium, and low impact soil areas (FIGURE 2). The existing chloride concentrations in the saturated zone as described in Section 3.2.5.2 were assigned as initial concentrations in FEFLOW.

3.2.6 Chloride Transport Calibration

The spill history including the introduction of chloride into the subsurface is unknown but was assumed to have occurred before decommissioning the Former Calmar Battery in the 1960s. Quantitative transport calibration to observed chloride concentrations is not possible due to the lack of information on source history. However, the time range for possible spills, the field and literature values for flow and transport parameters, estimated advective velocity, and current extent of chloride impacts bound the possible chloride transport directions and distances. To provide confidence in the ability of the model to predict future chloride concentrations 50-year transport simulations were conducted to evaluate the consistency between:

- simulated migration of peak chloride concentration compared to advective velocity
- simulated extent of chloride migration vertically and horizontally compared to observed extent

The calibrated transport parameters (Table 6) and chloride source locations were shown to provide a good representation of transport conditions by comparison to current conditions. The specific lines of evidence include:

- simulated approximate horizontal advective transport distance of 20 m over 50 years. This distance is less than predicted based on the advective velocity for sand in the supplemental Phase 2 ESA (Matrix 2014a), but consistent with clay or a discontinuous sand unit.
- simulated vertical advective transport distance of at least 12 m from the water table to the upper bedrock is consistent with the advective velocity estimated in the supplemental Phase 2 ESA (Matrix 2014a)
- simulated chloride impacts in upper bedrock
- simulated downward migration of chloride impacts from 14-12 a to 14-11 b.
- consistency of the mapped and simulated chloride impact area

Based on these lines of evidence, the model was considered suitable to predict future chloride migration.

4 CHLORIDE TRANSPORT SIMULATION RESULTS

4.1 Base Case Model Run

The base case scenario simulated the migration of chloride in the saturated zone from current conditions for 200 years. In this base case scenario, no remediation was simulated. Chloride migration in the overlying till units was simulated to be downward, with some lateral dispersion and minimal advection in the northwestward flow direction. Through all 200 years of the simulation the peak chloride concentration at Conjuring Creek was simulated to be background (20 mg/L). Within the potential bedrock DUA, a peak chloride concentration of 7,880 mg/L was modelled approximately 30 years into the simulation (Figure 12). The maximum extent of simulated 230 mg/L chloride concentrations within the potential bedrock DUA was approximately 140 m in the north-south direction and 100 m in the east-west direction (Figure 13) from Former Flare Pit, and occurred approximately 135 years into the simulation

Item 9.d

Maximum Chloride Concentration in Bedrock (mg/L), occuring at time = 30 years

1:2,500

25 0 25 50 m

NAD 1983 UTM Zone 12N

Reference: Imagery (2013) obtained from Valtus © (2014) used under license.

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Maximum Simulated Chloride Concentration in Potential Bedrock DUA (Base Case)

Date:	Project:	Technical:	Reviewer:	Drawn:
10 Jun 2014	17295-508	G. Merritt	D. Abbey	C. Curry

Figure 12

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Item 9.d

Maximum Plume Extent, occuring at time = 135 years

1:2,500

25 0 25 50 m

NAD 1983 UTM Zone 12N

Reference: Imagery (2013) obtained from Valtus © (2014) used under license.

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Maximum Simulated Extent of Chloride Impacts in Potential Bedrock DUA (Base Case)

Date:	Project:	Technical:	Reviewer:	Drawn:
10 Jun 2014	17295-508	G. Merritt	D. Abbey	C. Curry

Figure 13

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4.2 Excavation Scenarios

Removal of soil in the shallow subsurface is planned to meet Alberta Tier 1 guidelines (AENV 2010) for a number of constituents of concern including metals and hydrocarbons. The excavation areas are shown in the Phase 2 ESA report (Matrix 2014a). Some chloride mass will be removed in the process of excavating areas identified as a by-product to contain the other constituents of concern, which will thereby lower the total amount of chloride that could reach potential receptors.

Based on the CSM and the base case model simulation, several excavation scenarios were simulated to evaluate the impact that such excavation would have on receptors. These excavation scenarios consisted of removing initial chloride mass in the saturated zone (subsoil) from the base case model in accordance with a particular clean-up criteria, as well as removing the mass flux boundary conditions, which represent mass flux from the unsaturated zone (i.e., the soil zone) from areas identified to be part of the excavation.

4.3 Soil Zone

Removal of chloride mass within in the unsaturated zone was represented by removing the mass flux boundary conditions derived from the HYDRUS modelling that represented unsaturated zone chloride loading to the water table. The result of this simulation was that peak concentration in the potential bedrock DUA remained unchanged (7,879 mg/L). This is primarily due to the majority of chloride and highest concentrations being within the saturated zone, and excavation of the shallow subsurface removes very little soil within high chloride concentration areas.

4.4 Subsoil

To assess risk to receptors for different clean up criteria, five excavation scenarios were simulated. In each scenario, the concentration boundary conditions representing chloride loading from the unsaturated zone were removed to simulate the planned excavation of metal and hydrocarbon areas. A given soil concentration clean-up criterion was then used to identify all areas/depths within the model that exceeded that criterion. The initial concentration in areas that exceeded the criterion was assigned an initial chloride concentration of zero. The volume of soil exceeding the criterion and the volume of soil required to be excavated to this criterion (volume of soil above clean up concentration + volume of soil located above these volumes) is shown in Table 7. For each scenario, a 200-year simulation was completed and the peak chloride concentration in the potential bedrock DUA was recorded (Table 7). In all simulations, peak concentration occurred about 30 years into the simulation. Alternative excavation scenarios using area and depth-specific criteria can likely reduce the excavated volumes and further reduce impacts to the potential receptors but these scenarios were not simulated at this time.

Table 7 Soil Concentration Excavation Levels

Soil Concentration Excavation Criterion (mg/L)	Groundwater Concentration Excavation Criterion (model) (mg/L)	Volume of Soil Above Criteria (m^3)	Total Volume of Soil Required to be Excavated (m^3)	Simulated Peak Chloride Concentration in Potential Bedrock DUA (mg/L)
None	None	0	0	7,879
15,000	75,000	6,890	7,210	5,353
10,000	50,000	9,763	15,313	4,197
5,000	25,000	27,348	32,343	2,652
1,000	5,000	88,058	105,770	936

Model simulations suggest soil excavation can reduce peak chloride concentration in the potential bedrock DUA. However elevated chloride occurs within shallow bedrock and deep overburden. In the current conceptualization, the distance from the top of bedrock to the potential DUA is assumed to be approximately 5 m. This distance is insufficient for dispersion to reduce the chloride concentration below 230 mg/L. The current conceptualization of a 5 m thick siltstone is conservative but consistent with the current depth of investigation. Regional hydrogeologic conditions (HCL 1999) suggest that actual conditions in the Horseshoe Canyon member below the site may be more favourable for increased dispersion as the depth to a DUA may be more than 5 m and will thus further reduce the peak chloride concentration. Further site investigation could provide more information on the characteristics of the bedrock below the upper few metres and provide insight on the potential for further reduction in chloride concentrations before reaching a potential bedrock DUA.

4.5 Uncertainty Analysis

All models are simplified representations of the real-world systems. The groundwater flow system and chloride transport represented in this project was calibrated to available hydraulic head data and chloride concentrations in groundwater and qualitative information about the system. The set of parameters used to calibrate the model reflect the CSM and the supporting field data. However, this set of parameters is non-unique and other parameter sets may produce an equally well-calibrated model.

The range of parameter values shown in the “Estimated Range” column of Table 3 shows the initial uncertainty in the model input parameters. Through the calibration, range of parameter values that could be used in combination with others while still representing the observations was narrowed. The parameters that were most sensitive, or had the narrowest parameter range that would calibrate the model were the recharge rate and hydraulic conductivity of the low permeability overburden units. In addition, recharge and the overburden hydraulic conductivity is highly correlated. In contrast, the following parameters and inputs were not well constrained by the observations and calibration:

- bedrock unit thickness and hydraulic conductivity

- thickness of upper siltstone
- transmissivity of the potential bedrock DUA
- scaling factor for soil chloride concentrations to groundwater concentrations
- dispersivity assigned to overburden and bedrock units

The uncertainty in these parameters can mean that a range of predictions (e.g., chloride concentrations) are possible, and there are limited observations to judge the plausibility of an outcome. Formal uncertainty analysis that would evaluate the range of outcomes is beyond the scope of this project. To address uncertainty, values for the most uncertain parameters were assigned from the estimated range that were consistent with observation data but would result in the largest peak chloride concentrations. The following describes the approach to selecting values for the most uncertain parameters:

- The source zone was designed to use peak-measured chloride concentrations and represent spatial extent of plume proportional to that peak concentration. As such the source zone in the model possesses in some places higher chloride concentrations than the observed values. In no location does the source zone in the model possess a chloride concentration below what was observed in the field.

- Recharge in the model was calibrated to 30 mm/year, which is approximately 20% higher than simulated in the VSMB/HYDRUS modelling conducted for the site (23 mm/year) Higher recharge increases the amount of fluid flux going through the overburden units, which transports chloride mass downwards to the potential bedrock DUA.

- Thickness of confining bedrock unit (siltstone) is unknown but represented as 5 m in the model, which was found to be the thinnest it could be and achieve an adequate calibration. However, potential exists for this unit to be thicker than what is conceptualized in the model. As discussed above, if this were the case, simulated peak chloride concentrations in the bedrock DUA could be reduced, as the distance to the DUA would be increased, allowing for additional dispersion.

- Conductivity of the overburden units is correlated with recharge. The number of combinations is limited by the observed vertical downward gradients on site. Since flow direction is downward, recharge drives flow and transport to the bedrock DUA, in addition to some preferential pathways that allow limited lateral movement. Using the high range of estimated recharge results in a set of parameters promote higher concentrations in the potential DUA while still representing the observed conditions.

- Only downward flow in the root zone was considered to emphasize chloride loading to the water table and the potential impact on the saturated zone receptors (e.g., the potential bedrock DUA). This is consistent with root zone water balance modelling (VSMB) and observations on-site.

- Dispersivity parameters of 20 m and 2 m for longitudinal and transverse dispersion were assigned respectively to all hydrostratigraphic units. These values are considered representative of the system scale and minimize the effects if numerical dispersion.

These values could be refined using more formal uncertainty analysis and additional data collection. However, the approach presented provides appropriate means for evaluating the ability of the excavation scenarios to protect receptors.

5 SUMMARY AND CONCLUSIONS

A Tier 2c Site-Specific Risk Assessment was initiated in fall 2013 to further evaluate the risk to receptors and develop site-specific remediation criteria to protect all receptors. Additional field investigations were completed in February 2014 to evaluate groundwater pathways and soil and subsoil conditions north and northwest of site, downgradient of former production area, and within known areas of soil and groundwater impacts. Numerical modelling was undertaken to simulate the peak chloride concentrations at identified receptors, evaluate the efficacy of alternative remediation and risk management scenarios, and determine the excavation volumes for each alternative to support the risk assessment for the site. Regional and site-specific data supporting the CSM were reviewed and compiled into GIS software and these data were represented in the numerical models to simulate flow and transport chloride in the subsurface. The numerical modelling conducted to support the risk assessment suggests the following conclusions:

- The sand units intersected by boreholes and wells are laterally discontinuous. They can represent preferential pathways over short distances, but predominant transport direction is downward.

- Average annual recharge is 23 mm/year but can range from 5 to 30 mm/year.

- Strong downward gradients and regional mapping/characterization of the Horseshoe Canyon Formation suggest the potential for a bedrock DUA below the depth of investigation at the site.

- Groundwater samples typically show greater chloride concentrations than soil salinity samples due to analytical method differences. Groundwater chloride concentrations were as much as five times the soil estimates. However, the soil chloride samples were employed to define the spatial variations in groundwater concentrations for the whole source area, whereby the soil sample concentrations were scaled by a factor of five to estimate groundwater concentrations at all soil sample locations.

- Observed water level and chloride concentration field data were used as calibration targets and provide confidence in the ability of the model to represent the physical system and estimate future chloride concentrations.

- Chloride concentrations within the root zone are simulated to decline to levels below 230 mg/L within the next 50 years assuming historical climate conditions prevail and observed downward gradients between the root zone and saturated zone are maintained.

- Chloride is simulated to migrate primarily downwards towards a potential bedrock DUA within the Horseshoe Canyon Formation This DUA may currently have elevated chloride concentrations.

- Chloride concentrations at Conjuring Creek are simulated to remain at background concentrations for at least 200 years, indicating low risk to this receptor.

- Peak chloride concentration within the potential bedrock DUA is simulated to be as high as 7,880 mg/L if no excavation is conducted.

- Under the current conceptualization, chloride concentrations above 230 mg/L are not simulated to extend off site within the bedrock DUA.

- Based on the simulated scenarios, excavation of all soil with concentrations greater than 1,000 mg/L (up to 100,000 m^3 of soil) will not result in a peak chloride concentration in the potential bedrock DUA below 900 mg/l.

- Additional characterization may provide information allowing for less conservative representation of the bedrock and source concentrations that may show additional dispersion before reaching the potential bedrock DUA.

- Alternative excavation scenarios using more area and depth-specific criteria can likely reduce the excavated volumes and further reduce impacts to the potential receptors but these scenarios were not simulated at this time.

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Item 9.d

Canadian Natural

April XX, 2025

First &Last Name
Title
Town of Calmar
4901 – 50 Avenue
Calmar, Alberta T0C 0V0

Re: **Canadian Natural Resources Ltd.**
Risk Management Plan for the Former Calmar 09-25 Battery Affected Lands
09-25-049-27W4M

Canadian Natural Resources Limited (Canadian Natural) retained Matrix Solutions Inc., a Montrose Environmental company (Matrix), to prepare the attached Risk Management Plan (RMP) for the former Calmar Battery and affected lands located within 09-25-049-27 W4M. This cover letter and attached figure has been prepared to communicate the attached RMP to all affected stakeholders and to provide a summary of the site history and exposure control measures included within the RMP.

Site History

The former wellsite and associated battery began operations in the 1950s. The oil well (License #0003284) was drilled in 1951 and abandoned in 1959. By 1975, all battery-related facilities were removed and surface reclamation was completed.

In 2012, as per the requirements of the *Subdivision and Development Regulation (SDR)* and the Alberta Energy Regulator (AER) Directive 079 (AER, 2022), the Town of Calmar informed Canadian Natural of their plans to develop the property described as Zolner Park located within NE-25-049-27W4M. In addition, the Town of Calmar shared with Canadian Natural that they completed a Phase 2 Environmental Site Assessment (ESA) on the subject property, during which elevated salinity, petroleum hydrocarbon (PHC), metals, and polycyclic aromatic hydrocarbon (PAH) contamination was identified in the soil and groundwater (Nichols Environmental (Canada) Ltd., 2012). Canadian Natural completed a Phase 1 ESA in October 2012 (Marquis Alliance Energy Group Inc., 2012) and took immediate action in early 2013 to remedy the gas migration identified at the well during the October 15, 2012 inspection, then continued to work in consultation with the Town of Calmar to further assess the risk associated with contamination identified and develop a remediation plan (Matrix, 2015).

In 2016, a remedial excavation was completed targeted to remove PHC, PAH, and metal contamination that posed a potential risk to human health (Matrix, 2017). Soils exhibiting elevated electrical conductivity (EC; a measure of salinity) and sodium adsorption ratio (SAR; a measure of sodicity) exceeding site-specific remedial objectives (SSROs) were also removed.

The attached RMP was prepared post remediation to address potential risks associated with residual contaminants left in place at depth and provide appropriate exposure control measures to mitigate those risks (Matrix, 2021).

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Exposure Control Measures

The following table and attached Figure 1, are intended to provide a summary of the exposure control measures outlined in the RMP. Should any discrepancy be identified between this summary and the attached RMP document, the RMP document (Matrix, 2021) takes precedent.

Table A: Summary of Exposure Control Measures

Location	Residual Risk	Exposure Control Measure
Underlying bedrock aquifer	Groundwater in the underlying bedrock aquifer has/will become affected for a period of time by the residual salinity remaining in the soil.	Administrative – Town of Calmar is supplied with drinking water from the City of Edmonton (drinking water supply wells should not be drilled and installed within the Town of Calmar)
Area 1 – Rooting Zone (0-1.5m depth)	There are no residual impacts in the rooting zone that require exposure control measures.	Not required.
Area 1 – Subsoil (>1.5m depth)	Residual salinity (EC & SAR) and metals (boron) impacts remain that pose a potential risk to ecological receptors through the direct soil contact exposure pathway.	Administrative – Soil below 1.5m should remain below 1.5m. Property development and/or excavation activity restrictions are in effect in this area.
Area 2 – Rooting Zone (0-1.5m depth)	Residual petroleum hydrocarbon impacts remain in the soil that pose a potential risk to ecological receptors through the direct soil contact exposure pathway.	Administrative – Soil is not to be disturbed to maintain 0.6m cover. The Alberta Energy Regulator (AER) stipulates in Directive 079: Surface Development in Proximity to Abandoned Wells (AER 2022) that surface structures are not permitted on top of an abandoned well and a minimum 5 m setback radius around the well must be maintained. Additional property development and/or excavation activity restrictions are in effect for the remainder of Area 2.
Area 2 – Subsoil (>1.5m depth)	Residual petroleum hydrocarbon impacts remain in the soil that pose a potential risk to ecological and human receptors through the direct soil contact exposure pathway and vapour inhalation (slab or basement) exposure pathway.	Administrative – Soil below 1.5m should remain below 1.5m with 1.5m cover remaining above. Property development and/or excavation activity restrictions are in effect in this area.

Item 9.d

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Risk Management Plan Acknowledgment

Canadian Natural respectfully requests that upon completion of review of the RMP document, the attached *Affected Third Party – Risk Management Plan No Objection* letter be signed and returned to acknowledge your awareness and acceptance of the RMP.

If you have any questions or require further information please contact the undersigned at (XXX) xxx-xxxx or email xxx.

Sincerely,

XXX

Attachments

- Figure 1 – Site Plan
- Risk Management Plan, Former Calmar 09-25 Battery, 09-25-049-27 W4M (Matrix, 2021)
- Affected Third Party – Risk Management Plan No Objection letter

References

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Canadian Natural Resources Limited

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AFFECTED THIRD PARTY - RISK MANAGEMENT PLAN NO OBJECTION

1. We, The Town of Calmar, are:
   a. the registered owner of the lands legally described as Zolner Park in 9-25-049-27 W4M (LINC 0028379865) "the Lands" **OR**
   b. have been authorized to sign this No-Objection on behalf of all of the Registered Owners of the Lands.
2. I am aware that Canadian Natural Resources Limited ("Person(s) Responsible") is submitting a Risk Management Plan proposal with respect to contamination emanating from their Source Land(s) legally described as: 09-25-049-27 W4M.
3. I am aware that the contamination on the above noted land is either causing or may cause adverse effects on the Lands of which I am the/a Registered Owner.
4. I acknowledge that I have reviewed and do not object to the Risk Management Plan proposed by the Person(s) Responsible. I understand that by not objecting to the Risk Management Plan proposed, that if, at any time, my Land is to be transferred or sold, I will give full disclosure of the state of the property by providing the interested parties with a copy of the above described RMP and any related information required.
5. By signing below, I understand that I do not object to entering into a Risk Management Plan with the Person(s) Responsible.

Dated this _____ day of _____ (month, YYYY).

_____ (Registered Owner)

of _____ (Mailing Address) Phone: _____

Witness Name: _____ Signature: _____
(Sworn before a commissioner of oaths)

Item 9.e

Town of Calmar

Request for Discussion (RFD)

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	
Title:	Municipal Development Plan Review and Update
Approved By:	CAO Losier
Agenda Item Number:	9 E

BACKGROUND/PROPOSAL:

Administration has prepared the first draft of the Municipal Development Plan as part of the Town's ongoing planning framework update. This draft reflects Council's previously endorsed vision and incorporates preliminary policy directions to guide growth, development, and community priorities.
The draft is not in its final format; the document layout and template will continue to be refined. The intent of this stage is to receive the Council's comments on the content, including the goals, policies, and policy actions, before proceeding to a public-facing version.

So far, as part of the engagement process, a survey has been distributed to the community, one-on-one sessions have been held with community stakeholders to understand their needs better, and the Municipal Development Plan page on the website includes a section for the public to ask questions. We have also posted the draft document presented to the Council today on our website, as part of the first step in the public engagement process for the draft document.

DISCUSSION/OPTIONS/BENEFITS/DISADVANTAGES:

- Council feedback is requested specifically on the policy content and overall direction.
- Any additional priorities or concerns identified by Council will be incorporated before the draft is finalized for public review and engagement.
- The final formatted draft will return to the Council for review before the adoption processes.

RECOMMENDED ACTIONS:

The Council reviews the draft Municipal Development Plan and provides comments to the Administration**,** allowing for revisions prior to preparing the public-facing version.

ATTACHMENTS

1. Draft – July 2025
2. Maps

Introduction

What is the Municipal Development Plan?

The Municipal Development Plan (MDP) guides the use of land and the Town of Calmar's development over time. It helps shape decisions about where new homes, businesses, parks, roads, and services will go while also considering the community's overall well-being.

The Municipal Government Act (MGA) requires that municipalities have an MDP to ensure well-planned and sustainable growth. The MDP outlines the vision for Calmar's future and provides policies to guide decisions.

This plan helps ensure that Calmar remains a vibrant and welcoming place to live, work, and play, while ensuring that Calmar thrives for future generations. The MDP is a living document that will be reviewed as needed to reflect evolving needs and goals.

Plan Purpose

The MDP is intended to guide land use, growth, and development in Calmar by

- Conforming to the MGA's requirements
- Defining the Town's future vision, goals, policies, and direction.
- Directing decision-making for the Council and the Development Authorities.
- Providing the foundation for the preparation of statutory and non-statutory plans.

Scope of the MDP

The MDP is a statutory plan adopted by bylaw that serves as a long-term blueprint for development. It is required under Section 632 of Alberta's MGA and guides how the town will develop. The MDP ensures that growth is balanced, sustainable, and aligned with the town's needs and values.

As required by the MGA, the MDP must address the following:

- **Future Land Use** – How land within the municipality will be used.
- **Future Development** – Proposals for future projects and initiatives.
- **Aligning land use, future growth, and infrastructure as per the** Intermunicipal Development Plan (IDP) with Leduc County.
- **Transportation Systems** – Planning transportation networks within the municipality and connections to neighboring areas.
- **Municipal Services and Facilities** – providing essential services and facilities to support the community.

How to Use This Plan

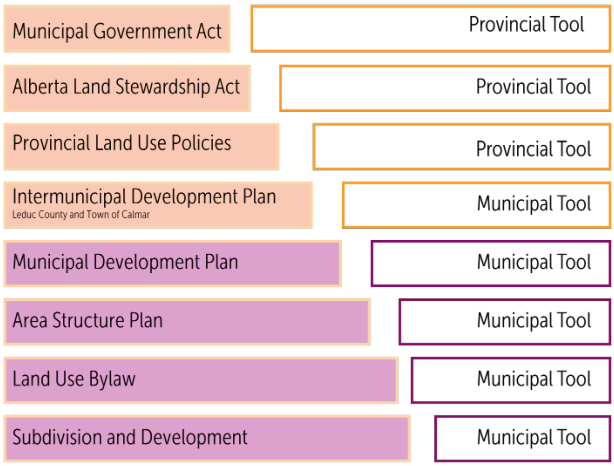
Town Council	This plan can guide the council's land-use and development decisions, serving as a foundation for reviewing Area Structure Plans and other community and/or master plans.
Residents	The plan outlines Calmar's long-term vision, helping residents and businesses understand how the town is expected to develop.
Developers and Investors	This plan outlines the town's expectations for development and growth, including key goals and the approval process for new projects.
Administration	Staff should utilize the plan to inform the development of programs, projects, and strategies.

Why is the MDP being Updated?

Calmar is growing and evolving, and the community plan must reflect our current position and our desired future direction. The MDP update is being informed through a transparent and inclusive process that involves community education and consultations. This ensures that the needs of the community are shared.

This update helps:

- **Prepare for Growth**: As more people and businesses call Calmar home, we need a strategic plan to guide growth.
- **Support the Community**: The updated plan will reflect the residents' needs and ideas, ensuring that Calmar remains a great place to live, work, and play.
- **Enhance Services and Infrastructure**: Planning enables informed decisions about roads, parks, utilities, and other essential services.
- **Protect What Matters**: Focus on the small-town charm and what is important to the community, celebrate history and the natural environment, and work towards building a strong, resilient future.
- **Align with Changing Times**: Updating the MDP enables us to respond to new challenges, opportunities, and trends, including sustainability, housing, recreation, and transportation.



Policy Context and Planning Hierarchy

The MDP is Calmar's highest-level planning document, providing a long-term vision for the community's growth and development. It is developed within Alberta's MGA framework, which requires municipalities to adopt an MDP to guide land use, infrastructure, and community development decisions. The MDP is supported by and aligned with several other provincial and municipal planning documents, creating a hierarchy that ensures consistency and coordination across all levels of planning

How to Read the Plan

This document is structured around a planning framework consisting of **Goals**, **Policies**, and **Policy Actions**. Together, these elements guide Calmar's long-term growth and development.

GOALS

Goals establish the overall framework and direction for the Town's future. They provide a foundation for more detailed policies.

"What are we striving to achieve?"

POLICY

Policies express the Town's long-term goals and strategic intentions. They form the foundation of the framework.

"What will we do to reach our goals?"

POLICY ACTION

Policy Actions identify the specific steps required to carry out each policy. They provide clear direction.

"How will the policies be put into practice?"

Why This Approach

Using a Policy and Policy Action framework ensures that the plan is both strategic and actionable:

- **Clarity and Consistency** – Policies provide the framework for providing consistent guidance for implementation.
- **Flexibility with Accountability** – Policies allow for adaptability over time, while directions hold the municipality accountable for achieving specific outcomes.
- **Guidance for Stakeholders** – Stakeholders understand the town's priorities and what is expected of them.
- **Improved Decision-Making** – The town can assess proposals and projects against established policies, ensuring consistent outcomes through clear direction and guidance.

This structure ensures that the plan remains focused on long-term goals while providing practical steps to achieve them.

Planning Process

Community Context

Population Data Disclaimer

All population figures and demographic information referenced in this document are based on the 2021 Census of Population conducted by Statistics Canada. Any projections or interpretations should be understood in the context of this data.

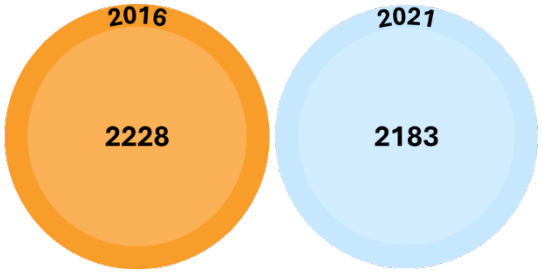
Location

The Town of Calmar is strategically located at the intersection of Highway 39 and Highway 795. Spanning 404.9 hectares, Calmar is just 10 minutes west of Leduc and Edmonton International Airport and less than 15 minutes southwest of Edmonton's newly annexed area. The town offers convenient access to major transportation routes while maintaining the charm of a small town. Situated in the heart of Alberta's agricultural and oilfield industries, Calmar benefits from its proximity to key economic centers while surrounded by the region's natural beauty. Additionally, the town is a short drive from popular recreational destinations, such as Wizard Lake and Pigeon Lake, making it an ideal location for business opportunities and outdoor adventures. The town primarily consists of residential development, supported by recreational, institutional, commercial, and industrial areas.

Population Overview

Based on the 2021 Census and subsequent estimates, Calmar has experienced minor fluctuations in population over the past several years.

Population Change (2016-2021): -2.0% decline

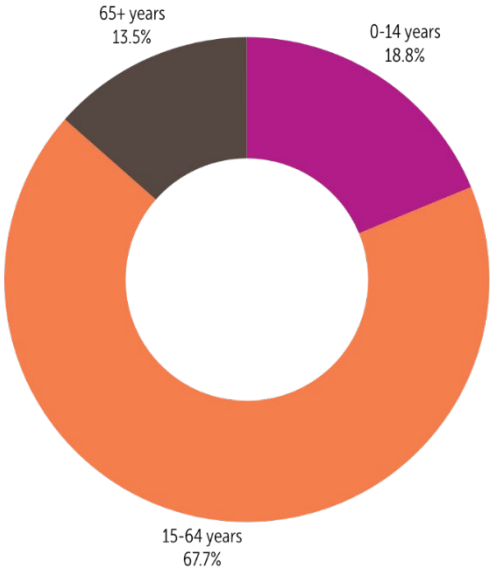


Population Projections

Projected at an annual growth rate of 1.6% (based on the average growth rate in the Edmonton Metro Region), Calmar's population is expected to rise from 2,183 in 2021 to about 2,927 by 2040. This steady increase highlights the need for proactive planning to expand housing, infrastructure, and community services. The town's location near the Edmonton Metro Region positions it well to attract new residents seeking more affordable, small community living.

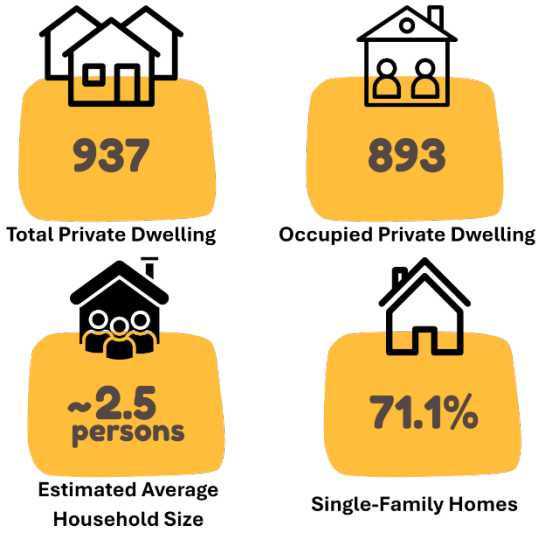
Age Distribution

A significant proportion of children, a substantial working-age population, and a moderate but growing senior cohort characterize Calmar's population. With a median age of 36.8 years, Calmar maintains a balanced age distribution and a strong representation of young families. There is a robust working-age population which supports the local economy and service base. The gradual increase in the senior population signals future needs for aging-in-place services.



2021 Census Housing Profile (Calmar)

The housing market remains primarily focused on single-family homes, though demand for rental properties and a wider range of housing options is increasing. There is growing interest in providing housing that strikes a balance between affordability and quality of life for seniors, retirees, and young families.



Land-Based Density

Land Area	**4.67 km^2**
Population Density	467.6 persons/km^2

Calmar's relatively small land area requires strategic land use management to accommodate growth while maintaining community character.

Calmar is a growing, family-oriented community that blends small-town charm with economic opportunity. With steady population growth, thriving industries in retail, oil and gas, manufacturing, healthcare, and trades, expanding housing options, and ongoing infrastructure investment, the town is well-positioned for sustainable development. Its strategic location, strong community amenities, and commitment to diversifying housing, enhancing youth spaces, and investing in services ensure Calmar remains an attractive and resilient place to live, work, and invest.

Vision

Vision: Calmar is a welcoming community and regional leader, the ideal place to call home and grow your business.

Mission: Calmar is where rural meets urban. We nurture a small-town lifestyle with big possibilities: innovative community programming, abundant recreational opportunities and a rich regional history.

Goals

Based on demographic and housing trends, community needs, and infrastructure, the following goals and considerations are to be pursued:

Growth Management

- Plan for moderate and steady population growth, aligning with regional trends and opportunities as well as infrastructure capacity.
- Review development and redevelopment opportunities with the servicing master plans to ensure a sufficient supply of developable land.

- Establish functional land use transition to minimize nuisances and/or incompatibilities.

Housing Diversity

- Encourage development of a range of housing types (e.g. duplexes, townhomes, apartments, suites, seniors' housing) to support diverse household needs.
- Promote affordable and rental housing options to address gaps in the current housing stock.

Infrastructure and Servicing

- Ensure infrastructure capacity is assessed and upgraded as necessary to accommodate projected growth.
- Coordinate long-term servicing strategies with projected population and employment forecasts.

Community Services

- Plan for expanded recreational, educational, and cultural facilities to support residents of all ages and needs.
- Prepare for increased demand for seniors' services, accessible housing, and aging-in-place initiatives.

Economic Development

- Support local business development and employment opportunities to reduce out-commuting.
- Explore opportunities for light industrial and commercial development that complement residential growth.
- Pursue investment attractions to increase the town’s financial sustainability and employment opportunities.

Environmental Stewardship

- Balance development with environmental protection and green space preservation.
- Promote sustainable development practices that support long-term community resilience.

Planning Policies

General Policies

Purpose:
Establish consistent guidance for all land use and development to support sustainable and orderly growth, aligning future development with the Town of Calmar's long-term vision.

	Policy	Policy Action
	Ensure that planning and development decisions comply with provincial legislation and municipal objectives to promote sustainable and efficient land use.	Align planning documents and amendments with: - Provincial Land Use Framework - Alberta Land Stewardship Act - Leduc County/Town of Calmar Intermunicipal Development Plan (IDP) Require Area Structure Plans (ASPs) for: - Urban expansion - Unplanned areas to assess feasibility, servicing, and contamination. Mandate technical studies for statutory plans under the Municipal Government Act (MGA), including: - Biophysical Assessment - Environmental Site Assessment - Geotechnical Assessment - Public Engagement Brief - Servicing Design Brief - Traffic Impact Assessment Ensure statutory plans align with IDP, Municipal Development Plan (MDP), and Servicing Master Plans. Use development agreements and/or development permits to outline infrastructure standards, financial obligations, and construction responsibilities. Prioritize infill within existing serviced areas over expansion into new growth areas that require significant infrastructure investments. Development into new areas shall be done in contiguous patterns. Implement MDP policies through the Land Use Bylaw (LUB).

Municipal Servicing and Infrastructure and Servicing

Purpose

Support sustainable, cost-effective municipal infrastructure to meet present and future needs. *Ensure that all development is supported by reliable, efficient, and sustainable municipal water, wastewater, and stormwater infrastructure that aligns with Town standards, master plans, and long-term growth objectives*.

	Policy	Policy Action
	Ensure infrastructure and servicing capacity support projected growth while distributing costs fairly.	Expand and maintain water, wastewater, and transportation systems and their capacity in line with growth needs and projections. Require developers to finance: - Service connections and the cost of the infrastructure to support their development - Oversizing costs Monitor and report on the Off-site Levy annually. Update the Off-Site Levy Bylaw when needed for equitable cost sharing. Implement stormwater management solutions utilizing naturalized ponds and pipe systems as outlined in the Stormwater Master Plan. Assign stormwater infrastructure costs to developers, with cost recovery options for future developments. Upgrade drainage in older neighborhoods by incorporating Low Impact Development (LID) methods (e.g., rain gardens, bioswales, permeable surfaces), were feasible. Update the Servicing Master Plans (water, sanitary, and storm) and the Transportation Master Plan as needed.
	Ensure infrastructure complies with Town standards, maintains proper access, mandates municipal service connections, and permits alternatives only if safe and sustainable.	Require all infrastructure servicing proposals (water, sanitary, and stormwater) to comply with the Town's Water, Sanitary, and Stormwater Master Plans, and Design and Construction Standards. All new developments must adhere to minimum right-of-way widths for municipal servicing corridors. Implement a minimum 3-meter width and 3 – meter setback for utility easements to ensure access for maintenance and future upgrades. Require all new developments to connect to municipal water and sewer services unless an approved ASP outlines compliant alternatives. Any alternative servicing must meet municipal and provincial standards for safety and sustainability.

	Require capacity assessments and regular reviews to ensure sustainable water and wastewater services, allowing alternative systems only if safe and compliant.	Require developers to submit hydraulic capacity assessments that demonstrate the proposed developments will not exceed system limits. Conduct regular infrastructure capacity reviews to inform long-term planning and investment decisions in the system. Require servicing capacity assessments for large-scale developments and future neighbourhoods. Ensure water and wastewater expansion aligns with long-term municipal infrastructure goals. Alternative wastewater systems may only be considered if they meet Alberta's environmental regulations and offer a safe and sustainable solution. Collaborate with regional partners and utility providers to facilitate efficient service delivery within and across municipal boundaries.
	Prioritize infrastructure upgrades and expansions that are financially sustainable, minimize ecological impact, align with long-term growth strategies, and capitalize on available funding opportunities.	Evaluate infrastructure proposals using: - Life-cycle cost analysis - Environmental sustainability criteria - Alignment with approved ASPs and MDP goals Encourage low-impact development (LID) practices for stormwater management, such as rain gardens, bioswales, retention ponds, and permeable surfaces. Establish regular monitoring for water and wastewater infrastructure performance and flow detection. Focus water infrastructure investment on Downtown, Established, and Planned Neighbourhoods to support infill and redevelopment. Ensure water service extensions are phased and contiguous to optimize cost-effectiveness and minimize disruptions. Seek infrastructure funding from external sources (federal, provincial and private) and develop partnerships for cost-sharing and long-term resilience.
	Require developers to fund necessary infrastructure, extend services for continuity, and protect key wetlands for flood mitigation and ecological value.	Require developers to fund on-site and off-site municipal infrastructure using: - Off-site levies - Bylaws - Development agreements and permits. Require developers to extend utilities and roads' rights-of-way to ensure logical service continuity.

		Require developments to identify and protect key wetlands for flood mitigation and ecological benefits.

Environmental Protection and Sustainability Policies

Purpose:

Protect and enhance natural systems while ensuring compliance with environmental regulations.

	Policy	**Policy Action**
	Preserve natural areas and ensure development complies with federal and provincial environmental standards and regulations.	Comply with all relevant environmental legislations governing air quality, water quality, floodplains, and hazards. Require Phase I Environmental Site Assessments for ASPs, as well as LUB amendments and subdivisions if the parcel of land being targeted is not within an ASP area. Ensure environmental studies are: - Less than one year old at submission, or - Updated with letters and/or reports if between one and four years old. Environmental studies that are older than four years shall be redone. Dedicate Environmental Reserve (ER) lands or Environmental Reserve Easements (EREs) during subdivision. Engage the Province early regarding Crown water body interests. Contemplate designating Conservation Reserves (CR) or Conservation Easements (CE) for environmentally significant lands that do not qualify as ER, with MGA-compliant compensation.

Parks, Open Spaces, and Recreational Lands Policies

Purpose:

Develop an interconnected network of parks and open spaces to enhance accessibility, recreation opportunities, quality of life, and ecological connectivity.

	Ensure public access to quality parks and open spaces.	• Require 10% of developable land as Municipal Reserve (MR) through:
		  ○ Land for parks, schools, or recreation
		  ○ Cash-in-lieu contributions (at market value)
		  ○ Deferred dedication for future site assembly
		• Ensure MR lands:
		  ○ Are comparable in quality to developable land

		○ Avoid areas with greater than 15% grade or with flood susceptibility • Connect MR dedications to ER, Crown lands, and other MR parcels to form continuous recreational corridors. • Provide trails and access points around stormwater facilities, with trail corridors located above high-water marks and eligible for MR dedication. • Retain Town ownership of MR sites until required for school construction. • Require Council review before disposing of any MR land, taking into account surrounding uses and community recreation needs.

Planning and Economic Development Coordination Policies

Purpose:

Support proactive land use planning and promote economic vitality through coordinated municipal strategies.

	Foster economic development and orderly growth through updated planning frameworks and infrastructure alignment.	• Update the Water, Wastewater, and Stormwater Master Plans to reflect growth forecasts and support the desired land uses. • Maintain the current LUB. • Develop and implement: ○ Economic Development Framework ○ Wayfinding Strategy ○ Servicing Master Plans to support growth • Apply a phased development approach that prioritizes infill and contiguous development before outward expansion. • Support economic growth through streamlined development approvals, effective infrastructure coordination, and regulatory processes.

Economic Development

Support Local Economy and Business

To foster a resilient and diverse local economy by supporting existing businesses, encouraging entrepreneurship, enhancing the vitality of downtown and commercial areas, and strengthening partnerships that create employment opportunities and attract investment to Calmar.

	Policy	**Policy Action**
	Promote the downtown area by supporting a vibrant mix of residential, cultural, and commercial uses.	Encourage mixed-use developments that integrate housing with commercial and cultural spaces. Explore sponsorship incentives for façade improvements and the adaptive reuse of underutilized buildings. Establish and enforce property maintenance standards for vacant lots and buildings to ensure their upkeep and preservation. Encourage artists, craftspeople, and small businesses to establish themselves in the downtown area.
	Promote well-designed, accessible commercial areas that prioritize pedestrian comfort and integrate active transportation infrastructure.	Encourage shared off-street parking to improve accessibility and reduce congestion. Require site designs that include sidewalks, trails, and other active transportation amenities. Explore street-oriented development with rear-lot parking. Promote the inclusion of landscaped public spaces and design elements that soften the appearance of large parking areas.
	Support economic growth through strategic partnerships with regional stakeholders to attract businesses, strengthen workforce development, and expand local employment opportunities.	Collaborate with nearby municipalities, Leduc Nisku Wetaskiwin Regional Chambers of Commerce, and industry partners to identify and pursue regional economic opportunities. Explore initiatives that help attract and retain skilled labor in Calmar.
	Promote home-based businesses and low- to medium-impact mixed-use	Permit a range of home occupations that do not negatively impact surrounding properties. Establish clear guidelines for signage, parking, and customer traffic.

	developments as means of fostering entrepreneurship and local employment, while ensuring compatibility with residential neighborhoods.	Assist transitions from successful home businesses to commercial storefronts over time. Enable mixed-use development that does not negatively impact surrounding properties, along arterial or collector roads in residential districts.

Commercial and Industrial Development

To support a diverse, resilient, and strategically located commercial and industrial sector that contributes to Calmar's economic growth, creates local employment opportunities, and enhances the Town's regional competitiveness while ensuring compatibility with surrounding land uses and infrastructure.

	Policy	**Policy Action**
	Ensure commercial and industrial developments are strategically located and minimize conflicts with residential areas.	Require commercial developments adjacent to residential areas to reduce noise and traffic impacts by: - Increasing setbacks and/or landscaped buffers. - Providing fencing and screening along property boundaries. - Strategically positioning loading areas, storage, parking, signage, and waste collection away from residential properties. Promote economic development strategies that expand employment opportunities and enhance Calmar's regional competitiveness.
	Support and promote economic development opportunities that capitalize on Calmar's strategic location along Highway 39 and Highway 795	Encourage the establishment of commercial development along Highway 39 and Highway 795. Ensure that new highway commercial developments are located outside of the downtown core. Require all proposed developments along provincial highways to obtain necessary access approvals from Alberta Transportation and Economic Corridors. Promote site planning and design that facilitates safe and efficient freight movement while minimizing impacts on adjacent land uses.
	Support the strategic development and expansion of designated business parks and light industrial areas.	Encourage business and light industrial development in the Highway 39 Industrial Park and South Industrial Park. Ensure these areas have direct and efficient access to truck routes and Highway 39 to support transportation needs and minimize the impact of industrial traffic. Require new industrial subdivisions to be designed with appropriate infrastructure to accommodate heavy vehicle movement.

		Request a risk assessment (at the developer's expense) for any industrial proposal that may pose safety hazards or environmental risks. Promote development incentives for businesses in designated industrial areas.

Strategic Economic Growth

This section aims to support long-term economic development that aligns with Calmar's character and enhances local employment opportunities. Its purpose is to guide land use and infrastructure decisions that attract investment, diversify the local economy, and strengthen Calmar's role as a regional service center.

	Policy	**Policy Action**
	Capitalize on transportation corridors, including Highway 39 and the railroad, to attract logistics and industrial activities.	Collaborate with Alberta Transportation and Economic Corridors, as well as regional partners, to enhance access, safety, and transportation infrastructure.
	Support economic development initiatives that expand employment opportunities and promote economic growth.	Encourage investment in high-value industries, business parks, and regional economic hubs. Promote regional collaborations that enhance connectivity and business expansion.

Environment and Environmental Stewardship

Environmental Education and Community Engagement

Building a resilient and sustainable community requires a shared understanding and active participation. Environmental education and engagement empower residents, schools, and businesses to adopt practices that protect natural resources and support the Town's environmental goals.

	Foster a culture of environmental stewardship and awareness by engaging residents, institutions, and businesses in sustainable practices.	Develop public education programs on stormwater and solid waste management, as well as water conservation. Collaborate with schools and community groups to promote sustainability and environmental stewardship. Implement interactive learning opportunities tied to municipal infrastructure and environmental goals.

Environmental Protection and Conservation

Protecting Calmar's natural systems is essential to maintaining ecological health, community well-being, and resilience to climate impacts. These policies guide development and conservation practices to safeguard wetlands, creeks, and remnant forests while supporting responsible growth and environmental stewardship.

	Protect and enhance Calmar's natural ecosystems, including wetlands, creeks, and remnant forests, through informed planning, development regulations, and ecological conservation practices.	Protect Conjuring Creek and adjacent wetlands by designating them as ER during subdivision. Identify natural ecosystems including wetlands, creeks and remnant forests. Maintain a minimum 6-meter vegetated buffer along water bodies, with greater setbacks as needed based on biophysical assessments. Require geotechnical and wetland studies for developments near sensitive environmental features to ensure appropriate setbacks and risk mitigation. Attempt to preserve and integrate remnant forests into open space networks. Require a delineation and professional assessment of any development that impacts wetlands or forested areas. Ensure compliance with the Provincial Water Act for projects that involve disturbances to wetlands.

Urban Forest and Habitat

Urban forests and natural habitats play a vital role in enhancing biodiversity, improving air quality, and enriching community life. These policies promote proactive stewardship through tree planting, habitat conservation, and thoughtful integration of forested areas into parks and green spaces.

	Promote healthy urban forest ecosystems and biodiversity through tree planting, habitat protection, and implementation of forestry policies.	Develop and implement the Urban Forestry Policy. Encourage an annual and a memorial tree-planting program to increase tree cover and community engagement. Conduct studies to protect and maintain remnant forests. Integrate treed areas into green space and parks planning.

Environmental Compliance

Ensuring environmental compliance and responsible land stewardship is critical to protecting public health, ecological systems, and long-term community sustainability. These policies establish clear expectations for development, risk management, and remediation while aligning local practices with evolving provincial and federal regulations.

	Ensure all development and land use activities support environmental protection, comply with applicable regulations, and proactively address contamination, hazards, and ecological health risks. Regularly update local policies and	Require development applications to demonstrate compliance with federal and provincial environmental regulations, including air and water quality standards, floodplain management, and hazard mitigation measures. Mandate the submission of environmental reports or assessments from qualified professionals.

	procedures to reflect changes in provincial and federal environmental standards.	
	Ensure all development and land use activities support environmental protection and comply with applicable regulations.	Implement risk management, monitoring, and remediation strategies for contaminated sites on public lands to ensure environmental protection and compliance with regulations. Promote the reclamation, remediation, and redevelopment of contaminated and brownfield sites to protect public health and the environment. Collaborate with provincial agencies, institutions, and environmental organizations to identify, assess, clean up, and reclaim contaminated lands.

Climate Adaptation and Resilience

Preparing for climate change and environmental hazards is essential to safeguard community health, infrastructure, and natural systems. These policies integrate adaptation strategies, risk reduction measures, and public education to strengthen Calmar's resilience to a changing climate.

	Policy	**Policy Action**
	Integrate climate adaptation and hazard mitigation measures into community planning and infrastructure to improve resilience to environmental change.	Conduct climate risk assessments and identify vulnerable areas. Advocate for green infrastructure, such as bioswales, permeable paving, and tree canopies. Develop public programs for climate education and emergency preparedness. Invest in resilient infrastructure and explore external funding opportunities to support initiatives. Ensure development in flood-prone areas meets setback and geotechnical study requirements.

Complete Communities

Mobility, Connectivity, and Public Spaces

Develop a connected and inclusive multimodal transportation system and network of parks and trails that support active transportation, enhance public spaces, and meet the community's recreational and mobility needs.

	Policy	**Policy Action**
	Ensure a well-connected, accessible, and sustainable network of parks and trails that meets community needs and enhances public spaces.	Prepare a **Transportation Master Plan** to establish a hierarchy of travel modes and infrastructure priorities. Integrate **Complete Streets** principles into the design of roads, sidewalks, and trails to support walking, cycling, and public transit. Encourage **bicycle parking** in all non-residential and multi-family residential developments. Require **multi-use pathways and/or sidewalks** in new developments to support active transportation.
	Require new Area Structure Plans to incorporate accessible, safe trail networks that connect key destinations and integrate with existing Reserve lands.	Require new Area Structure Plans (ASPs) to include trail networks that connect key destinations (e.g., Downtown, Conjuring Creek, regional recreation areas). Ensure trail designs include rest areas, safety features, and accessibility standards. Require new developments to integrate trail connections with existing MR and ER lands.
	Plan and provide accessible parks, trails, and recreational facilities through needs assessments, as well as neighborhood-scale green spaces that enhance livability and	Conduct a Needs Assessment to identify required parks, trails, and recreational facilities. Encourage the development of accessible parks and open spaces as key components of neighbourhood design. Promote neighbourhood-scale green spaces and public gathering areas to improve livability and encourage active lifestyles.

	support active lifestyles.	
	Collaborate regionally to enhance trail connectivity and pursue external funding for trails, parks, and transportation infrastructure development.	Collaborate with regional partners to **expand trail connectivity** across municipal boundaries. Seek **external funding** to support the development of trails, parks, and transportation infrastructure.

Urban Agriculture and Community Food Security

To enhance local food resilience and community well-being by supporting urban agriculture, promoting access to fresh, locally grown food, and integrating food-growing opportunities into public and private spaces.

	Policy	Policy Action
	Support urban agriculture initiatives to enhance local food production, sustainability, and community engagement.	Assist the development of community gardens and urban agriculture pilot projects by identifying and securing suitable land for local food-growing initiatives. Explore the integration of urban agriculture in schools and senior housing to foster intergenerational learning. Promote food security and edible landscapes in public spaces by amending municipal standards to support local food-growing capacity.

Placemaking, Identity, and Community Building

Celebrate Calmar's unique identity and foster a strong sense of place through public art, heritage conservation, beautification, and inclusive community engagement.

	Policy	**Policy Action**
	Preserve and celebrate Calmar's heritage and cultural identity by protecting historic sites, guiding sensitive redevelopment, supporting public art and beautification, and	Identify, protect, and conserve heritage sites and structures to preserve Calmar's historical assets. Consider redevelopment guidelines or other mechanisms in Downtown and heritage areas that maintain architectural character and cultural significance. Support public art installations, streetscape beautification, and landscaping that celebrate Calmar's cultural identity.

	fostering community engagement through dedicated programs and funding.	Explore and secure dedicated funding streams for public art and heritage conservation initiatives. Promote community participation in cultural programs such to foster local pride and engagement.
	Enhance streets, sidewalks, and trails in heritage and civic areas to improve walkability, connectivity, and public realm beautification.	Consider designs for sidewalks and trails that are safe, accessible, and comfortable for all users, including seniors and people with disabilities. Incorporate street furniture, lighting, and landscaping that reflect and enhance the character of heritage and civic areas. Prioritize pedestrian and cycling connectivity between key destinations such as parks, schools, and community amenities. Endorse the use of wayfinding signage to improve navigation and highlight historical or cultural features. Encourage traffic calming measures to enhance safety and encourage slower vehicle speeds in pedestrian-priority zones. Regularly maintain and upgrade existing pathways to ensure quality and accessibility.
	Foster an engaged, inclusive community by supporting diverse public participation, partnering with local organizations, and encouraging citizen-led events that strengthen social connection and promote active living.	Develop a public engagement strategy that ensures representation from a diverse cross-section of the community. Support citizen-led events (e.g., festivals, block parties, local markets) that build social cohesion. Partner with local organizations to promote active living, arts, and social inclusion initiatives.

Housing Diversity and Neighborhood Vitality

Support a diverse range of housing options and neighborhood types that promote affordability, efficient land use, revitalization, and long-term sustainability across all areas of Calmar.

	Policy	**Policy Action**

	Promote a variety of housing choices that support affordability, accessibility, and community diversity.	Encourage partnerships with non-profits, developers, and government agencies to expand affordable housing options. Utilize tools such as density bonusing and reduced parking requirements to facilitate the development of affordable housing. Integrate affordable housing within both new and existing neighborhoods, ensuring access to transportation, services, and amenities.
	Ensure new neighbourhoods achieve appropriate residential densities to support efficient land use, infrastructure investment, and a diverse housing supply.	Establish density categories to guide ASP preparation: • Low Density (25 and under du/nrha) – Single-detached, semi-detached, duplex • Medium Density (26-65 du/nrha) – triplex, fourplex, row housing, and apartments up to 3 storeys • High Density (66 and above du/nrha) – 3 or more storeys apartment building, special housing (i.e. senior housing) Direct medium- and high-density housing near arterial and collector roads and connected to the active transportation network. Orient multi-unit housing toward public streets to support pedestrian activity and enhance the streetscape. Regularly review and update the LUB to ensure alignment with density and housing diversity goals.
	Support the revitalization of Downtown and mature neighbourhoods through well-designed infill and mixed-use development.	Support infill and mixed-use redevelopment in Downtown and mature neighborhoods along collector or arterial roads. Support and investigate incentives for redevelopment projects aligned with community revitalization goals. Encourage densification to optimize existing infrastructure and maximize resource utilization. Ensure that new infill development is compatible with the existing neighborhood character and incorporates energy-efficient, contemporary design. Promote the reuse of structurally sound buildings to conserve resources and preserve their heritage value.

Downtown Redevelopment and Infrastructure

Revitalizing Downtown is key to strengthening Calmar's role as a vibrant commercial, cultural, and residential center. These policies guide redevelopment, infrastructure investment, and public realm improvements to create a dynamic, pedestrian-friendly core that supports sustainable growth.

	Policy	Policy Action
	Enhance Downtown as Calmar's commercial, cultural, and residential hub while supporting sustainable infrastructure development.	Encourage pedestrian-friendly streetscapes, public gathering spaces, and high-quality architectural design. Maintain an off-site levy program to fund infrastructure improvements and explore other funding mechanisms. Implement strategic parking management, including money-in-lieu programs for future parking development.

Emergency Services and Community Safety

Reliable emergency services and proactive safety measures are essential to protect residents and enhance community well-being. These policies focus on strategic partnerships, safe design practices, and public education to support a secure and resilient Calmar.

	Policy	Policy Action
	Ensure high-quality emergency services and public safety through strategic planning and collaboration.	Strengthen regional agreements for police, fire, rescue, and medical services. Apply Crime Prevention Through Environmental Design (CPTED) principles in civic facility planning. Promote public education on emergency preparedness and community safety initiatives.

Inclusive and Sustainable Neighbourhood Design

Promote the development of inclusive, sustainable, and well-integrated neighborhoods that offer diverse housing options, foster community engagement, and enhance livability while considering environmental and social impacts.

	Policy	Policy Action
	Promote inclusive, diverse neighborhoods by requiring a mix of housing types, supporting aging in	Require a mix of housing types in all future ASP containing residential areas, including single-detached, semi-detached, row housing, apartments, and suites.

	place, ensuring universal accessibility, and encouraging communal spaces that foster social connection.	Support aging in place by promoting housing, services, and amenities that cater to the needs of seniors. Promote universal accessibility in residential developments, parks, transportation systems, and public spaces. Encourage developments to incorporate communal gathering spaces in multi-unit buildings to foster interaction.
	Ensure new development is compatible with adjacent neighborhoods by integrating complementary design, appropriate scale, and setbacks.	Ensure compatibility with adjacent neighborhoods in terms of height, massing, design, and setbacks. Ensure that new developments complement existing neighborhoods, while also addressing concerns regarding privacy, parking, functionality, and environmental impacts. Address nuisances such as on-street parking congestion, visual intrusion, and noise, especially near commercial zones or highways. Use landscaping, fencing, and thoughtful design to ensure smooth transitions between developments.
	Promote sustainable, walkable neighborhoods with connected green spaces, low-carbon design, and resilient local materials.	Promote active transportation through pedestrian-oriented design, green spaces, and trail networks. Ensure new neighborhoods incorporate and connect ER and MR lands, stormwater ponds, and natural areas. Encourage neighborhood design that reduces its carbon footprint, utilizes local materials and labor, and enhances environmental resilience.

Glossary of Abbreviations and Terms

Area Redevelopment Plan (ARP): A statutory plan, adopted by bylaw, that outlines proposed redevelopment and sets forth municipal policies for a specified area.

Area Structure Plan (ASP): A statutory plan, adopted by bylaw, that provides a policy framework for the evaluation of proposals for outline plans, land use redistricting, subdivision and development of a specified area of land in the municipality.

Council: Town of Calmar Council

Development: Any excavation or stockpile and the creation of either of them; a building or an addition to it; the replacement, repair, or construction of a building; the placement of a building in, on, over, or under land; a change of use of land or a building; a change in the intensity of use of land or a building.

Development Agreement (DA): Contract between a property owner or developer and the city, often including terms not otherwise required through existing regulations.

Development Permit (DP): Document that includes approved site and building development plans illustrating land use, landscaping, built form, intensity of use, and appearance of the site and buildings, as well as conditions of development approval.

Environmental Reserve (ER): A designated area of land, often established during subdivision, that is intended to protect environmentally sensitive features or areas prone to hazards. These areas may include swamps, ravines, floodplains, or land near water bodies, such as lakes and rivers.

Environmental Site Assessments (ESA): A process used to evaluate the potential for, or the presence of, environmental contamination on a property.

Infill Development: Development or redevelopment that occurs within a previously developed area.

Infrastructure: Services and facilities for which the municipality has capital investment and maintenance responsibilities, including roadways, sidewalks, streetlights and traffic signals, solid waste management systems, water distribution systems, storm sewers, wastewater sewers, sports fields, playgrounds, arenas, and vehicles and equipment, civic buildings, parks, boulevard trees.

Intermunicipal Development Plan (IDP): A long-term strategic plan between two or more municipalities that share a boundary.

Land Use Bylaw (LUB): A legal document that regulates how land and buildings can be used and developed within a municipality.

Low Impact Development (LID): Land use planning and engineering design approach to managing stormwater runoff, which emphasizes conservation and use of on-site natural features to protect water quality through infiltrating, filtering, storing, evaporating, and detaining runoff close to its source.

Mixed Use Development (MUD): Development that includes a mixture of different but compatible land uses, such as residential, commercial, industrial, institutional, recreational, and public spaces, on the same parcel or in proximity, to increase density, reduce development footprint, and improve public accessibility to amenities.

Municipal Development Plan (MDP): A comprehensive, long-term policy document that guides the future growth and development of a municipality.

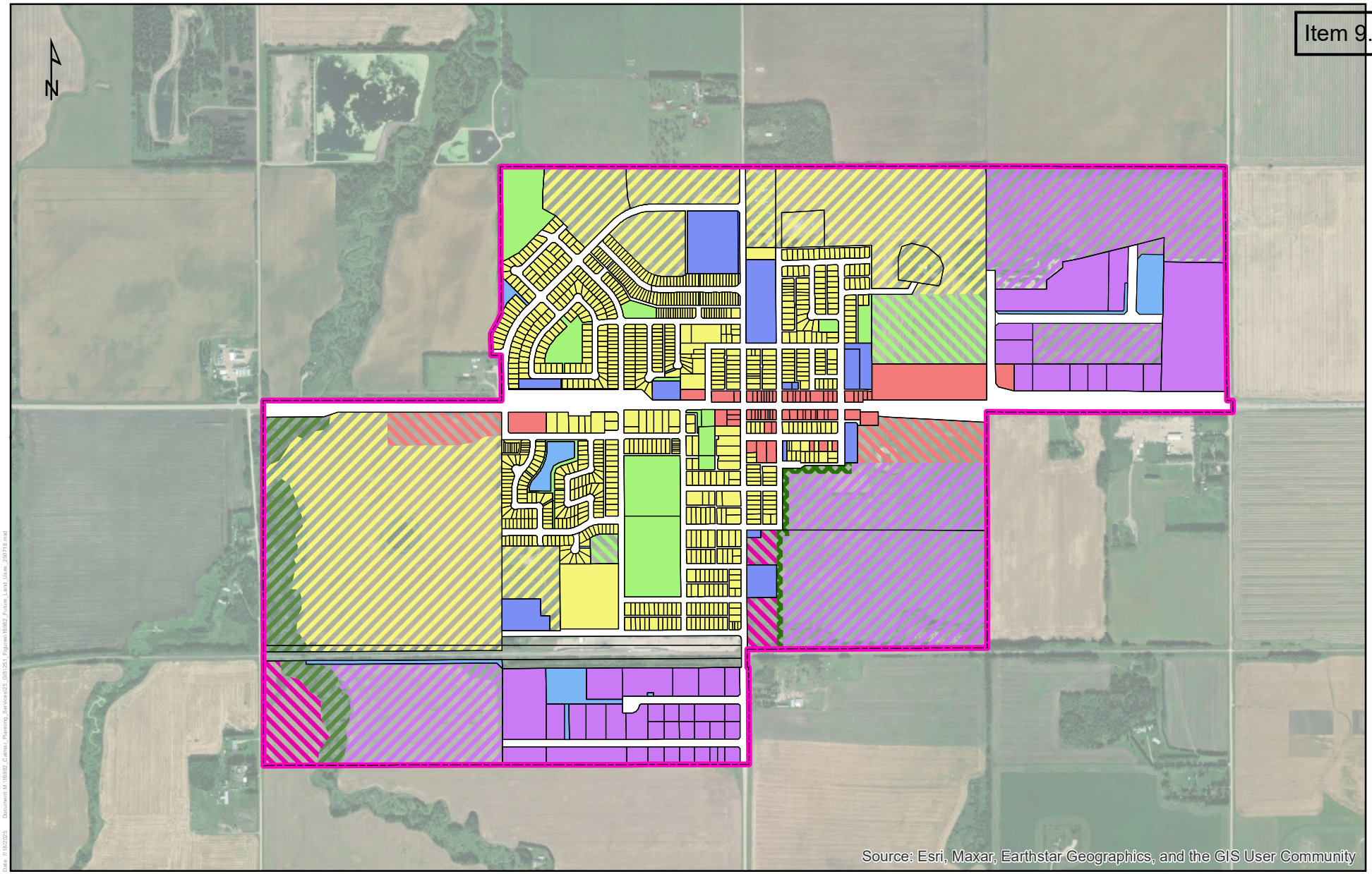
Municipal Government Act (MGA): The Municipal Government Act, Statutes of Alberta 2000 Chapter M-26, as amended from time to time.

Municipal Reserve (MR): Land that is dedicated by a developer during the subdivision process for public use, typically for parks, recreation, or school purposes, as outlined in the Municipal Government Act.

Off-Site Levy (OSL): Development levy that the council may impose by bylaw under the MGA for infrastructure required to support growth.

Statutory Plan (SP): Plans required or enabled by the Municipal Government Act that are adopted by municipal councils through public hearings, which include municipal development plans, intermunicipal development plans, area structure plans, and area redevelopment plans.

Subdivision: Creation or separation of new titled parcels of land from an existing parcel of land.



TOWN OF CALMAR

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- Town Boundary
- Residential
- Commercial
- Industrial
- Institutional
- Parks and Open Space
- Public Utility
- Circulation
- Future Residential
- Future Commercial
- Future Industrial
- Special Study Area
- Future Park
- Future Environmental
- Future Buffer

MUNICIPAL DEVELOPMENT PLAN UPDATE

POTENTIAL FUTURE LAND USES IN CALMAR

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
REVENUE					
00-General					
1-00-00-110	Residential Taxes	($2,776,700.00)	($2,772,851.89)	($3,848.11)	99.9%
1-00-00-111	Non-Residential Taxes	(759,377.00)	(766,237.16)	6,860.16	100.9%
1-00-00-112	Minimum Tax Levy	(6,200.00)	(6,278.90)	78.90	101.3%
1-00-00-115	Special Tax	0.00	0.00	0.00	0.0%
1-00-00-116	Allowance for Uncollected Tax	0.00	0.00	0.00	0.0%
1-00-00-130	Franchise Agreements	(685,000.00)	(359,511.95)	(325,488.05)	52.5%
1-00-00-510	Penalties & Costs	(90,000.00)	(108,338.27)	18,338.27	120.4%
1-00-00-515	Tax Recovery Costs	(1,600.00)	(1,600.00)	0.00	100.0%
1-00-00-550	Investment Return	(120,000.00)	(56,173.04)	(63,826.96)	46.8%
		(4,438,877.00)	**(4,070,991.21)**	**(367,885.79)**	**91.7%**
11 - Legislative					
1-11-00-590	Other General Revenue	0.00	0.00	0.00	0.0%
		0.00	**0.00**	**0.00**	**0.0%**
12 - Administration					
1-12-00-490	Administration Costs Recovered	(8,000.00)	(18,748.26)	10,748.26	234.4%
1-12-00-495	Assessment Appeals	0.00	(1,000.00)	1,000.00	0.0%
1-12-00-551	Tax Recovery Properties - Property	0.00	0.00	0.00	0.0%
1-12-00-590	Other Revenue - Administration	(500.00)	(2,282.50)	1,782.50	456.5%
1-12-00-730	Federal Government Grants	0.00	0.00	0.00	0.0%
1-12-00-840	Provincial Government Grants	(54,690.00)	0.00	(54,690.00)	0.0%
1-12-00-850	Conditional Grants - Other Governments	0.00	0.00	0.00	0.0%
1-12-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
1-12-01-540	EVCharging Revenue	(200.00)	(252.74)	52.74	126.4%
		(63,390.00)	**(22,283.50)**	**(41,106.50)**	**35.2%**
21 - Policing					
1-21-00-590	Policing - Other Revenue	0.00	0.00	0.00	0.0%
		0.00	**0.00**	**0.00**	**0.0%**
23 - Fire					
1-23-00-590	Other General Revenue - Protective	0.00	0.00	0.00	0.0%
1-23-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
		0.00	**0.00**	**0.00**	**0.0%**
24 - Disaster Services					
1-24-00-590	Other General Revenues	0.00	0.00	0.00	0.0%
1-24-00-840	Provincial Grant	0.00	0.00	0.00	0.0%
1-24-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
		0.00	**0.00**	**0.00**	**0.0%**
26 - Constabulary Services					
1-26-00-350	Contract with Other Local Governments	(44,500.00)	(15,361.87)	(29,138.13)	34.5%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
1-26-00-410	Municipal Fines	(15,000.00)	(115.73)	(14,884.27)	0.8%
1-26-00-510	Provincial Fines	(15,000.00)	(10,854.00)	(4,146.00)	72.4%
1-26-00-520	Animal License Fees	(1,000.00)	(480.00)	(520.00)	48.0%
1-26-00-521	Business License Fee	(19,500.00)	(14,975.00)	(4,525.00)	76.8%
1-26-00-522	Regional Business License	(50.00)	(100.00)	50.00	200.0%
1-26-00-590	Other General Revenue	0.00	(2,005.56)	2,005.56	0.0%
1-26-00-840	Provincial Conditional Grants	0.00	0.00	0.00	0.0%
1-26-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
1-26-01-410	Municipal Fines	(15,000.00)	(3,651.00)	(11,349.00)	24.3%
		(110,050.00)	**(47,543.16)**	**(62,506.84)**	**43.2%**
	32 - Transportation				
1-32-00-410	Costs Recovered	0.00	0.00	0.00	0.0%
1-32-00-590	Other General Revenue	(5,000.00)	(602.50)	(4,397.50)	12.1%
1-32-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
		(5,000.00)	**(602.50)**	**(4,397.50)**	**12.1%**
	41 - Water				
1-41-00-410	Sale of Water	(656,400.00)	(330,083.51)	(326,316.49)	50.3%
1-41-00-490	Water Connection Fees	(2,000.00)	(1,750.00)	(250.00)	87.5%
1-41-00-500	Sale of Bulk Water	(50,000.00)	(41,957.90)	(8,042.10)	83.9%
1-41-00-510	Penalties and Costs	(4,000.00)	(2,438.13)	(1,561.87)	61.0%
1-41-00-590	Other Revenue Water	0.00	0.00	0.00	0.0%
1-41-00-730	Federal Grants	0.00	0.00	0.00	0.0%
1-41-00-840	Provincial Conditional Grants	0.00	0.00	0.00	0.0%
1-41-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
		(712,400.00)	**(376,229.54)**	**(336,170.46)**	**52.8%**
	42 - Sanitary				
1-42-00-410	Sanitary Sewer Fees	(418,000.00)	(214,717.15)	(203,282.85)	51.4%
1-42-00-500	Water & Sewer Infrastructure	(90,000.00)	(51,772.39)	(38,227.61)	57.5%
1-42-00-590	Other General Revenue	(85,000.00)	(11,232.00)	(73,768.00)	13.2%
1-42-00-730	Federal Grants	0.00	0.00	0.00	0.0%
1-42-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
		(593,000.00)	**(277,721.54)**	**(315,278.46)**	**46.8%**
	43 - Solid Waste				
1-43-00-410	Garbage Service Fees	(190,000.00)	(98,673.60)	(91,326.40)	51.9%
1-43-00-500	Recycling Fees	(25,000.00)	(22,713.52)	(2,286.48)	90.9%
1-43-00-590	Other General Revenue	0.00	(1,618.68)	1,618.68	0.0%
1-43-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
		(215,000.00)	**(123,005.80)**	**(91,994.20)**	**57.2%**
	51 - Family & Community Support				
1-51-00-410	Fees & Programs	(500.00)	(2,920.00)	2,420.00	584.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
1-51-00-590	Other General Revenue	(600.00)	(1,152.88)	552.88	192.1%
1-51-00-840	Provincial Grant	0.00	0.00	0.00	0.0%
1-51-00-850	Regional FCSS Grant	(37,500.00)	(37,548.00)	48.00	100.1%
1-51-01-590	Christmas Elves Program Revenues	(3,500.00)	(1,472.70)	(2,027.30)	42.1%
		(42,100.00)	**(43,093.58)**	**993.58**	**102.4%**
61 - Planning					
1-61-00-400	Land Sales	0.00	0.00	0.00	0.0%
1-61-00-410	Service Fees	(6,500.00)	(3,543.81)	(2,956.19)	54.5%
1-61-00-411	Subdivision Fees	(1,000.00)	(20,925.00)	19,925.00	2092.5%
1-61-00-510	Safety Codes Council	0.00	0.00	0.00	0.0%
1-61-00-520	Development Permits	(4,200.00)	(4,125.00)	(75.00)	98.2%
1-61-00-530	Building Permits	(55,000.00)	(43,540.87)	(11,459.13)	79.2%
1-61-00-590	Other General Revenue	0.00	(1,000.00)	1,000.00	0.0%
1-61-00-730	Conditional Grants - Federal	0.00	0.00	0.00	0.0%
1-61-00-840	Conditional Grants - Provincial	0.00	0.00	0.00	0.0%
1-61-00-900	Off Site Levies	0.00	0.00	0.00	0.0%
1-61-00-920	Contributed from Reserves	0.00	0.00	0.00	0.0%
		(66,700.00)	**(73,134.68)**	**6,434.68**	**109.6%**
62 - Economic Development					
1-62-00-410	Promotional Revenue	0.00	0.00	0.00	0.0%
1-62-00-590	Other General Revenue	(1,000.00)	0.00	(1,000.00)	0.0%
1-62-00-840	Conditional Grant - Provincial	0.00	0.00	0.00	0.0%
1-62-00-920	Transfer From Reserve	(35,000.00)	0.00	(35,000.00)	0.0%
		(36,000.00)	**0.00**	**(36,000.00)**	**0.0%**
72-00 - Parks General					
1-72-00-590	Other General Revenues	(7,000.00)	(3,605.50)	(3,394.50)	51.5%
1-72-00-591	Fair Revenues - Calmar Days	0.00	0.00	0.00	0.0%
1-72-00-592	Program Center Rental	(4,000.00)	(2,460.00)	(1,540.00)	61.5%
1-72-00-850	Other Local Government Grants	(190,000.00)	0.00	(190,000.00)	0.0%
1-72-00-860	Grants from Others	(4,000.00)	(2,270.00)	(1,730.00)	56.8%
1-72-00-920	Transfer From Reserve	0.00	0.00	0.00	0.0%
		(205,000.00)	**(8,335.50)**	**(196,664.50)**	**4.1%**
72-01 - Parks Sportsgrounds					
1-72-01-410	Rental Fees	(9,000.00)	(6,935.00)	(2,065.00)	77.1%
1-72-01-411	Community Hall Rental Fees	0.00	0.00	0.00	0.0%
1-72-01-590	Other General Revenue	0.00	0.00	0.00	0.0%
1-72-01-860	Grants from Others	(10,000.00)	0.00	(10,000.00)	0.0%
		(19,000.00)	**(6,935.00)**	**(12,065.00)**	**36.5%**
72-02 - Parks Arena					
1-72-02-410	Ice Rental Fees	(180,000.00)	(103,559.76)	(76,440.24)	57.5%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
1-72-02-590	Other General Revenue	(11,000.00)	(916.66)	(10,083.34)	8.3%
1-72-02-850	Other Local Government Grants	0.00	0.00	0.00	0.0%
1-72-02-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
		(191,000.00)	**(104,476.42)**	**(86,523.58)**	**54.7%**
	72-03 - Fair Revenue				
1-72-03-591	Calmar Days	(500.00)	0.00	(500.00)	0.0%
		(500.00)	**0.00**	**(500.00)**	**0.0%**
	74 - Library				
1-74-00-410	Fines & Memberships Fees	0.00	0.00	0.00	0.0%
1-74-00-490	General Revenue	(800.00)	(120.89)	(679.11)	15.1%
1-74-00-590	Book Sales	0.00	0.00	0.00	0.0%
1-74-00-840	Provincial Library Operating Grant	(21,477.00)	0.00	(21,477.00)	0.0%
1-74-00-841	Other Grants	(9,000.00)	0.00	(9,000.00)	0.0%
1-74-00-850	Other Local Government Contributions	(85,000.00)	0.00	(85,000.00)	0.0%
1-74-00-920	Drawn from Reserves	0.00	0.00	0.00	0.0%
1-74-01-850	Other Local Government Contributions	(2,600.00)	0.00	(2,600.00)	0.0%
		(118,877.00)	**(120.89)**	**(118,756.11)**	**0.1%**
	97 - Requisitions				
1-97-00-745	Education Levy - Residential	(672,630.83)	(672,264.69)	(366.14)	99.9%
1-97-00-750	Education Levy - Non-Residential	(210,387.10)	(212,723.49)	2,336.39	101.1%
1-97-00-755	Leduc Foundation Levy	(37,321.00)	(37,353.36)	32.36	100.1%
1-97-00-757	Rural Policing Levy	0.00	0.00	0.00	0.0%
		(920,338.93)	**(922,341.54)**	**2,002.61**	**100.2%**
	TOTAL REVENUES	(7,737,232.93)	(6,076,814.86)	(1,660,418.07)	78.5%
	Check Sum (Must be zero)	**0.00**	**0.00**	**0.00**	**0.0%**
	EXPENSES				
	11 - Legislative				
2-11-00-110	Wages & Salaries	0.00	0.00	0.00	0.0%
2-11-00-115	Overtime	0.00	0.00	0.00	0.0%
2-11-00-130	Employer's Contributions	0.00	0.00	0.00	0.0%
2-11-00-136	WCB Fees	0.00	0.00	0.00	0.0%
2-11-00-148	Training & Development	7,150.00	0.00	7,150.00	0.0%
2-11-00-215	Freight & Postage	700.00	253.14	446.86	36.2%
2-11-00-217	Telephone	8,500.00	4,062.90	4,437.10	47.8%
2-11-00-220	Advertising	2,100.00	0.00	2,100.00	0.0%
2-11-00-222	Memberships & Subscriptions	12,000.00	4,659.76	7,340.24	38.8%
2-11-00-223	Special Projects	20,000.00	0.00	20,000.00	0.0%
2-11-00-224	Other Projects	14,500.00	9,590.40	4,909.60	66.1%
2-11-00-231	Audit Fees	0.00	0.00	0.00	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-11-00-250	Building Repairs & Maintenance	1,000.00	0.00	1,000.00	0.0%
2-11-00-270	Insurance	3,800.00	3,112.72	687.28	81.9%
2-11-00-510	Printing & Stationary	1,200.00	465.99	734.01	38.8%
2-11-00-511	Special Events Hosting	3,000.00	530.29	2,469.71	17.7%
2-11-00-520	Equipment, Parts Repairs &Maint	1,000.00	0.00	1,000.00	0.0%
2-11-00-540	Power	1,900.00	1,246.20	653.80	65.6%
2-11-00-541	Natural Gas	1,300.00	687.07	612.93	52.9%
2-11-00-590	Other General Expenses - Legislative	8,000.00	1,798.50	6,201.50	22.5%
2-11-01-110	Councillor Faulkner - Remuneration &	20,100.00	9,411.33	10,688.67	46.8%
2-11-01-130	Councillor Faulkner - Benefits	1,000.00	505.59	494.41	50.6%
2-11-01-140	Councillor Faulkner - Meals & Lodging	0.00	0.00	0.00	0.0%
2-11-01-148	Councillor Faulkner - Training &	3,700.00	4,690.84	(990.84)	126.8%
2-11-01-212	Councillor Faulkner - Mileage	1,000.00	172.29	827.71	17.2%
2-11-13-110	Councillor Gardner - Remuneration &	20,100.00	11,556.33	8,543.67	57.5%
2-11-13-130	Councillor Gardner - Benefits	1,000.00	675.57	324.43	67.6%
2-11-13-140	Councillor Gardner - Meals & Lodging	0.00	0.00	0.00	0.0%
2-11-13-148	Councillor Gardner - Training &	3,700.00	4,967.65	(1,267.65)	134.3%
2-11-13-212	Councillor Gardner - Mileage	1,000.00	687.23	312.77	68.7%
2-11-17-110	Mayor Carnahan - Remuneration & Fees	29,150.00	12,825.00	16,325.00	44.0%
2-11-17-130	Mayor Carnahan - Benefits	1,350.00	708.67	641.33	52.5%
2-11-17-140	Mayor Carnahan - Meals & Lodging	0.00	0.00	0.00	0.0%
2-11-17-148	Mayor Carnahan - Training &	3,700.00	84.00	3,616.00	2.3%
2-11-17-212	Mayor Carnahan - Mileage	1,000.00	0.00	1,000.00	0.0%
2-11-18-110	Councillor Benson - Remuneration &	21,300.00	7,306.33	13,993.67	34.3%
2-11-18-130	Councillor Benson - Benefits	1,000.00	535.67	464.33	53.6%
2-11-18-140	Councillor Benson - Meals & Lodging	0.00	0.00	0.00	0.0%
2-11-18-148	Councillor Benson - Training &	3,700.00	0.00	3,700.00	0.0%
2-11-18-212	Councillor Benson - Mileage	1,000.00	0.00	1,000.00	0.0%
2-11-19-110	Councillor McKeag - Remuneration &	20,100.00	8,841.33	11,258.67	44.0%
2-11-19-130	Councillor McKeag - Benefits	1,000.00	514.05	485.95	51.4%
2-11-19-140	Councillor McKeag - Meals & Lodging	0.00	0.00	0.00	0.0%
2-11-19-148	Councillor McKeag - Training &	3,700.00	1,025.45	2,674.55	27.7%
2-11-19-212	Councillor McKeag - Mileage	1,000.00	140.38	859.62	14.0%
		225,750.00	**91,054.68**	**134,695.32**	**40.3%**
	12 - Administration				
2-12-00-100	Amortization	0.00	0.00	0.00	0.0%
2-12-00-105	Accretion Expense	0.00	0.00	0.00	0.0%
2-12-00-110	Wages & Salaries	345,796.16	183,436.42	162,359.74	53.0%
2-12-00-115	Overtime	500.00	250.54	249.46	50.1%
2-12-00-130	Employer Contributions	78,617.19	38,126.45	40,490.74	48.5%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-12-00-136	Workers' Compensation Board Fees	5,460.00	2,952.22	2,507.78	54.1%
2-12-00-140	Meals & Lodging	0.00	0.00	0.00	0.0%
2-12-00-148	Training & Development	9,500.00	4,553.94	4,946.06	47.9%
2-12-00-210	Vehicle Allowance	0.00	0.00	0.00	0.0%
2-12-00-212	Mileage	1,000.00	262.94	737.06	26.3%
2-12-00-215	Freight & Postage	3,600.00	2,073.72	1,526.28	57.6%
2-12-00-217	Telephone	7,500.00	4,226.07	3,273.93	56.3%
2-12-00-220	Advertising	1,000.00	595.00	405.00	59.5%
2-12-00-222	Memberships & Subscriptions	2,500.00	1,945.71	554.29	77.8%
2-12-00-223	Recognition & Bonuses	800.00	0.00	800.00	0.0%
2-12-00-231	Auditor	24,000.00	0.00	24,000.00	0.0%
2-12-00-232	Assessment Services	24,000.00	10,257.10	13,742.90	42.7%
2-12-00-233	Legal Fees	10,000.00	4,271.86	5,728.14	42.7%
2-12-00-250	Building Repairs & Maintenance	10,500.00	1,894.85	8,605.15	18.0%
2-12-00-270	Insurance	8,000.00	7,430.36	569.64	92.9%
2-12-00-290	Entertainment & Hospitality	2,000.00	0.00	2,000.00	0.0%
2-12-00-510	Printing & Stationary	4,500.00	2,121.41	2,378.59	47.1%
2-12-00-511	Household Goods & Miscellaneous	4,000.00	1,087.16	2,912.84	27.2%
2-12-00-512	Janitor Contract	0.00	0.00	0.00	0.0%
2-12-00-513	Equipment Leases & Contracts	275,000.00	65,752.76	209,247.24	23.9%
2-12-00-516	Alarm Maintenance	550.00	300.00	250.00	54.5%
2-12-00-520	Equipment Parts, Repairs, &	5,100.00	1,813.02	3,286.98	35.5%
2-12-00-540	Power	4,850.00	3,738.66	1,111.34	77.1%
2-12-00-541	Natural Gas	5,400.00	3,893.51	1,506.49	72.1%
2-12-00-590	Other General Expenses	6,500.00	1,227.51	5,272.49	18.9%
2-12-00-761	Transfer to Reserves	530,550.00	0.00	530,550.00	0.0%
2-12-00-810	Bank Charges & Fees	9,000.00	7,501.78	1,498.22	83.4%
2-12-00-831	Debenture Principle	0.00	0.00	0.00	0.0%
2-12-00-832	Debenture Interest	0.00	0.00	0.00	0.0%
2-12-00-910	Tax Cancellations	0.00	400.00	(400.00)	0.0%
2-12-00-920	Bad Debts	0.00	0.00	0.00	0.0%
2-12-00-999	Contingency Fund	50,000.00	8,267.33	41,732.67	16.5%
2-12-01-148	All Staff Training	1,000.00	219.75	780.25	22.0%
2-12-01-540	EV Power	6,000.00	3,878.97	2,121.03	64.6%
		1,437,223.35	**362,479.04**	**1,074,744.31**	**25.2%**
	21 - Policing				
2-21-00-745	Provincial Policing Requisition	114,544.00	115,489.00	(945.00)	100.8%
		114,544.00	**115,489.00**	**(945.00)**	**100.8%**
	23 - Fire				
2-23-00-250	Building Repairs & Maintenance	0.00	0.00	0.00	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-23-00-270	Insurance	3,000.00	2,409.85	590.15	80.3%
2-23-00-514	Contracted Services & Communications	185,000.00	0.00	185,000.00	0.0%
2-23-00-540	Power	0.00	0.00	0.00	0.0%
2-23-00-541	Natural Gas	0.00	0.00	0.00	0.0%
		188,000.00	**2,409.85**	**185,590.15**	**1.3%**
24 - Disaster Services					
2-24-00-110	Wages & Salaries	50,215.30	27,406.67	22,808.63	54.6%
2-24-00-115	Disaster - Overtime Earnings	2,000.00	0.00	2,000.00	0.0%
2-24-00-130	Employer Contributions	8,536.60	5,511.83	3,024.77	64.6%
2-24-00-136	WCB Fees	780.00	421.74	358.26	54.1%
2-24-00-140	Meals & Lodging	0.00	0.00	0.00	0.0%
2-24-00-148	Training & Development	11,000.00	1,953.34	9,046.66	17.8%
2-24-00-217	Disaster Services Emergency Line	2,800.00	540.89	2,259.11	19.3%
2-24-00-231	Audit Fees	0.00	0.00	0.00	0.0%
2-24-00-250	Building Repairs & Maintenance OH&S	4,000.00	356.80	3,643.20	8.9%
2-24-00-520	Equipment Parts, Repairs & Maintenance	5,000.00	1,244.37	3,755.63	24.9%
2-24-00-522	Vehicle Parts, Repairs & Maintenance	500.00	0.00	500.00	0.0%
2-24-00-540	Power	1,100.00	625.04	474.96	56.8%
2-24-00-541	Natural Gas	1,760.00	1,057.85	702.15	60.1%
2-24-00-590	Other General Expenses	12,200.00	1,853.04	10,346.96	15.2%
2-24-00-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
2-24-00-762	Transfer to Capital Budget	0.00	0.00	0.00	0.0%
		99,891.90	**40,971.57**	**58,920.33**	**41.0%**
26 - Constabulary Services					
2-26-00-110	Wages & Salaries	186,013.70	79,230.70	106,783.00	42.6%
2-26-00-115	Overtime	2,000.00	0.00	2,000.00	0.0%
2-26-00-130	Employer Contributions	33,482.47	15,683.70	17,798.77	46.8%
2-26-00-136	WCB Fees	1,560.00	843.50	716.50	54.1%
2-26-00-140	Meals & Lodging	0.00	0.00	0.00	0.0%
2-26-00-148	Training & Development	11,000.00	3,396.61	7,603.39	30.9%
2-26-00-210	Vehicle Expense	300.00	0.00	300.00	0.0%
2-26-00-211	Vehicle Allowance	0.00	0.00	0.00	0.0%
2-26-00-215	Freight & Postage	1,200.00	557.44	642.56	46.5%
2-26-00-217	Telephone	3,000.00	2,578.63	421.37	86.0%
2-26-00-220	Advertising	500.00	0.00	500.00	0.0%
2-26-00-222	Memberships & Subscriptions	6,500.00	5,158.59	1,341.41	79.4%
2-26-00-223	Victims Services	0.00	0.00	0.00	0.0%
2-26-00-225	Citizens on Patrol	0.00	0.00	0.00	0.0%
2-26-00-231	Audit Fees	0.00	0.00	0.00	0.0%
2-26-00-233	Legal Fees	2,000.00	0.00	2,000.00	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-26-00-235	Vet & Pound Fees	5,000.00	1,485.72	3,514.28	29.7%
2-26-00-270	Insurance	4,000.00	3,213.13	786.87	80.3%
2-26-00-510	Printing & Stationary	1,200.00	448.31	751.69	37.4%
2-26-00-511	Household Goods & Miscellaneous	1,000.00	360.88	639.12	36.1%
2-26-00-513	Contracted Services	8,000.00	12,268.22	(4,268.22)	153.4%
2-26-00-520	Equipment Parts, Repairs & Maintenance	6,000.00	5,971.17	28.83	99.5%
2-26-00-521	Fuel & Oil	6,400.00	2,301.88	4,098.12	36.0%
2-26-00-522	Vehilce Parts, Repairs & Maintenance	6,000.00	1,160.22	4,839.78	19.3%
2-26-00-540	Power	1,600.00	1,884.70	(284.70)	117.8%
2-26-00-541	Natural Gas	2,700.00	1,586.79	1,113.21	58.8%
2-26-00-590	Other General Expenses	0.00	0.00	0.00	0.0%
2-26-00-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
2-26-01-240	Bylaw Enforcement	30,000.00	6,705.00	23,295.00	22.4%
		319,456.17	**144,835.19**	**174,620.98**	**45.3%**
	32 - Transportation				
2-32-00-105	Accretion Expense	0.00	0.00	0.00	0.0%
2-32-00-110	Wages & Salaries	168,065.91	74,926.19	93,139.72	44.6%
2-32-00-115	Overtime	5,200.00	1,749.86	3,450.14	33.7%
2-32-00-116	On Call	8,000.00	5,121.75	2,878.25	64.0%
2-32-00-117	Casual Labour	0.00	0.00	0.00	0.0%
2-32-00-130	Employer Contributions	26,890.55	15,541.21	11,349.34	57.8%
2-32-00-136	Workers Comensation Board Fees	1,820.00	984.07	835.93	54.1%
2-32-00-140	Meals & Lodging	0.00	0.00	0.00	0.0%
2-32-00-148	Training & Development	5,000.00	449.86	4,550.14	9.0%
2-32-00-210	Vehicle Allowance	0.00	0.00	0.00	0.0%
2-32-00-212	Mileage	500.00	0.00	500.00	0.0%
2-32-00-215	Freight & Postage	600.00	189.54	410.46	31.6%
2-32-00-217	Telephone	5,000.00	2,321.29	2,678.71	46.4%
2-32-00-220	Advertising	500.00	0.00	500.00	0.0%
2-32-00-230	Engineering Fees	22,000.00	2,697.28	19,302.72	12.3%
2-32-00-231	Audit Fees	0.00	0.00	0.00	0.0%
2-32-00-250	Building Repairs & Maintenance	18,000.00	11,158.17	6,841.83	62.0%
2-32-00-252	R/R Ditch Maintenace	0.00	0.00	0.00	0.0%
2-32-00-253	Roadway Maintenance	58,000.00	6,106.59	51,893.41	10.5%
2-32-00-254	Sidewalk Maintenance	35,000.00	31,653.45	3,346.55	90.4%
2-32-00-260	Equipment Lease & Rental	2,500.00	(233.10)	2,733.10	(9.3%)
2-32-00-270	Insurance	22,000.00	16,671.36	5,328.64	75.8%
2-32-00-510	Printing & Stationary	600.00	448.91	151.09	74.8%
2-32-00-511	Shop Supplies & Miscellaneous Supplies	15,000.00	11,590.53	3,409.47	77.3%
2-32-00-513	Contracted Services	17,500.00	15,699.12	1,800.88	89.7%

	2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-32-00-516 Alarm	100.00	0.00	100.00	0.0%
2-32-00-520 Equipment Maintenance & Repair	41,000.00	28,094.42	12,905.58	68.5%
2-32-00-521 Fuel & Oil	36,000.00	14,714.03	21,285.97	40.9%
2-32-00-522 Vehicle Parts, Repairs & Maintenance	10,000.00	7,740.98	2,259.02	77.4%
2-32-00-523 Small Tools	4,500.00	2,215.84	2,284.16	49.2%
2-32-00-524 Traffic Safety Devices	4,600.00	2,326.19	2,273.81	50.6%
2-32-00-530 Road Materials	45,000.00	32,869.65	12,130.35	73.0%
2-32-00-531 Safety Equipment	5,500.00	2,322.21	3,177.79	42.2%
2-32-00-540 Power	20,250.00	9,774.72	10,475.28	48.3%
2-32-00-541 Natural Gas	9,070.00	5,449.27	3,620.73	60.1%
2-32-00-542 Power - Street Lights	163,000.00	93,306.85	69,693.15	57.2%
2-32-00-590 Other General Expenses	5,000.00	0.00	5,000.00	0.0%
2-32-00-761 Transfer to Reserves	0.00	0.00	0.00	0.0%
2-32-00-831 Debenture Principle	176,756.00	87,739.33	89,016.67	49.6%
2-32-00-832 Debenture Interest	68,770.00	35,023.14	33,746.86	50.9%
	1,001,722.45	**518,652.71**	**483,069.74**	**51.8%**
41 - Water				
2-41-00-110 Wages & Salaries	168,065.91	74,925.12	93,140.79	44.6%
2-41-00-115 Overtime	5,000.00	1,749.84	3,250.16	35.0%
2-41-00-116 On Call	16,000.00	5,121.75	10,878.25	32.0%
2-41-00-130 Employer Contributions	26,890.55	15,539.22	11,351.33	57.8%
2-41-00-136 Workers' Compensation Board Fees	1,820.00	984.07	835.93	54.1%
2-41-00-140 Meals & Lodging	0.00	0.00	0.00	0.0%
2-41-00-148 Training & Development	7,500.00	2,971.29	4,528.71	39.6%
2-41-00-210 Vehicle Allowance	0.00	0.00	0.00	0.0%
2-41-00-212 Mileage	500.00	0.00	500.00	0.0%
2-41-00-215 Freight & Postage	800.00	253.14	546.86	31.6%
2-41-00-217 Telephone	6,100.00	3,024.37	3,075.63	49.6%
2-41-00-220 Advertising	500.00	0.00	500.00	0.0%
2-41-00-222 Memberships & Subscriptions	750.00	366.42	383.58	48.9%
2-41-00-231 Audit Fees	0.00	0.00	0.00	0.0%
2-41-00-250 Building Repairs & Maintenance	1,250.00	1,135.51	114.49	90.8%
2-41-00-253 Infrastructure Maintenance	0.00	0.00	0.00	0.0%
2-41-00-260 Equipment Lease & Rental	250.00	0.00	250.00	0.0%
2-41-00-270 Insurance	13,000.00	10,035.28	2,964.72	77.2%
2-41-00-300 Water Purchases	382,000.00	204,870.25	177,129.75	53.6%
2-41-00-510 Printing & Stationary	4,000.00	1,853.55	2,146.45	46.3%
2-41-00-511 Household Goods & Miscellaneous	2,000.00	37.56	1,962.44	1.9%
2-41-00-512 Janitor Service	0.00	0.00	0.00	0.0%
2-41-00-513 Contracted Services	5,000.00	3,596.25	1,403.75	71.9%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-41-00-516	Alarm	0.00	0.00	0.00	0.0%
2-41-00-520	Equipment Parts, Repairs & Maintenance	26,000.00	3,479.71	22,520.29	13.4%
2-41-00-521	Fuel & Oil	3,400.00	1,152.42	2,247.58	33.9%
2-41-00-522	Infrastructure Repairs	64,000.00	40,504.08	23,495.92	63.3%
2-41-00-523	Small Tools	500.00	18.95	481.05	3.8%
2-41-00-530	Water Meters	40,000.00	29,767.00	10,233.00	74.4%
2-41-00-540	Power	26,750.00	15,959.47	10,790.53	59.7%
2-41-00-541	Natural Gas	17,875.00	14,015.05	3,859.95	78.4%
2-41-00-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
2-41-00-831	Debenture Principle	32,971.00	16,362.41	16,608.59	49.6%
2-41-00-832	Debenture Interest	12,295.00	3,077.17	9,217.83	25.0%
2-41-00-920	Bad Debts	0.00	140.65	(140.65)	0.0%
		865,217.45	**450,940.53**	**414,276.92**	**52.1%**
	42 - Sanitary				
2-42-00-105	Accretion Expense	0.00	0.00	0.00	0.0%
2-42-00-110	Wages & Salaries	168,065.91	74,926.19	93,139.72	44.6%
2-42-00-115	Overtime	3,300.00	1,749.86	1,550.14	53.0%
2-42-00-116	On Call	16,000.00	5,121.75	10,878.25	32.0%
2-42-00-130	Employer Contributions	26,890.55	15,541.21	11,349.34	57.8%
2-42-00-136	Workers' Compensation Board Fees	1,820.00	984.07	835.93	54.1%
2-42-00-140	Meals & Lodging	0.00	0.00	0.00	0.0%
2-42-00-148	Training & Development	4,500.00	1,856.86	2,643.14	41.3%
2-42-00-210	Vehicle Allowance	0.00	0.00	0.00	0.0%
2-42-00-215	Freight & Postage	1,000.00	253.14	746.86	25.3%
2-42-00-217	Telephone	3,100.00	1,222.35	1,877.65	39.4%
2-42-00-230	Engineering Fees	0.00	0.00	0.00	0.0%
2-42-00-231	Audit Fees	0.00	0.00	0.00	0.0%
2-42-00-253	Infrastructure Maintenance	0.00	0.00	0.00	0.0%
2-42-00-254	Weed Control	1,500.00	0.00	1,500.00	0.0%
2-42-00-260	Equipment Lease & Rental	1,250.00	0.00	1,250.00	0.0%
2-42-00-270	Insurance	14,500.00	10,944.71	3,555.29	75.5%
2-42-00-510	Printing & Stationary	500.00	232.99	267.01	46.6%
2-42-00-511	Household Goods & Miscellaneous	650.00	0.00	650.00	0.0%
2-42-00-513	Contracted Services	18,000.00	13,562.63	4,437.37	75.3%
2-42-00-516	Alarm	0.00	0.00	0.00	0.0%
2-42-00-520	Equipment Parts, Repairs & Maintenance	15,000.00	5,485.73	9,514.27	36.6%
2-42-00-521	Fuel & Oil	2,400.00	1,074.24	1,325.76	44.8%
2-42-00-522	Vehicle Parts, Repairs & Maintenance	1,600.00	977.56	622.44	61.1%
2-42-00-523	Small Tools	500.00	661.00	(161.00)	132.2%
2-42-00-525	Water & Sewer Infrastructure	35,000.00	21,858.68	13,141.32	62.5%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-42-00-530	Chemical Supplies	13,000.00	6,616.50	6,383.50	50.9%
2-42-00-540	Power	76,000.00	34,071.68	41,928.32	44.8%
2-42-00-761	Transfer to Reserves	85,000.00	0.00	85,000.00	0.0%
2-42-00-831	Debenture Principle	53,047.00	26,237.17	26,809.83	49.5%
2-42-00-832	Debenture Interest	4,161.00	5,559.26	(1,398.26)	133.6%
2-42-00-920	Bad Debts	0.00	0.00	0.00	0.0%
		546,784.45	**228,937.58**	**317,846.87**	**41.9%**
	43 - Solid Waste				
2-43-00-110	Salaries & Wages	60,179.75	46,043.64	14,136.11	76.5%
2-43-00-115	Overtime	2,300.00	797.11	1,502.89	34.7%
2-43-00-116	On Call	0.00	2,324.75	(2,324.75)	0.0%
2-43-00-130	Employer Contributions	9,628.76	9,928.73	(299.97)	103.1%
2-43-00-136	Workers' Compensation Board Fees	1,820.00	984.10	835.90	54.1%
2-43-00-215	Freight & Postage	800.00	253.14	546.86	31.6%
2-43-00-231	Audit Fees	0.00	0.00	0.00	0.0%
2-43-00-270	Insurance	4,400.00	3,313.54	1,086.46	75.3%
2-43-00-300	Landfill Fees & Charges	22,000.00	11,788.49	10,211.51	53.6%
2-43-00-510	Printing & Stationary	500.00	232.99	267.01	46.6%
2-43-00-513	Contracted Services	29,500.00	10,600.20	18,899.80	35.9%
2-43-00-514	Garbage Service Contract	105,000.00	53,284.86	51,715.14	50.7%
2-43-00-515	Recycling Service Contract	20,000.00	11,226.96	8,773.04	56.1%
2-43-00-540	Power	1,050.00	0.00	1,050.00	0.0%
2-43-00-541	Natural Gas	5,200.00	4,126.96	1,073.04	79.4%
2-43-00-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
		262,378.51	**154,905.47**	**107,473.04**	**59.0%**
	49 - Recycling				
2-49-00-513	Recycling Contraced Services	0.00	0.00	0.00	0.0%
2-49-00-515	Recycling Service Contract	0.00	0.00	0.00	0.0%
		0.00	**0.00**	**0.00**	**0.0%**
	51 - Family & Community Services				
2-51-00-110	Wages & Salaries	24,500.00	13,108.60	11,391.40	53.5%
2-51-00-115	Overtime	500.00	26.33	473.67	5.3%
2-51-00-130	Employer Contributions	4,165.00	1,074.78	3,090.22	25.8%
2-51-00-136	Workers' Compensation Board Fees	1,040.00	562.33	477.67	54.1%
2-51-00-140	Meals & Lodging	0.00	0.00	0.00	0.0%
2-51-00-148	Training & Development	2,200.00	0.00	2,200.00	0.0%
2-51-00-210	Vehicle Allowance	0.00	0.00	0.00	0.0%
2-51-00-212	Mileage	500.00	0.00	500.00	0.0%
2-51-00-215	Freight & Postage	500.00	253.14	246.86	50.6%
2-51-00-217	Telephone	550.00	281.44	268.56	51.2%

	2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-51-00-220 Advertising	500.00	0.00	500.00	0.0%
2-51-00-221 Program Hosting Expense	12,000.00	8,612.58	3,387.42	71.8%
2-51-00-222 FCSS Municipal Cost Share Portion	14,200.00	13,551.00	649.00	95.4%
2-51-00-225 Volunteer Recognition	2,500.00	0.00	2,500.00	0.0%
2-51-00-231 Audit Fees	0.00	0.00	0.00	0.0%
2-51-00-260 Office Rental	0.00	0.00	0.00	0.0%
2-51-00-270 Insurance	0.00	0.00	0.00	0.0%
2-51-00-510 Printing & Stationary	800.00	1,179.14	(379.14)	147.4%
2-51-00-511 Household & Miscellaneous Goods	300.00	0.00	300.00	0.0%
2-51-00-520 Equipment Parts, Repairs & Maintenance	400.00	0.00	400.00	0.0%
2-51-00-540 Power	0.00	0.00	0.00	0.0%
2-51-00-541 Natural Gas	0.00	0.00	0.00	0.0%
2-51-00-590 Other General Expenses	500.00	120.00	380.00	24.0%
2-51-01-511 Christmas Elves Prog. Donation Exp.	4,000.00	0.00	4,000.00	0.0%
2-51-01-512 Christmas Elves Prog. Hosting Exp.	0.00	0.00	0.00	0.0%
	69,155.00	**38,769.34**	**30,385.66**	**56.1%**
61 - Planning & Development				
2-61-00-110 Wages & Salaries	96,089.00	61,109.26	34,979.74	63.6%
2-61-00-115 Overtime	0.00	0.00	0.00	0.0%
2-61-00-130 Employer Contributions	14,413.35	12,197.97	2,215.38	84.6%
2-61-00-136 Workers' Compensation Board Fees	1,040.00	562.32	477.68	54.1%
2-61-00-140 Meals & Lodging	0.00	0.00	0.00	0.0%
2-61-00-148 Training & Development	5,500.00	1,187.93	4,312.07	21.6%
2-61-00-150 S.D.A.B. Meeting Fees	3,000.00	0.00	3,000.00	0.0%
2-61-00-210 Vehicle Allowance	0.00	0.00	0.00	0.0%
2-61-00-215 Freight & Postage	1,500.00	591.47	908.53	39.4%
2-61-00-217 Telephone	1,200.00	278.48	921.52	23.2%
2-61-00-220 Advertising	1,100.00	0.00	1,100.00	0.0%
2-61-00-221 Title & Land Seaches	1,000.00	350.00	650.00	35.0%
2-61-00-222 Memberships & Subscriptions	2,100.00	1,533.65	566.35	73.0%
2-61-00-223 Subdivision & Development Costs	0.00	0.00	0.00	0.0%
2-61-00-230 Engineering Fees	32,000.00	6,510.78	25,489.22	20.3%
2-61-00-231 Audit Fees	0.00	0.00	0.00	0.0%
2-61-00-232 Inspection Fees	20,000.00	18,506.32	1,493.68	92.5%
2-61-00-233 Legal Fees	10,000.00	4,746.24	5,253.76	47.5%
2-61-00-234 Planning Fees	0.00	0.00	0.00	0.0%
2-61-00-510 Printing & Stationary	750.00	310.64	439.36	41.4%
2-61-00-513 Contracted Services	35,000.00	15,280.00	19,720.00	43.7%
2-61-00-515 Other Contracted Services	0.00	0.00	0.00	0.0%
2-61-00-520 Cost of Land Sold	0.00	0.00	0.00	0.0%

	2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-61-00-540 Admin Power	0.00	0.00	0.00	0.0%
2-61-00-591 Cost of Land Re-Sale	0.00	0.00	0.00	0.0%
2-61-00-761 Transfer to Reserves	0.00	0.00	0.00	0.0%
	224,692.35	**123,165.06**	**101,527.29**	**54.8%**
62 - Economic Development				
2-62-00-110 Wages & Salaries	112,538.24	66,200.08	46,338.16	58.8%
2-62-00-115 Overtime	2,550.00	0.00	2,550.00	0.0%
2-62-00-130 Employer Contributions	16,880.74	13,240.16	3,640.58	78.4%
2-62-00-136 Workers' Compensation Board Fees	2,080.00	1,124.65	955.35	54.1%
2-62-00-140 Meals & Lodging	0.00	0.00	0.00	0.0%
2-62-00-148 Training & Development	4,300.00	3,266.29	1,033.71	76.0%
2-62-00-210 Vehicle Allowance	0.00	0.00	0.00	0.0%
2-62-00-212 Mileage	1,000.00	0.00	1,000.00	0.0%
2-62-00-215 Freight & Postage	700.00	253.14	446.86	36.2%
2-62-00-217 Telephone	600.00	300.00	300.00	50.0%
2-62-00-220 Advertising	16,000.00	6,695.00	9,305.00	41.8%
2-62-00-222 Memberships & Subscriptions	4,000.00	2,892.73	1,107.27	72.3%
2-62-00-223 Promotion & Research	20,000.00	8,723.28	11,276.72	43.6%
2-62-00-231 Audit Fees	0.00	0.00	0.00	0.0%
2-62-00-510 Printing & Stationary	900.00	512.91	387.09	57.0%
2-62-00-511 Miscellaneous	600.00	17.62	582.38	2.9%
2-62-00-513 Contracted Services	0.00	0.00	0.00	0.0%
2-62-00-540 Power	0.00	0.00	0.00	0.0%
2-62-00-761 Transfer to Reserves	0.00	0.00	0.00	0.0%
2-62-00-900 Grants to Others	35,000.00	0.00	35,000.00	0.0%
	217,148.98	**103,225.86**	**113,923.12**	**47.5%**
72-00 - Parks General				
2-72-00-105 Accretion Expense	0.00	0.00	0.00	0.0%
2-72-00-110 Wages & Salaries	120,385.06	59,880.03	60,505.03	49.7%
2-72-00-112 Getaway Supervisors Contract	0.00	0.00	0.00	0.0%
2-72-00-115 Overtime	10,000.00	4,110.52	5,889.48	41.1%
2-72-00-130 Employer Contributions	18,057.76	11,990.67	6,067.09	66.4%
2-72-00-136 Workers' Compensation Board Fees	2,080.00	1,124.65	955.35	54.1%
2-72-00-140 Meals & Lodging	0.00	0.00	0.00	0.0%
2-72-00-148 Training & Development	3,750.00	68.10	3,681.90	1.8%
2-72-00-210 Vehicle Allowance	0.00	0.00	0.00	0.0%
2-72-00-212 Mileage	1,200.00	0.00	1,200.00	0.0%
2-72-00-215 Freight & Postage	800.00	253.14	546.86	31.6%
2-72-00-217 Telephone	2,700.00	1,669.61	1,030.39	61.8%
2-72-00-220 Advertising	1,500.00	0.00	1,500.00	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-72-00-221	Promotions & Hosting	13,000.00	6,303.87	6,696.13	48.5%
2-72-00-222	Memberships & Subscriptions	1,100.00	0.00	1,100.00	0.0%
2-72-00-225	Volunteer Recognition	500.00	0.00	500.00	0.0%
2-72-00-231	Audit Fees	0.00	0.00	0.00	0.0%
2-72-00-250	Facility Maintenance	4,300.00	1,043.70	3,256.30	24.3%
2-72-00-270	Insurance	4,000.00	3,035.36	964.64	75.9%
2-72-00-510	Printing & Stationary	3,200.00	1,553.25	1,646.75	48.5%
2-72-00-511	Household & Miscellaneous Supplies	1,000.00	1,410.70	(410.70)	141.1%
2-72-00-513	Contracted Services	2,000.00	1,036.00	964.00	51.8%
2-72-00-540	Power	3,300.00	2,624.26	675.74	79.5%
2-72-00-541	Natural Gas	2,500.00	1,799.29	700.71	72.0%
2-72-00-590	Communities in Bloom	42,000.00	25,399.11	16,600.89	60.5%
2-72-00-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
2-72-00-762	Transfer to Capital Budget	0.00	0.00	0.00	0.0%
2-72-00-823	Financing - Solar Panels	0.00	0.00	0.00	0.0%
		237,372.82	**123,302.26**	**114,070.56**	**51.9%**
	72-01 - Parks Sportsgrounds				
2-72-01-110	Wages & Salaries	112,537.10	72,710.68	39,826.42	64.6%
2-72-01-115	Overtime	8,500.00	4,775.84	3,724.16	56.2%
2-72-01-116	On Call	0.00	1,800.00	(1,800.00)	0.0%
2-72-01-117	Casual Labour - Parks	45,000.00	0.00	45,000.00	0.0%
2-72-01-130	Employer Contributions	28,356.68	16,190.54	12,166.14	57.1%
2-72-01-136	Workers' Compensation Board Fees	1,560.00	843.50	716.50	54.1%
2-72-01-140	Meals & Lodging	0.00	0.00	0.00	0.0%
2-72-01-148	Training & Development	5,300.00	273.59	5,026.41	5.2%
2-72-01-220	Advertising	500.00	0.00	500.00	0.0%
2-72-01-231	Audit Fees	0.00	0.00	0.00	0.0%
2-72-01-250	Facility Maintenance	51,000.00	20,175.28	30,824.72	39.6%
2-72-01-260	Equipment Lease & Rental	2,200.00	0.00	2,200.00	0.0%
2-72-01-270	Insurance	13,000.00	5,281.60	7,718.40	40.6%
2-72-01-511	Miscellaneous Supplies	10,000.00	6,003.49	3,996.51	60.0%
2-72-01-513	Contracted Services	26,500.00	17,545.45	8,954.55	66.2%
2-72-01-520	Equipment Parts, Repair & Maintenance	16,600.00	12,587.70	4,012.30	75.8%
2-72-01-521	Fuel & Oil	9,700.00	1,508.70	8,191.30	15.6%
2-72-01-522	Vehicle Parts, Repairs & Maintenance	2,900.00	2,020.16	879.84	69.7%
2-72-01-523	Small Tools	1,500.00	224.93	1,275.07	15.0%
2-72-01-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
		335,153.78	**161,941.46**	**173,212.32**	**48.3%**
	72-02 Parks Arena				
2-72-02-110	Wages & Salaries	112,537.10	81,249.59	31,287.51	72.2%

	2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-72-02-115 Overtime	8,500.00	5,561.32	2,938.68	65.4%
2-72-02-116 On Call	0.00	1,800.00	(1,800.00)	0.0%
2-72-02-117 Arena - Casual Labour	37,000.00	0.00	37,000.00	0.0%
2-72-02-130 Employer Contributions	25,421.31	16,142.75	9,278.56	63.5%
2-72-02-136 Workers' Compensation Board Fees	1,560.00	843.50	716.50	54.1%
2-72-02-140 Meals & Lodging	0.00	0.00	0.00	0.0%
2-72-02-148 Training & Development	6,000.00	3,068.31	2,931.69	51.1%
2-72-02-215 Freight & Postage	800.00	253.09	546.91	31.6%
2-72-02-217 Telephone	2,700.00	1,115.12	1,584.88	41.3%
2-72-02-222 Memberships	1,150.00	441.00	709.00	38.3%
2-72-02-231 Audit Fees	0.00	0.00	0.00	0.0%
2-72-02-250 Facility Maintenance	23,000.00	15,691.86	7,308.14	68.2%
2-72-02-270 Insurance	39,000.00	31,327.95	7,672.05	80.3%
2-72-02-510 Printing & Stationary	750.00	248.42	501.58	33.1%
2-72-02-511 Household & Miscellaneous Supplies	13,000.00	2,926.28	10,073.72	22.5%
2-72-02-513 Contracted Services	15,000.00	10,189.72	4,810.28	67.9%
2-72-02-516 Alarm	500.00	0.00	500.00	0.0%
2-72-02-520 Equipment Parts, Repair & Maintenance	30,000.00	1,799.19	28,200.81	6.0%
2-72-02-521 Fuel & Oil	1,900.00	967.91	932.09	50.9%
2-72-02-523 Small Tools	700.00	0.00	700.00	0.0%
2-72-02-540 Power	49,000.00	45,670.38	3,329.62	93.2%
2-72-02-541 Natural Gas	34,300.00	24,402.92	9,897.08	71.1%
2-72-02-590 Safety Equipment	3,000.00	0.00	3,000.00	0.0%
2-72-02-591 Donations	0.00	0.00	0.00	0.0%
2-72-02-761 Transfer to Reserves	0.00	0.00	0.00	0.0%
2-72-02-821 Debenture Interest	5,228.00	2,645.00	2,583.00	50.6%
2-72-02-822 Debenture Principle	12,547.00	5,207.97	7,339.03	41.5%
2-72-02-920 Bad Debts	0.00	0.00	0.00	0.0%
	423,593.41	**251,552.28**	**172,041.13**	**59.4%**
72-03 - 06 Fair Expenses				
2-72-03-221 Calmar Fair Days	33,000.00	4,545.52	28,454.48	13.8%
2-72-04-221 Canada Day	2,500.00	4,067.93	(1,567.93)	162.7%
2-72-05-221 Christmas in the Park	5,000.00	0.00	5,000.00	0.0%
2-72-06-221 First Night	14,000.00	0.00	14,000.00	0.0%
	54,500.00	**8,613.45**	**45,886.55**	**15.8%**
74 - Library				
2-74-00-105 Accretion Expense	0.00	0.00	0.00	0.0%
2-74-00-110 Wages & Salaries	129,220.00	57,629.56	71,590.44	44.6%
2-74-00-115 Overtime	0.00	0.00	0.00	0.0%
2-74-00-130 Employer Contributions	12,000.00	6,989.57	5,010.43	58.2%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
2-74-00-136	Workers' Compensation Board Fees	3,000.00	843.49	2,156.51	28.1%
2-74-00-140	Meals	300.00	0.00	300.00	0.0%
2-74-00-148	Training & Development	1,000.00	317.91	682.09	31.8%
2-74-00-150	Honariums	1,000.00	110.52	889.48	11.1%
2-74-00-212	Mileage	400.00	0.00	400.00	0.0%
2-74-00-215	Freight & Postage	100.00	0.00	100.00	0.0%
2-74-00-217	Telephone	2,100.00	1,089.33	1,010.67	51.9%
2-74-00-220	Advertising & Promotions	0.00	0.00	0.00	0.0%
2-74-00-222	Memberships	600.00	99.00	501.00	16.5%
2-74-00-223	Special Projects	2,000.00	646.14	1,353.86	32.3%
2-74-00-224	Subscriptions	600.00	42.71	557.29	7.1%
2-74-00-231	Audit Fees	3,500.00	0.00	3,500.00	0.0%
2-74-00-233	Legal Fees	0.00	0.00	0.00	0.0%
2-74-00-250	Building Repairs & Maintenance	100.00	0.00	100.00	0.0%
2-74-00-270	Insurance	1,680.00	1,305.33	374.67	77.7%
2-74-00-510	Printing & Stationary	1,500.00	50.66	1,449.34	3.4%
2-74-00-511	Household & Miscellaneous Supplies	400.00	522.81	(122.81)	130.7%
2-74-00-512	Janitor Contract	3,000.00	1,126.80	1,873.20	37.6%
2-74-00-520	Equipment Parts, Repair & Maintenance	500.00	446.34	53.66	89.3%
2-74-00-521	Furnishings	0.00	124.95	(124.95)	0.0%
2-74-00-523	Books & Videos	5,000.00	2,486.03	2,513.97	49.7%
2-74-00-540	Power	4,600.00	3,120.90	1,479.10	67.8%
2-74-00-541	Natural Gas	5,900.00	4,293.31	1,606.69	72.8%
2-74-00-590	Other General Expenses	0.00	0.00	0.00	0.0%
2-74-00-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
2-74-01-222	Yellowhead Membership Fees	11,000.00	5,184.63	5,815.37	47.1%
2-74-01-231	Audit Fees	0.00	0.00	0.00	0.0%
2-74-01-250	Building Repairs & Maintenance	1,000.00	260.00	740.00	26.0%
2-74-01-270	Insurance	3,200.00	2,409.85	790.15	75.3%
2-74-01-520	Equipment Repair & Maintenance	500.00	0.00	500.00	0.0%
2-74-01-590	Other General Expense	0.00	0.00	0.00	0.0%
		194,200.00	**89,099.84**	**105,100.16**	**45.9%**
	97 - Requisitions				
2-97-00-745	Education Requisitions - Residential	672,630.83	306,718.82	365,912.01	45.6%
2-97-00-750	Education Requisitions - Non-Residential	210,387.10	96,407.70	113,979.40	45.8%
2-97-00-755	Leduc Foundation Requisition	37,321.00	37,321.00	0.00	100.0%
2-97-00-757	Rural Policing Levy	0.00	0.00	0.00	0.0%
		920,338.93	**440,447.52**	**479,891.41**	**47.9%**
	TOTAL EXPENSES	**7,737,123.56**	**3,450,792.69**	**4,286,330.87**	**44.6%**
	Check Sum (Must be zero)	**0.00**	**0.00**		

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
NET (SURPLUS)/LOSS		**(109.37)**	**(2,626,022.17)**		
ASSETS					
3-00-00-110	Payroll Advance	0.00	0.00	0.00	0.0%
3-00-00-111	Prepaids	0.00	954.12	(954.12)	0.0%
3-00-00-112	Petty Cash	0.00	300.00	(300.00)	0.0%
3-00-00-113	Petty Cash - Library	0.00	0.00	0.00	0.0%
3-00-00-114	Petty Cash - Arena	0.00	0.00	0.00	0.0%
3-00-00-115	Petty Cash - Recreation	0.00	200.00	(200.00)	0.0%
3-00-00-116	Petty Cash - Vending Machine for Arena	0.00	0.00	0.00	0.0%
3-00-00-117	Petty Cash - Fire Department	0.00	0.00	0.00	0.0%
3-00-00-120	General Bank Account	0.00	5,277,535.11	(5,277,535.11)	0.0%
3-00-00-121	Alberta Treasury Branch	0.00	0.00	0.00	0.0%
3-00-00-122	CIBC Investments	0.00	0.00	0.00	0.0%
3-00-00-123	Tax Sale Proceeds - Trust Asset	0.00	0.00	0.00	0.0%
3-00-00-124	XMAS Elves - ATB	0.00	27,934.39	(27,934.39)	0.0%
3-00-00-210	Current Property Taxes Receivable	0.00	1,205,206.37	(1,205,206.37)	0.0%
3-00-00-212	Arrears of Property Taxes Receivable	0.00	448,197.80	(448,197.80)	0.0%
3-00-00-214	Allowance for Doubtful Tax Accounts	0.00	0.00	0.00	0.0%
3-00-00-270	Construction Advances Receivable	0.00	0.00	0.00	0.0%
3-00-00-280	Utilities Receivable	0.00	169,789.29	(169,789.29)	0.0%
3-00-00-290	Accounts Receivable	0.00	208,892.50	(208,892.50)	0.0%
3-00-00-291	Utility/Tax Clearing Account	0.00	0.00	0.00	0.0%
3-00-00-292	Cash Receipts Suspense	0.00	0.00	0.00	0.0%
3-00-00-294	Accrued Interest Receivable	0.00	0.00	0.00	0.0%
3-00-00-295	GST Receivable	0.00	(17,138.62)	17,138.62	0.0%
3-00-00-296	Education Tax Underlevy	0.00	0.00	0.00	0.0%
3-00-00-297	Non-Res Education Tax Underlevy	0.00	0.00	0.00	0.0%
3-00-00-301	General Investments	0.00	0.00	0.00	0.0%
3-00-00-302	Tax Sale Investments TA# 0169	0.00	0.00	0.00	0.0%
3-00-00-303	Tax Sale Investment TA# 0123	0.00	0.00	0.00	0.0%
3-00-00-304	Tax Sale Investment TA# 0457	0.00	0.00	0.00	0.0%
3-00-00-305	Land Held for Resale	0.00	0.00	0.00	0.0%
3-00-00-410	AMFC Investment	0.00	0.00	0.00	0.0%
3-00-00-510	Engineering Structures	0.00	30,720,298.77	(30,720,298.77)	0.0%
3-00-00-511	Accum Amort - Engineered Structures	0.00	(12,920,662.54)	12,920,662.54	0.0%
3-00-00-520	Buildings	0.00	15,361,472.56	(15,361,472.56)	0.0%
3-00-00-521	Accum Amort - Buildings	0.00	(6,139,229.92)	6,139,229.92	0.0%
3-00-00-530	Machinery & Equipment	0.00	3,854,861.12	(3,854,861.12)	0.0%
3-00-00-531	Accum Amort - Machinery & Equipment	0.00	(1,999,145.55)	1,999,145.55	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
3-00-00-540	Land for Own Use	0.00	1,230,622.94	(1,230,622.94)	0.0%
3-00-00-541	Accum Amort - Land Improvements	0.00	(112,702.82)	112,702.82	0.0%
3-00-00-550	Vehicles	0.00	684,639.68	(684,639.68)	0.0%
3-00-00-551	Accum Amort - Vehicles	0.00	(484,760.99)	484,760.99	0.0%
3-00-00-560	Land Improvements	0.00	286,581.07	(286,581.07)	0.0%
3-12-00-295	GST - 57.14 - Municipal Purposes	0.00	79,561.39	(79,561.39)	0.0%
3-12-00-296	GST - 42.86 - Municipal Purposes	0.00	0.00	0.00	0.0%
3-41-00-290	Payroll Clearing Account	0.00	0.01	(0.01)	0.0%
	TOTAL ASSESTS	**0.00**	**37,883,406.68**	**(37,883,406.68)**	**0.0%**
	Check Sum	**0.00**	**0.00**		
	LIABILITES				
4-00-00-000	Assest Retirement Obligation	0.00	(3,073,883.00)	3,073,883.00	0.0%
4-00-00-120	Deferred Revenue - Conditional Grants	0.00	0.00	0.00	0.0%
4-00-00-121	Deferred Revenue - Education Tax	0.00	0.00	0.00	0.0%
4-00-00-122	Deferred Revenue - Operating	0.00	0.00	0.00	0.0%
4-00-00-123	Tax Sale Proceeds - Trust Liability	0.00	0.00	0.00	0.0%
4-00-00-124	Deferred Revenue - Developer	0.00	0.00	0.00	0.0%
4-00-00-125	Deferred Revenue - Business Licenses	0.00	0.00	0.00	0.0%
4-00-00-200	Vacation Pay Payable	0.00	(43,827.74)	43,827.74	0.0%
4-00-00-201	Sick Pay Payable	0.00	(60,440.04)	60,440.04	0.0%
4-00-00-202	Overtime Payable	0.00	(15,434.61)	15,434.61	0.0%
4-00-00-210	E.I. Rebate	0.00	(1,613.70)	1,613.70	0.0%
4-00-00-230	C.P.P.	0.00	0.00	0.00	0.0%
4-00-00-231	UIC Payable	0.00	0.00	0.00	0.0%
4-00-00-232	Income Tax Payable	0.00	0.00	0.00	0.0%
4-00-00-240	Fire Fighters Association Fees Payable	0.00	0.00	0.00	0.0%
4-00-00-250	AMEBS Payable	0.00	7,599.51	(7,599.51)	0.0%
4-00-00-260	GST Payable	0.00	(26,068.54)	26,068.54	0.0%
4-00-00-265	Safety Codes Council	0.00	(69.28)	69.28	0.0%
4-00-00-271	R.R.S.P. Contributions	0.00	0.00	0.00	0.0%
4-00-00-290	Accounts Payable Suspense	0.00	0.00	0.00	0.0%
4-00-00-300	Short Term Operating Loan	0.00	0.00	0.00	0.0%
4-00-00-310	Debentures Payable	0.00	(3,174,014.54)	3,174,014.54	0.0%
4-00-00-323	Long Term Loan - Treasury Branch	0.00	0.00	0.00	0.0%
4-00-00-400	Accrued Liabilites	0.00	0.00	0.00	0.0%
4-00-00-410	Accrued Interest Debentures	0.00	(21,130.35)	21,130.35	0.0%
4-00-00-430	Capital Lease Debt	0.00	(177,895.12)	177,895.12	0.0%
4-00-00-663	Equity in Fixed Assets	0.00	(24,056,181.00)	24,056,181.00	0.0%
4-00-00-900	Accumulated Surplus	0.00	0.00	0.00	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
4-00-00-990	Accumulated Deficit	0.00	(545,596.42)	545,596.42	0.0%
4-00-00-991	Prior Period Adjustment	0.00	0.00	0.00	0.0%
4-41-00-470	Bulk Water Deposits	0.00	(3,570.00)	3,570.00	0.0%
4-41-00-471	Deposits - Water Meters	0.00	0.00	0.00	0.0%
4-42-00-421	Prepaid Local Improvements - Sewer	0.00	0.00	0.00	0.0%
4-42-00-422	Lagoon Key Deposit	0.00	0.00	0.00	0.0%
4-61-00-470	Mobile Home Performance Deposit	0.00	0.00	0.00	0.0%
4-61-00-472	Southbridge Phase 4 - Development	0.00	(80,043.00)	80,043.00	0.0%
4-61-00-473	Development Agreement Deposits	0.00	0.00	0.00	0.0%
4-61-00-474	Construction Deposits	0.00	(92,000.00)	92,000.00	0.0%
4-61-00-475	Southbridge Phase 2 - Development	0.00	(230,786.50)	230,786.50	0.0%
4-61-00-476	Security Deposit SB Hayduk	0.00	(6,160.00)	6,160.00	0.0%
4-61-00-477	Incentive Grant Reserve	0.00	0.00	0.00	0.0%
4-62-00-290	Ticket Sales Payable	0.00	0.00	0.00	0.0%
4-72-00-470	Recreation Facility Deposits	0.00	(2,653.55)	2,653.55	0.0%
4-72-00-475	First Night Celebration Donations	0.00	0.00	0.00	0.0%
4-77-00-635	Reserve from Sale of Karen's Cafe	0.00	0.00	0.00	0.0%
4-77-00-636	Land Sale Reserve	0.00	0.00	0.00	0.0%
4-77-00-710	Operating Contingency Reserve	0.00	(500,874.70)	500,874.70	0.0%
4-77-00-715	Debenture Stabilization Reserve	0.00	(55,344.00)	55,344.00	0.0%
4-77-00-720	Incentive Reserve Grant	0.00	(26,690.54)	26,690.54	0.0%
4-77-00-725	Economic Development Reserve	0.00	(20,000.00)	20,000.00	0.0%
4-77-00-900	Off Site Levy Reserve	0.00	0.00	0.00	0.0%
4-77-00-901	Water Offsite Reserve	0.00	(73,028.35)	73,028.35	0.0%
4-77-00-902	Sewer Offsite Reserve	0.00	(131,740.15)	131,740.15	0.0%
4-77-00-903	Transportation Offsite reserve	0.00	(64,189.35)	64,189.35	0.0%
4-77-00-905	Infrastructure Reserve	0.00	(2,747,615.13)	2,747,615.13	0.0%
4-77-00-910	Fleet Services Reserve	0.00	(45,000.00)	45,000.00	0.0%
4-77-00-915	Water Play Park Reserve	0.00	0.00	0.00	0.0%
4-77-00-920	Arena Compressor Reserve	0.00	0.00	0.00	0.0%
4-77-00-925	Town Hall Reserve	0.00	(123,776.86)	123,776.86	0.0%
4-77-00-930	Protective Services Reserves	0.00	0.00	0.00	0.0%
4-77-00-935	Disaster Services Reserve	0.00	(26,308.46)	26,308.46	0.0%
4-77-00-940	Constabulary Reserve	0.00	0.00	0.00	0.0%
4-77-00-945	Transportation Reserve	0.00	0.00	0.00	0.0%
4-77-00-949	Parks Trail Reserve	0.00	(53,366.46)	53,366.46	0.0%
4-77-00-950	Parks Facility Reserve	0.00	(83,024.48)	83,024.48	0.0%
4-77-00-951	Arena Building Reserve	0.00	(192,888.35)	192,888.35	0.0%
4-77-00-955	Library Facility Reserve	0.00	(10,188.89)	10,188.89	0.0%
9-99-99-999	Clearing Account	0.00	(1,000.00)	1,000.00	0.0%

	2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
TOTAL LIABILITIES	**0.00**	**(35,758,803.60)**	**35,758,803.60**	**0.0%**
Check Sum	**0.00**	**0.00**	**0.00**	**0.0%**
NET (SURPLUS)/LOSS		**(2,626,022.17)**		
NET CAPITAL		**501,419.09**		
		(37,883,406.68)		

CAPITAL REVENUE

5-11-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-11-00-640	Contributed from Reserve	0.00	0.00	0.00	0.0%
5-11-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-12-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-12-00-636	Debenture Borrowing - Office Reno's	0.00	0.00	0.00	0.0%
5-12-00-640	Contributed from Reserve	0.00	0.00	0.00	0.0%
5-12-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-23-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-23-00-635	From Borrowing	0.00	0.00	0.00	0.0%
5-23-00-640	Contributed from Reserve	0.00	0.00	0.00	0.0%
5-23-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-23-00-900	Revenue Acct - Contributed from Other	0.00	0.00	0.00	0.0%
5-23-00-910	Sale of Fixed Assets	0.00	0.00	0.00	0.0%
5-24-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-24-00-640	Contributed from Reserve	0.00	0.00	0.00	0.0%
5-24-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-26-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-26-00-640	Contributed from Reserve	(35,000.00)	0.00	(35,000.00)	0.0%
5-26-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-32-00-550	Investment Interest	0.00	0.00	0.00	0.0%
5-32-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-32-00-635	From Borrowing	0.00	0.00	0.00	0.0%
5-32-00-640	Contributed from Reserve	(147,825.00)	0.00	(147,825.00)	0.0%
5-32-00-650	Conditional Grants	(632,175.00)	0.00	(632,175.00)	0.0%
5-32-00-900	Contributed from Other	0.00	0.00	0.00	0.0%
5-32-00-910	Sale of F/A	0.00	0.00	0.00	0.0%
5-32-01-636	Debenture Borrow	0.00	0.00	0.00	0.0%
5-41-00-550	Investment Interest	0.00	0.00	0.00	0.0%
5-41-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
5-41-00-636	Debenture Borrowing	0.00	0.00	0.00	0.0%
5-41-00-640	Contributed from Reserve	(172,948.00)	0.00	(172,948.00)	0.0%
5-41-00-650	Conditional Grants	(2,052.00)	0.00	(2,052.00)	0.0%
5-42-00-550	Investment Interest	0.00	0.00	0.00	0.0%
5-42-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-42-00-635	From Borrowing	0.00	0.00	0.00	0.0%
5-42-00-640	Contributed from Reserve	(65,000.00)	0.00	(65,000.00)	0.0%
5-42-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-42-00-910	Sale of Fixed Assets	0.00	0.00	0.00	0.0%
5-43-00-640	Contributed from Reserve	(40,000.00)	0.00	(40,000.00)	0.0%
5-61-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-61-00-635	From Borrowing	0.00	0.00	0.00	0.0%
5-61-00-640	Contributed from Reserve	(26,000.00)	0.00	(26,000.00)	0.0%
5-61-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-62-00-630	Community/Economic Development	0.00	0.00	0.00	0.0%
5-72-00-635	From Borrowing	0.00	0.00	0.00	0.0%
5-72-00-640	Contributed From Reserves	0.00	0.00	0.00	0.0%
5-72-00-910	Sale of Fixed Assets	0.00	0.00	0.00	0.0%
5-72-01-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-72-01-640	Contributed from Reserve	(10,000.00)	0.00	(10,000.00)	0.0%
5-72-01-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-72-01-670	Parks - County Cost Share	0.00	0.00	0.00	0.0%
5-72-01-900	Parks - Contributed from Other	0.00	0.00	0.00	0.0%
5-72-02-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-72-02-640	Contributed from Reserve	(18,500.00)	0.00	(18,500.00)	0.0%
5-72-02-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-72-02-660	Federal Grants	0.00	0.00	0.00	0.0%
5-72-02-900	Arena - Contributed from Other	(18,500.00)	0.00	(18,500.00)	0.0%
5-74-00-550	Investment Interest	0.00	0.00	0.00	0.0%
5-74-00-630	Contributed from Operating	0.00	0.00	0.00	0.0%
5-74-00-640	Contributed from Reserve	0.00	0.00	0.00	0.0%
5-74-00-650	Conditional Grants	0.00	0.00	0.00	0.0%
5-74-00-900	Library - Contributed from Other	0.00	0.00	0.00	0.0%
		(1,168,000.00)	**0.00**	**(1,168,000.00)**	**0.0%**
	CAPITAL EXPENSE				
6-11-00-630	Legislative	0.00	0.00	0.00	0.0%
6-12-00-630	Administrative	0.00	0.00	0.00	0.0%
6-23-00-630	Protective Services	0.00	0.00	0.00	0.0%
6-23-00-761	Transfer to Reserve	0.00	0.00	0.00	0.0%
6-24-00-630	Disaster Services	0.00	0.00	0.00	0.0%

		2025 BUDGET	2025 ACTUAL	2025 VARIANCE	2025 %
6-26-00-630	By-Law & Constabulary Services	35,000.00	30,039.55	4,960.45	85.8%
6-32-00-610	43 Street Intersection	0.00	0.00	0.00	0.0%
6-32-00-620	Transportation/Building	0.00	0.00	0.00	0.0%
6-32-00-630	Transportation	400,000.00	42,070.58	357,929.42	10.5%
6-32-00-640	Transportation/Land	0.00	0.00	0.00	0.0%
6-32-00-650	Transportation Vehicles	380,000.00	310,080.00	69,920.00	81.6%
6-32-00-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
6-32-01-610	Lateral Upgrades	0.00	0.00	0.00	0.0%
6-32-01-630	Transportation - 2005	0.00	0.00	0.00	0.0%
6-32-02-610	Roads/Sidewalks Upgrades	0.00	0.00	0.00	0.0%
6-32-02-630	Transportation - 2006	0.00	0.00	0.00	0.0%
6-32-03-630	49 Ave & 47 St Upgrades	0.00	0.00	0.00	0.0%
6-32-04-630	Electronic Sign	0.00	0.00	0.00	0.0%
6-41-00-610	Water Reservoir Expansion	0.00	0.00	0.00	0.0%
6-41-00-630	Water Services	175,000.00	96,387.05	78,612.95	55.1%
6-41-00-761	Water - Transfer to Reserve	0.00	0.00	0.00	0.0%
6-42-00-610	Sewer Mains	0.00	0.00	0.00	0.0%
6-42-00-630	Sanitary Sewer	65,000.00	9,538.70	55,461.30	14.7%
6-43-00-630	Solid Waste	40,000.00	9,041.50	30,958.50	22.6%
6-51-00-630	Family & Community Services	0.00	0.00	0.00	0.0%
6-61-00-630	Planning & Development	26,000.00	0.00	26,000.00	0.0%
6-62-00-630	Community/Economic Development	0.00	0.00	0.00	0.0%
6-72-00-630	RecreationAdmin. Equipment	0.00	0.00	0.00	0.0%
6-72-01-630	Recreation Sportsgrounds	0.00	0.00	0.00	0.0%
6-72-01-640	Parks Land	10,000.00	(1,900.00)	11,900.00	(19.0%)
6-72-01-650	Parks Vehicles	0.00	0.00	0.00	0.0%
6-72-01-761	Transfer to Reserves	0.00	0.00	0.00	0.0%
6-72-02-620	Arena Building	20,000.00	0.00	20,000.00	0.0%
6-72-02-630	Arena	17,000.00	6,161.71	10,838.29	36.2%
6-72-02-761	Transfer to Reserve - Arena	0.00	0.00	0.00	0.0%
6-74-00-620	Library Building	0.00	0.00	0.00	0.0%
6-74-00-630	Library/Culture Services	0.00	0.00	0.00	0.0%
		1,168,000.00	**501,419.09**	**666,580.91**	**42.9%**
	Totals:	**0.00**	**501,419.09**	**(501,419.09)**	**0.0%**

Item 10.b

Town of Calmar

Request for Decision (RFD)

Meeting:	Regular Meeting
Meeting Date:	July 28,2025
Originated By:	DCS Bryans/CAO Losier
Title:	LAPP
Approved By:	CAO Losier
Agenda Item Number:	10 B

BACKGROUND/PROPOSAL:

The Town of Calmar first explored the potential of joining LAPP, the largest pension fund in Alberta with over 315,000 members (46,000 municipal), early in 2022, however because of the program restrictions and the financial implications of them it was decided not to pursue this. In 2024 Administration once again gave consideration to joining and after discussions with a LAPP funding advisor we were informed that many of the restrictions that the Town would have originally faced would be relaxed making it much more manageable for the Town to join, but due to other budgetary priorities the decision was made not to present the information to Council throughout the budget process.

DISCUSSION/OPTIONS/BENEFITS/DISADVANTAGES:

The two main restrictions being lifted are:

1) moving 100% of staff from the current RRSP plan to LAPP upon transferring over, and
2) 100% current staff enrollment.

This means that the Town could stagger enrollment into the plan (i.e. one group of employees are moved over first, the next group of employees are enrolled at a later date) and that we could also grandfather our current employees, that should they chose to not join LAPP they would not have to, they could remain in the RRSP plan or not participate in either.

With basic calculations of current employer contributions to the RRSP plan compared to what they would be in LAPP, if 100% of the currently enrolled participants were to move to LAPP this would result in an increased employer expense annually of approximately $50,000. Based on previous conversations with employees, Administration expects that not all eligible employees will choose to join the plan.

Important considerations noting the additional $50,000 expense:

1) This is based on all current eligible employees (or ones that will become eligible in 2026) transferring out of RRSP and into LAPP.

2) This is based on no salary increases (performance or COLA) in 2026, if salaries increase contributions will increase.
3) Any new employee hired after the Town joins LAPP will have mandatory enrolment. Only current employees will be grandfathered with the ability to remain outside of the plan.
4) This amount will fluctuate with the addition or change of staff, with an average expense of $6,000/year for non-management employee.

Philosophical goal

In additional to the funding perspective, the Town must consider as an employer the goal it wants to achieve with the benefits. Currently, the RRSP plan consists of a contribution of both employee and employer to witch the employee has access to at any given point. An employee desiring to withdraw from the plan can do so by filing out a form after discussing the implication with an RBC staff. It does provide maximum flexibility to the staff, and it is an optional benefit. However, there is no guarantee that funds will be available at retirement as withdrawals are available at any time. The RBC manager to the Town's account confirmed that the only way to ensure that the funds will be only accessible at retirement is to select an actual pension plan as the benefit.

COSTS/SOURCE OF FUNDING (if applicable)

In the 2026 budget cost could range from an additional $30,000 to $50,000. In future years this amount will change based on salaries and staffing levels.

RECOMMENDED ACTION:

Administration is looking for direction from Council as to whether this benefit should be considered in the 2026 operational budget.

Town of Calmar

Department Report (DR) – Office of the CAO

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	CAO Losier
Title:	Office of the CAO Report
Approved By:	CAO Losier
Agenda Item Number:	11 A

KEY INITIATIVES/METRIC:

Administration

For the period of May and June 2025, Administration focused on a few requests for proposals (RFP's). Administration reviewed the proposals for the utility rate review and selected Corvus. Contract negotiations occurred in June with the intent of signing the document in July (now completed). The work on this project will start in August.

The second RFP was for the street sweeper. This was awarded at the end of May, and the town now has it in its possession. It was used in the recent street sweeping exercise. Administration is please to inform Council that significant savings occurred for this project.

During this period, the Town also launched a request for qualifications (RFQ) for the Enterprise Resource Planning (ERP) Software. Several service providers responded to the Town's RFQ, and demonstration of the various products were schedule for July. More details on this initiative will be made available to Council once all the demonstrations have been completed.

Administrative change

During this period, Calmar posted the position for the Community Peace Officer vacancy. After meeting a few candidates, a selection was made, and the new CPO will be starting in August. Prior to the starting date, an announcement will be made.

Operational change

During this period, Administration introduced new events including the Oilers Watch Parties (arena), Games Night (program center), and Creative Night (program center). These events were free for the public, drop-in style, and containing a minimum of structure to test various options and explore opportunities and limitations. Before Administration presents the 2026 events calendar, more work and analysis will be required regarding the goals and outcomes we would like to see as we are planning next year's events.

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:
The new events enabled the Town to acquire some information, but more analysis is needed before recommendations are made. There appears to be some excitement within the community about Creative Nights, and this could be a new area for the town to explore.

Regarding new services, Administration has been working towards enabling a grass clipping depot for the residents. The depot is located at the Public Works shop along 44 Avenue. Administration is targeting the opening of this new service in August.

ITEMS NEEDING INVESTIGATION:
The contract for solid waste management is coming to an end in September. Therefore, the Town will have to launch an RFP in July and proceed to the evaluation in August. This will allow for the selected proponent to be in operation as of October 1st.

The current report is submitted for discussion. Administration is available to answer questions from Council.

Town of Calmar

Department Report (DR) - PD

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	Eanimi Agube
Title:	Planning & Development Report
Approved By:	CAO Losier
Agenda Item Number:	11 B

KEY INITIATIVES/METRIC:

Development Permits

As illustrated in the May and June Growth reports, 14 development permits were issued. 3 Single Family Detached Dwellings, 2 basement developments, 3 home-based and store businesses, 2 decks, 1 garage and 2 industrial permits (fence and change of use).

Subdivisions

During this period, the Administration worked with the Subdivision Authority for the 42 units Hawks Landing Subdivision (Stage 2). Administration also worked with the applicant of the HI-Way 39 Stage 2 in preparation for the endorsement of the plan.

Redistricting / Land Use Bylaw (LUB) amendments

During these two months, the three lots subdivided on 5022 50 Street were redistricted to direct control as a pilot project for the council to monitor the effects of lot sizes like those in that area of town.

Compliance certificate

No compliance letter requests were processed.

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:

The administration has been in contact with the owners at the entrance of Southbridge regarding the development of the 8-unit townhouses; they intend to start development before the end of summer. Development started in the smaller lot pilot area on 51 Avenue. The administration has met with the developers of the commercial bays on Main Street, awaiting their development permit application. They already have a site plan ready and are working on the commercial bay designs. The Master Plan reviews and updates have been initiated, including the completion of the initial survey for the Municipal Development Plan Review and Update.

ITEMS NEEDING INVESTIGATION:

Several of the recent single-detached dwelling developments have proposed larger driveways to accommodate the demand for multiple-car garages. This is leading to either a need for a variance or for builders to make alterations to the site plans. At this time, the Land Use Bylaw has a maximum requirement of 7.3 meters for residential driveways.

The current report is submitted for discussion. Administration is happy to answer questions from Council.

Town of Calmar

Department Report (DR) - CS

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	DCS Bryans
Title:	Corporate Services Report
Approved By:	CAO Losier
Agenda Item Number:	11 C

KEY INITIATIVES/METRIC:

- Current Operating & Capital budgets were presented to Council May 5 for adoption.
- The 2025 Tax Rate Bylaw was adopted at the same meeting.
- Administration spent May 6th preparing the levies to print and mail out on May 8th
- Assessment Open House had six property owners attend.
- There have been seven assessment revisions done (resulting from the open house or emails/phone calls to our assessor), reducing our overall assessment base by $155,000.
- In June Administration processed over $2,100,000 worth of property tax payments.
- I had two demos of ERP software at the GFOA conference
- The RFQ period for the ERP vendors closed June 20, there were six submitted (including two from different support providers for the same software).
- LGFF grant applications have been submitted for the street sweeper and the master plans.

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:

- The initial budget workbook has been sent to all department heads.
- Demos are being arranged for the second week in July for the new ERP

ITEMS NEEDING INVESTIGATION:

- There are potentially two assessment appeals that may be filed.
- Working on submitting the CCBF grant application, once we have the final numbers in July the application can be submitted.
- Departmental budget presentations to Council will begin in July.
- A final decision on the new ERP will be made in the coming months.
- eScribe training is still progressing; with the June 16th regular council meeting and the June 25th committee of the whole meeting being conducted live in eScribe.

This current report is submitted discussion and Administration is happy to answer questions from Council.

Item 11.d

Town of Calmar

Department Report Enforcement Services

MAY / JUNE 2025

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	CPO Leggio
Title:	Enforcement Services Report
Approved By:	CAO LOSIER
Agenda Item Number:	11 D

KEY INITIATIVES/METRIC:

- 1 cat to Kennel – calls are down
- 0 Dogs to Kennel – calls are down
- Dog bark complaints are way down
- 2025 Year to Date Department STATISTICS ATTACHED.
- Held 2nd Weed / Unsightly / OHV, Open house June 26, 2025:
    - Two in attendance
    - Questionnaire given to both (Attached) (One additional questionnaire from office walk in).
    - No OHV questions.
    - Open house social media notifications recorded daily to confirm open house information was active and available.
- Feedback Highlights:
    - Use fines to gain compliance which would shorten timeline of enforcement with no remedial.
    - Advertise enforcement states – number of violators as well as tickets or enforcement contractor required.
    - Incentives for well kept yards – awards / gifts
    - Effective communication to notify residents of ongoing enforcement.
    - Enforce alleys.

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:

- Looking at a provincial law enforcement grant for law enforcement initiatives.
- Looking to hold DUI information with RCMP at high school in the fall.

- Enforcement will do a soft 1st weed list NOT including any alleys – Alleys not to be enforced as per Council direction.

ITEMS NEEDING INVESTIGATION:

- Grants
- Snow sidewalk clearing process review to begin in July.

The current report is submitted for discussion. Administration is happy to answer questions from Council.

TOWN OF CALMAR OHV

INFORMATION SHEET

For a copy of the complete Off-Highway Vehicle (OHV) Bylaw, please visit https://calmar.ca/wp-content/uploads/2022/01/Bylaw-2020-14.pdf

The Alberta Traffic Safety Act allows municipalities to enact a bylaw to permit OHV operation on Municipal maintained roads and public property.

Off-Highway Vehicles (OHVs) include:

Snowmobiles, quads, mini-bikes, and any additional means of transportation powered other than by muscular or wind power and are built for cross-country travel on land.

You Must:

✓ Travel in the same direction as vehicles travelling on the roadway;
✓ Travel in single file;
✓ Travel on the shoulder or parking lane of the roadway or, where it is safe to do so, in the adjacent ditch, except when making a left-turn onto an adjacent roadway;
✓ Travel at a maximum speed not exceeding 40 kilometers per hour or the posted speed limit, whichever is lower;
✓ Be registered and insured pursuant to the Traffic Safety Act;
✓ Be at least 16 years of age and hold a valid operator's license; or
✓ Be at least 14 years of age and hold a valid Class 7 Operator's License and is supervised by a person who is at least 18 years old and holds a valid Operator's License and either occupying the passenger seat on the OHV or is on another OHV travelling in close proximity;
✓ Ensure you stop the OHV before crossing a road;
✓ Yield the right of way to all other vehicles and persons on the road; and
✓ Drive across the most direct, shortest, and safest route of travel available.

Restrictions:

*No travelling on Municipal Property or County Parks;
*No travelling on private property without permission;
*No traveling on a highway, except in accordance with the Bylaw or as otherwise permitted under the Traffic Safety Act;
*No traveling on a rural road between the hours of 11:00 p.m. and 7:00 a.m.
*No travelling on the road or ditch with OHV that is not equipped with headlamps, tail lamps, an exhaust muffler, and such other equipment as required by the Off-Highway Vehicle Regulation;

*No riding as a passenger where the number of persons riding the OHV exceeds the seating capacity of the OHV;

*No traveling on any Highway where the County has placed a sign or signs prohibiting such operation; and *No traveling in streams, rivers, lakes or on beds or shores of watercourses, wetlands, or waterbodies unless on designated trail or crossing, or if granted special authorization by Environmental and Parks.

Protective Gear When traveling on Public Land, helmets are required for OHV's unless you are on a side by side and person(s) are wearing seat belts, and the OHV has a roll cage.

To operate an OHV, the operator and passenger must wear a Safety Helmet securely attached to the person's head unless you are excluded as per the Traffic Safety Act or Occupational Health and Safety Act. A Safety Helmet is defined as a helmet intended for use by an operator or passenger of an OHV that meets one or more of the standards for motorcycle safety helmets adopted in the Vehicle Equipment Regulation passed pursuant to the Traffic Safety Act.

Where can you drive OHV'S in Leduc County

You can operate an OHV on your own private property, or on other property if you have permission from the owner. You cannot operate an OHV within hamlets – including Buford, Looma, Kavanagh, Rolly View, Sunnybrook and New Sarepta – except when entering or leaving the hamlet using the most direct route to and from your home. You may operate an OHV in the ditch adjacent to a roadway if travelling single-file and in the same direction as adjacent traffic. Where there is no ditch, or where you need to bypass a hazard or obstacle in the ditch, you may travel in the parking lane (or the furthest right lane of the roadway where there is no parking lane). Your speed must not exceed 40 kilometres per hour, or the posted speed limit if it is less than 40 kilometres per hour.

Useful websites:

- http://www.albertatrailnet.com/for-trail-users/alberta-trailmaps/https://www.alberta.ca/public-land-use.aspx https://aohva.com/
- https://www.alberta.ca/motorized-recreation-on-public-land.aspx https://open.alberta.ca/publications/9781460143308
- https://aohva.com/
- https://www.alberta.ca/motorized-recreation-on-public-land.aspx
- https://www.alberta.ca/public-land-closures

TOWN OF CALMAR WEED AND UNSIGHTLY OPEN HOUSE

June 26, 2025

QUESTIONNAIRE

WEEDS / UNSIGHTLY:

- What height should the grass be before enforcement gets involved? _____
- What forms of communication would you prefer Enforcement to use when remedials

  are handed out? _____
- Should Enforcement focus more, or less, on weeds and unsightly? _____
- Should Enforcement only issue fines for non-compliant yards and not issue

  remedials? _____
- Should Enforcement Issue fines **AND** hire contractors to clean weeds? _____
- Should Weeds only be enforced on a complaint-based call? _____

DO YOU HAVE ANY SUGGESTIONS AS TO HOW THE PROCESS COULS BE IMPROVED UPON OR IDEAS TO GAIN COMPLIANCE FOR WEED AND UNSIGHTLY PROPERTIES?

_____
_____
_____
_____
_____

OHV

- Should Calmar have an OHV bylaw? _____
- Do you feel the currant bylaw is too lax or too strong? _____
- Do you feel OHV" s should be allowed to operate on town roads? _____
- Do you feel Calmar has an OHV problem? _____
- Did you know it's against the Traffic Safety Act to ride an OHV on Range Roads and TWP roads? _____
- Are you aware of neighboring farmers complaining of illegal OHV trespass on their property? _____
- Are you aware you can only ride in ditches with proper

To Admin, all Council x5, and Enforcement Thanx

Item 11.d

TOWN OF CALMAR WEED AND UNSIGHTLY OPEN HOUSE

June 26, 2025

June 28/25 - listening to CFCW 9-11AM - About time you guys advertised there. At Mikes 24 - all surrounding Town passed wishes on CFCW but Calmar - was free!!

QUESTIONNAIRE

RECEIVED
JUL 11 2025
TOWN OF CALMAR - INT MB

WEEDS / UNSIGHTLY:

- What height should the grass be before enforcement gets involved? 8"
  Better yet - If general condition of lawn a mess, uneven, decrepit appearance - call them. Use common sense.
- What forms of communication would you prefer Enforcement to use when remedials are handed out? Too labor intensive - Concentrate on "trouble" residents w/ past noncompliance. One discussion - do your lawn or we will - full cost to resident!
- Should Enforcement focus more, or less, on weeds and unsightly? Too much expense Spent on unsightly or too tall. ≈ 6 days/month time wasted. Cut citizen @ age to do observe - let ToC staff print remedials which is all clued to dirty messy yet.
- Should Enforcement only issue fines for non-compliant yards and not issue remedials? bother w/ remedial. Unless all bother billed back to dirty yard - don't first offence? - subsequent dbling everytime. Direct to tax roll!!
- Should Enforcement Issue fines **AND** hire contractors to clean weeds? No 21 days or such nonsense. Must be knocked down in max. 7 days unless steady rain. Common sense needed.
- Should Weeds only be enforced on a complaint-based call? No - could use complaint basis - I feel if Enforce sees issue - fine and keep dbling - If Elder or disabled - compassion needed.

DO YOU HAVE ANY SUGGESTIONS AS TO HOW THE PROCESS COULD BE IMPROVED UPON OR IDEAS TO GAIN COMPLIANCE FOR WEED AND UNSIGHTLY PROPERTIES?

First and foremost - Town Properties must lead by example.
Don't expect anyone to show leadership if T of C messy or overgrown.
Contractors coming to our community - as they're guests per se must be dealt with severely. Treat our Town respectful - will respect you.
Far too much debris blowing around that should have been put in dumpster - NO deviance - Major fines - again dbl each time.
You can't place dumpster on road for a month - maybe a day at most.
OHV Keep dumpster on your property. Bill all removal to contractor - very severe.

- Should Calmar have an OHV bylaw? No Quads or Skidoos in T of C. On trailer to area someone wants that fricken noise!!!
- Do you feel the currant bylaw is too lax or too strong? I see quads & skidoos in Town so obvious too lax. Too much noise. Also very noisy motorcycles.
- Do you feel OHV" s should be allowed to operate on town roads? Trailers out of Town only
- Do you feel Calmar has an OHV problem? Far too noisy for me. Get the hell out of town. Town city - loud - 1st offence $1000.00 next dbl. they'll learn fast put on a proper muffler.
- Did you know it's against the Traffic Safety Act to ride an OHV on Range Roads and TWP roads? Yes -
- Are you aware of neighboring farmers complaining of illegal OHV trespass on their property? Yes
- Are you aware you can only ride in ditches with proper eqpt and licensing + plates. -Yes Not necessary to rev hell out of machine either. Respect the resident and you'll be respected.

P.S. - As there only 3½ months to election this damned grass issue has been beat to death. To me another questionnaire - delay tactic till election. Residents are now angry but powers to be were informed 4 months ago. Also complaints given with no response from T of C. No we don't need another meeting - no more Council or Admin time needed.
Unkempt yard - must be dealt with - Common sense needed if Compassion needed ie disabled or Elder. If Lazy - too damned bad Pay. Council & Admin Enforcement given public input but so frustrating that very little acted on. Yet wages still pd - no results!!

Item 11.d

TOWN OF CALMAR WEED AND UNSIGHTLY OPEN HOUSE

June 26, 2025

QUESTIONNAIRE

WEEDS / UNSIGHTLY:

- What height should the grass be before enforcement gets involved? 6"
- What forms of communication would you prefer Enforcement to use when remedials

  are handed out? Written at the door
- Should Enforcement focus more, or less, on weeds and unsightly? More on the alley ways.
- Should Enforcement only issue fines for non-compliant yards and not issue

  remedials? yes notices a week or two later a fine
- Should Enforcement Issue fines **AND** hire contractors to clean weeds? will they pay for cut weeds
- Should Weeds only be enforced on a complaint-based call? _____

DO YOU HAVE ANY SUGGESTIONS AS TO HOW THE PROCESS COULS BE IMPROVED UPON OR IDEAS TO GAIN COMPLIANCE FOR WEED AND UNSIGHTLY PROPERTIES?

Delagate the check with Office of Public Works.

Fines increase for repeat offenders.

Add cost with property taxes.

OHV

- Should Calmar have an OHV bylaw? Yes.
- Do you feel the currant bylaw is too lax or too strong? Lax
- Do you feel OHV" s should be allowed to operate on town roads? No.
- Do you feel Calmar has an OHV problem? Yes.
- Did you know it's against the Traffic Safety Act to ride an OHV on Range Roads and TWP roads? I wasn't aware but don't have an OHV.
- Are you aware of neighboring farmers complaining of illegal OHV trespass on their property? Yes.
- Are you aware you can only ride in ditches with proper

TOWN OF CALMAR WEED AND UNSIGHTLY OPEN HOUSE

June 26, 2025

QUESTIONNAIRE

WEEDS / UNSIGHTLY:

- What height should the grass be before enforcement gets involved? 5"-6"
- What forms of communication would you prefer Enforcement to use when remedials

  are handed out? E-mail or taped to front door.

- Should Enforcement focus more, or less, on weeds and unsightly? Somewhat more OR delegate the inspection to Town employees. (Public Works)
- Should Enforcement only issue fines for non-compliant yards and not issue remedials? Fines ~~eight~~ after a ~~week~~ warning a week prior.
- Should Enforcement Issue fines **AND** hire contractors to clean weeds? YES ~~no~~ repeat offenders
- Should Weeds only be enforced on a complaint-based call? No

DO YOU HAVE ANY SUGGESTIONS AS TO HOW THE PROCESS COULD BE IMPROVED UPON OR IDEAS TO GAIN COMPLIANCE FOR WEED AND UNSIGHTLY PROPERTIES?

- Use Town employees (Public Works) for inspection process.
- Issue fines after a warning - week to comply
- Repeat fines for continued non-compliance

OHV

- Should Calmar have an OHV bylaw? _____
- Do you feel the currant bylaw is too lax or too strong? Unsure.
- Do you feel OHV" s should be allowed to operate on town roads? Slowly, responsibly + only to go to where they are going
- Do you feel Calmar has an OHV problem? Noise-wise (speed), yes. Responsible riders are a non-issue.
- Did you know it's against the Traffic Safety Act to ride an OHV on Range Roads and TWP roads? Yes
- Are you aware of neighboring farmers complaining of illegal OHV trespass on their property? No.
- Are you aware you can only ride in ditches with proper _____

Yes.

Helmet Enforcement!

2025

CALMAR ENFORCEMENT DEPARTMENT STATISTICS

MONTH	TOTAL FOR THE MONTH	CALLS FOR SERVICE	TRAFFIC STOPS	TRAFFIC TICKETS	TRAFFIC WARNINGS:	COMMUNITY ENGAGEMENT	CPO REQUEST RCMP ASSISTANCE	CALLS DIRECTED TO RCMP:	RIDE A ALONG	REMEDIAL ORDERS / LETTERS
JANUARY	402 in 20 shifts	177	26	21	5	16	2	8	0	147
FEBRUARY	210 in 24 shifts	143	22	18	4	11	0	12	0	0
MARCH	169 In 18 shifts	123	12	8	4	9	6	7	0	0
APRIL	166 In 20 shifts	108	15	9	6	8	5	13	0	2
MAY	106 In 13 shifts	68	11	7	4	5	3	8	0	0
JUNE	235 In 15 shifts	137	10	6	4	3	8	6	0	61
JULY										
AUGUST										
SEPTEMBER										
OCTOBER										
NOVEMBER										
DECEMBER										

YTD	**1288**	**754**	**96**	**69**	**27**	**52**	**24**	**54**	**0**	**149**

Town of Calmar

Department Report Emergency Management

MAY / JUNE 2025

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	CPO Leggio
Title"	Enforcement Services Report
Approved By:	CAO LOSIER
Agenda Item Number:	11 E

KEY INITIATIVES/METRIC:

- Website portal
- Looking into Calmar specific emergency or notification app. – In discussion with CAO

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:

- Website Portal – New website company to take over implementation.
- Organizing Emergency Management open house for June/July
- ICS 300 to be held in the fall
- Tabletop exercise to be held in the fall
- Emergency Committee meeting to be held early winter.
- Section Chief and Emergency Committee information boxes to be distributed and discussed with each section chief in August 2025

ITEMS NEEDING INVESTIGATION:

- Look for possible grants related to our department. – Mayor Carnahan informed Emergency Management department of free masks being distributed for air quality concerns due to ongoing fires – Masks were sent to the front desk and advertised free for residents. None have been picked up todate.
- More response partnerships/MOU's

The current report is submitted for discussion. Administration is happy to answer questions from Council.

Town of Calmar

Department Report (DR) - PW

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025.
Originated By:	G. Nielson / K. Murphy
Title:	Public Works Report
Approved By:	CAO Losier
Agenda Item Number:	11 F

KEY INITIATIVES/METRIC:

- Drinking Water Chlorine samples x106
- Bacteriological Samples x10
- Wastewater Samples (W50 & W50C) x16
- May & June Building Inspections completed.
- Submit May & June Drinking Water Monthly Report to AEP.
- Lagoon power panel repaired and repositioned properly.
- Repair drainage plates on Highway 39 walking trail x2.
- Built new compound at PW yard for grass & branches. New chain link fencing, concrete Lego blocks x40 and base work completed.
- Located 70+ CC valves and logged into Silversmith Data with pictures and locations.
- Set up/tear down multiple watch parties for NHL playoff games at the Arena.
- Gravelled and bladed multiple back alleys in town.
- Set up 3x aerator pontoons with new motors and shafts.
- New signage installed on 49 Ave and the corner of 52 St/52 Ave.
- Opened the Spray Park for the season.
- Southbridge stage 4 utility installation. Water, Sanitary & Storm.
- First lift of paving completed for SB stage 4 and on the corner of 52 St/47 Ave.
- Southbridge stage 4 sidewalk/curb/gutter installation.
- 47 Ave concrete repairs completed.
- Gravelled 42 & 43 Ave's and applied 3 totes of Magnesium Chloride for dust control.
- Spring Clean up. Total of 39 trucks hauled to the dump, one full 40' metal bin from General Scrap and 63 008 lbs of garbage hauled away.
- Installed Southbridge fountains.
- Installed 17 water meters between replacement meters and new builds.
- Received new confined space entry & rescue equipment. Tri-pod, Fall Arrest and Rescue Winch.

- Created an SDS binder for the Program Centre.
- Received the new Odra Street Sweeper from Superior + orientation for new operators.
- Drained Hawks Landing storm pond to appropriate level.
- 5017-49 St sanitary service repair completed by Jurassic Mechanical.
- Mow West Lagoon with Kubota Tractor.
- Mow East Lagoon with Kubota Tractor.
- Mow 42 Ave, 43 Ave ditches and the Industrial Park pond with Kubota Tractor.
- Paint main street curbs.
- Pothole patching x55 bags of EZ street.
- Confined Space entries 25-09. Pulled pump #3 in Lift Station #1 multiple times to removes pieces of plywood and metal grating.
- Got the Town float ready for the Leduc Parade.
- Raise multiple CC valves to grade before concrete was poured.
- Sweep all walking trails with Kubota Sweeper x2.
- Install new welcome sign on the West Entrance.
- Set up 2nd water truck for extreme temperatures.
- Street sweep Highway 795 and 44 Ave.
- Set up new 6" pump with proper hoses and couplings. Weld jack stands on back of pump x2.
- Take old peace officer unit in for new motor and finish stripping old parts off it.
- Set up for Lemonade Stand and Resident Appreciation Event + clean up.
- Sprayed all Town sidewalks and Lift Stations with Start Up.
- Assisted the Parks Department: Mowing the Spray Park, Program Centre, Woodland Front, Woodland Back, Ball Diamonds and the Ball Diamond Park. Set up soccer nets, Hung flower baskets. Spraying park walkways with start up & Identified weed inspection addresses.
- Drawing reviews for Hawks stage 2 and Southbridge stage 4
- Attended and monitored pressure test and chlorination of Southbridge stage 4 as well as the subgrade proof roll and granular base proof roll.
- Ongoing Masterplans work, provided update at COW meeting.
- Q2 workplans.

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:
Staff Training:

Mike Fudge: N/A
Kevin Murphy: N/A
Shawn Steil: N/A
Graydon Nielson: N/A
Ed Frankiw: N/A
Jason Hart: N/A

ITEMS NEEDING INVESTIGATION:
N/A

The current report is submitted for discussion. Administration is happy to answer questions from Council.

Town of Calmar

Department Report (DR) - ED

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	S. McIntosh
Title:	May/Jun 2025 Economic Development Report
Approved By:	CAO Losier
Agenda Item Number:	11 G

KEY INITIATIVES/METRIC:

1. The Town of Calmar Attraction Guide is in its last stage of design. Our consultant is going to have it back to us by the end of July at the latest. Once we have it back, we can begin our social media blitz and start targeting our future businesses and residents.
2. The second round to the Downtown Façade Improvement program is now closed. We have 5 businesses that have submitted applications. Hayduk Lumber & Hardware, the Calmar Bakery, Wild Summit Co., Zyp Art Gallery, and Is Good Coffee and more. We should see another nice improvement to our downtown.

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:

1. 2025 – 2029 Economic Development Strategy creation is in its final stages as well. The final draft will be coming to Council for the August 18, 2025 council meeting for approval. Once approved the economic development team will be diving into the strategy.

ITEMS NEEDING INVESTIGATION:

1. Economic Development is looking into new incentives for 2026. Moving our Downtown Façade Improvement program to an area that should benefit the growth that Calmar is experiencing. Grants to builders and businesses that buy land and build a new business, buy an existing business and open the existing business or start a new business, and to industrial businesses that move to Calmar to open a large operation and hopefully result in the need for more serviced industrial land; to name a few.

The current report is submitted for discussion. Administration is happy to answer questions from Council.

Town of Calmar

Department Report (DR) - PR

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	I. Miller
Title:	Recreation Report
Approved By:	CAO Losier
Agenda Item Number:	11 H

KEY INITIATIVES / METRICS: May–June

RECREATION

Outdoor User Group Engagement

Continued engagement with local outdoor user groups to coordinate the use of Calmar's public spaces, ensuring scheduling efficiency and addressing group-specific needs.

Spring/Summer Event Planning

Advanced planning efforts for a new Community Nights series, designed to replace the Summer Getaway. These events aim to provide inclusive, engaging programming for residents of all ages.

Sponsor and Partner Collaboration

Met with key recreation partners to explore collaborative opportunities and gather input on seasonal programming, sponsorship, and event alignment.

Calmar Days Planning and Coordination

Significant preparation was undertaken for Calmar Days, including vendor bookings, community organization outreach, and securing attractions such as a ninja course, gaming bus, and food trucks. Site layout planning and event scheduling are in progress.

Stanley Cup Watch Parties

In response to the Edmonton Oilers' Stanley Cup run, Recreation hosted free community watch parties at Mike Karbonik Arena, fostering community spirit and local engagement.

Summer Staff and Canada Summer Jobs

Secured four Canada Summer Jobs positions (three Outdoor Recreation Staff and one Recreation Programmer). Time was invested in writing the application, developing job postings, conducting interviews, and onboarding staff.

Ball Diamond Scheduling and Maintenance

Managed seasonal ball diamond bookings and maintained strong communication with youth baseball and slo-pitch teams. Field conditions were monitored and updates shared to minimize disruptions from weather.

Technology and IT Collaboration

Continued collaboration with Shing Digital to address IT needs, streamline inventory naming conventions, support new staff onboarding, and explore the use of AI tools to enhance internal operations.

Recreation Communications and Branding

Developed and distributed branded materials, social media content, and print promotions to raise awareness of summer programming, partnerships, and upcoming events.

NEW IDEAS / TRENDS / PROGRAMS / SERVICES

Community Nights

Launching this summer, Community Nights will be hosted at the Program Centre and rotate weekly between "Creative Night" and "Games Night." The program replaces Summer Getaway and is designed for all ages. Activities will include painting, music, card games, and board games—offering a relaxed and welcoming environment.

Play Dates – Outdoor Transition

The Play Dates program has successfully shifted to outdoor delivery, taking advantage of seasonal weather. Participation remains strong and continues to grow as families engage in structured outdoor activities.

The current report is submitted for Council review. Administration welcomes any questions or feedback.

Town of Calmar

Department Report (DR) – (FCSS)

Meeting:	Regular Meeting
Meeting Date:	July 28, 2025
Originated By:	M. Leibel
Title:	Department Report – Family and Community Support Services (FCSS)
Approved By:	CAO Losier
Agenda Item Number:	11 I

KEY INITIATIVES/METRIC:

Here is a quick summary of FCSS in the months of May and June:

- **Volunteer Appreciation:** Volunteer Appreciation was held on Saturday, May 3, 2025, with a total of 32 attendees. The event was catered by Phat Tony's. As part of our Gemstone Survey, we asked volunteers: *"As a result of volunteering, I believe I am making a difference."* Out of the 28 responses, all 28 participants selected "Strongly Agree."

- **Golden Rules:** We had two local seniors volunteer their time to share stories and engage with the Grade 4 class. All 37 students participated enthusiastically, enjoying meaningful conversations and forming wonderful connections with the seniors. Based on the positive response, we've confirmed this program will continue annually and we're excited to expand it beyond just Grade 4 to include more students in the future.

- **Seniors Appreciation:** Seniors Appreciation was held on Thursday, June 5, 2025, at the Calmar Seniors Centre, with 38 people in attendance. Lunch was generously catered by Kosmos. As part of our Gemstone Survey, we asked: *"I feel a stronger sense of belonging in my community."* We were pleased to see all 26 respondents select "Strongly Agree."

- **Seniors Health and Wellness Chair Exercise Classes:** Attendance has steadily grown to 15 participants each week, with a great mix of both male and female attendees. Our final class was held on May 15, and we hope to offer the program again this fall.

- **Lemonade Stand & Resident Appreciation:** The event took place on Saturday, June 21, 2025, from 4:30 PM to 8:30 PM. We received 14 Lemonade Stand applications, out of the 15 available spots, with 13 participants attending the event. Attendance for the event was estimated at approximately 350 people. Around 450 burgers were served throughout the evening. The indoor movie screening of *Despicable Me 4* had an audience of about 80 viewers.

- **Meetings attended:**
    - Interagency Meeting
    - Library
    - Multi Municipal Meeting
    - Leduc Regional Housing
    - Communities In Bloom
    - Communications

- **Clients This Month:**
    - Phone Calls: 47
    - Emails: 12
    - Walk-ins: 14
    - Booked Appointments: 8

NEW IDEAS/TRENDS/PROGRAMS/SERVICES:

Here are a couple of the programs and events that will be coming up:

- Grass Buddies: July 2025 – I will be launching a new program called *Grass Buddies*, the guidelines are similar to Snow Angels, but for lawn care.
- FCSS Website Page Update: July 2025 - I'll be ensuring that all resources, programs, and events are current and fully updated with the latest information on the FCSS page, Including adding the Seniors Tax Deferral Program.
- The Guide to Grants to Organizations: Wednesday July 22, 2025
- Back-To-School BBQ: Monday August 25, 2025
- Home Alone Course – Partnering with Leduc County FCSS: Sept. 23, 2025
- Truth and Reconciliation – **TBD** -Sept. 24, 2025
- Christmas Elves Applications Open – Nov. 12, 2025
- Cooking Class – Partnering with Leduc County Family Resource Network: Nov. 19, 2025

ITEMS NEEDING INVESTIGATION:

The current report is submitted for discussion. Administration is happy to answer questions from Council.

Town of Calmar

Growth Report for Discussion

Meeting:	Regular Council Meeting
Meeting Date:	July 28, 2025
Originated By:	Eanimi Agube
Title:	Growth Report – July 2025
Approved By:	CAO Losier
Agenda Item Number:	11 J

BACKGROUND:

The following table depicts the development permits approved in May and June.

Permit #	Date applied	Civic Address	Applicant	Project	Value	Variance	Type	Authority	Date approved	Comments
2025-020D		5022 50 Street	Built with Passion	single detached dwelling	$285,000.00	Yes	Permitted Use		May 5th, 2025	Requested a bigger driveway
2025-021D	May 5, 2025	5253 47 Avenue	Built with Passion	single detached dwelling	$285,000.00	Yes	Permitted Use		May 6th, 2025	Requested a bigger driveway
2025-022D	May 5, 2025	4710 49 Street	OCDN Properties	single detached dwelling	$444,000.00	No	Permitted Use		May 9th 2025	

2025-023D	May 6, 2025	5012 53 Avenue	Candyce Baines	Basement Development	$4,500.00	No	Permitted Use		May 9th 2025	
2025-024D	May 13, 2025	31 Westview Crescent	Shirley Pedersen	Home-Occupation-Minor		No	Permitted Use		5/14/2025	
2025-025D	May 14, 2025	4729 50 Avenue	Skip Bromley	Health Services		No	Permitted Use		5/14/2025	
2025-026D	May 8, 2025	SE-31-49-26-W4	Glen Vinet	Fence	$68,155.00	No	Permitted Use		5/16/2025	
2025-027D	May 8, 2025	SE-31-49-26-W4	Glen Vinet	Change of use	$68,155.00	No	Permitted Use		5/16/2025	
2025-028D	May 19, 2025	5119 53 Avenue	Alvin Ryan	Solar Panel	$26,699.52	No	Permitted Use		5/21/2025	
2025-029D	May 28, 2025	5310 47 Street	McKeracher Robert and Jasman, Michael	deck	$2,000.00	No	Permitted Use		5/28/2025	

Permit #	**Date applied**	**Civic Address**	**Applicant**	**Project**	**Value**	**Variance**	**Type**	**Authority**	**Date approved**	**Comments**
2025-030D	June 13, 2025	5019 50 Street	Don McLachlan and Robin Scott	garage	$40,000.00	No			17-Jun-25	
2025-031D	June 16,2025	13 Parkview Crescent	Built with Passion	Basement Development	$49,640.00	No			17-Jun-25	
2025-032D	June 23, 2025	4801 54 Avenue	Arlynn Pretry	Home Occupation-Minor		No			24-Jun-25	

2025-033D	June 24, 2025	25 Calmar Trailer Park	Linda Kitsco	Deck Development	$3,000.00	No			25-Jun-25	

Mayor Sean Carnahan

Item 12.a

Council Report May – June 2025

In addition to regular council meetings, Special council meetings and various correspondence and administration duties

April 30th – Black Gold School Division – Attended the annual community engagement session, where breakout sessions were held to discuss topics related to the operations of the schools such as student teacher interaction, bullying within the student bodies, how it is being dealt with and how it affects the students. Discussion was also held about the acceptance of students with special needs and those with different lifestyle choices and optional education opportunities that are available to the students.

May 8th – Housing is Key Breakfast Fundraiser – attended the Leduc housing foundation annual event to continue to bring recognition to the foundation and the housing needs for seniors, low income and those fleeing homelessness and violence.

May 20th – Subdivision Authority – attended meeting to review and discuss subdivision application for Hawks Landing stage 2.

May 22nd – Leduc Regional Housing Foundation – attending meeting and had discussion on the following items: Gaetz landing II surplus – the foundation has some final work to complete and all the last item invoice to receive. The provincial funding model required municipal support to be eligible to receive, so the goal now is to have the ministry allow the surplus to be rolled into future housing foundation capital projects. March and April financial statements were presented by the finance committee, and the foundation remains in a positive position. The government of Alberta has provided an additional $86K to the foundation to be held in our Deferred Operating Reserve Fund, however they have now expanded the items these funds can be used for such as suite renovation. The 2024 annual report was reviewed with a couple of small minor changes and approved for distribution.

May 27th – Calmar Library Board – attended library board meeting where reports related to library operations were received. The 2024 audited financial statements were reviewed and approved and the 2024 Yellowhead Regional Library Annual report was received and reviewed.

June 19th – Leduc Regional Housing Foundation - attended the finance committee meeting, reviewed and recommended the April and May financial statements be presented to the board. The 2026 budget was reviewed with a few small adjustments suggested related to possible reinstatement of carbon tax, utility costs and basic inflationary items on certain line items within the budget. The budgets were then accepted to be presented to the board. Mr. Hart recommended honorarium adjustments be made in advance of the upcoming municipal elections as values have been held constant for the last 3 years.

June 21st – Resident Appreciation Event – attend the annual appreciation event that was held in the Mike Karbonik arena due to weather. This year's event included a lemonade stand display, where councillor Faulkner, Benson and I were the honorary judges. The 2024 Calmar annual highlights were presented to the community in attendance. Guest speaker MLA Andrew Boitchenko joined us and had great words about Calmar success, growth and some advice for all our little business entrepreneurs. The event was very well attended, and the children really had a blast with the lemonade stands. The evening ended with an indoor movie to wrap up.

June 24th - Calmar Library Board – attended library board meeting where reports related to library

operations were received.

June 26th - Police Funding Model Review - attended a virtual meeting for municipal leaders to take part in the Alberta police funding model review being completed by Meyer Norris Penny as part of the police funding program. The event was focused on providing statistical information about the policing costs, how the model worked and to garner community engagement into the future of the police funding model. Attached to this report are some of my notes from the event and some interesting slides.

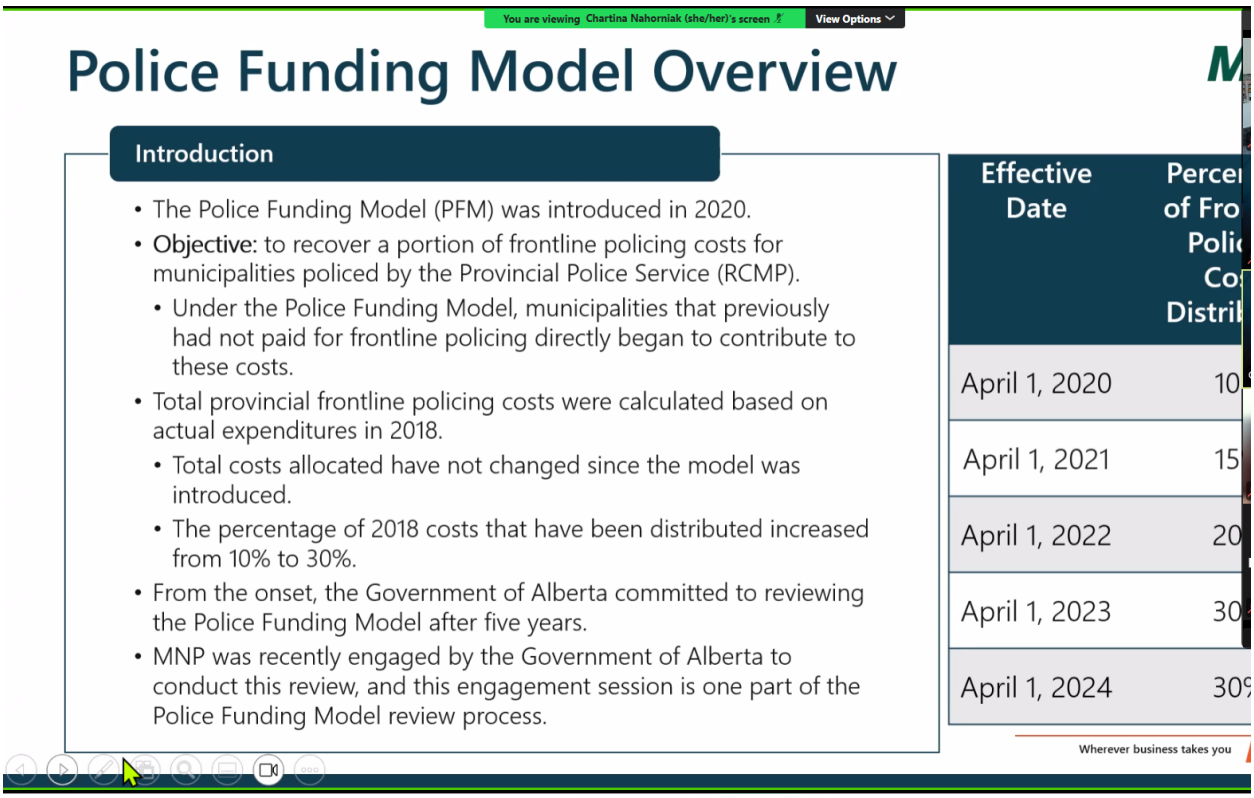
June 26th - Leduc Regional Housing Foundation – attended the board meeting, where senior leadership team presented on the 4 pillars of the board, what has been accomplished and what is being worked on. The May operation results were presented to the board and approved. The board received and reviewed the 2026 budget for all services and approved as presented. Board honorariums were presented and approved as presented. The governance committee presented the board governance survey summary, and the board continues to be a strong board with representation that covers all the requirements as set out by GOA guidelines. The governance chair discussed the upcoming Executive Director's review process which will be completed for our September meeting. Discussion was had about a future property management contract between the LRHF and TLA developments. The contract contains no risk to LRHF as the property manager, however, will be a new source of funding for the foundation.

June 27th - Municipal Mutual Agreement – met with the mayors of Leduc County, Thorsby and Warburg, to sign the Family Community Support Services agreement to ensure support services are available to all in the region.

Police Funding Model Review – with elected officials

Nolan Dyck secretary of Indigenous affairs and policing

- Looking at sustainability
- The government is absorbing some costs currently
- Rcmp costs are going up 57% surprising to everyone.
- Are we getting value for our spend municipalities are paying the same and goa is covering the current gap.
- Goa used to pay for policing and could not sustain that.
- 430 added rcmp policing head count for 235,000,000 – why so much for head? Inflationary costs – payout required rcmp unionized drove up benefit costs, wages.
- Rcmp – 245K per head Calgary and Edm – under 200K



MNP

Frontline Policing Positions

The table below outlines the year-over-year changes in frontline policing positions under the Police Funding Model from 2018-19 to 2023-24, categorized by position type. PPSA policing positions have increased by **219 RCMP Officers**, excluding the enhanced policing positions that were absorbed by the Province as part of the implementation of the model.

Comparison with Current Costs

MNP

In 2024/25, the Government of Alberta absorbed **36.6%** of the frontline policing costs which should have been allocated to municipalities under the Police Funding Model.

If municipalities were to pay the full 30% of 2024/25 frontline policing costs, this would result in a **57.7%** increase to the municipal portion of frontline policing under the current Police Funding Model formula.

Municipal Portion of Frontline Policing	
	2024 / 25 Costs
30% of Current Frontline Policing Costs	$110,057,661
Cost Distributed to Municipalities through the Police Funding Model in 2024/25 (Based on 2018/19 Actuals)	**$69,800,000**
Remaining Frontline Costs Absorbed by the GoA	**$40,257,661**

Cost Formula

Base Cost Formula

- Weighted equalized assessment (50%) + weighted population (50%) = Base Cost

Modifier Formulas (Subsidies)

- **Shadow population:** Subsidy given (max 5%) if officially recognized by the Government of Alberta or according to the President of Treasury Board and Minister of Finance.
- **Crime Severity Index (CSI):** Subsidy given (0.05% per CSI point) if a municipality's three-year average is above the rural three-year municipal average.
- **Detachment:** Subsidy of 5% given for towns, villages, and summer villages with a population under 5,000 that do not have a detachment in their community.

Policing Reinvestment

Reinvestment Approach

- The Police Funding Model generated revenue that will be reinvested into provincial policing, with a priority on increasing core policing.
- The RCMP and Alberta Justice and Solicitor General (now Alberta Public Safety & Emergency Services) developed a plan to invest in RCMP officers and civilian staff with several key reinvestment priorities.

Reinvestment Priorities

- Support rural detachment enhancement
- Expand aerial observation capability
- Undertake methamphetamine and opioid initiatives
- Address auto theft
- Continue to advance the Call Management Initiative
- Enhance General Investigative Services
- Further support vulnerable persons, missing persons, and homicide investigations

Communication and Input

MNP

Interim Provincial Police Advisory Board

- The Interim Alberta Police Advisory Board was established as part of the Police Funding Model implementation. The objective of the board is to provide a forum for the PPSA municipalities to discuss provincial policing priorities.
- The interim advisory board consists of 11 voting members including:
  - Representatives from the Rural Municipalities of Alberta, Alberta Municipalities, and the Alberta Association of Police Governance.
  - Two community member representatives from each of Alberta's four RCMP districts (8 representatives total)
- Through this venue, municipalities can provide valued advice in matters related to the provincial police strategic and financial plans and further advocate for the resources their communities need to the leadership at the Ministry and the RCMP.

Community Safety and Wellbeing Practice

MNP

MNP has established a structured Community Safety and Wellbeing practice providing a wide range of consulting services to policing organizations, provincial justice departments (corrections and courts), fire and paramedic organizations, and related organizations that focus on homelessness, addictions, and family violence.

Sector Challenges

- Rising costs of essential community and public safety services
- Increased mental health & substance use issues
- Complexity of interconnected service systems

Why It Matters

- Strong partnerships with citizens & organizations are more critical than ever
- Need for more effective, efficient, and sustainable service delivery

Our Services

- Organizational & operational reviews
- Strategic & business planning
- Process improvement
- Technology implementation

MNP's Clients

- Municipal police services
- RCMP & contract partners
- Rural communities & First Nations
- Fire & paramedic services
- Addiction, mental health, homelessness organizations
- Governments (all levels)

Our Value

- Deep expertise across jurisdictions
- Practical, tailored solutions
- Strong understanding of community safety and public safety and how they intersect with complex social issues

Police Funding Model Review Objectives

MNP

The Government of Alberta has engaged MNP LLP (MNP) to conduct a review of the Police Funding Model in line with the Government of Alberta commitment in 2020. The review will include actionable recommendations for fairness, shared fiscal responsibility, and sustainability informed through the following activities:

1. Identify challenges and what is working well with the PFM from the perspectives of municipalities, the Ministry of Public Safety and Emergency Services, and the RCMP.
2. Evaluate the current methodology in terms of equitable and fair distribution of costs and re-investment based on service levels.
3. Conduct qualitative and quantitative analysis to determine future needs related to the governance, administration, and cost-sharing of police services.

Stakeholder Engagement Methods

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Today's session is part of a broader series of engagements taking place throughout June and July across the province.

- **Townhall Sessions** with elected officials from municipalities impacted by the current Police Funding Model
- **Focus Groups** with administrative leaders in municipalities impacted by the current Police Funding Model
- **Online Survey** to gather additional input from elected officials and administrative leaders on their primary concerns and suggestions for improvement related to the Police Funding Model
- **One-on-One Interviews** with subject matter experts from the provincial ministries responsible for administering the model, and the RCMP, as Alberta's contracted provincial police service
- **One-on-One Interviews** with municipal associations including the Rural Municipalities of Alberta and Alberta Municipalities

Council Report

Don Faulkner

July 21, 2025

High Performance Governance is all about our **Organizational Ability to Lead, Imagine New Possibilities and Achieve Operational Excellence.**

June 2/25, Regular Council Meeting

- Please refer to the Calmar Web Site for agenda and minutes.

June 3/25, Legion Meeting

- I attended the regular monthly meeting of the Legion as a member of the Legion and expressed my sadness for the conflict regarding the “Watch Party”. I said that things go better and have greater chances for success when we work together. I also said there are things that we could have done on both sides to make this event a greater success and told them that I personally would like to see better communication and closer ties with our community organizations.

June 4 & 6/25, I attended the Oilers Watch Party at the Arena

- I attended the Watch Party at the arena, huge shout out to our staff for all their efforts in making this event a success.

June 5/25, Seniors Appreciation Lunch

- I attended the FCSS Seniors Appreciation Lunch, big thank you to Mikala and her helpers for their efforts in putting together this event, it was well attended and appreciated.

June 6/25, Committee of the Whole

- Please refer to the Calmar Web Site for agenda and minutes.

June 7-12/25, I attended the ACE (Water Commission) Conference

- I will report more in my Water Commission Report.

June 12 & 14, I attended the Oilers Watch Parties at the Arena and the Legion.

- I attended the Watch Party at the arena, huge shout out to our staff for all their efforts in making this event a success. I did split my time between our party at the arena and the party at the legion.

June 16/25, Regular Council Meeting

- Please refer to the Calmar Web Site for agenda and minutes.

June 18/25, Leduc & District Regional Waste Management Commission Board Meeting

- **Manager's Report**; Waste Volumes, hhigher volumes of construction and demolition (C&D) and asbestos continue to be recorded, resulting in roughly 4,000 MT of increased tonnage. Organics Processing, Due to the heavy rains we have experienced this Spring, the amount of leaf and yard organics is very high. Soil Inventory, In May we received just over 2,000 MT of revenue generating cover; the largest monthly volume in 2025. The site was also successful in securing a large remediation project in Leduc County which will see 49,000 MT of chloride impacted soils brought in over the next several years. We were able to further reduce our stockpiles by an additional 218 MT. Site Activities and Security, on May 31, 2025, a large fire broke out on the North side of Area 2. This incident is currently under a thorough investigation and will be discussed in closed. The use of pyrotechnics for the Gull Program has been paused until the source of the fire can be determined. Collaboration with Other Regions, Recent topics of discussion have included landfill fires, heat detection devices and lithium fire suppressants. Health and Safety, Field level hazard assessments and "Stop and Speak" cards are processes E360uses to enforce a culture of safety that includes all employees on site as well as visitors. Municipal Reporting, I have a link for those interested in looking into this in more detail. Site Inspections, a site inspection was completed on June 9. Capital Project Updates, Airspace Reclamation (East Landfill Phase 2 Bio cover Removal) – Next steps are to stake out the area at the same time surveyors are in to stake out the diversion pad. This is expected to take place in July. Surface Water Improvements – Culvert inspections have been completed as part of the surface water management plan. Next steps are to clean out existing culverts and replace those that are damaged. Equipment GPS System – The RFP for GPS landfill compaction was awarded to Olio (Carlson Equipment) with installation and training scheduled for late Summer or early Fall. Diversion Pad – The RFP will be released shortly, with completion scheduled for mid-September.

- **Public Education & Communication Strategy;** Website Updates, Administration has streamlined the Facility website for ease of access. The website has undergone edits to encourage a smoother experience for the public. Advertising Signs, Administration has gathered options to create a sign advertising the use of the landfill to the public. This includes: a pull up banner, an aluminum sign and a coroplast sign. The board decide to start with ordering an aluminum and coroplast sign for each community, we should be able to use the aluminum sign at our grass/yard waste drop off and the coroplast sign where we have events as an education tool.
- Monthly meeting for July and August have been cancelled and consideration for cancelling the October meeting (due to the election) will be discussed in September.

June 19/25, Capital Region Southwest Water Service Commission Board Meeting

- **Manager's Report**; Nisku Booster Station, there are ongoing vibration issues with the pump system at the Nisku Booster Station, these lie with the contractor (Maple Reinders). Due to these issues, the grand opening has been delayed. **Municipal Developments**, administration has received 7 notifications of subdivision development/extensions, 3 are from Calmar. **Regional Water Customer Group**, EPCOR reviewed Health Canada's guidelines and screening values for perfluoroalkyl and polyfluoroalkyl substances (PFAS's), sampling is required annually, done quarterly in the raw water and distribution systems. Information about a water availability study by the Government of Alberta was presented and more information on that is available upon request. The RWCG discussed the Rain Wise Stormwater Rebate Program which is an incentive program in the City of Edmonton. Water demand was reviewed and will be discussed further at the Technical subcommittee meeting. The cost-of-service subcommittee shared that they are meeting with EPCOR on the final element of the methodology around not paying for fire protection where pipes are artificially larger than needed. **The City of Beaumont Elan Subdivision**, the consultants, on behalf of Elan subdivision developer in the City of Beaumont, has been working with administrator to obtain a crossing agreement for work over CRSWSC water transmission main. **City of Beaumont Line Extension to St. Vital Reservoir**, the City of Beaumont Administration submitted a draft drawing set of a proposed water transmission line connecting the St. Vital Reservoir to the CRSWSC water transmission line. **Leduc County – New Sarepta New Connection**, administration has been communication with Leduc County Administration and supporting consultants to discuss a potential new connection. **Water Master Plan**, Administration and Associated Engineering held the kick-off meeting for the Water Master Plan on May 15, 2025. **Hazardous Building Materials Assessment**, at the January 16, 2025, board meeting, administration was directed to conduct hazardous materials testing at facilities used by the Commission for operations, administration will be following up with members to ensure that the critical actions are completed. **Board Policies**, there are two board policies that must be reviewed this year. **Emergency Planning,** preliminary quotes from Westcan have been received for the installation of a lightning rod and grounding wire at Highway 21 Booster Station. **Commission Facility Locates,** commission operators completed 163 Utility Safety Partner locates as of June 2025 on Commission Facilities, as compared to 158 as of May of 2024.
- **Treasurer's Report**; **2025 Financial Update**, there should be approximately 42% of the budget spent/earned. Overall, the commission is on track with respect to expenses with an overall budget spent of 41%. Management expenses are under budget with 30% of the budget spent and operation expenses are on budget for the year with 42% of the budget spent. More information is available upon request.
- **2025 ACE Conference,** I attended various educational sessions that covered topic like line leakage, PFAS's, and community engagement. As always walking the trade show

floor with Shawn and Rich was extremely helpful in learning more about the equipment that makes our systems work and systems that would be advantageous in the future. It was also a great opportunity to get to know our members and staff better, team building at its best.

- **Next meeting September 18, 2025**.

June 20/25, ATB 85+ Service Celebration

- I attended the open house celebration of having the ATB in Calmar for 85 years. I was very impressed to hear that they have been a part of our community for that long. Met the owners and local (Leduc and Calmar) employees of ATB. Cake and coffee, making connections with local business.

June 21/25, Lemonade Stand Day & Residents Appreciation BBQ

- Well attended event, awesome lemonade stands, and an incredible range of lemonade served. Cooked burgers and helped with the popcorn.
- Huge thanks to our staff for their hard work, particularly Mikayla for her leadership in making this event a huge success.

June 25/25, Committee of the Whole

- Please refer to the Calmar Web Site for agenda and minutes.

June 26/25, Chamber Golf Tournament (Red Tail Landing)

- Another incredible opportunity for networking.

Krista Gardner Councillor Report

June 2025

June 2nd- Regular Council Meeting

June 3rd- Ministry of Environment Presentation on Changes to Regulations Involving Lagoons

June 5th- Edmonton Regional Waste Advisory Committee

We had a presentation from [Re]Waste, discussing innovative alternatives for plastic waste with interesting potential for municipalities. We also discussed the potential for the committee to move forward with seeking out grants to fund future projects that will benefit the entire region (in the wake of the dissolution of the EMRB).

June 5th- Calmar Seniors' Appreciation Luncheon

I was thrilled to attend and briefly speak to the seniors in attendance about the importance of their contributions to our community. We had a good turn out and a lovely meal.

June 5th- Assessment Open House

As a resident, I attended the Assessment Open House with Powers & Associates, where we can ask questions of the assessor. There were a number of people there and I appreciated the opportunity to learn more about how our assessment in determined,

June 6th- Elected Officials Education Program Course- Regional Partnerships

June 6th- Committee of the Whole Meeting

June 7-12th- Capital Region Southwest Water Services Commission American Waterworks Association Annual Conference and Exposition

June 13th- Elected Officials Education Program Course- Regional Partnerships

June 16th- Yellowhead Regional Library

The Board approved the 2026-2030 Strategic Plan- Charting the Course Together. One highlight from the document is the Strategic Compass, which will help guide decision making during uncertain times. Another topic of discussion was an Alberta Municipalities resolution being submitted for this coming convention for increased funding for libraries. The 2024 annual report was approved for distribution by the executive committee. The bulk

of the meeting was a debate on a proposed $0.88 per capita increase to membership fees, which is an 18% increase and would need to be ratified by all individual members per the Master Membership Agreement. Opinions varied.

June 16th- Regular Council Meeting

June 19th- Capital Region Southwest Water Services Commission Board Meeting

June 20th- Elected Officials Education Program Course- Regional Partnerships

June 20th- Calmar Alberta Treasury Branch 85th Anniversary Celebration

I dropped in to give well wishes on this substantial achievement to everyone at Calmar ATB! Congratulations on this milestone!

June 21st- Calmar Lemonade Stand and Resident Appreciation BBQ

What an amazing evening! My daughter participated in the Lemonade Stand competition (read- I did most of the work lol) and had a fantastic time. There were so many smiling faces. The BBQ was well-attended, and I had lots of great conversations with locals. We then watched Despicable Me 4 and I was busy handing out free popcorn. Huge thanks to all of our sponsoring businesses. We can't do these types of events without you. Also huge thanks to all the kids who participated and to our MLA Andrew Boitchenko for joining us the evening,

June 25th- Summer Municipal Leaders Caucus Webinar

June 25th- Committee of the Whole Meeting

June 26th- Summer Municipal Leaders Caucus

June 27th- Alberta Municipalities Board Meeting

May Council Report

Councillor Jaime McKeag Reber

May 1st- Business Brunch- Along with Councillors Gardner and Faulkner I attended the Business Brunch where I had the opportunity to speak with several of our local business owners about concerns, such as dust from the main street entering Main Street businesses. We spoke about the cleanliness of Calmar and how some were extremely happy with the spring cleaning, and some were not. I was able to share some of Communities in Blooms efforts, drum some volunteers and prepare the business community for the sponsorship letters that were going out that week. I was happy to share that my own business Wild Summit Co was opening that Day and felt a warm welcome from our community.

May 1st- Policy and By-Law Committee

May 3rd- Volunteer Appreciation Lunch- Happy to join this well attended event and grateful for the work done my FCSS Mikayla and the Administration team. Great conversations with volunteers and a wonderful lunch.

May 4th- MAY THE FORCE BE WITH YOU MOVIE DAY- While attendance for this movie was a little low, I was thrilled to attend and to bring my son with me. A core memory built for sure as he still asks if we are going to the movies every time we pass the arena now. I'm happy we are using the arena in another capacity!

May 5th- Regular Council Meeting- Please see meeting minutes

May 6th- Calmar Play Dates- Lead Volunteer

May 7th- Calmar Open Gym Night- Lead Volunteer Low attendance to due to all the sports starting up.

May 13th- Calmar Play Dates- Fire Hall Edition- One of my favourite events to date! We had so many kids and families show up. Leduc County FCSS, Councillor Gardner and FCSS Mikayla were able to be on scene for a little bit. The firehall did an amazing job showing the kids around and letting them test out the Firehose to hit some pillions. Thank you to Rec Coordinator Ian and FCSS Mikayla for bringing granola bars and juice boxes for the kids. Overall- very well received and a great way to end the Spring season.

May 14th- Calmar Open Gym Night- Cancelled. Will all the sports starting up on time we made the decision to cancel the Open Gym for the last week, and I was a little burnt out from the previous week's commitments.

May 20th- Subdivision Board Meeting- Please see meeting minutes

May 20th- Regular Council Meeting- Please see meeting minutes

May 21st- FCSS Advisory Committee- Rave review from Leduc County about our Calmar Playdates Firehall event and the great turn out. Heard about many other programs happening for the summer

in our area and will work together with our FCSS and Leduc County to try and bring more of the programing to Calmar.

June Council Report

Councillor Jaime McKeag Reber

Thank you to my fellow councillors who were able to cover for me for any meetings I was unable to attend due to be on holidays in the states with my family.

While there we took plenty of time to visit parks in nearly every State that we passed through and joked we were on an "Infrastructure Tour" and I have several ideas for Parks and Recreation initiatives in the future. There was one park called a sensory park in Katy, Texas that was stunningly built but also informative of to the visitors of different plans, water cycles, grass and bugs in the area. I look forward to sharing these ideas with my Communities in Bloom Committee.

June 2nd- Regular Council Meeting- Please see meeting minutes

June 6th- Committee of the Whole – Presented about the idea to personally host the 1000 Miles Fundraising event for a Pump Track/Skate Park build in the Calmar Outdoor Recreational Grounds Park. The idea was met with positive feed back.

June 16th- Regular Meeting of Council – Please see meeting minutes but happy to report the agreement of the Town of Calmar's Pledge of $10 per Mile to the 1000 Miles Fundraising event!

Carey Benson Councillor Report June 2025

June 2nd Regular Meeting of Council

- Please review the agenda and minutes on The Town of Calmar website for more information.

June 6th Committee of the Whole

- Please review the agenda and minutes on The Town of Calmar website for more information.

June 16th Regular Meeting of Council

- Please review the agenda and minutes on The Town of Calmar website for more information.

June 24th Communities in Bloom

- Attended the meeting as Councillors McKeag Reber's alternate. We spent the majority of the meeting discussing the planning for the CIB judges coming to town and how we as a committee can achieve it.

June 24th Library Board Meeting

- Yellowhead Regional Library (YRL) approved their 2026-2030 Plan