ADMINISTRATION REPORT
REZONING & PLAN AMENDMENT
RIVER VALLEY CAMERON

16850 – ANTHONY HENDAY DRIVE NW;

16880 – ANTHONY HENDAY DRIVE NW; AND

16910 – 35 AVENUE NW

To allow for the development of a 10-megawatt solar power plant in the North Saskatchewan River Valley, adjacent to the E.L. Smith Water Treatment Plant.

Aerial Image captured May 2018

RECOMMENDATION

Administration is in **SUPPORT** of this application because it:

- aligns with policy direction in The Way We Grow, The Way We Green and the draft City Plan by supporting key sustainability objectives;
- will be regulated by a Direct Development Control Provision (DC1) that provides mitigation measures and requires post construction wildlife monitoring to identify impacts and additional mitigation opportunities if impacts exceed provincial standards;
- is located on lands identified for the future expansion of the E.L. Smith Water Treatment Plant, of which the proposed use is both compatible and complementary; and
- supports City Council's Climate Resilience goal of transitioning to a low carbon future, with clean air and water and offers adaptations to a changing climate as well as Edmonton's Community Energy Transition Strategy target to generate 10% of Edmonton's electricity locally by 2035.

APPLICATION HISTORY & REFERRAL

Bylaw 18889 & Charter Bylaw 18890 originally went to the June 17, 2019, Public Hearing and was referred back to administration to:

1. Work with EPCOR Water and Enoch Cree Nation to continue engagement activities and return to a future Public Hearing. Engagement activities should include:
    a. Sharing archeological report and traditional knowledge to further interpret the findings and site history in consultation with Alberta Culture, Multiculturalism and Status of Women;
    b. Potential partnerships and collaborate on site interpretation, vegetation and harvesting, project naming and potential economic opportunities; and
    c. Offer to collaborate on the design and shared use of publicly accessible open space.

2. Work and reporting necessary to allow Council to fully consider whether the location within the River Valley should be deemed essential by Council.

Addressing Motion 1:

EPCOR and Enoch Cree Nation have met on a regular basis and developed a path forward that includes support for the proposed solar power plant, as noted in the "Public Engagement" section below and as attached, Enoch Cree Nation Re-Engagement Summary Report &

September 2020 Supplemental Enoch Cree Nation Re-engagement Report (Appendix 2.A. & 2.B.).

Addressing Motion 2: Part 2: ‘Deeming Essential’

To satisfy the the terms of Reference for the Site Location Study and subsequent Environmental Review report, EPCOR provided:

1. E.L. Smith Solar Project Site Location Study (dated January 31, 2020)
2. Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm - Wildlife Addendum (dated January 2020)
3. Municipal E.L. Smith WTP Solar Farm Project Monitoring and Mitigation Plan (dated August 2020)

Administration’s review and deemed essential analysis are included in the E. L. Smith Solar Project Environmental Review (Appendix 1.A) and in a condensed form in the Environmental Review section below.

SUMMARY

Edmonton is in the midst of reformulating its strategic level plans. In 2019, City Council approved ConnectEdmonton, a community vision for Edmonton to 2050. Currently, Administration is advancing The City Plan, the new combined Municipal Development Plan and Transportation Master Plan that charts out how we will get to a future city, a city that has the benefits we enjoy today with new opportunities for the future. To get to that future, the choices ahead are going to be complex because cities have so many diverse and often competing interests. The choices to be made are not always going to be easy or obvious and there will be trade-offs along the way.

This application by EPCOR Water Services Inc. (EWSI) to develop a 10-MW solar power plant in the North Saskatchewan River Valley to supply power to the E. L. Smith Water Treatment Plant represents one of those choices. One that is complex, with competing interests and policy, tangible impacts and benefits, and trade-offs.

The proposed solar power plant will occupy a 22 hectare previously disturbed site that has been identified for the expansion of the E. L. Smith Water Treatment Plant. Although complimentary to that use and the negative impacts associated with the proposed development are localized to the site and the nearby surrounding lands, the proposal increases industrial development within the Rivery Valley.

Long standing and detailed existing policy direction to conserve and protect the river valley competes with newer city-wide strategic policy direction to become more climate resilient as set out in ConnectEdmonton and other directional planning documents such as The Way We Green and Edmonton's Community Energy Transition Strategy which set out a target to have 10% of the electricity consumed within the City of Edmonton, generated within the boundaries of the City of Edmonton by 2035.

Impacts on vegetation and wildlife habitat have been partly addressed by reducing the footprint, an increased setback from the river, vegetation restoration of three hectares of native trees and shrubs to enhance wildlife habitat, and an ongoing Wildlife Monitoring and Mitigation plan and an Adaptive Management Framework has been prepared to determine and apply additional necessary mitigations post construction if needed. However, the project will result in a net loss of 19.7 hectares of habitat, have adverse connectivity impacts, and increased risk of wildlife mortality due to avian collisions and entrapment.

The 'Deemed Essential' analysis and accompanying site location study concluded that the project demonstrated:

- strong *Financial* benefits with the River Valley location being the most cost effective due to its co-location next to the water treatment plant and behind the grid advantages*;*
- provides some *Social* benefits with the ability to partner with Enoch Cree Nation;
- *Environmental* impacts with mitigation gaps and loss of habitat; and
- mixed *Institutional* benefits surrounding the trade off of the ability to provide local power generation to help meet the 10% goal of local generation, but within a River Valley setting which is directed to be preserved and protected.

Through the public consultation, Administration received a mix of feedback with the majority being concerned about the development. Positive comments included support for green and alternative energy while comments of concern included environmental and wildlife impacts, aesthetics, and policy alignment. Epcor has worked with Enoch Cree Nation to address their concerns. There has been extensive sharing of archeological information, sharing of project information and site visits with Enoch Elders and Knowledge Holders, exploration of potential partnerships and collaboration on design and shared use of publicly accessible spaces at the E.L. Smith site which has led to Enoch's position of support for the proposed project and the signing of a memorandum of understanding that formalizes their commitment to working together in the spirit of reconciliation and collaboration.

Through a comprehensive review, Administration has chosen to support this application and the development of a solar power plant with the recognition that many inherent trade-offs have been made. It is viewed that the resulting unmitigated impacts on local and natural biodiversity functions resulting in the placement of a solar power plant in the River Valley is an acceptable tradeoff to advance the recent and bold climate resilience ambition that Edmonton is striving for. This ambition is embedded in the goals and action towards climate resilience and meeting the strategic goal that *Edmonton is transitioning to a low carbon future, has clean air and water, and is adapting to climate change.*

THE APPLICATION

The application is comprised of two related Bylaws:

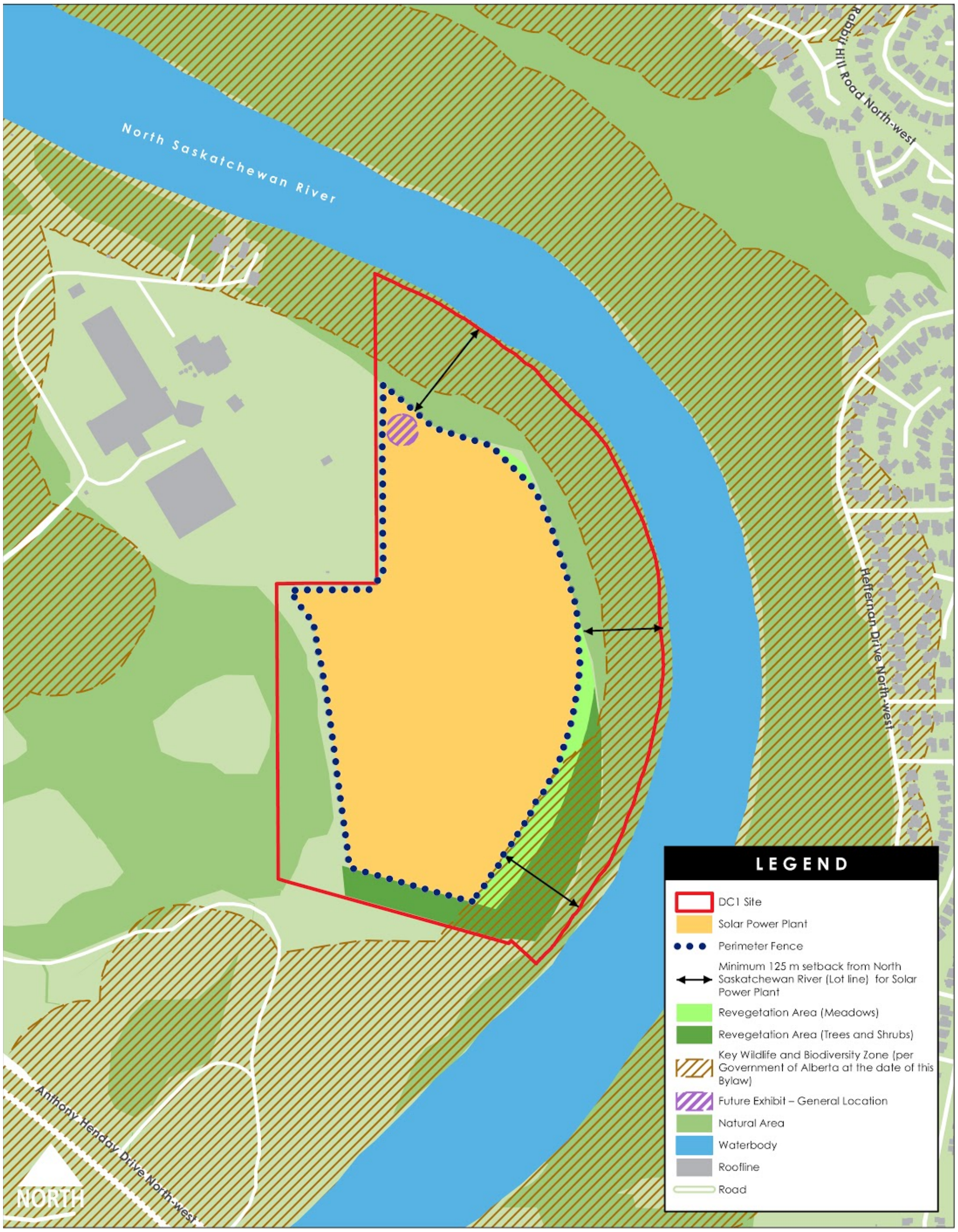
1. BYLAW 18889 proposes to amend the North Saskatchewan River Valley Area Redevelopment Plan by redesignating the affected site from *Metropolitan Recreation and Environmental Protection Zone* to a *Direct Development Control Provision* to permit the development of a Renewable Energy Device (solar power plant) in the river valley. The amendment alters the Plan's land use concept map and revises the wording of several objectives and policies.

2. CHARTER BYLAW 18890 proposes to amend the Zoning Bylaw by rezoning the site from (A) Metropolitan Recreation Zone to (DC1) Direct Development Control Provision to permit the development of Minor and Major Impact Utility Services uses. These uses would allow for the development of a Renewable Energy Device (solar power plant) and permit the future expansion of the water treatment plant.

PROPOSED (DC1) DIRECT DEVELOPMENT CONTROL PROVISION

The general purpose of the DC1 is to permit utility systems limited to a Renewable Energy Device (solar power plant) and the potential expansion of the water treatment plant, and complementary uses. The proposed DC1 includes the following uses and site specific regulations:

- Major and Minor Impact Utility Services.
- Public Libraries and Cultural Exhibits, Publicly Accessible Private Park, Public Park, Urban Gardens and Special Events uses are added to enable educational and interpretive exhibits and/or a demonstration site and other special events.
- Mitigation measures including:
    - A minimum setback of 125 m (an increase from 100 m) from any lot line abutting the North Saskatchewan River.
    - Detailed landscaping plans for the revegetation of native meadows, trees and shrubs on the southern boundary of the site.
    - A commitment for no development in the key wildlife biodiversity zone as identified in the Concept Plan (new).
    - An agreement to conduct a Wildlife Monitoring and Mitigation Plan and create an Adaptive Management Plan (new), if residual impacts due to the solar power plant are found to have occured, to be submitted and approved post construction.
- A maximum building height of 18 m (the maximum under the (PU) Public Utility Zone).
- A fence to be installed and maintained along the perimeter of the solar power plant, in accordance with an attached concept plan.
- Screening for all loading, parking, activity areas, and mechanical installations.



CONCEPT PLAN

THE PROPOSED DEVELOPMENT

EWSI proposes to develop a solar power plant, or a “solar farm”, on lands immediately south of the E. L. Smith Water Treatment Plant. As proposed, the facility will be made up of approximiately 45,000 solar panels, generate 10 MW of electrical power, and occupy approximately 22 hectares of land. The solar power plant will produce 20,000 MWh of power annually, reduce EWSI power consumption from the grid by 21%, reduce associated green-house gas emissions, and make the water treatment system more resilient.

The energy generated by the panels is intended to power the water treatment plant with the opportunity to transmit excess power to the larger electrical grid. Batteries to store power and draw upon during periods of low solar energy generation would be located off site and on the abutting water treatment plant site.

The facility delivers on EWSI’s Green Power Initiative and commitment to obtain approximately 10% of its power requirements from locally produced renewable sources. The project is sized to align with $1.9 million annual funding approved for the Green Power Initiative by City Council through the performance based rate process in 2016. The business case analysis by EWSI indicates that the current proposal provides twice the power supply at the lowest direct monetary cost. EWSI intends to conduct research on solar energy and operate associated educational programming at the facility.

SITE AND SURROUNDING AREA

The site is located on a large terrace in the North Saskatchewan River valley, along the northwest bank of the river, north of Anthony Henday Drive NW, and adjacent to the existing E.L. Smith Water Treatment Plant. The closest developed urban areas are the residential neighbourhoods of Cameron Heights (due west) and Henderson Estates (due east) situated above the site and abutting the edge of the river valley. Although planned, the river valley trail system does not yet exist in this portion of the river valley. The existing land use zoning of the site and surrounding lands is detailed below.

Site / Direction	**Existing Zoning**	**Current Use**
Site	(A) Metropolitan Recreation Zone	Undeveloped
North	(PU) Public Utility Zone (A) Metropolitan Recreation Zone	E.L. Smith Water Treatment Plant (Minor Impact Utility Services use) North Saskatchewan River
East	(A) Metropolitan Recreation Zone	North Saskatchewan River
South	(A) Metropolitan Recreation Zone	Undeveloped green field
West	(A) Metropolitan Recreation Zone	Treed slopes / natural area

AERIAL VIEW #1 OF SITE

AERIAL VIEW #2 OF SITE

GROUND LEVEL VIEW OF THE SITE

Not including the E.L Smith Water Treatment Plant property to the north, the site consists of three titled lots totaling 40.13 hectares in area, all of which are owned by EWSI. Although a portion of the site was formerly cultivated farmland, that area has been allowed to naturally revegetate, largely with grasses and isolated pockets of native trees. Areas not previously cultivated, including along the river and escarpment slopes, are occupied by stands of mature native trees. Fencing along the east and south sides of the site restricts trespass. Vehicular access to the site is via E.L. Smith Road NW and controlled by a gate.

Two of the three parcels that comprise the site were transferred from the City to EWSI in 1999. The third parcel was purchased by EWSI from a private landowner in 2001. The Master Agreement, which outlined the transfer of assets from the City to EWSI when it was created as a private company, notes that it is intended for the potential future expansion of the water treatment plant.

PLANNING ANALYSIS

Administration's planning analysis for this application focused on two policy streams and two scales of impact. The two streams are applicable land use based policy, versus applicable city-wide goals and policy. The scales of impact are on the site and surrounding area, versus the entire community.

This proposal for a solar farm within the River Valley, represents one of those instances where competing policy is set against one another. It is clear, there are numerous policies that support the preservation and conservation of the River Valley and at the same time policy direction supports the advancement of the proposal that would generate sustainable energy that creates a resilient power source to supply the city with clean water.

The river valley and ravine system forms the central spine of Edmonton's open space and biodiversity network, and is more than 8,400 hectares in area[1]. The proposed solar power plant is set to occupy a 22 hectare previously disturbed site that has been identified for the expansion of the E. L. Smith Water Treatment Plant, a complementary adjacent use. The negative impacts associated with the proposed development are localized to the site and the nearby surrounding lands. The application proposes mitigation measures that partially; but, do not fully address all of the impacts associated with this project.

These unmitigated impacts represent the trade-off for pursuing a development that is a tangible example of Edmonton becoming a more resilient City while advancing its goals of transitioning its energy sources to allow for a low carbon future.

Policy Analysis

A comprehensive review of the existing policy documents was undertaken including:

- **ConnectEdmonton**; Edmonton's Strategic Plan 2019-2028
- **The Way We Grow**, Edmonton's current (as of writing) Municipal Development Plan;
- **The draft City Plan**, draft Municipal Development Plan and Transportation Master plan scheduled to be heard by City Council in September 2020

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[1] Based on the North Saskatchewan River Valley Area Redevelopment Plan Boundary and not including the recently annexed areas.

- **North Saskatchewan River Valley Area Redevelopment Plan** (NSRV ARP)
- **The Way We Green**; Edmonton's Environmental Strategic Plan
- **Breathe***,* Edmonton's, Green Network Strategy;
- **Ribbon of Green SW+NE**; and
- **The Community Energy Transition Strategy**
- **Edmonton Metropolitan Growth Plan**

Land-use Policy

The review of land use related policy clearly indicates there is considerable well established and new direction that would avoid the proposal altogether. Edmonton and the region have long identified the river valley and ravine system as a highly important open space and natural feature in the city and therefore to be largely preserved and protected, while allowing opportunities for recreational and educational programming, and limited necessary development. The City's overarching approach to meeting these objectives is to:

- protect, restore, maintain, and enhance the River Valley system of conserved natural areas;
- steadily acquire land within the river valley and ravine system - with the view that the City will be the best steward in protecting the land;
- generally limit subdivision and development of uses on public and private lands by maintaining land use zoning that restricts development to farms, parks and recreation related uses, and other small scale improvements, many of which generally cannot obtain and cannot be developed without municipal services;
- generally allow recreation and park based activities that minimize impact to the natural aspects of the system;
- allow specific areas to be more intensively developed such as the early settlement residential neighbourhoods of Rossdale, Riverdale and Cloverdale, and designated activity nodes such as the Zoo, and Fort Edmonton Park; and
- only allow larger scale specific development subject to justifying their need to be located in the river valley and ravine system, and subject to applying mitigative measures that avoid, minimize, mitigate and offset impacts, in that order.

This approach is detailed in, The Way We Grow, the draft City Plan, The Way We Green, Breathe, the Ribbon of Green, and the North Saskatchewan River Valley Area Redevelopment Plan. The objectives and related policies of these plans address the preservation, protection and enhancement of the natural environment.

However, through all of these plans, there are land use policies that contemplate proposals of this kind at a local scale and identify paths to their approval through the application of a mitigation approach. The mitigation approach limits the impact upon the natural functions and character of the environment and allows for the sensitive development of facilities that are required to be sited within the North Saskatchewan River Valley.

This mitigation approach is outlined within the NSVR ARP which outlines in policy 3.5.1 and 3.5.3 that major facilities shall not be developed unless deemed essential by City Council. Further, these facilities are subject to an environmental impact screening assessment and a detailed Site Location Study which make a River Valley location essential and must be prepared for Council approval. The ‘deemed essential’ analysis has been applied to this project and is further discussed below in the Technical Review section.

City-wide Goals & Policy

A review of a number of city-wide goals and policy does support this proposal. This includes one of its four main strategic goals from ConnectEdmonton: *Edmonton is transitioning to a low carbon future, has clean air and water and is adapting to a changing climate*. This goal is supported by a number of policy objectives detailed through: The Way We Grow, draft The City Plan, The Way We Green, and the Community Energy Transition Strategy. The common approach through all of these documents include:

- transition Edmonton’s energy to renewable and sustainable sources
- making Edmonton resilient to disturbances from climate change that could affect its energy supplies and distribution system; and
- advancing Edmonton along a path to a low carbon future.

Pursuit of these goals will require transformational change over the next 10 years and in some cases challenge, or reprioritize a number of other existing policy objectives and direction elsewhere in Edmonton’s policy set.

LAND USE COMPATIBILITY

The proposed solar power plant is a complementary use to, and will support the operation of the adjacent water treatment facility. Studies have been completed to indicate that the solar power plant will have a limited impact (noise, glare and visibility) on the surrounding residential and recreational areas. It’s ecological impact is thoroughly reviewed in the Environmental Review section.

Views

Views of the proposed solar power plant vary depending on the point of observation and may be affected by vegetation and elevation. Visibility of the proposed solar power plant by the residents of the Cameron Heights neighbourhood (immediately west of the site) will be limited to a small number of residential properties generally at the top of the river bank. Residential properties along the top-of-bank in the Henderson Estates Neighbourhood on the south side of the river will have the most unobstructed views to the site during the fall and winter months when the foliage is absent; and lesser view during the spring and summer months when foliage is present.

Views to the site by trail users on the south bank will vary depending upon the point of observation and views from Anthony Henday Drive are also limited and transitory to the travelling public.

Noise

The inverter stations are the only equipment that will generate some sound. To help mitigate the potential nuisance, EWSI will enclose the inverters and locate them away from the perimeter fence. EWSI retained Stantec Consulting Ltd. to conduct a Noise Impact Assessment of the solar power plant that concluded the predicted cumulative sound level at the most impacted dwelling would be below the permissible sound levels by a margin of three decibels (AUC Rule 012 for Noise Control). EWSI has committed to take measures to ensure the noise complies with the City of Edmonton's Community Standards Bylaw 14600 and the AUC Rule 012 for Noise Control.

Glare

EWSI retained Solas Energy Consulting Inc. to conduct a glare analysis for 16 observation points near the project site including residences, pathways and roads in the area. The findings concluded that the solar power plant would have a low potential to result in hazardous glare conditions. EWSI submitted that the power plant "is expected to have either no glare or low levels of glare at most locations, including the residences along the east and west ridges of the North Saskatchewan River Valley."

ENVIRONMENTAL REVIEW

Part two of City Council's motion at the June 17 Public Hearing was aimed at directing the applicant to complete the "work and reporting necessary to allow Council to fully consider whether the location within the River Valley should be deemed essential by Council." As a result EWSI submitted:

1. E.L. Smith Solar Project Site Location Study (dated January 31, 2020)
2. Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm - Wildlife Addendum (dated January 2020)

Administration's review and findings of those subsequent reports are included in the E. L. Smith Solar Project Environmental Review (Appendix 1.A.). Administration's review followed the NSRVARP Bylaw process which directs reviewers to assess the "*costs, social, environmental and institutional constraints which make a River Valley location essential"* (Section 3.5.3), and identified:

- Difficulty in completing a comprehensive analysis of alternative sites based on the hypothetical nature of the sites considered and lack of site specific information for review;

- Financial efficiencies only possible in a river valley location including; tax benefits, no cost to interconnect to the grid, reduced operational costs, and no land acquisition costs;
- No environmental constraints that make a river valley location essential for this infrastructure; however, implications for adverse impacts to habitat loss, fragmentation, wildlife movement, and potential avian mortality due to the proposed location; and
- Provides Social benefits with the ability to partner with Enoch Cree Nation
- No rationale as to why the proposed Institutional benefits could not be achieved from a location outside of the river valley.

Municipal Environmental Impact Assessment (MEIA)

The MEIA (Appendix 1.E. & 1.F.) identifies and describes potential impacts of a proposal on the local environment, both negative and positive, and identifies how those impacts can be avoided, minimized, mitigated, and offset.

Studies prepared by the applicant indicate there will be little to no impact to several aspects of the environment including aquatic habitat, wetlands, soil quality, groundwater, air, and noise. A site stormwater management plan will address site hydrology.

Where impacts are noted, proposed mitigation measures include:

- A minimum setback of 125 m from any lot line abutting the North Saskatchewan River.
- Revegetation of three hectares of native meadows, trees and shrubs on the southern boundary of the site.
- No development in the key wildlife biodiversity zone as identified in the Concept Plan (Appendix 1B.)

Administration's review (Appendix 1.C.) of the January 2020 Wildlife Addendum to the February 22 2019 MEIA, concludes the full hierarchy of possible mitigation, including avoid, minimize, restore, and offset has not been fully considered and outstanding adverse environmental impact are anticipated. These include:

- Habitat loss and fragmentation and an overall net loss of 19.7 ha of habitat;
- Connectivity impacts, through lengthening a wildlife pinch point along the river; and
- Expected increase in wildlife mortality due to avian collisions and entrapment.

To address some of the outstanding impacts, EWSI has agreed to prepare a Wildlife Monitoring and Mitigation Plan (Appendix 1.G.) and, if residual impacts are found to have occured post construction, an Adaptive Management Plan following the attached Adaptive Management Framework (Appendix 1.H.) will be prepared and submitted. This work will lead to a better understanding of how the currently proposed mitigations perform with respect to wildlife mortality and connectivity, and potentially require the application of additional mitigation measures. The 19.7 ha of habit loss remains unmitigated.

Alberta Environmental and Parks: *Wildlife Directive for Alberta Solar Energy Projects*

Alberta Environment and Parks (AEP) released the Wildlife Directive for Alberta Solar Energy in October 2017. This Directive summarizes potential wildlife issues associated with solar energy projects and sets out requirements and recommendations for solar energy projects to avoid or mitigate the risk to wildlife and wildlife habitat during the siting, construction and operational phases of the projects.

EWSI consulted with AEP at the time of its application to the Alberta Utilities Commission. AEP advised it would not require a referral report as the project is proposed in an urban area where the Wildlife Directive is not applicable. EWSI also obtained a letter from AEP confirming that an environmental impact assessment is not required under provincial legislation, and a letter from the Canadian Environmental Assessment Agency confirming that an environmental assessment is not required under federal legislation.

PUBLIC ENGAGEMENT

As part of the proposal to develop the solar power plant, both EWSI and the City of Edmonton held public engagement events. As part of the application to the Alberta Utilities Commission (AUC), EWSI was required to conduct wide reaching consultation with owners and residents in the surrounding area. This consultation included notification to properties within two kilometers of the site, door knocking at all properties within 800 metres of the site, a public meeting and consultation with 21 Indigenous Nations/communities. EWSI further engaged with 13 Indigenous Nations/communities on the project through site visits, active participation in archaeological investigations and or/information exchanges.

Administration held two meetings in the vicinity of the proposed solar power plant (see below for summary information and Appendix 2.C. and 2.D. - Public Engagement for more detailed information). Two advance notifications for the application were issued with the first sent to nearby surrounding properties. After the application was amended to apply a DC1 Provision instead of the PU Zone, a second advance notification was sent to a larger area encompassing almost 1400 properties.

Addressing Part 1 of Council's referral, Enoch Cree Nation and EWSI established a bi-weekly working group and met regularly to work through a number of engagement activities and ensure Enoch Cree Nation's concerns were addressed. In addition to the establishment of an ongoing working group, the major outcomes of this dialog are:

1. Facilitation of full access to all archeological data, reports and artifacts.
2. Sharing of project information and site visits with Enoch Elders and Knowledge Holders.
3. Establishing potential partnerships and collaborate on site interpretation, vegetation and harvesting, project naming and potential economic opportunities.

4. Signing of a memo of understanding between Enoch Cree Nation and EWSI that formalizes their commitment to working together in the spirit of reconciliation and collaboration.

A more detailed description of the community consultation with Enoch Cree Nation is summarized in Appendix 2.A. - Enoch Cree Nation Re-Engagement Summary Report & Appendix 2.B. - September 2020 Supplemental Enoch Cree Nation Re-engagement Report.

APPLICANT LED PUBLIC MEETING July 19, 2017	● Number of attendees: 83 ● Number of feedback forms in support: 23 ● Number of feedback forms with undeclared support or concerns: 31 ● Number of feedback forms in opposition: 3 ● Common comments in support included: Support for green energy / alternative energy and good use of underutilized land. ● Common comments in opposition included: Environmental concerns, concerns over the efficiency of solar panels and concerns over recreational programming within the area.
1St Advance Notice July 6, 2017	● Number of recipients: 15 ● Number of responses in support: 2 ● Number of responses in opposition: 6 ● Common comments in support included: Support for green energy ● Common comments in opposition included: Environmental impacts, precedent of allowing development in the river valley and the loss of open space within the river valley.
CITY LED OPEN HOUSE February 13, 2018	● Number of attendees: 23 ● Number of feedback forms in support: 3 ● Number of feedback forms in opposition: 5 ● Common comments in support included: Green energy, low impact development and opportunity for trail linkages and educational programming ● Common comments in opposition included: Impact on trails, location of proposed solar power plant, environmental impacts and how the project aligns with City Policy.

2nd ADVANCE NOTICE May 1, 2018	● Number of recipients: 1391 ● Number of responses in support: 1 ● Number of responses in opposition: 17 ● Common comments in support included: Support for green energy ● Common comments in opposition included: Environmental impacts, proposed location in the river valley, aesthetic visual concerns & concerns over recreational programming within the area.
CITY LED INFORMATION SESSION April 23, 2019	● Number of attendees: 36 ● Number of feedback forms in support: 0 ● Number of feedback forms in opposition: 19 ● Common comments in opposition included: Location of the proposed solar power plant, environmental impacts, impacts to wildlife, precedent setting, and how does the project align with City Policy.

PREVIOUS CITY COUNCIL/COMMITTEE ACTIONS and REGULATORY APPROVALS

City Council & Utility Committee

On October 25, 2016, City Council approved Bylaw 17698 that included a special rate adjustment ($1.9 million per year) for the Green Power Initiative under which EWSI will convert approximately 10% of its conventional power consumption to locally produced renewable resources.

On February 23, 2018, August 23, 2018 and May 10, 2019, Utility Committee received information reports that provided updates on the Green Power Initiative and on the business case to locate a solar power plant adjacent to the E.L. Smith Water Treatment Plant.

Alberta Utilities Commission (AUC)

On February 20, 2019 the Alberta Utilities Commission approved EWSI's application to construct and operate the solar power plant (Decision 234-D01-2019) adjacent to the E.L Smith Water Treatment Plant. In issuing its decision the Commission:

- '*...finds that approval of the project is in the public interest having regard to the social, economic, and other effects of the project, including its effect on the environment*' (item 1, pg. 1)
- '*...recognizes that the North Saskatchewan River valley, the location proposed for the project, is an important resource for the City of Edmonton and its citizens, upon*

> *consideration of the current land-use of the site, combined with the mitigation measures proposed and commitments made by EPCOR Water, it is satisfied that the social and environmental impacts would not be significant*' (item #2, pg. 1).

The *Municipal Government Act,* Section 619, provides that a municipality must approve a plan amendment and land use bylaw amendment to the extent it complies with an Alberta Utilities Commission approval. Notwithstanding this obligation, the AUC in its decision acknowledged, "that EPCOR Water is working through the City of Edmonton's process for rezoning the land and for a development permit for the application". EWSI has confirmed it will only advance the proposed solar power plant project with the required land use approvals by City Council (Bylaws 18889 / 18890) and Administration (development permits).

Alberta Culture and Tourism (ACT): Historical Resource Act

A Historical Resources Act approval was granted on September 13, 2018, by Alberta Culture and Tourism.

CONCLUSION

Administration recommends that City Council **APPROVE** this application.

APPENDICES

1. A. E.L. Smith Solar Project Environmental Review
   B. E.L. Smith Solar Project Location / Concept Plan
   C. Administrations Review Comments - Municipal Environmental Impact Assessment
   D. E.L. Smith Solar Project - Site Location Study
   E. E.L. Smith Solar Project Environmental Impact Assessment
   F. Municipal Environmental Impact Assessment - Wildlife Addendum
   G. E.L. Smith WTP Solar Farm Project Wildlife Monitoring and Mitigation Plan
   H. E.L. Smith Solar Farm Adaptive Management Framework
   I. EWSI Response to Administration's Review of the MEIA and SLS Technical Review - March 18, 2020
2. Public Engagement
   A. Enoch Cree Nation Re-Engagement Summary Report
   B. September 2020 Supplemental Enoch Cree Nation Re-engagement Report
   C. "What We Heard" (City of Edmonton Open House - February 13, 2018) Engagement Summary
   D. "What We Heard" (City of Edmonton Information Session - April 14, 2019) Engagement Summary
3. Approved ARP - Bylaw 18569
4. Proposed ARP - Bylaw 18889
5. Application Summary

E. L. Smith Solar Project Environmental Review

Site Location Study and Environmental Impact Assessment

This Report addresses Part (2) of the motion on June 17, 2019 to allow Council to fully consider whether the location within the River Valley should be deemed essential by Council.

Executive Summary

EPCOR Water Services Inc. (EWSI) has proposed a 10-megawatt solar power plant on lands immediately south of the E. L. Smith Water Treatment Plant, within the North Saskatchewan River Valley. Following Part (2) of the motion from the June 17, 2019 Public Hearing, an Environmental Impact Assessment, Site Location Study, and Administrative technical review of those reports, were prepared to support City Council's understanding of the proposed River Valley location (Appendix 1.B. of Administration Report).

The Site Location Study compares hypothetical alternate locations and determined that the proposed river valley location provides the strongest financial benefits for the project. The Environmental Impact Assessment identifies impacts on the local environment, including habitat loss and fragmentation, negative impacts to wildlife movement, and uncertainty regarding future avian mortality. EWSI has proposed setbacks from the river and a post-development revegetation plan as mitigation measures, and also proposes an adaptive management plan if wildlife monitoring demonstrates ongoing negative impacts. Technical review of the submitted reports indicate that adverse environmental effects are predicted.

Report

EPCOR Water Services Inc. (EWSI) has proposed a 10- megawatt solar power plant on lands immediately south of the E. L. Smith Water Treatment Plant, located within the North Saskatchewan River Valley, as shown on Appendix 1.B. of Administration Report. The facility will have up to 45,000 solar panels, generate 10 MW of electrical power, and occupy 22 hectares of land. The installation will power the water treatment facility with excess power transmitted to the electrical grid.

EWSI indicates that the proposed location:

- Provides the strongest financial benefits when attached to the E. L. Smith Water Treatment Plant, as this location allows for economic efficiencies through co-location (“behind-the-meter” benefits);
- Provides for increased research and education opportunities because of the central river valley location;
- Has environmental impacts that can be addressed through EWSI’s proposed setbacks, revegetation, and monitoring program; and
- Aligns with many of the City’s Energy Transition Strategy objectives of generating 10% of Edmonton’s electricity locally and reducing greenhouse gas emissions in Edmonton by 35% between 2005 and 2035.

As a private corporation, constructing a project on private land, EWSI would normally be exempt from following the North Saskatchewan River Valley Area Redevelopment Plan (NSRVARP) Bylaw approval process. However, the motion made at the June 17, 2019 Public Hearing, required an Environmental Impact Assessment Report and Site Location Study to support Council’s review and build understanding of the river valley location.

Administration's review followed the NSRVARP Bylaw process which directs reviewers to assess the “*costs, social, environmental and institutional constraints which make a River Valley location essential”* (Section 3.5.3). Comments (Attachment 1.c.-Administration Report) were based on the same criteria as a public project, and identified:

- Difficulty in completing a comprehensive analysis of alternative sites based on the hypothetical nature of the sites considered and lack of site specific information for review;
- Financial efficiencies only possible in a river valley location including; tax benefits, no cost to interconnect to the grid, reduced operational costs, and no land acquisition costs;
- No environmental constraints that make a river valley location essential for this infrastructure; however, implications for adverse impacts to habitat loss, fragmentation, wildlife movement, and potential avian mortality due to the proposed location; and
- Provides Social benefits with the ability to partner with Enoch Cree Nation
- No rationale as to why the proposed Institutional benefits could not be achieved from a location outside of the river valley.

Site Location Study

The Site Location Study (SLS) reviews alternative locations with respect to their financial, social, environmental, and institutional constraints, and assess if a river valley location is essential for successful development. The Site Location Study prepared by EWSI (Appendix 1.D. of Administration Report) explored the feasibility of eight power-generation options, with four hypothetical alternatives located in or near Edmonton, but outside the river valley. This analysis provided a justification for the chosen site. Actual constraints and opportunities with respect to the financial, social, environmental, and institutional impacts of an alternative location are therefore speculative.

According to EWSI, the proposed benefits in net carbon reduction include a contribution of 0.28% towards Edmonton's 10% renewable energy goal. The SLS does not identify technical reasons why this can not be achieved in alternate locations outside the river valley. However, the location attached to the E. L. Smith Water Treatment Plant - and therefore the location within the river valley - is considered necessary by EWSI to achieve the "behind the meter" benefits of an attached facility. The benefits described by ESWI include:

- Eliminating the costs of connecting the solar project to the grid, lower ongoing transmission costs, and reduced operating costs;
- No additional land purchase costs; and
- Tax-exempt status as the majority of power is consumed on-site.

Along with the financial justification, the EWSI report describes how the E. L. Smith location allows for research opportunities directly related to "behind the meter benefits" as well as public education benefits because of the central location. From an environmental perspective, EWSI contends that the environmental impacts with the selected site are addressed through the proposed setbacks, revegetation, and wildlife monitoring program. Because the environmental impacts for alternative locations are unknown, EWSI indicates no certainty that adverse effects in a different location would be less in comparison.

The review of the SLS identified that by limiting the report to hypothetical alternative locations, it is not possible to complete a comprehensive review of moving the project to a location outside of the river valley. In an attempt to objectively quantify the costs and "social, environmental and institutional constraints which make a River Valley location essential" Administration uses 20 criteria for evaluation divided equally between the four constraint categories identified in Bylaw 7188 (ie. Financial, Social, Environmental and Institutional). Criteria are based on the benefits and constraints identified within the SLS by the proponent and the environmental impacts identified in the Environmental Impact Assessment.

Of the 20 criteria analyzed, it was found that the proponent was able to justify five (increased from four after the submission of Enoch Cree Nation's Re-Engagement Summary Report) factors that support the river valley location. These supporting factors of the river valley location identified through the SLS were predominately based on financial factors. Given Provincial guidance for limiting fragmentation in wildlife migration corridors such as the NSRV and recommendations that "*solar energy projects should not be sited in … valleys of large permanent watercourses...*" it is unlikely that a location outside the River Valley would result in a similar level of adverse environmental impacts. It is also possible that a site outside the River Valley could retain similar social and institutional benefits compared to the selected location.

Note:
The SLS identifies an opportunity for a 4 MW Battery Energy Storage System (BESS) to be connected to the Solar Farm however; as the BESS is currently proposed to be located within the existing water treatment plant area, outside the subject property, and not part of this application, Administration has not reviewed the environmental impacts of the storage system.

Environmental Impact Assessment
The Environmental Impact Assessment (EIA) Report (Appendix 1.E. and Appendix 1.F. of Administration Report) considered potential impacts related to the following:

- Terrain and soils;
- Surface water and hydrology;
- Vegetation species and communities;
- Wildlife species and habitat;
- Viewscape; and
- Heritage Resources.

Most of the proposed site is perennial pasture, with a tree stand near the northern boundary. The site is intended for the future expansion of the Water Treatment Plant if required. EWSI completed additional wildlife monitoring since the June 17, 2019 Public Hearing which identified movement through the project area and resulted in a change to the wildlife impact from low to moderate. Administration's review shows that environmental impacts are expected to occur due to:

- Habitat loss and fragmentation for some species due to an overall net loss of 19.7 ha of open meadow habitat, through disturbance and fencing of the site and indirect effects due to sensory disturbance (noise, light, etc.);
- Negative impacts to wildlife connectivity due to lengthening the restricted portion of the wildlife corridor/passage that currently exists along the river from 0.56 km to 1.8 km (220%), and reducing access to the river by introducing fencing around the solar farm; and
- Increased risk of avian mortality through collision or entrapment. The scale of this impact is unknown, as no comparable projects in similar jurisdictions and environments have been identified and therefore data is not available.

Administration’s review identifies that the hierarchy of possible mitigation, (avoid, minimize, restore, and offset) has not been used to fully minimize impacts, and outstanding adverse environmental impacts are anticipated. Mitigation measures proposed include:

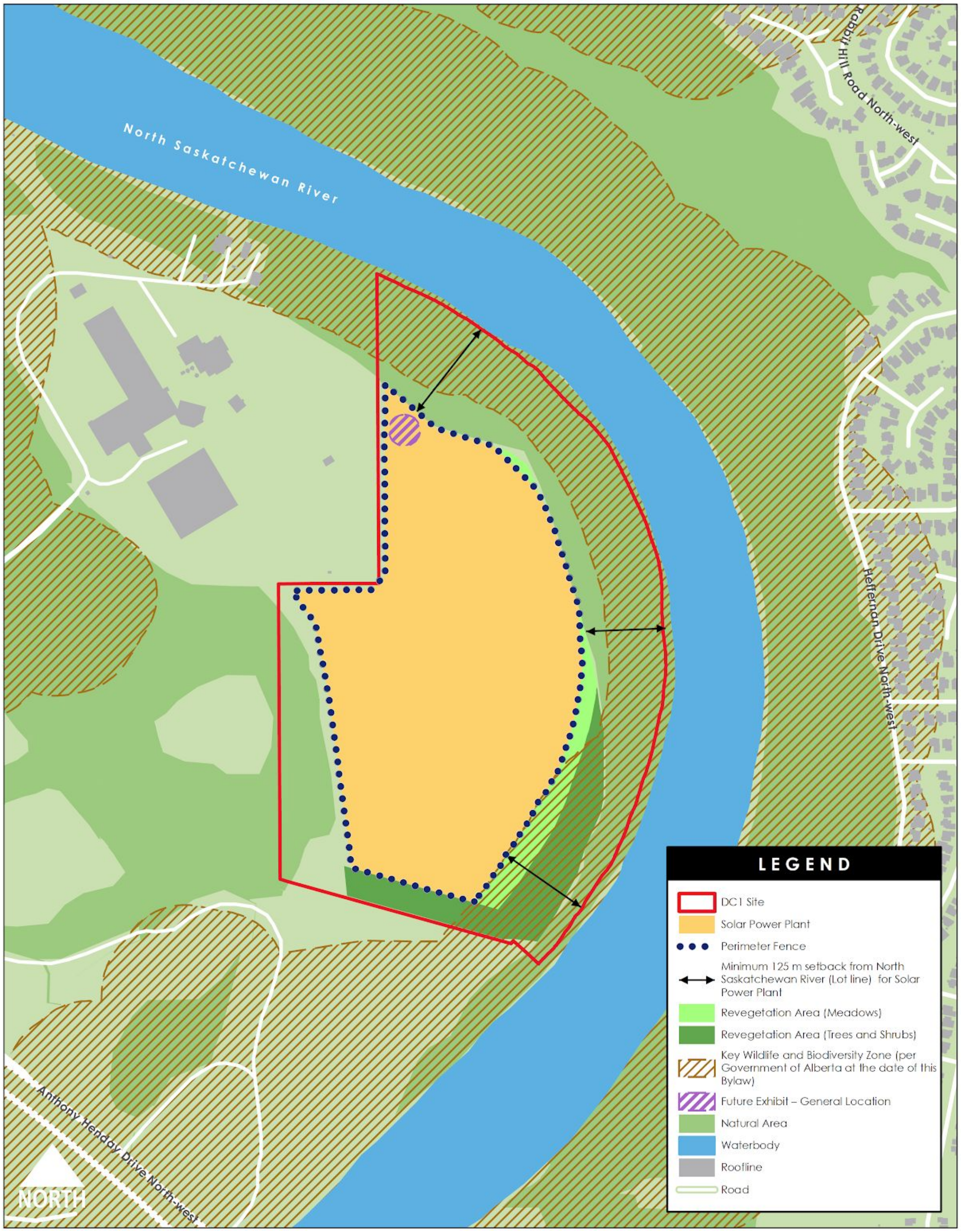
- Avoid - The SLS reviewed hypothetical alternate locations and deemed the river location was required to achieve the project goals;
- Minimize - ESWI has proposed additional setbacks from the river;
- Restore - ESWI has proposed revegetation on the site and surrounding area with native plantings;
- Offset - There are no formal biodiversity offsets proposed to mitigate the habitat loss and fragmentation.

To address concerns regarding wildlife movement and potential avian mortality, ESWI has proposed implementation of post construction Wildlife Monitoring and Mitigation Plan (Appendix 1.G. of Administration Report) and an Adaptive Management Framework (Appendix 1.H. of Administration Report) which follows the Provincial Wildlife Directive.

The lack of comparable projects poses challenges in assessing the scale of impacts and effective mitigation; Administration concurs with conclusions in the EIA that the few mitigation measures that exist to prevent avian mortality are not proven to be effective at this time.

E. L. Smith Solar Project Location

CONCEPT PLAN



Urban Form and Corporate Strategic Development
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February 27, 2020

RE: Technical review of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020 and the report titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020

This technical review is intended to address Council's June 17, 2019 motion for City Administration to complete "*work and reporting necessary to allow Council to fully consider whether the location* [of the E. L. Smith Solar Farm] *within the River Valley should be deemed essential by Council.*"[1]

Given this direction from Council, two technical reports associated with the E. L. Smith Solar Farm proposal have been reviewed by City Administration's relevant subject matter experts following the direction provided in Section 3.5.3 of North Saskatchewan River Valley and Ravine System ARP (Bylaw 7188) which states:

> "*It is a policy of this Plan that all proposals for the development of a major facility … shall be subject to an environmental impact screening assessment as outlined in Schedule D, and a detailed site location study detailing costs, and social, environmental and institutional constraints which make a River Valley location essential must be prepared for Council approval.*"

This review was completed in accordance with standard review practices for Bylaw 7188 and comments reflect the standards that a public project would be held accountable to.

This document is divided into the following sections:

A. Summary of technical review findings
B. Review of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020
C. Review of the EIA addendum titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020
D. Review of the *Sustainability Value Analysis of the E.L. Smith Solar Farm Project – SLAJ Addendum Report dated January 2020*
E. Administration's outstanding review items of "*Municipal Environmental Assessment for the E. L. Smith Solar Farm (February 2019)*"
F. Literature Cited

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[1] Part 2 of a 2 part Council motion from the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890. Refer to Section 3.7 of the June 17, 2019 Council minutes: http://sirepub.edmonton.ca/sirepub/mtgviewer.aspx?meetid=2264&doctype=MINUTES

Section A: Summary of technical review findings

Summary of review findings of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020

Following the June 17, 2019 Council motion Administration provided a Terms of Reference (TOR) for the Site Location Study (SLS). While the submitted SLS was formatted to follow the provided SLS TOR, the information and recommendations that were included were those previously provided under the Site Justification Analysis Report (SLAJ) that was submitted with the last council report, and did not provide any additional or new information. City administration provides our assessment and evaluation of the SLS as outlined below:

- The site location analysis provided only considers hypothetical locations in providing an analysis for potential sites outside of the river valley location.
- This hypothetical analysis has resulted in a predetermination of the E.L. Smith location primarily based on the financial benefit from the "behind the meter" option, which focused on a financial evaluation for the justification of EPCOR water services 2017-2021 Performance Based Rate (PBR).
- Alternatives for non-river valley locations should not be limited by the scope of the work, and should provide equal consideration for the environmental or social constraints which form part of the evaluation for a River Valley location being deemed essential.
- The justification for a river valley location being deemed essential would be more applicable if actual alternatives were included, such as the utilization of degraded lands (e.g. brownfield sites), co-location of solar panels with underutilized land (including industrial and agricultural land etc), and other similar locations that have been a common practice both nationally and internationally for utility-scale solar farms.

In an attempt to objectively quantify the costs and "*social, environmental and institutional constraints which make a River Valley location essential*" Administration utilized 20 Criteria for evaluation divided equally between the four constraint categories identified in Bylaw 7188 (i.e. Financial, Social, Environmental and Institutional). These criteria were based on benefits and constraints that were identified within the SLS by the proponent and also from environmental impacts identified within the Environmental Impact Assessment.

Constraint that makes a RV location essential	**Summary rationale for Constraint Evaluation that makes a RV location essential***
Financial	Administration evaluated the financial constraint against five criteria. Three of the five criteria that supported the River Valley being essential were linked to cost savings from: tax benefits associated with being a municipal owned corporation and reduced operational and land purchase costs. The impacts to the average ratepayer is not clearly articulated within the SLS provided as the offsite comparisons are hypothetical.

Social	Of the five social constraints that were evaluated, none were identified as making a RV location essential for this project and one constraint was not able to be evaluated due to lack of information. Some social constraints, such as aesthetics, are believed to be improved with the absence of industrial infrastructure in the natural setting of the River Valley, regardless of design.
Environmental	Of the five environmental constraints evaluated, none were identified by either the proponent or other parties that would make a RV location essential for the proposed infrastructure.
Institutional	Of the five major institutional criteria assessed that relate to this project, it was shown that the project only supports one constraint: the City's goal of increasing locally produced energy (the project would add 0.28%[2] to Edmonton's total 10% goal). However, if locally is defined as the Edmonton area, then an argument could be made that the River Valley is not essential to achieve this goal.

*Further details and supporting information related to the conclusions above are detailed in Section B of this review.

Based on the constraints analysis above, the potential for adverse environmental effects are not considered to be outweighed by the other assessed financial, social and institutional constraints and only the financial aspects could justify deeming the project as essential.

Summary of review findings of the EIA addendum titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020

Upon review of the January 2020 Wildlife Addendum to the February 22, 2019 draft EIA, technical reviewers from Administration conclude the following:

1. With the exception of a few study gaps, the wildlife addendum collected additional wildlife baseline information that was requested by Administration to address outstanding EIA review items[3].
2. The baseline information collected supports Administration's original conclusions about negative impacts to biodiversity in the area, specifically around:
    - Habitat loss and fragmentation and an overall net loss of 19.7 ha of habitat (most notably for medium to large wildlife) and indirect effects due to sensory disturbance.
    - Connectivity impacts, in particular increased adverse impacts to the existing passage along the river through lengthening, and blockage of wildlife access to the river through the open field.
3. The additional work completed does not address previously outlined concerns around reducing future wildlife mortality due to avian collisions and entrapment.
4. Despite new baseline information, the report has identified no additional mitigation opportunities to reduce environmental impacts through the application of the mitigation hierarchy (avoid, minimize, restore and offset).

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[2] ETAC E.L. Smith Solar Letter, dated January 22, 2019

[3] "*Open Space Strategy outstanding review items of Municipal Environmental Assessment for the E. L. Smith Solar Farm*" dated February 2019 (dated August 19, 2019)

Given the above, the Municipal Environmental Impact Assessment (MEIA) and Addendum have missed opportunities to reduce adverse environmental effects predicted from the project by maintaining the full scope and size of the proposal and not exploring mitigation options that avoid or minimize the physical impacts. Background and supporting information related to each of the four conclusions above are detailed in Section C of this review.

Section B: Review of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020

Following the June 17, 2019 Council motion Administration provided a Terms of Reference for the Site Location Study (SLS). While the submitted SLS was formated to follow the provided SLS TOR, the information and recommendations that were included were those previously provided under the Site Justification Analysis Report (SLAJ) formerly submitted with the last council report. No new information has been provided.

In an attempt to objectively quantify the costs and "*social, environmental and institutional constraints which make a River Valley location essential*" Administration selected 20 Criteria for Evaluation divided equally between the four constraint categories identified in Bylaw 7188 (i.e. Financial, Social, Environmental and Institutional). These criteria were based on benefits and constraints that were identified within the SLS by the proponent and also from environmental impacts identified within the EIA.

See pages 6-9 for Table 2: *River Valley Location Deemed Essential Test- Constraints Analysis Table (Criteria for Evaluation)*

River Valley (RV) Location Deemed Essential Test- Constraints Analysis (Criteria for Evaluation)

Constraints	**Potential criteria for Evaluation of E.L.Smith Solar Farm Project**		**River Valley Location Deemed Essential**			**Remarks**
			Yes	**No**	**Unknown**	
Financial	1	Cost Saving through tax exemptions because of onsite Power Consumption (Back of Meter option available)	√			[1]Onsite power consumption was permitted to operate this project on a non-taxable basis considering EWSI as a municipally owned entity. The impacts to average ratepayers are not clearly articulated within the SLS provided as the offsite comparisons are hypothetical.
	2	Cost saving for Land Purchase	√			Potential cost for land purchase was not outlined in the SLS. So this review assumes other Epcor properties are not available for solar use.
	3	Operational cost saving	√			Proximity of the site to the water treatment facility
	4	Grant funding ($10 million) from NRCan to enhance the E.L. Smith Project			√	Unable to assess: while the Battery Energy Storage System (BESS) is mentioned in the SLS, no details of other project costs/constraints are provided. Therefore, related benefits are uncertain until the project is fully evaluated
	5	HDR evaluation of financial benefit from their Ecosystem Valuation and conclusion based on the break even analysis			√	[2]Unable to assess: This analysis is based on multiple assumptions and scenarios that potentially have variable preference and can result in different conclusions based on an individual stakeholders perspectives.
Financial Constraints Evaluation			3	0	2	
Social	1	Project promotes and connects Edmontonians and Albertans to their history and diverse cultural heritage.			√	Given the ongoing conversation with ENOCH Nation it is yet unclear if there are confirmed partner commitments to move forward with the proposed plan at this specific RV site. Administration is unaware of the opportunities the project provides and is unable to provide an objective evaluation
	2	The E.L. Smith Solar Project provides significant potential for enhancing research and education of large scale renewable energy in Edmonton.		√		The ability for a solar farm to have significant potential for enhancing research and education is not dependent on a river valley location. Research and educational opportunities will not be lower in an Edmonton based off-site location. Parking access and visitor facilities would not be as constrained at a tableland location with fewer geotechnical constraints.

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[1] *It is important to note that financial benefits from back of the meter can only be applied to this facility because it is a municipally owned corporation. In addition to supporting Council's motion of applying the "deemed essential" decision to this Municipally owned corporation it should be highlighted that such financial incentives are not available to private business/industry if they look to obtain comparable financial benefits in the future. Therefore, this project can not be considered as a standard since such financial benefits are not applicable in those cases and should be considered a one off in securing such benefits that can not be scaled up to promote solar farm projects for local renewable energy production.*

[2] *City administration's previous evaluation of this report determined that "* Understanding the complete ecosystem valuation (ecological, aesthetic, and social) of E.L. Smith Solar Farm through site investigation following scientifically proven standard method was not a scope of the HDR report. Therefore, the relative findings and comparative analysis as presented within the SLAJ and HDR report should be considered with precaution.*" (Please see City Administration's March 2019 previous review comments and recommendations on the SLAJ-HDR Addendum report)*

	3	The E.L. Smith Solar Project provides significant potential for enhancing awareness of large scale renewable energy in Edmonton.		√		The ability for a solar farm to have significant potential for enhancing awareness is not dependent on a river valley location. Although this location provides high visibility and awareness to the project, no other locations outside the RV were evaluated
	4	Project provides significant social benefits from locating within the River Valley for improving Edmontonians quality of life including recreational experience		√		Approval of this project does not result in the building of any new trails or recreational infrastructure and technical documents provided do not assess the cumulative impacts of such trails on the area. The City utilizes many other methods to complete access and trail networks within other areas of the RV, therefore this social constraint is not dependent on the approval of a solar farm at this RV site.
	5	Project provides significant social benefits from locating within the River Valley for improving Edmontonians quality of life including aesthetic experience		√		The ability for a solar farm to have significant aesthetic value is not dependent on a river valley location. Indeed, aesthetics was a concern expressed by local communities and in public consultation documents. Many Edmontonians have expressed the River Valley as the jewel of Edmonton, although there are varying aesthetic values, locating them in the RV would not improve the, well documented, aesthetic values of many Edmontonians.
Social Constraints Evaluation			0	4	1	
Environmental		No Environmental constraints were identified in the submitted reports that make a RV location essential for this major facility. There were however multiple adverse impacts outlined in the submitted EIA documentation that will impact the ability "*to ensure preservation of the natural character and environment of the North Saskatchewan River Valley and its Ravine System*" (Goal #1, Bylaw 7188):				
	1	Project ensures preservation of areas which have potential wildlife habitat		√		An overall net loss of 19.7 ha of open meadow habitat (most notably for medium to large wildlife) and indirect effects due to sensory disturbance will result from this project should a RV location be chosen. See Section C.2a (below) for more details.
	2	Project ensures the maintenance of local and regional wildlife connectivity		√		Increased adverse impacts to the existing wildlife corridor/passage along the river through its lengthening by 220% from what currently exists are expected and not mitigated for. There will also be a wildlife barrier to access the river through the tame meadow which is proposed to be fenced. See Section C.2b for more details.
	3	Project does not result in wildlife mortality		√		Based on a review of existing scientific literature, the wildlife Addendum, and as confirmed in the original EIA, this project is expected to result in increased wildlife mortality in the area due to bird collisions with solar collectors. See Section C.3 for more details.

	4	Project meets “Site Selection criteria” (100.1 Standards) in preventing significant negative effects on wildlife following the Wildlife Directive for Alberta Solar Energy Project-AEP		√		[3]Wildlife Directive and 100.1 Standard was not applied to this project citing AUC Rule 007 that solar project review by AEP Wildlife biologist is not required when solar energy projects are located within urban areas. Therefore, no technical review on wildlife impacts was completed by Provincial Biologists during the Provincial review process. The Wildlife Directive states that “solar energy projects should not be sited in valleys of large permanent watercourses...”.
	5	Preservation of Native Vegetation: Project planned for the river valley and ravine system ensured that natural vegetation be preserved.		√		Project was not able to protect the remaining forested parkland vegetation, tame meadow and associated habitat within the project area. This could have been achieved through the adoption of primary mitigation measures.
Environmental Constraints Evaluation			0	5	0	
Institutional	1	River Valley ARP goals and objectives: Project supports the preservation, natural character and environment of the river valley and provides opportunities for recreational, aesthetic and cultural activities.		√		The project has adverse environmental impacts that remain unmitigated (see above and Section C.4). Building of recreational infrastructure is outside of the scope of this project. Natural character and aesthetics of the RV will be impacted by the introduction of industrial infrastructure.
	2	The Way We Grow and Breathe: Project will compliment multifunctional network of park and open space (green networks) that supports healthy ecosystems and diverse wildlife habitats, and meets the needs of communities present and future by connecting people with year-round opportunities to learn, commute, recharge, recreate, gather and celebrate.		√		Edmonton’s current MDP directs administration to “*Protect, preserve and enhance the North Saskatchewan River Valley and Ravine System as Edmonton’s greatest natural asset*” (Objective 7.3.1). The project will reduce the potential available open space and RV habitat (> 30 years) and negatively impact the green network and associated functions that are not found outside of the River Valley. There are a few opportunities for research and education on solar infrastructure related to this project, but a RV location is not required for this and Breathe, nor the MDP, does not prioritize green energy education at the expense of ecological, wellness and celebration networks.
	3	Community Energy Transition Strategy: Project aligns with the City’s ambition of generating 10% Edmonton’s electricity locally and to reduce greenhouse gas emission.	√			The project would contribute 0.28% to Edmonton’s total 10% goal of increasing locally produced energy. However, if locally is defined as the Edmonton area, then an argument could be made that the River Valley is not essential to achieve this
	4	Edmonton City Plan-Greener as We Grow: The project committed for good design and conscious decisions to preserve and protect our environment, promote climate resilience		√		[4]With appropriate mitigation measures to avoid, reduce, minimize and offset environmental impacts the project would promote sustainable development that generates renewable energy and protect the natural character of the river valley ecosystem. Currently the project does not provide such

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[3] *Wildlife Directive for Alberta Solar Energy Projects- Government of Alberta 2017 “100.1.1 Solar energy projects and temporary work spaces must be sited to avoid or minimize their occurrence in important wildlife habitats. Generally, solar energy projects should not be sited in areas of native grasslands, native parkland, old growth forest stands, named water bodies, valley breaks (including coulees), valleys of large permanent watercourses and the eastern slope region.” This Directive ensures that off-site locations will have reduced effects on wildlife if an alternative site is reviewed. Please refer to the Wildlife Directive for Alberta Solar Energy Projects for details*

[4] *June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890, Administration presented to Council that “Epcor has verbally agreed to collaboratively assist Administration in the development of a biodiversity offset framework which is intended to follow the mitigation hierarchy of avoid, minimize, restore and offset.”*

		and strengthen our ecological systems.				solutions. There has been no evaluation to determine if the project will result in overall net gains in climate resilience and therefore is unknown at this time.
	5	Draft Ribbon of Green: The project area is listed under a broader category of “Active/Working Landscape” and is consistent with the Draft-Ribbon of Green Classification.			√	The draft Ribbon of Green has not yet been finalized or shared with the City Council. The draft RoG classification is intended to facilitate expansion of the wastewater treatment functionality. Should the area not be required for facility expansion, the area is to be re-evaluated to determine the appropriate land use classification.
Institutional Constraints Evaluation			1	3	1	
Cumulative summary of Constraints Analysis			**4**	**12**	**4**	

Section C: Review findings of the EIA addendum titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020

Upon review of the January 2020 wildlife addendum to the February 22, 2019 draft EIA, technical reviewers from Administration conclude the following:

1. With the exception of a few study gaps, the wildlife addendum collected additional wildlife ***baseline information*** that was requested by Administration to address outstanding EIA review items (see Section D).
2. The baseline information collected supports Administration's original conclusions about ***negative impacts to biodiversity*** in the area, specifically around:
    a. Habitat loss and fragmentation with an overall net loss of 19.7 ha of habitat (most notably for medium to large wildlife) and indirect effects due to sensory disturbance.
    b. Connectivity impacts: in particular increased adverse impacts to the existing passage along the river through its lengthening and blockage of wildlife access to the river through the open meadow
3. The additional work completed does not address previously outlined concerns around reducing future ***wildlife mortality*** due to bird collisions of the project
4. With this new baseline information, technical reviewers from Administration feel there are ***missed mitigation opportunities*** to further reduce environmental impacts through the application of the mitigation hierarchy (avoid, minimize, restore and offset).

Given the above, technical reviewers within Administration have not found that the Municipal Environmental Impact Assessment (MEIA) as submitted avoids, or significantly reduces, the adverse environmental effects predicted to result from the project. Background and supporting information related to each of the four conclusions above are listed below.

1) Summary of baseline information

Both the Municipal Environmental Impact Schedule A (Bylaw 7188) and the Alberta Utilities Commission Rule 007 (AUC 2017) requires that proponents of solar farm projects ensure that environmental information, effects and mitigation are addressed in the application. These documents and best management practices dictate that pre-construction wildlife surveys are key components to inform appropriate site selection and mitigation of impacts to wildlife and wildlife habitat from the construction and operation of solar energy projects.

Administration's previous review of this projects EIA[4] outlined that the report was incomplete because wildlife assessments were not completed for many of the species expected in the area. As such, the Administration requested further biodiversity information and monitoring to fill in this gap (see Section D). Most of Administration's requests were completed with the exception of:

- Wildlife trail camera placement within the corridor along the river to assess existing use of this corridor by wildlife

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[4] December 2019, "*Second Circulation Comments on AA18-13 EL Smith Solar Farm EIA and SLAJ Report, NW 3-52-25 W4M and SW 10-52-25 W4M, Edmonton, Alberta*"

- Temporary wildlife trail camera placement at the center of the tame meadow
- Summer browse/pellet counts
- Descriptions of proposed native seed mix to be used under the solar panels

From the additional biodiversity monitoring that was completed, the following wildlife information was found:

Birds:

- 23 bird species were identified; some species used both forested and tame meadow while others specialized in one vegetation community (e.g. savannah sparrow found within the tame meadow area)
- two species of management concern were identified:
    - common yellow throat which live in thick, tangled vegetation in a wide range of habitats but are most common in wet areas, which tend to have dense vegetation low to the ground.
    - least flycatcher which breeds in deciduous or mixed forests and occasionally in coniferous stands with a preference for breeding sites near clearings or edges.
- Species diversity scores were not shown to be statistically different between the forested and tame meadow vegetation communities

Medium-large mammals:

- Urban adapted mammal species: coyote and deer were detected across the Local Area of Assessment (LAA) in both the forested and tame meadow area
- Large ungulates:
    - Elk was found along the south edge of the LAA in both the forested and tame meadow area
    - Moose was detected at one site, along an existing access road
    - Because there was no monitoring site within the corridor along the river, it was not possible to determine if urban sensitive species such as moose and elk utilize this area for movement
- Other medium mammals found included porcupine and red fox
- Track counts showed:
    - high deer use of both forested and tame meadow areas depending on season
        - Tame meadow areas were more highly used in the November 2019 sampling session, with the report suggesting this is likely due to deer use of the open meadow during ungulate rut
        - Forested areas had higher track counts in the January 2020 sampling session, likely a result of deer utilizing this habitat for shelter during cold periods
    - Number of species observed was similar for both forested and tame meadow habitat when sampling effort is taken into account (i.e. 1.3 species/km days sampled for each habitat type)

Other:

- Small mammals: no species specific surveys were completed, but track counts identified snowshoe hare, red squirrel, short tailed weasel, and small rodents (mice and voles)
- Bats: no species specific surveys completed
- Reptiles: no species specific surveys completed

2) Negative impacts to biodiversity

a) Habitat loss and fragmentation

With this new baseline biodiversity monitoring data, technical reviewers are better able to review the potential impacts of the project on wildlife habitat in the area. Contrary to the EIA suggestion that the tame field provides "*low suitability habitat for wildlife species*", this baseline data supports Administration's December 2018 conclusions that such meadow openings within the river valley's forest matrix are important habitat for wildlife. In particular, this baseline data:

- Provides evidence that both bird and mammals species utilize the tame meadow
- Of the large mammal species with enough information to analyze (i.e. deer) both the forested and meadow habitat is used for different life history requirements (e.g. browse, shelter) in different seasons
- More urban sensitive species such as moose and elk were detected in the area, highlighting the role that the site has in maintaining regional wildlife connectivity and migration for species that are not known to stay locally (i.e. non-resident species)
- Shows urban adapted mammal species (coyote and deer) were detected across the Local Area of Assessment (LAA)
- Identifies wildlife species (e.g. least flycatcher) that benefit from the edge habitat created between the forested and tame meadow habitat types
- Shows number of species observed was similar for both forested and tame meadow habitat when sampling effort is taken into account (i.e. 1.3 species/km days sampled)

The Province defines wildlife habitat as "*the terrestrial and aquatic environments and* ***associated ecosystem elements*** *that in combination provide the requirements of food, shelter and space needed to support self-sustaining populations of wildlife.*" This tame meadow area, while disturbed, has been demonstrated to be a key matrix component of the City's ecological network that is surrounded by one of the Edmonton Region's best remaining biodiversity core areas.

With respect to this project, there will be significant long term (>30 years) habitat loss in the form of a tame meadow area that, given the current configuration of the existing fence, is permeable to both terrestrial and aerial wildlife. As such, It is unclear how a net of only 0.7 ha of new forest plantings will offset the net loss of 19.7 ha of tame meadow habitat currently used by native wildlife.

In addition, the EIA outlines that indirect effects (e.g. sensory disturbance) on habitat are "*predicted to be adverse and extend into the LAA*" for the duration of the project (30 years). This conclusion is supported by research which has shown that the construction and operation of solar farm infrastructure has resulted in habitat loss and fragmentation in other areas (BLM and DOE 2012). Solar energy infrastructure and associated construction and operational activities can result in decreased habitat quality and/or lead to avoidance of the area by some wildlife species. Additionally, it can attract more urban adapted species, such as magpies or ravens (Knight and Kawashima 1993, Kristan and Boarman 2003, Lovich and Enne 2011), potentially compounding the loss of more sensitive wildlife from the area.

The draft EIA does make the following statement "*The removal of perennial pasture and replacement with approved native seed mix is expected to increase habitat function and species diversity for small mammals during operations*." However, it is not clear what mechanism or research supports that a naturalized seed mix is going to be better (or worse) than the tame meadow which is currently present. Confounding this hoped for outcome is the fact that there is no discussion on how a native seed mix (or its associated small mammal population) responds to being shaded by solar panels or solar infrastructure maintenance. More information is required if the EIAs statement is to be supported.

In August 2019, the Administration did request further information on the proposed native seed mix and what wildlife the proposed mix was to support. No further information has been provided in the EIA addendum or was submitted through other materials.

b) Connectivity impacts

Now that site-specific wildlife surveys have been conducted to assess pre-development wildlife use of this area, it has been confirmed that, with respect to wildlife movement, the meadow is highly permeable to both terrestrial and arboreal wildlife movement as evidenced by the presence of moose, deer, elk coyote, and other wildlife. It also confirms that the following statements in the EIA are not supported by ground truthed site specific surveys, indeed, many of the statements are in opposition to what is now known about the use of the site:

- ”*...existing movements of wildlife through the PDA may be limited.*”
- “*...the lower pump house north of the PDA and E.L. Smith WTP likely limits movement of wildlife along the NSR currently.*”
- “*...the narrow passage underneath the highway may effectively prohibit many wildlife species from crossing under the Henday*.”
- Suggestion on page 4.5 that the project area is not part of the ecological network and does not provide an ecological linkage function.

The February 2020 EIA wildlife addendum only suggests an update to one of the EIAs conclusions: it estimates an increase in the expected adverse magnitude of effects of the project on wildlife movement in the area. However, no new mitigation proposals are submitted.

With respect to impacts to wildlife connectivity specifically along the river corridor, this technical review concurs with the analysis outlined in the draft EIA that the development of the proposed solar infrastructure (fence and panels), will have a significant impact to wildlife connectivity within the area for the extent of the project’s life (>30 years) - “***primarily at the 100 m buffer along the NSR***” (page 6.16). This is because there will be an increase in length of the corridor from 0.56 km (existing length of corridor) to 1.8 km (post construction). This results in a lengthening of the blockage of wildlife access to the river by 220% and provides limited avenues for escape for wildlife for almost 2 km along the proposed river ”corridor”. Again, however, no new proposed mitigation measures have been included in the EIA addendum to address this project’s impacts on wildlife connectivity. This will negatively impact both local and regional connectivity for multiple to tens of generations of wildlife (>30 years) depending on the natural history characteristics (e.g. life expectancy, habitat preferences, urban adaptability) of the wildlife species in question. These impacts have not been adequately addressed in this draft EIA, therefore, the claim that the “*project preserves existing ecological connectivity*” is not supported.

In the absence of having completed any wildlife monitoring within the existing 0.56 km river corridor (i.e. no camera and limited track transects were placed within the center of the corridor), the EIA (page 6.18) does attempt to provide literature support for continued use of a lengthened 1.8 km corridor and refers to research about how coyotes and deer utilize urban environments and then

attempts to suggest that this shows that 100m wide corridors are used by wildlife in general. However, the conclusion drawn is inappropriate for this area because:

- the scientific references used do not assess 1.8 km long, 100m wide corridors, the research was only assessing wildlife use of buffers between urban environments that was next to habitat patches
- the references are limited to only two urban adapted species (coyote and deer) and are not likely applicable for some of the more urban-avoiders now shown to use the project site (e.g. moose, elk)
- Therefore, the conclusions drawn based on these references that all wildlife movement between habitat patches can be accommodated within 100m corridors is not supported by the studies referenced.

Currently, there is no site-specific data, or support, that wildlife species will use a 1.8km long-100 m wide buffer for movement along, or access to, the river. As noted in the draft EIA, the project is located "*within the NSR Valley which is a provincially significant Natural Area and a regional biological corridor*." The area's significance to regional biodiversity and connectivity has been reaffirmed in multiple planning documents (Ribbon of Green 1992, GeoWest 1993, Natural Connections 2007, Breathe 2017). The Province of Alberta also identifies the significance of this area and classifies the North Saskatchewan River Valley as a Key Wildlife Biodiversity Zone (KWBZ, ESRD 2015). The "*KWBZ is … identified for its contribution to wildlife migration corridors. The zones are intended to prevent loss and fragmentation of habitat, maintain migration corridors, prevent vehicle access, prevent sensory disturbance during energetically stressful periods for wildlife, and prevent barriers to wildlife corridors*"

Important climate resilience consideration

Maintaining ecological connectivity is recognized as a key strategy for climate change resiliency (Heller and Zavaleta, 2009; Hilty et al., 2006; Stein et al., 2014), in particular, maintaining or restoring riparian corridors (Crist 2013). As the climate continues to change local and regional species will experience increased stress and continued habitat loss. As such, Path 5 of Climate Resilient Edmonton[5] sets the City on a path to prepare for changing ecosystems, with Goal 10 outlining the need to ensure "*Edmonton's natural ecosystems continue to provide essential ecosystem goods and services such as clean air, clean water, and biodiversity.*" Therefore, projects that encourage continued anthropogenic fragmentation of important biodiversity corridors, as is found in the River Valley, should also be viewed with a lense to impact the City's ability to achieve its climate resilience as well as biodiversity goals.

Important cumulative impact consideration: potential impact of future recreational trails

Another item to consider with respect to the impact of future wildlife use in the project area is with respect to recreational trails. Specific to connectivity, research has shown that edge effects of trail development reduces wildlife use of an area within at least 100 m of trails (see "Figure 5"; reproduced from Lenth, Knight, and Brennan 2008. Natural Areas Journal). Because of this depth of edge effect it is expected that there will be a large percentage of the area within the 1.8 km-100m wide corridor that will become unsuitable for species of wildlife should a trail be located within any remaining wildlife corridor (even though the habitat may be otherwise suitable).

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[5] Climate Resilient Edmonton: Adaptation Strategy and Action Plan (2019)

This issue will be further compounded should a wildlife impermeable fence further impede the ability of wildlife to move safely away from human recreational use to avoid human/wildlife conflict in proximity of the trail. Therefore, both the Administration and Council should consider impacts of future recreational trails on wildlife connectivity and habitat use as a cumulative impact to this project.

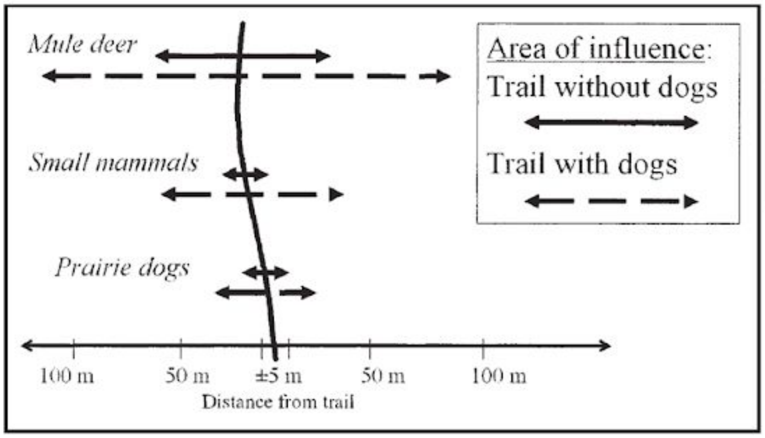

Figure 5. Conceptual diagram of the effects of recreationists alone or recreationists with dogs on mule deer and small mammal activity and prairie dog burrow location within a trail corridor in a protected area.

3) Continued Wildlife mortality

Based on a review of existing scientific literature, the wildlife Addendum, and as confirmed in the original EIA, this project is expected to result in increased wildlife mortality in the area due to bird collisions with solar collectors. We also concur with the draft EIA conclusion that the few mitigation measures that do exist around preventing bird mortality have not been proven to be effective at this time.

Contrary to what is stated in the Wildlife EIA addendum (page 3.7), increased research in recent years has documented that wildlife mortality does occur at multiple solar energy projects across North America (Kagan et al. 2014, Walston Jr. et al. 2016). Most research has focused on the risk to birds due to collision with solar collectors where they are either killed on impact or are stranded after impact and die from predation, injuries, dehydration or starvation (Kagan et al. 2014, Huso et al. 2016, Walston Jr. et al. 2016). It is thought that waterbirds in particular are attracted to solar farm areas as the polarised light reflected off of panels may be similar to light reflecting off water (Horvath et al. 2009, Kagan et al. 2014). However, song birds have also died due to collisions and stranding, likely as a result of foraging for insects that are attracted to solar collectors and congregate in areas with warmer temperatures above the panels (Horvath et al. 2009, Hernandez et al. 2014, Kagan et al. 2014).

The mortality impacts of solar farms become that much more important to consider when solar projects are proposed in important wildlife zones. It is also important to note that the Local Area of Assessment is in immediate proximity to known waterfowl breeding and loafing habitat. By being surrounded by natural upland, water bodies and arboreal corridors, a solar farm at this location may

increase the likelihood of the solar farm being viewed as aquatic habitat. In addition, the surrounding natural habitat will also be attractive to avian predator populations which are known to increase their use of an area when above-ground structures associated with solar farm infrastructure can act as perches (Helzer 1999, Barber et al. 2010,Lovich and Enne 2011, BLM and DOE 2012, Grippo et al. 2014). Research on mortality sinks around solar farms has yet to be studied.

The draft EIA does indicate that the project will "*increase the risk of mortality primarily due to the potential for birds to collide with solar panels.*" However, it then goes on to suggest that the implementation of two untested mitigation measures will be used until such point when "*mortalities are documented to be above acceptable limits*." Despite this commitment, Administration has not yet received the following documents requested in our August 2019 comments (Section D):

- Prepare wildlife monitoring and mitigation plan which is to be approved prior to the project being constructed
- Within this plan, define how "unacceptable risk" will be measured by the project
- Propose additional mitigation measures prior to project construction

4) Missed mitigation opportunities

Despite supporting the Administration's findings about the negative impacts of the project to habitat, ecological connectivity, and wildlife mortality, the EIA wildlife addendum articulates that no new mitigation measures will be required and none are proposed. Therefore, this conclusion does not address City Administration's recommendation to mitigate the predicted long term adverse effects on habitat loss and fragmentation, connectivity and wildlife mortality.

At the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890, Administration presented to Council that "*Epcor has verbally agreed to collaboratively assist Administration in the development of a biodiversity offset framework which is intended to follow the mitigation hierarchy of avoid, minimize, restore and offset*."[6]

Global practice[7] in the exploration and implementation of biodiversity offsets starts with a demonstration that all reasonable steps have been taken within the mitigation hierarchy prior to moving on to offsetting. After it has been illustrated that steps to avoid and minimize ecosystem impact and biodiversity loss have been incorporated into a project's design, the project can then proceed to the final step of the mitigation hierarchy which is called offsetting. Conservation actions that are not designed to result in No Net Loss and preferably Net Gain are not considered biodiversity offsets.

Given the direction above, the following mitigation review is provided in an order of priority that aligns with the IUCN's recommendations of:

I. Avoid;
II. Minimize;
III. Restore/rehabilitate and offset

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[6] Administration's presentation to Council at the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890. Refer to timestamp 6:33:40 of the June 17, 2019 Council minutes: http://sirepub.edmonton.ca/sirepub/mtgviewer.aspx?meetid=2264&doctype=MINUTES

[7] Biodiversity Offsets: Effective Design and Implementation (http://www.oecd.org/env/resources/Biodiversity%20Offsets_Highlights_for%20COP12%20FINAL.pdf)

I. Avoid: move project site to an area that reduces impact to the North Saskatchewan River Valley which is a Provincial Key Wildlife Biodiversity Zone

The literature is clear that the most important factor to consider in the review of significant solar infrastructure is appropriate site placement because biodiversity impacts are highly site-specific. As with any infrastructure project, well-sited solar infrastructure minimizes impact on biodiversity and limits the need for mitigation measures. For example, research back to the 1990's points to the fact that solar energy infrastructure has inherently low impacts on wildlife when integrated into an existing anthropogenic footprint such as on rooftops.[8]

The Province of Alberta also has clear guidelines that solar projects should be sited to avoid or minimize their occurrence in important wildlife habitats. Areas such as native parkland and "*valleys of large permanent watercourses*" (e.g. North Saskatchewan River Valley) should be avoided in order to avoid or minimize solar power infrastructure in Provincially mapped Key Wildlife and Biodiversity Zones - such as the area of the LAA. This Directive ensures that off-site locations will have reduced effects on wildlife if an alternative site is reviewed. Municipally, the City of Edmonton also has multiple Bylaws and Policies that speak to the prioritization of nature conservation and restoration within the North Saskatchewan River Valley including the area in question.

Given the IUCN Policy on Biodiversity Offsets,[9] scientific research of solar farm impacts on biodiversity, Provincial guidelines and Municipal Policy direction, from an environmental perspective the best scenario is one in which the solar farm footprint is moved outside of the River Valley which is Edmonton's key wildlife and biodiversity zone. Such avoidance will:

- Continue to enable the City to work towards achieving its renewable energy generation goals while also reducing greenhouse gas emissions;
- Show no net loss in wildlife habitat and connectivity
- As supported by the literature, result in reduced mortality of avian wildlife due to lower waterbird abundance in brown field or agricultural areas

Mitigation measures proposed for this project that support "avoidance":

- No avoidance mitigations have been proposed for this project
- Specifically, the Site Location Study provided was limited in its analysis and did not consider viable alternative location opportunities including utilization of degraded lands (e.g. brownfield sites, co-location of solar panels with underutilized land including industrial and agricultural land etc.) which is a common practice both nationally and internationally for utility scale solar farm site selection (see Section B for more details).
- It has been mentioned that the long-term plan for this site is for future water treatment operation expansions as the City grows with the conclusion being that the site will eventually be disturbed, so there is no value to protecting it now. However, temporal avoidance of negative impacts to this site (of >30 years) while water treatment processes and infrastructure become more efficient and less ecologically invasive could eventually lead to permanent avoidance, or a reduced infrastructure footprint in the future, while allowing the site to act as habitat in its current (or restored) state until such time as water treatment expansion is required.

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[8] A detailed reference list that supports this review can be found in Administration's Second Circulation Comments on AA18-13 EL Smith Solar Farm EIA and SLS

[9] https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_059_EN.pdf

- It is noted that the project proponent is exploring a competitive procurement for new renewable power from a wind farm in southern Alberta for the remainder of grid sourced electricity used by Water Services[10]. By procuring additional renewable power from this source negative environmental impacts related to renewable energy generation at this site can be avoided.

II. Minimize: reduce the size of the project footprint

Should it be determined (through Council approval of the site location) that a River Valley location is required, the next step in the mitigation hierarchy is to minimize project impacts. Such impacts would be most effectively minimized by reducing the footprint of the solar farm[11]. This would:

- Reduce wildlife mortality by reducing the size of the perceived solar "lake";
- Limit habitat loss due to retention of a portion of the tame meadow;
- Enable the creation of a wider bigger buffer along the valley edge to maintain more effective wildlife movement; Corridor along the NSRV that is wide enough to offset the trail edge effects of human use on biodiversity;
- Similarly, widen the vegetated buffer along the south edge of the site

Current mitigation measures proposed for this project that support mitigation through "minimization":

- A 100m setback from the river is proposed:
    - Due to the lack of site-specific data collection, it is unknown if urban-sensitive wildlife (e.g. elk, moose, some medium mammals) will use a lengthened 1.8 km long corridor (a 220% increase from the original corridor length), especially if a formal recreational trail is developed within it for the future.
- A 40 metre vegetated buffer along the south edge of the site was proposed:
    - This review took into consideration that it will take 30-50 years for this buffer to mature and become effective as the proposed forested wildlife corridor.
    - Site specific information currently shows that only urban adapted wildlife species use the 30m pinch point to the NE of the existing Plant, putting caution into evaluating the effectiveness of a 40m buffer for use by urban sensitive species.
- See Section C2b for supporting details

III. Restore/rehabilitate and offset

The IUCN Policy on Biodiversity Offsets indicate that "*Only after applying the earlier steps in the mitigation hierarchy should biodiversity offsets be employed to address the residual impact in order to achieve at least No Net Loss and preferably a Net Gain at the project level. Conservation actions intended to achieve offset outcomes must result in a direct measurable biodiversity gain equivalent to the residual loss arising from the impacts on biodiversity associated with a project in order to be considered a biodiversity offset. Conservation actions that are not designed to result in No Net Loss and preferably Net Gain are not biodiversity offsets*."

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[10] Epcor Water Services Inc. Water Services & Drainage Services 2020 Annual Operational Plans (Page 33), accessed from http://sirepub.edmonton.ca/sirepub/cache/2/pdo0hprlwm2bb0i3h3ibvfz0/91052702232020063820732.PDF

[11] Original 2017 proposal was for a 5MW facility. Other options include reducing to 10MW or less.

Using these guidelines, the following options were explored for their ability to provide "restoration and biodiversity offsets" that would result in biodiversity gain for the project:

- Onsite restoration/biodiversity offset options:
    - Avoidance (as above) and restoration of a portion of the existing tame meadow;
    - Restoration/enhancement of current "pinch points" of the site (e.g. the impacted area to the NE of the existing power plant)
    - Commitment for long term protection of restored tame meadow, surrounding natural areas, and widened river buffer;
    - Allowance for wildlife movement to the River from forested areas, potentially through a W-E corridor
- Offsite restoration/biodiversity offset options:
    - Improve connectivity/habitat at other Epcor owned sites within the river valley
    - Identification and protection of currently unprotected and previously cleared sites within the River Valley in order to gain a favourable offset ratio.
    - protection of currently unprotected sites within the River Valley or tablelands in order to gain a favourable offset ratio.
    - Such biodiversity offsets would potentially see local increases in biodiversity in an area away from the project's area of impact
    - Long term biodiversity protection would be ensured if restored areas were held in protected area status

Current mitigation measures proposed for this project that support "restore/rehabilitate and offset" do not meet the standard of No Net Loss are therefore not considered as biodiversity offsets. For example:

- The project proposes a net gain of 0.7 ha of new forest plantings.
    - Taking this net gain of potential habitat into account, the project does not offset the net loss of 19.7 ha of tame meadow habitat currently used by native wildlife.
- While a vegetation plan was mentioned as a mitigation measure, neither the EIA nor the SLS provides information on the proposed revegetation of the fenced area that will exclude medium-large mammals. Given this, there is no ability for reviewers to assess how a native seed mix (or its associated small mammal population) responds to being shaded by solar panels and other solar infrastructure.
- There is mention in the SLS that the proponents propose to transfer 12.7 hectares (31.5 acres) of sloped forested land to the City for permanent protection. While permanent protection improves the long term certainty of biodiversity conservation for this parcel , the City has not yet assessed the status of these lands, nor is there any agreement in place for a land transfer. Ownership of land does not constitute a biodiversity offset under IUCN standards however; the City has not yet developed its own biodiversity offsets and long term protection of key corridors could be considered when the City initiates formal biodiversity offsets standards.

Important notes on monitoring plans:

- They are not considered a mitigation tool
- Rather they are required under a Biodiversity Offset Framework to monitor for "*direct measurable biodiversity gain equivalent to the residual loss arising from the impacts on biodiversity associated with a project*"

- As such, the project commits that “*Wildlife monitoring (during and post construction) as well as vegetation monitoring will be implemented to evaluate the effectiveness of and to adapt the mitigation measures and an annual monitoring report will be provided to the City and Alberta Environment and Parks*”
- The SLS indicates that the wildlife monitoring and mitigation plan is to be approved prior to the project being constructed.

Section D: Review findings of Sustainability Value Analysis of the E.L. Smith Solar Farm Project – SLAJ Addendum Report dated January 2020

EPCOR though this addendum report acknowledge a broader range of literature that was suggested by City reviewers through previous revision These studies include ecosystem valuation of forest and grassland ecosystems in the close proximity of urban areas that have considered social and recreational values of specific ecosystems that was not considered previously in the HDR report. The break even analysis presented with an addendum report did not acknowledge social and recreational values given the assumption that the E.L. Smith site is a restricted access, fenced and maintained for the potential future expansion and not available for recreation.

Outcomes of one scenario that consider ecosystem valuation including social and recreational values would significantly reduce the projected benefit of the project (From $18.7 million differences to $2-3 million for high end ecosystem values as shown under Table 3, Page 8). Although EPCOR suggested literature for additional reference (Table 3, Page 8 of HDR Addendum Report) but did not consider potential outcomes of those scenarios for consideration under the summary and recommendation section of the addendum report.

Our outstanding comments in review of site justification analysis still remain the same. Understanding the complete ecosystem valuation (ecological, aesthetic, and social) of E.L. Smith Solar Farm through site investigation following scientifically proven standard methods was not a scope of the HDR report. Therefore, the relative findings and comparative analysis as presented within the SLAJ and HDR report should be considered with precaution (Please see City Review Memo on SLAJ 2019 for more detailed review comments).

The HDR report considered the E.L. Smith Solar Farm Project site predominantly represents the grassland Ecosystem for the valuation estimates. The prairie grassland ecosystems in general were identified for lower ranges of valuation estimates as compared to other ecosystems. In our opinion, the E.L. Smith Solar Farm Site is a part of Aspen Parkland Ecoregion that supports a transitional grassland ecoclimate. Most of the parkland ecoregion is now farmland but in its native state, the landscape was characterized by trembling aspen, mixed tall shrubs, and intermittent grassland. The majority of the project site is visibly disturbed but given the intact natural forest habitat within its surrounding areas and remnant forested patch inside the E.L.Smith Solar site, this location should be treated as a Aspen Parkland ecosystem as compared to the prairie grassland.

(Note: E.L. Smith Solar Farm EIA and associated biophysical assessment have identified the majority of wildlife/bird species are associated with the Aspen Poplar Woodland Alliance vegetation community that was detected within the PDA).

Section E: Administration’s outstanding review items of “*Municipal Environmental Assessment for the E. L. Smith Solar Farm (February 2019)*”

Open Space Strategy outstanding review items of *Municipal Environmental Assessment for the E. L. Smith Solar Farm”* dated February 2019

August 19, 2019

Outstanding Issue	**Gap**	**Approach proposed to date**	**CoE Mitigation Review Approach*****
Impact on Habitat Loss and Fragmentation	-See Key Assumption 1* -Conclusion III, IV, V (Bullet 1)** -Issue: B, C, F (f)**	-Camera grid -Winter tracking -Summer browse and pellet counts -Proposed native seed mix: monitor to ensure its effectiveness **-Other approaches can also be proposed for consideration**	Propose mitigation measures in the following order: 1) Avoid impact, 2) Minimise impact, 3) Restore and 4) Offset impacts.
Impact on Connectivity	-See Key Assumptions 2-5* -Conclusion III, IV, V (Bullet 2)** -Issue: D, F (a-e)** -Assess movement between slope and riparian habitat -Impact of fence on other species, like ground nesting birds	-Camera grid -Winter tracking -Summer browse and pellet counts **-Other approaches can also be proposed for consideration**	Propose mitigation measures in the following order: 1) Avoid impact, 2) Minimise impact, 3) Restore and 4) Offset impacts.
Impact on Wildlife Mortality	-Conclusions II, IV, V (Bullet 3)**	-Prepare monitoring plan -Define unacceptable risks -Commit to public release of reports -CoE to be considered regulatory agency **-Other approaches can also be proposed for consideration**	Propose mitigation measures in the following order: 1) Avoid impact, 2) Minimise impact, 3) Restore and 4) Offset impacts.
Other	-Conclusion I** -Issue A, C, E, G** -Public confusion that recreational trail construction and approval is part of this project -Lack of clarity of trail location and impact	-Update based on baseline data review -Clearly state location of trail easement has not been determined, trail building is not part of this project, and that cumulative impacts of project and any future trail remains to be assessed (especially if proposed through corridor on east of PDA)	Update based on obtained information

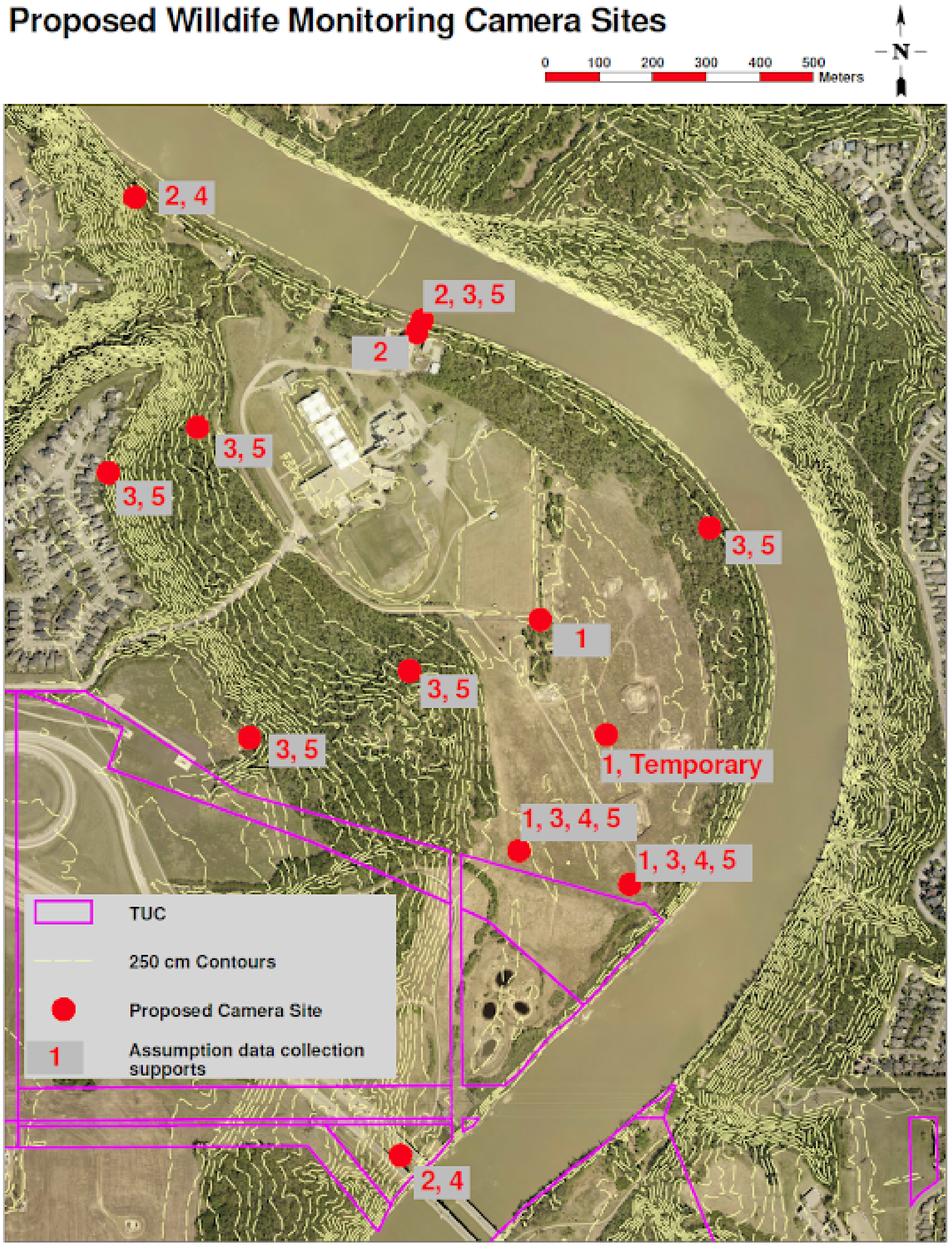
*Document title: “*Proposed Epcor Solar Wildlife Camera Monitoring Plan*” (June 13, 2018)

**Document title: “*Urban Analysis review of wildlife assessment and results outlined in the report titled “Municipal Environmental Assessment for the E. L. Smith Solar Farm” dated February 2019*” (March 12, 2019)

***See also:

- mitigation comments in Administrations December 6,2018 comments; ensure outstanding comments are addressed

- Administrations April 2019 comments which state: “*...it is the assessment of this review that it has not been demonstrated that the proposed mitigation measures will minimize the predicted long term adverse effects on: Habitat loss and fragmentation, ...Connectivity, ...and Wildlife mortality due to bird collisions with solar collectors...*”; ensure additional mitigation measures are explored and presented



Section F: Literature Cited

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E.L. Smith Solar Project
Site Location Study
January 31, 2020

EPCOR WATER SERVICES INC.

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1.0 EXECUTIVE SUMMARY

1. In its 2017-2021 Performance Based Rate ("PBR") Application, which was approved by the Edmonton City Council ("City") in October 2016 (under Bylaw 17698), EPCOR Water Services Inc. ("EWSI") included a Green Power Initiative which commits EWSI to obtaining approximately 10 per cent of its energy consumption from new (additional) locally produced renewable sources starting in 2018. Based on the results of its analyses of potential alternatives for achieving this green power initiative in the most prudent means available, EWSI is proposing to proceed with the E.L. Smith Solar Project (the "E.L. Smith Solar Project" or the "Project").

2. The E.L. Smith Solar Project is a 12 MW solar farm on private land owned by EWSI, adjacent to the E.L. Smith Water Treatment Plant ("WTP"). The entire site where the Solar Project will be located is not publicly-accessible today, and the long-term plan for this site is for future water treatment operation expansions as the City grows. As water treatment processes and infrastructure have become more efficient, and Edmontonians are using more water efficient appliances in their homes, EWSI expects that this expansion will not be needed until after the solar farm's expected lifetime of 30 years. EWSI considers the interim use of this site for the Project is entirely consistent with the requirements and objectives of the City's November 2018 draft *Ribbon of Green* and the relevant goals, objectives and policies of the North Saskatchewan River Valley Area Redevelopment Plan ("NSRV ARP" or "Bylaw 7188").

3. EWSI prepared its Land Development Application[1] ("LDA") for the Project and a supporting Municipal Environmental Impact Assessment ("MEIA", authored by Stantec, dated February 2019). The purpose of the LDA is to i) apply for re-zoning of the EPCOR-owned land where the Project is located from a Metropolitan Recreation Zone (A) to a Direct Development Control Provision (DC1) (Charter Bylaw 18890) and ii) apply for an amendment to the NSRV ARP to more explicitly authorize the development of the solar farm (Bylaw 18889). EWSI's LDA for the Project was brought forward to a Public hearing on June 17, 2019. At this hearing, City Council deferred a decision regarding the LDA and passed the a two-part motion which directed City Administration to[2]:

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[1] In support of EWSI's Land Development Application for the E.L. Smith Solar Project, EWSI included a Site Location Analysis and Justification Report which includes further details of the institutional, financial, environmental and social opportunities and constraints analysis.

[2] http://sirepub.edmonton.ca/sirepub/mtgviewer.aspx?meetid=2264&doctype=MINUTES

i) *"…work with EPCOR Water and Enoch First Nation to continue engagement activities and return to a future Public Hearing…"*

ii) *"…work and reporting necessary to allow Council to fully consider whether the location within the River Valley should be deemed essential by Council."*

4. This Site Location Study ("SLS") is intended to support City Administration in addressing the second part of the City Council motion. The first part of the motion will be addressed by way of a separate report to Council.

5. The Project is not publicly owned nor on public land and Council is not committing funds for capital expenditure for the development of the Project; therefore, the Project is not subject to the provisions of Sections 3.5.1 and 3.5.3 of the Bylaw 7188 which requires a site location study to be prepared and a river valley location to be deemed "essential" by City Council. Although deeming a river valley location "essential" is not a legal requirement for this Project, City Administration is requesting that EWSI prepare this SLS to respond to the second part of the Council motion passed June 17, 2019. This SLS supports EWSI's Land Development for the Project and will allow City Council to determine if the Project would meet the same "essential" test as publicly owned projects. This SLS has been prepared in accordance with the City's terms of reference and evaluates the Project's proposed location in the river valley based on institutional, financial, environmental and social opportunities and constraints. On balance, if the Project were moved to an offsite location, the potential for lower adverse environmental effects are considerably outweighed by the financial, social and institutional constraints. EWSI considers that the results of this SLS should provide City Council with confidence in making a determination that the proposed Project site at the E.L. Smith Water Treatment Plant is essential.

6. An independent, science-based, Municipal Environmental Impact Assessment (MEIA) for the Project, prepared by Stantec, concludes that while there are potential adverse environmental effects, they can be avoided, reduced or controlled using a number of recommended mitigation measures. Some of the important mitigation measures include: reducing the footprint of the Project to increase the setback from the river to 100 metres; revegetation of the entire project site replacing non-native perennial pasture[3] with native

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[3] The Alberta Biodiversity Monitoring Institute identifies perennial pastures and other non-native plant communities in the Prairie and Parkland Regions as having detrimental ecological effects, including reducing local

vegetation; creation of a 40 metre vegetated buffer along the south edge of the site; and revegetation of 7.4 acres resulting in a net gain of native trees and shrubs on the site to enhance wildlife habitat and connectivity and create a visual and noise buffer for the Project. EWSI intends to implement all of these mitigation measures as well as other mitigations recommended in the MEIA. Wildlife monitoring (during and post construction) as well as vegetation monitoring will be implemented to evaluate the effectiveness of and to adapt the mitigation measures and an annual monitoring report will be provided to the City and Alberta Environment and Parks[4].

7. In accordance with EWSI's commitments in the proposed Direct Control Provision (per the LDA) to develop a wildlife monitoring and mitigation plan, EWSI has been working with Stantec to complete additional wildlife monitoring and collect additional wildlife baseline data prior to construction. From June 2019 to January 2020, Stantec collected additional wildlife data which is summarized in its Wildlife Addendum to the MEIA, dated January 2020. Based on the additional wildlife data collected, Stantec concluded that potential residual effects of the Project remain the same as the original MEIA with the exception of changes in wildlife movement - where magnitude was changed from low to low-to-moderate. This means that changes to wildlife movement may occur for medium and large mammals but movement for other wildlife is unlikely to be affected. Stantec also determined that, while evidence of mammal use was observed throughout the Project area, there is also evidence that wildlife is successfully using narrow corridors adjacent to the E.L. Smith WTP as effective passage through the area and therefore, *development of the Project is unlikely to prevent wildlife movement along the North Saskatchewan River*[5]. Furthermore, the planned mitigations to revegetate approximately 40 metres of native trees and shrubs along the south edge of the site will provide additional structural connectivity and reduce the indirect effects of the Project on wildlife movement.

8. Based on its review of EWSI's facility application for the Project, including the Stantec environmental assessments, the Alberta Utilities Committee ("AUC") issued a decision approving the Project on February 20, 2019. , the Commission issued Decision 23418-D01-2019, approving the Project. In its Decision, the AUC determined that "*Although the Commission*

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biodiversity and providing lower nutritional value for grazing wildlife relative to native vegetation (page 3.2 of the Stantec MEIA Wildife Addendum (December 2019).

[4] Wildlife Addendum to MEIA for the E.L. Smith Solar Project, Stantec, December 4, 2019.

[5] Wildlife Addendum to MEIA for the E.L. Smith Solar Project, Stantec, December 4, 2019.

recognizes that the North Saskatchewan River valley, the location proposed for the project, is an important resource for the City of Edmonton and its citizens, upon consideration of the current land-use of the site, combined with the mitigation measures proposed and commitments made by EPCOR Water, it is satisfied that the social and environmental impacts would not be significant." A further summary of the AUC's decision along with other regulatory approvals for the Project is provided in Attachment 1 to this SLS.

9. On August 27, 2019, Edmonton City Council declared a climate emergency and directed that City Administration bring back a revised Community Energy Transition Strategy in 2020 with a more aggressive ten-year action plan to achieve a 1.5 degree global average temperature increase. Edmonton's current greenhouse gas reduction targets are not sufficient to achieve the 1.5 degree limit which was the target recognized by the Edmonton Declaration in March 2018. The *Getting to 1.5^{O}c* report[6], presented to City Council in August 2019, emphasized the importance of renewable energy sources in achieving these goals. The E.L. Smith Solar Project, if approved, would not only contribute towards Edmonton's Community Energy Transition Strategy but would also provide significant potential for enhancing education and awareness of large scale renewable energy in Edmonton.

10. EWSI recognizes that its proposed E.L. Smith Solar Project requires the City to balance the need to protect the NSR Valley under the NSRV ARP with emerging goals set out under ConnectEdmonton and other policy documents including Edmonton's Community Energy Transition Strategy. The proposed Project is consistent with the relevant goals, objectives, and policies of the NSRV ARP. This SLS demonstrates that, while there is the potential for some adverse local environmental effects, EWSI intends to take several actions to mitigate these potential effects. Furthermore, any potential residual effects are far outweighed by the significant benefits to the City of Edmonton achieved through a large scale renewable energy project which demonstrates the City's leadership action on climate change in a cost-effective and responsible manner.

11. Moving the E.L. Smith Solar Project to an offsite location is significantly more costly (by greater than $16 million net present value) due to a number of "behind the meter" benefits only available at the site of the E.L. Smith WTP. Furthermore, EPCOR has been awarded a total of $10 million in grant funding from Natural Resources Canada ("NRCan") to enhance the E.L. Smith Project with a micro-grid system and approximately 4 MW Battery Energy Storage System

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[6] https://www.edmonton.ca/city_government/documents/PDF/GettingTo1-5DiscussionPaper.PDF

("BESS"). The grant funding is only applicable to the E.L. Smith site due to its connection to the E.L. Smith Water Treatment Plant electrical load.

12. The E.L. Smith Solar Project will reduce Edmonton's dependence on conventional energy and make its water operations more resilient to climate change. Moving the Project to an offsite location not connected to the E.L. Smith WTP would not provide the same community integration, education and research opportunities for the city of Edmonton. There can be no assurance that an off-site location will have reduced potential effects to wildlife as it will depend on the particular ecological characteristics of a selected site. EWSI is not considering moving the Project to an offsite location due to the additional costs to ratepayers, the missed opportunity for incorporating a grant-funded micro-grid system and the missed education and research opportunities.

13. For all of these reasons, EWSI considers that the results of this SLS should provide City Council with confidence in making a determination that the proposed location of the E.L. Smith Solar Project in the NSR Valley adjacent to the E.L. Smith Water Treatment Plant is essential. As such, the re-zoning of the EPCOR-owned land where the Project is proposed to be located (from A to DC1) and the requested amendment to the NSRV ARP to more explicitly authorize the development of a solar farm at the existing E.L. Smith Water Treatment Plant site, should be approved. Approving the requested amendment to Bylaw 7188 and rezoning the lands required for the Project will not set a precedent for future development applications of solar farms because EWSI's proposed amendments[7] to Bylaw 7188 will only permit the development of a solar farm at the E.L. Smith water treatment plant site and the City will always maintain the authority and discretion to consider any development application on its individual merits.

1.1 Independent HDR Triple Bottom Line Analysis

14. EWSI engaged HDR Corporation ("HDR") to conduct an independent triple bottom line analysis comparing the E.L. Smith Solar Project to the alternatives on the basis of their financial, environmental and social impacts. The triple bottom line framework reflects a holistic view of the Project that takes into account not just the economic and financial aspects, but social

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[7] EWSI has proposed amendments to Sections 2.6, 3.5.1 and 4.2 of Bylaw 7188 specifically to permit the development of a solar farm on the privately held lands at the E.L. Smith water treatment plant site, as a contiguous expansion of, and primarily to supply power to, the E.L. Smith Water Treatment Plant.

(including aesthetic and recreational) and environmental aspects as well.[8] HDR's triple bottom line analysis relied on widely used and accepted[9] approaches for triple bottom line type of cost benefit analysis. HDR relied on Project information and financial analysis from EWSI, third party land values from a 2018 analysis of land prices within a 40 km radius of Edmonton, an independent EIA prepared by Stantec, results of EWSI's extensive stakeholder consultations, broad review of economic literature and other studies and feedback from a June 2018 triple bottom line analysis workshop.

15. HDR's original report, the August 2018 HDR Sustainability Value Analysis of the E.L. Smith Solar Farm Project (the "August 2018 HDR Report") is provided as Attachment 2-A. An addendum to the August 2018 HDR Report is provided as Attachment 2-B (the "October 2019 HDR Addendum") and provides an analysis of the E.L. Smith Solar Project compared to an offsite solar project using the breakeven approach with both HDR's recommended ecosystem values from economic literature as well as the City Administration's proposed ecosystem values. Using both sets of ecosystem values, HDR concludes[10]:

> *In summary, HDR's original conclusions remain: for the offsite solar alternative to be the preferred alternative, decision makers would have to: (i) place a very high ecosystem value on the E.L. Smith site and (ii) believe that the project development at E.L. Smith would result in adverse impacts to the ecosystem that are high in magnitude. The high ecosystem valuation for the E.L. Smith project site is not supported by the literature. The potential for adverse ecosystem impacts that are high in magnitude are not supported by the MEIA.*

1.2 Organization of the Site Location Study

16. This SLS has been prepared in accordance with the City's terms of reference and includes the following three sections:

- project description and scope;
- location analysis and justification; and
- social, financial, environmental and institutional opportunities and constraints assessment.

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[8] Page 7 of HDR's Sustainability Value Analysis of the E.L. Smith Solar Farm Project, August 12, 2018.

[9] For example, the breakeven (threshold) approach is aligned with Cost Benefit Analysis, 5th Edition Boardman, Greenberg, Vining, and Weimer. The MAE approach is consistent with cost benefit analysis used by the Treasury Board of Canada (https://www.tbs-sct.gc.ca/rtrap-parfa/analys/analys-eng.pdf).

[10] EPCOR Water Services Inc. SVA of the E.L. Smith Solar Farm Project - Addendum Report, January 31, 2020

2.0 PROJECT DESCRIPTION AND SCOPE

17. EPCOR is planning to construct a solar farm on its property located at 3900 E.L. Smith Road to supply renewable energy to its E.L. Smith Water Treatment Plant (herein referred to as the “Project” or “Solar Project”) and to interconnect the Solar Project to the Alberta Interconnected Electric System and the electrical distribution system of EPCOR Distribution & Transmission Inc. (“EDTI”). The proposed Project will include the installation of up to 45,000 solar panels and associated electrical equipment on EWSI’s property south of the E.L. Smith Water Treatment Plant.

18. E.L. Smith is one of two water treatment plants in the City of Edmonton and has been in operation since 1976. The E.L. Smith WTP is the larger of the two plants. It treats water from the North Saskatchewan River and provides clean drinking water to approximately 750,000 customers or 65% of the Edmonton population (the Rossdale WTP serves the remaining 35% of Edmonton). The E.L. Smith WTP also provides bulk water to approximately 190,000 regional customers in communities north and west of Edmonton including Beaumont, Leduc, Morinville, Nisku, Onoway, Spruce Grove, St. Albert, Stony Plain and Sturgeon County.

19. The proposed Project site is located on 54 acres of land owned by EWSI and is adjacent to the existing E.L. Smith Water Treatment Plant. The entire site including the Solar Project is not publicly-accessible today, and is planned for future expansion of EWSI’s water treatment operations to accommodate not just city of Edmonton population growth but also regional growth. As water treatment processes and infrastructure have become more efficient, and Edmontonians are using more water efficient appliances in their homes, EWSI expects that this expansion will not be needed until after the solar farm’s expected lifetime of over 30 years.

20. The water treatment plant currently has an average annual electricity requirement of approximately 44,000 MWh (megawatt hours). The proposed 12 MW Solar Project is expected to generate approximately 21,500 MWh of electricity annually of which about 70% is expected to be consumed at the E.L. Smith WTP. The remaining 30% of generation, during hours when the output of the Solar Project exceeds the load at the WTP, will be exported to the Alberta Interconnected Electric System (the “grid”) and sold into the Alberta wholesale electricity market. This plan has been reviewed and approved by the Alberta Utilities Commission.

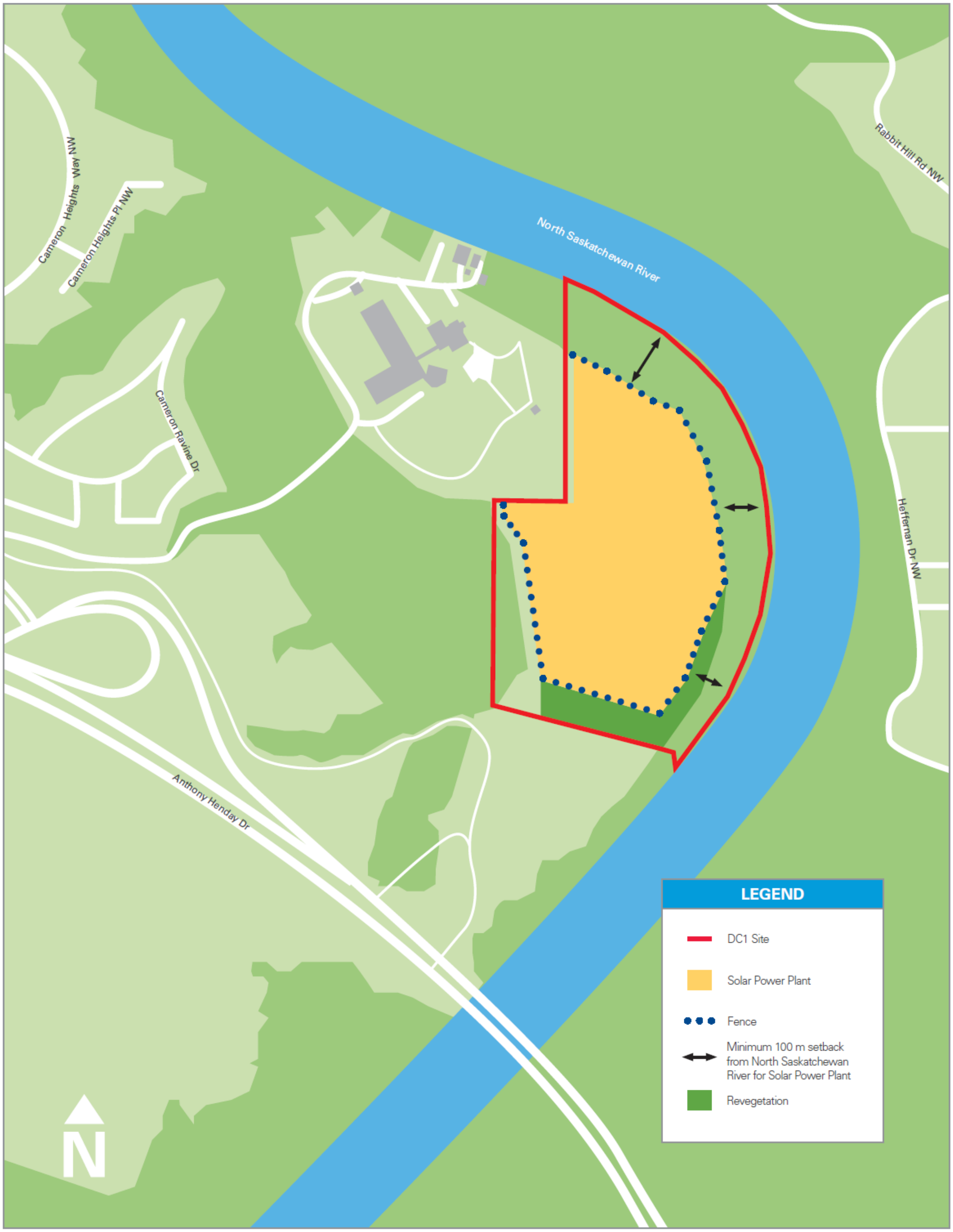
21. The proposed Solar Project will involve connecting up to 45,000 solar panels to the E.L. Smith Water Treatment Plant and EDTI's electrical distribution system. The Solar Project scope and description is as follows (further technical details are provided in the EIA):

- parallel rows of solar panels mounted on racking and anchored to the ground using an embedded pile system with average depth of 5 metres depending on soil conditions;
- each solar panel approximately one metre wide and two metres in length, designed to absorb sunlight instead of reflecting it, therefore minimal glare is expected;
- each row of solar panels up to three panels high and multiple panels long, raised approximately one metre above ground and spaced 5-10 metres apart;
- four inverter stations to house the electrical infrastructure for electrical connector systems and new underground AC cables, installed using open trench methodology, running from the inverter stations to a new interconnection point building located on the north side of the project development area
- certain civil works including site access roads, minor grading and select tree removal; and
- a new security fence to enclose the solar farm designed to consider small animal movement and ways to enhance the aesthetics and overall viewscape.

22. A map of the proposed Project is provided in Figure 2.0-1 below. Figure 2.0-1 illustrates the proposed solar panel installation area west of the North Saskatchewan River and adjacent to the E.L. Smith Water Treatment Plant, the proposed new security fence line surrounding the solar panel installation area and the proposed DC1 rezoning area. Additional maps of the Project are provided in the Preliminary Concept Plans (Attachment 3).

Figure 2.0-1

E.L. Smith Solar Project DC1 Rezoning Area



23. Due to the scale of the proposed solar power Project, City Administration determined it is a Major Impact Utility Service. EWSI is applying for a (DC1) Direct Development Control Provision to the affected lands which will accommodate utility systems or works limited to a Renewable Energy Device (solar power plant), complementary uses and the future expansion of the water treatment plant. The Project will be regulated by a Direct Development Control Provision that requires a wildlife monitoring and mitigation plan to be approved prior to being constructed.

2.1 Refinement of the Project Design and Scope

24. Since May of 2017, EWSI has held consultations with the public, industry, government agencies, Indigenous communities, and non-government organizations to gain feedback on the Project. Through this process, EWSI consulted with over 850 stakeholders. Of these stakeholders, less than 1% expressed opposition to the Project and approximately 10% declared their support. The majority of stakeholders did not express support or opposition to the Project.

25. EWSI recognizes the importance of the NSR Valley to Edmontonians and shares the view that this valuable natural resource must be protected. EWSI's water treatment and wastewater treatment operations are located in NSR Valley and EWSI is committed to protecting the river valley parkland for future generations. This commitment guides how EWSI designs, builds and operates its water and wastewater infrastructure now and into the future. The proposed Project has carefully balanced the City of Edmonton's climate change resilience goals with responsible development within the boundaries of the river valley on expansion lands for the E.L. Smith Water Treatment Plant. The plan is supported by EWSI's thorough stakeholder and public engagement and consultation processes and has sought to maximize research and education opportunities to better understand solar energy technology.

26. Based on feedback from the consultation process, EWSI evaluated its 2017 Project plan and made the following adjustments:

- reduced the overall Project footprint to address concerns relating to aesthetics, land reclamation, the environment, and wildlife. At the narrowest point, the security fence line will be set back at least 100 metres (previously 30 metres) from the river;
- reduced the Project site area further by 1 acre along the southern boundary to provide a 40 metre wide vegetated buffer for additional wildlife connectivity and a visual buffer;

- provide the City of Edmonton with access through EWSI's property (outside the solar farm security fence line) for future recreational trails to allow connectivity of the surrounding trail system;
- revegetation of 7.4 acres along the south and southeast boundary with native trees and shrubs to provide a net gain of tree and shrub habitat for wildlife and additional wildlife connectivity;
- strategically located bird and bat boxes in the forested slope west of the site to provide habitat enhancement structures; and
- enhanced post-construction wildlife monitoring program that not only addresses provincial guidelines but in collaboration with the City, to include potential monitoring programs such as wildlife movement.
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27. EWSI also held two workshops in Q4 2018 and Q1 2019 with stakeholders to explore ideas regarding the integration of the E.L. Smith Solar Project into the Edmonton community. From these workshops, conceptual plans were developed. The EPCOR Solar Farm Community Integration Site Interpretation Concept Plan (the "Preliminary Concept Plan") for the Project site is provided as Attachment 3. The Preliminary Concept Plan provides more detailed maps which includes enhancements to the Project design for aesthetics and natural landscape, revegetation areas, interactive public demonstration sites to promote educational awareness of solar technology and understanding of the historical cultural significance of the Project site.

28. The Project will promote and connect Edmontonians and Albertans to their history and diverse cultural heritage through the development of an interpretive site that may include permanent displays and art. The following provides a list of potential partners which EWSI is working with to develop innovative ideas to meet the community integration objectives listed. EWSI is actively looking for interested agencies, institutes and community groups who would like to get involved in meeting the community integration objectives of the Project.

- Indigenous communities
- City of Edmonton
- Edmonton Public and Catholic School Districts
- University of Alberta
- Northern Alberta Institute of Technology
- EPCOR's Community Advisory Panel
- Pollinator Partnership

3.0 LOCATION ANALYSIS AND JUSTIFICATION

29. The following sections include EWSI's responses to questions outlined in the City's terms of reference ("TOR") for the SLS.

TOR Question 1. What other locations were considered for this project including other river valley and non-river valley locations?

30. Two studies were completed which considered alternative locations: (i) EWSI's detailed financial evaluation of alternatives presented to Utility Committee in August 2018 (Attachment 4); and (ii) as requested by Utility Committee, an independent triple bottom line study completed by HDR (Attachments 2A and 2B).

EWSI Detailed Financial Analysis

31. In August 2018, EWSI presented a report to Utility Committee outlining its financial evaluation of the following eight alternatives to meeting the commitment, in its 2017-2021 PBR application, to replacing at least 10% of its conventional energy demand with new (additional) locally produced renewable sources:

1. **Grid Supply** – purchase of conventional power from the grid
2. **Grid Supply + Generic Market RECs** – purchase of conventional power from the grid and generic (non-additional) Renewable Energy Credits[11] ("RECs") available in the market
3. **Off-site Wind Farm** – build and operate (or contract to purchase power from[12]) an off-site wind farm in southern Alberta. This would meet the "Additional" criteria but not "Local".
4. **E.L. Smith Solar Project** – build and operate the proposed E.L. Smith Solar Project.
5. **Off-site Local Solar Farm** – build and operate (or contract to purchase power from a third party) the E.L. Smith Solar farm at an off-site location within 40 kilometres of the city of Edmonton (meeting the "local" criteria) and connect to the grid, but not tied directly to any of EWSI's operating sites.

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[11] RECs from such a project is purchased a third party contract, the annual financial impacts to EWSI ratepayers is assumed to be equivalent.

6. **Commercial Rooftop Solar** – build and operate 100kW to 250kW solar power systems on the rooftops of 104 commercial buildings in Edmonton.
7. **Residential Rooftop Solar** – build and operate 3,268 small scale (3kW to 9kW) solar panels on residential rooftops within Edmonton.
8. **EWSI Rooftop Solar** – build and operate solar panels on the rooftops of EWSI buildings and reservoirs including Rossdale clarifiers, the Rossdale reservoirs, the E.L. Smith reservoirs and three field reservoirs.

32. On the basis of this financial evaluation, the E.L. Smith Solar Project was determined to be the best alternative to meeting EWSI's commitment. Moving the E.L. Smith Solar Project to an offsite location is significantly more costly to EWSI ratepayers (over $16 million net present value) due to a number of "behind the meter" benefits only available at the E.L. Smith site. Furthermore, there can be no assurance that the potential adverse environmental effects of building a solar plant at an offsite location will be reduced.

HDR Triple Bottom Line (Economic, Social, Environmental) Analysis

33. City of Edmonton's Utility Committee, in their role as economic regulator of EWSI, requested EWSI prepare a triple bottom line analysis of the alternatives. EWSI engaged HDR to provide the analysis of the first five of these alternatives. The EWSI Rooftop Solar alternative was excluded from HDR's analysis because, due to space constraints on EWSI buildings, it could only produce 5,000 MWh of renewable electricity annually. The residential and commercial rooftop alternatives were also excluded due to their high cost and complexity to implement.

34. In its report, HDR explains that developing a reasonable estimate of the ecosystem value of the 54 acres of land at the E.L. Smith site is not as straightforward as that for a "generic site". HDR notes that the 54 acre E.L. Smith site itself is quite unique in several ways:

- it is adjacent to an existing industrial site (the E.L. Smith Water Treatment Plant);
- it is adjacent to the North Saskatchewan River in the City of Edmonton;
- it is not really visible from the River due to wooded areas adjacent to the River;
- it is visible to some (a limited number) of homes above the site and from Anthony Henday Drive;
- it is visible from bike paths on both sides of the river;
- It is on private land which is also fenced and not accessible to the public; and
- it is grasslands in a river valley and contained within an urban forest.

35. For all of these reasons, HDR's selected approach to evaluate E.L. Smith Solar Project on a triple bottom line basis was purposely to **<u>not</u>** ascribe a specific ecosystem value for the site but rather to use a breakeven (or threshold) analysis to determine:

(i) how high the ecosystem value would have to be for the E.L. Smith site for the offsite solar alternative to be superior on a triple bottom line basis; and

(ii) whether this breakeven value is plausible given the outcomes from the economic literature (in other words, whether the breakeven value falls within the range of reasonableness as an estimate of the ecosystem value for the E.L. Smith land).

36. Based on this analysis, HDR's original conclusions remain:

…for the offsite solar alternative to be the preferred alternative, decision makers would have to: (i) place a very high ecosystem value on the E.L. Smith site and (ii) believe that the project development at E.L. Smith would result in adverse impacts to the ecosystem that are high in magnitude. The high ecosystem valuation for the E.L. Smith project site is not supported by the literature. The potential for adverse ecosystem impacts that are high in magnitude are not supported by the MEIA.

TOR Question 2. Could the proposed project reasonably function at a location outside of the North Saskatchewan River Valley Area Redevelopment Plan boundary?

37. While the solar farm could function at a location outside the North Saskatchewan River Valley Area Redevelopment Plan boundary, it would:

- be at a significantly higher cost to Edmonton water ratepayers;
- <u>not</u> provide the same societal benefits as the proposed Project would by integrating the project as a demonstration and research site into the community;
- <u>not</u> provide the opportunity to integrate a smart grid system consisting of a Battery Energy Storage System, funded by $10 million in government grants which is tied to the unique nature of this solar project at a "*behind the meter*" setting that combines the E.L. Smith electrical plant load with renewable generation and battery storage (NRCAN grant funding is only applicable to the E.L. Smith site due to the electrical load at the site);
- <u>potentially have similar adverse environmental effects</u>.

TOR Question 3. Is the project dependent on either the river valley and ravine location or the users of the park system?

38. While the E.L. Smith Solar Project is not dependent on the river valley directly, it is dependent on being located adjacent to the E.L. Smith water treatment plant which is necessarily located in the river valley. By reducing the conventional energy consumption at the water treatment plant, the Project will increase the climate resiliency of Edmonton's water operations. The Project derives significant cost savings to ratepayers due to its location next to the E.L. Smith water treatment plant. Furthermore, the community integration opportunities for education and research and the opportunity for a government funded BESS and micro-grid system are only available if the Project is located at the E.L. Smith site.

4.0 OPPORTUNITIES AND CONSTRAINTS ASSESSMENT

TOR Question 4. Identify potential constraints that relate to the project that make a river valley location essential. Provide justification based on constraints analysis (financial, social, environmental and institutional) which limit the feasibility of locating the project outside of the river valley.

39. The purpose of this opportunities and constraints assessment is examine the financial, social, environmental and institutional opportunities and constraints that make the proposed location within the NSRV ARP (Bylaw 7188) essential. The feasibility of locating the project at an offsite location[13] outside the NSRV is constrained by the financial, social and institutional factors described below. While there may be some potential for reduced adverse effects on wildlife of locating the Project outside the NSRV there can be no assurances of this. Furthermore, the potential for adverse environmental effects of the Project overall are expected to be minimal given EWSI's plan to mitigate many of the effects of locating the Project at the E.L. Smith WTP site both during construction and operations. All of EWSI's planned mitigations are detailed in the MEIA. Furthermore, EWSI will continue post-construction environmental monitoring programs and conducting research to learn from the Project in order to identify new mitigations.

40. On balance, the potential for reduced environmental effects at an offsite location are uncertain and, in any case, are considerably outweighed by the financial, social and institutional constraints. This conclusion is further supported in the Alberta Utilities Commission ("AUC") decision on the E.L. Smith Solar Project (Decision 2019-D01-23418). The AUC reviewed the environmental studies for the Project prepared by Stantec and results of EWSI's Participant Involvement Program[14] and concluded that the Project is "*in the public interest having regard to the social, economic, and other effects of the project, including its effect on the environment.*"[15]

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[13] An off-site local solar farm is assumed to be the same 12 MW size and similarly designed solar farm as the E.L. Smith Solar Project located within 40 kilometres of the city of Edmonton (meeting the City's "local" criteria) and connected to the grid, but not tied directly to any of EWSI's operating sites.

[14] EWSI completed a participant involvement program to support its Facility Application to the AUC. As part of this program, EWSI held consultations with the property owners and residents, Indigenous communities, community leagues and organizations, special interest groups, local businesses, elected officials, government agencies and the general public. Through this process, EWSI consulted with approximately 850 stakeholders. Of these stakeholders, less than 1% expressed opposition to the Project and approximately 6% declared their support. The majority of stakeholders did not express support or opposition to the Project.

[15] Page 1, Alberta Utilities Commission Decision 23418-D01-2019.

4.1 Financial Opportunities and Constraints

41. EWSI’s August 2018 E.L. Smith Solar Project Update to Utility Committee (Attachment 4) determined that the Project is 40% ($16.6 million net present value) lower in cost to Edmonton water ratepayers compared to an offsite solar option.

- Because the majority of the power generated from the Project will be consumed onsite by the E.L. Smith WTP (behind the meter), the Project generates significant savings in the E.L. Smith Water Treatment Plant’s conventional power purchase costs from the grid and associated wires costs and future capacity charges.
- Because the majority of power will be consumed onsite, EWSI, as a municipally owned entity is permitted to operate the Project on a non-taxable basis under section 95(9) of the Electric Utilities Act.
- The Project does not incur the incremental costs of acquiring land by using the available land at E.L. Smith which will not be in use for another 30 or more years for the expansion of the water treatment plant. This presents a unique opportunity for EWSI to provide a beneficial interim use for this land.
- The Project will not incur significant costs to interconnect to the grid as it can use the existing interconnections at the water treatment plant without needing to expand them.
- The Project has lower operating costs due to the proximity to EWSI’s water operations.

42. In addition to the $16.6 million (NPV) cost savings detailed above, the $10 million in grant funding from NRCAN to enhance the E.L. Smith Project with a micro-grid system and approximately 4 MW BESS would be lost if the Project was moved to an offsite location as this funding is only applicable to the E.L. Smith site due to its connection to load from the E.L. Smith Water Treatment Plant.

4.2 Social Opportunities and Constraints

43. Through collaboration with educational and research institutions, Indigenous communities, neighbouring residential communities, the City of Edmonton and special interest groups, EWSI will take full advantage of opportunities to design the Project and surrounding features to meet a number of community integration objectives which are contemplated in the

City's strategic plans (i) the *Way We Live: Edmonton's People Plan, (ii)* the *Way We Grow: Municipal Development Plan,* and *(iii) the Way We Green: Environmental Strategic Plan* and Edmonton's *Breath Strategy*.

- The Project's location will present a unique opportunity to enhance education and awareness of large scale renewable energy by creating a highly accessible demonstration / research site. There is an opportunity for the City to build future trails near the Project which will provide the public with up-close access to a large scale solar farm. This opportunity for public access is unlikely to be matched at offsite location. A demonstration site could be used for school tours of both the E.L. Smith Water Treatment Plant and the solar farm and an interpretative site for indigenous communities and archeological history of the land.
- Partnering with the University of Alberta and NAIT on research and training, EWSI will be able to provide a unique opportunity to study the operational and technical aspects of intermittent generation with industrial load in a "behind the meter" setting. EWSI is working with NAIT through its Alternative Energy Technology program, which is the only face-to-face instructional program specifically dedicated to training highly qualified personnel to design, construct, and maintain renewable energy systems in Western Canada. Under this program, NAIT had students working with EWSI to complete their Capstone project alongside the design and planning of the E.L. Smith Solar Farm. EPCOR and the University of Alberta (Future Energy Systems) entered into a memorandum of understanding to collaborate on research projects of mutual interest in the fields of energy and the environment.
- The Project will allow EPCOR to acquire experience on micro grid and BESS technologies and evaluate the impact of behind-the-meter smart grid systems, distributed energy resource management systems, and the impact of the solar generating facility on the distribution grid and the water treatment plant. In sharing its learnings with the rest of the electric utility community in the province of Alberta, EPCOR hopes to stimulate and advance the debate amongst market participants and regulatory agencies in the province Alberta, when it comes to the treatment of battery energy storage systems as an alternative to conventional transmission and distribution assets.

44. While some of the community integration objectives, such as a demonstration site, may be available at an off-site solar farm located within the City of Edmonton, the accessibility and level of use, and thus the resulting effectiveness, of an alternative location while unknown, is likely to be less impactful at a location outside of the NSR Valley and offsite of the E.L. Smith

Water Treatment Plant. An offsite solar farm will not be connected to EWSI operations and, as such, the opportunity to study renewable generation with industrial load in a behind-the-meter setting will not exist. Furthermore, as the $10 million grant funding for BESS is only applicable to a solar farm at the E.L. Smith WTP site, the associated research opportunities and experience with behind-the-meter smart grid systems will not be available at an offsite location.

4.3 Environmental Opportunities and Constraints

45. The independent, science based, Municipal Environmental Impact Assessment ("MEIA") prepared by Stantec examined the potential effects of construction and operation of the Project on specific ecosystem components including: terrain and soils; surface water bodies and hydrology; vegetation species and communities; wildlife species and habitat; viewscape; and heritage resources. The MEIA evaluates the existing environmental conditions and predicts potential residual effects of the Project following mitigation measures that EWSI plans to implement. The MEIA concluded that "*the potential adverse effects of the Project can be avoided, reduced or controlled using a combination of standard and Project-specific environmental mitigation measures. Monitoring during and post construction will be implemented to evaluate the effectiveness of any to adapt mitigation measures as required.*"

46. The NSR Valley is an important corridor that provides a variety of ecological functions and lifecycle requirements for wildlife. The Project is located inside the bounds of the NSR Valley within the existing WTP property on land which consists of approximately 90% previously disturbed/cultivated perennial pasture dominated by non-native vegetation, with the remaining 10% comprised of Balsam Poplar Woodland Alliance, Tall Shrubland Alliance, Short Shrubland Alliance and Aspen Poplar Woodland Alliance[16]. The potential for adverse environmental effects at an offsite location are uncertain as they will depend on the particular ecological characteristics of a selected site. For example, an offsite location outside of the North Saskatchewan River Valley may have a different mix of vegetation such as a higher proportion of native trees and shrubs or may be within a wildlife corridor. Both the Project and a solar farm at an offsite location would require vegetation removal for construction and installation of the solar infrastructure resulting in decreased wildlife habitat. However, the environmental effects could be different depending on such ecological characteristics such as the mix of vegetation and suitability for wildlife habitat. An offsite solar farm may still result in some disturbance to

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[16] Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm, February 2019, Stantec.

wildlife habitat depending on the selected location and may result in some reduction in wildlife movement due to requirement to fence the facility at any location. While there is limited information on the potential for wildlife mortality associated with collisions or through other mechanisms at solar farms, both alternatives have the potential to effect bird mortalities.

4.4 Institutional Opportunities and Constraints

47. As detailed below, the Project is in direct alignment with many City of Edmonton goals strategies and policies.

- **ConnectEdmonton -** The City of Edmonton recently approved ConnectEdmonton, a strategic plan for the city for 2019-2028 which includes Climate Resilience as one of its four strategic goals which require transformational change over the next 10 years. The E.L. Smith Solar Project aligns with this new vision for the city of Edmonton by expanding on renewable energy generation to mitigate climate change. The Project will contribute to expanding renewable energy sources in Edmonton and will further serve as an example to educate businesses and residents about the importance of individual environmental responsibilities.
- **The Way We Green -** Building this Project aligns with the objectives of the City's *The Way We Green: Environmental Strategic Plan* by converting a portion of EWSI's energy use to locally produced, renewable sources. The Project preserves existing ecological connectivity and EPCOR has committed to restoring the areas south and southeast of the Project area and enhancing the ecological value of the Project area by planting native plant species to attract and sustain bee, moth, beetle, wasp, fly, bird, bat and butterfly species and is a local solution to help preserve pollinator populations. It will involve the enhancement of ecological systems and biodiversity, and will facilitate the development of initiatives to engage and educate citizens about nature.
- **The Way We Live** - The Project will promote and connect Edmontonians and Albertans to their history and diverse cultural heritage through the development of an interpretive site that may include permanent displays and art.
- **Breath Strategy -** The Project is consistent with a number of the City's *Breathe – Edmonton's Green Network Strategy* strategic directions including safe and inclusive, vibrant spaces, community engagement, education and awareness, public access and connectivity, ecological integrity and adaptive management and flexible spaces.

- **Draft Ribbon of Green -** The Project is consistent with the City's November 2018 draft of the *Ribbon of Green* classification of the E.L. Smith Water Treatment Plant site (including the Project site) as Urban Services under the broader category of "Active/Working Landscapes" which can include improvements to the sustainability of existing operations as a "Compatible Uses, Compatible Facilities + Infrastructure".
- **Community Energy Transition Strategy** - The Project aligns with the City's Energy Transition Strategy objectives of generating 10% of Edmonton's electricity locally and to reduce greenhouse gas emissions in Edmonton by 35% from 2005 levels by 2035. The Community Energy Transition Strategy is in the process of being updated to align with the more aggressive international target which aims to limit global warming to 1.5^{o}C. Renewable energy is expected to play a significant role in Edmonton's updated Energy Transition Strategy and is identified as one of six "climate shifts"[17] proposed to form the basis of the updated strategy. EWSI is committed to taking action to reduce its own emissions and energy consumption. The E.L. Smith Project will reduce conventional power demands at EWSI's Edmonton water operations by 23% and greenhouse gas emissions by 20% or approximately 14,000 tonnes of CO2e, comparable to taking more than 2,500 vehicles off the road each year. The Project will help EPCOR achieve its goal of providing clean water to Edmonton and surrounding regions using clean energy.
- **Greenhouse Gas Management Plan -** The Project aligns with the City's *Greenhouse Gas Management Plan* for Civic Operations 2019-2030 concepts of additionality, local resiliency, and a portfolio approach to greenhouse gas reductions.
- **North Saskatchewan River Valley Area Redevelopment Plan ("NSRV ARP") -** The Project, as a utility project on private lands that accommodates the City's goals of nature preservation and parkland development, aligns with the goals, objectives, and policies of the NSRV ARP.

48. City of Edmonton's Energy Transition Advisory Committee ("ETAC") has written a letter to City Council (Attachment 5) in support of the E.L. Smith Project on the basis that it contributes to a number of Edmonton's Energy Transition Goals in Edmonton's current Community Energy Transition Strategy including:

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[17] https://www.edmonton.ca/city_government/documents/PDF/GettingTo1-5DiscussionPaper.PDF

- Generating 10% of Edmonton's electricity locally by 2035,
- Accelerate the greening of Alberta's electricity grid,
- Increasing the uptake of the distributed energy generation, and
- Ensuring Edmonton is an energy resilient City."[18]

49. In addition to developing the E.L. Smith Solar Project, EWSI will voluntarily transfer a 31.5 acre parcel of mostly forested river valley land west of the Project site to provide access to the river and for preservation of the land.

50. If the E.L. Smith Project was built at an offsite location, some of these same institutional opportunities would be achieved, however the following differences have been identified:

- an offsite alternative may not be as accessible as the proposed Project and therefore, may not be as effective as an education and demonstration site with close access to renewable energy through City of Edmonton river valley trail system. As such, moving the Project to an offsite location would mean a significant opportunity lost for Edmonton to showcase a large-scale renewable energy project within the city and to demonstrate its leadership action toward climate change.; and
- because the $10 million grant funding that EWSI has obtained from NRCAN is only applicable to the E.L. Smith site, the offsite alternative would not provide the same collaborative research opportunities with NAIT and the University of Alberta to explore, test, and adopt new energy technologies in a micro-grid setting (solar generation, and storage in a behind-the-meter setting with an essential services load).

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[18] Page 1, Edmonton Energy Transition Advisory Committee, Letter to Mayor Iveson and Council, January 22, 2019 (Attachment 5).

Other Regulatory Approvals

1. In addition to the approvals sought from the City of Edmonton through the Land Development Application, EWSI is committed to ensuring all other municipally, provincially and federally required regulatory approvals are obtained prior to construction. Below is an update on other regulatory processes and approvals received to date.

Alberta Utilities Commission

2. On March 14, 2018, EWSI filed a Facility Application to the Alberta Utilities Commission (the "Commission") to construct and operate the 12 MW E.L. Smith Solar Project and to interconnect the power plant to grid. On February 20, 2019, the Commission issued Decision 23418-D01-2019[1], approving the Project. In its Decision, the AUC determined that the Project is "in the public interest having regard to the social, economic, and other effects of the project, including its effect on the environment." The Commission further determined "Although the Commission recognizes that the North Saskatchewan River valley, the location proposed for the project, is an important resource for the City of Edmonton and its citizens, upon consideration of the current land-use of the site, combined with the mitigation measures proposed and commitments made by EPCOR Water, it is satisfied that the social and environmental impacts would not be significant."

3. The Commission's other key findings on the power plant included the following:

- Based on current land-use of the site, combined with EWSI's proposed mitigation measures, the Commission is "satisfied that the social and environmental impacts would not be significant."
- The Commission found that "technical, siting, emissions, environmental and noise aspects of the power plant have been met."
- The Commission concluded EWSI's alterations to the project to reduce the footprint, increase the separation from the river, and allow access to its property to enhance the river valley's trail system "demonstrate its willingness to adapt its project in response to concerns raised by stakeholders".
- The Commission determined EWSI's "community integration objectives to develop opportunities for social benefits, including educational opportunities around historical and cultural resources and solar power, would further mitigate or offset the social impacts that would occur".

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[1] http://www.auc.ab.ca/regulatory_documents/ProceedingDocuments/2019/23418-D01-2019.pdf

- The Commission found that stakeholder "concerns with the potential visual impacts will be mitigated to an extent because the site is located adjacent to the water treatment plant, has been previously disturbed, is currently an empty field with no public access." Further EWSI's "plans to enhance the natural aesthetics of the site using fence design, natural screening and other landscaping will help mitigate the visual impacts of the power plant."
- The Commission found that the Project is in compliance with AUC Rule 012: Noise Control requirements.
- The Commission found that EWSI's participant involvement program (stakeholder consultation) for the project is adequate and meets the requirements of AUC Rule 007.

4. In rendering its Decision, the Commission identified a "gap" in the existing legislative framework that does not expressly permit a new power plant to supply the electrical needs of the plant owner on its private property while simultaneously exporting excess energy generated from the new plant to other Alberta consumers through the grid. Notwithstanding this finding, the Commission approved the project "on the basis that EPCOR Water's intended purpose can be achieved through alternative means contemplated by the legislative scheme". On July 24, 2019, EWSI received AUC approval of its compliance plan to both supply and export excess energy to the grid under the Alberta Municipal Own Use Generation Regulation. This approval is provided in Attachment 6 to the SLS.

Alberta Culture and Tourism

5. The Project is situated on lands which are designated as having high potential for both archaeological and paleontological value. As such, EWSI retained Stantec to consult with Alberta Culture and Tourism ("ACT") to meet the requirements under the Historical Resources Act ("HRA"). Historic resources at the site have been documented and recorded in accordance with provincial legislation. EWSI has worked diligently with ACT to complete both archaeological and paleontological studies and has recently received an Approval with Conditions to proceed with the proposed E.L. Smith Solar Farm from Alberta Culture and Tourism. This approval, dated September 13, 2018, is included as Attachment 7 to the SLS. EWSI is committed to meeting all of ACT's approval conditions.

Alberta Environment and Parks

6. On April 30, 2018, Alberta Environment and Parks issued a letter to advise that staff had reviewed the E.L. Smith Solar Project information submitted by EWSI and that they have determined that a review and referral letter provided by an Alberta Environment and Parks Wildlife Biologist is not required for the Project. This letter is provided as Attachment 8 to this SLS.

Battery Energy Storage System and Micro-Grid Project

7. EWSI will seek the appropriate regulatory approvals from the City of Edmonton and Alberta Utilities Commission associated with the BESS and micro-grid project once final approval for the E.L. Smith Solar Project is received. The micro-grid together with the BESS is a separate and independent project from the E.L Smith Solar Project. The BESS, which consists of "sea-can style enclosures" containing batteries and electrical equipment, would be installed entirely within the existing E.L. Smith Water Treatment Plant site, currently zoned as Public Utility. While the E.L. Smith Solar Project can proceed and be developed without the BESS, the BESS is not feasible without a solar farm at the E.L. Smith Site. If the E.L. Smith Solar Project is approved, EWSI will be consulting with the City of Edmonton and other applicable regulators on next steps for permitting the BESS project.

EPCOR Water Services Inc.

Sustainability Value Analysis of the E.L. Smith Solar Farm Project

August 12, 2018

Table of Contents

Executive Summary

EPCOR Water Services Inc. (“EWSI”) is planning to construct a solar farm on its property located at 3900 E.L. Smith Road to supply renewable energy to its E.L. Smith Water Treatment Plant (“the project”). The solar farm will have a peak generation capacity of approximately 12 megawatts (“MW”). If the solar farm produces more energy than the water treatment plant can use, any excess will be exported back to the electrical grid.

The proposed project will involve installing up to 45,000 solar panels on EWSI’s property south of the E.L. Smith Water Treatment Plant and connecting the panels to the water treatment plant (“behind the meter) and EPCOR Distribution and Transmission Inc.’s ("EDTI”) electrical distribution system. The existing fence at the Project site will be upgraded to safely and securely enclose the solar farm.

After submitting the project Business Case Report “Solar Farm at E.L. Smith Water Treatment Plant Capital Business Case” dated February 23, 2018 to the City of Edmonton’s Utility Committee, the City requested that EWSI undertake a triple bottom line analysis (“TBL”) of the project. A triple bottom line analysis provides an overview of the economic/financial, social and environmental impacts of the project. EWSI commissioned HDR Corporation (“HDR”) to undertake the triple bottom line assessment.

A triple bottom line analysis of the solar farm project at E.L. Smith requires the project as defined to be compared to other specific and realistic alternatives. EWSI developed four other alternatives, as follows:

1. Grid Supply. This is the “Base Case” or “Business as Usual”. In this alternative, EWSI would purchase conventional power from the electricity grid. EWSI would not purchase any green energy, or otherwise provide for any reduction in CO2 or other GHG emissions.
2. Grid Supply + Generic REC’s.
3. Offsite Wind Farm.
4. Solar Project at E.L. Smith.
5. Offsite Local Solar Farm.

The triple bottom-line evaluation of renewable energy alternatives identifies and summarizes the trade-offs between the alternatives spanning financial, environmental and social considerations which are documented in both qualitative and quantitative terms. This Multiple Account Evaluation (MAE) framework recognizes that different stakeholders will have different perspectives on the relative importance of each of these criteria as well as the impact of each alternative on these same criteria. A combination of MAE and breakeven approaches is applied for the SVA. The MAE is appropriate in circumstances such as this where there is difficulty in applying social/environmental value to the land at EL Smith because the value depends on different stakeholders views. In this triple bottom line analysis, the break-even approach is used to attempt to monetize the environmental/social (ecosystem) value the decision maker would need to assign to the land at EL Smith to make the proposed Project equivalent to the offsite solar project.

The breakeven analysis is summarized in Figure 1. The blue bars in the charts represent the financial costs of each alternative while the red bars represent the emissions costs or benefits in the renewable cases. The yellow arrow highlights how significant any ecosystem damage would have to be at the E.L. Smith site for the Offsite Local Solar Farm to be preferable; this damage would have to be on average 25 times or more greater than the average values we see in the economic literature.

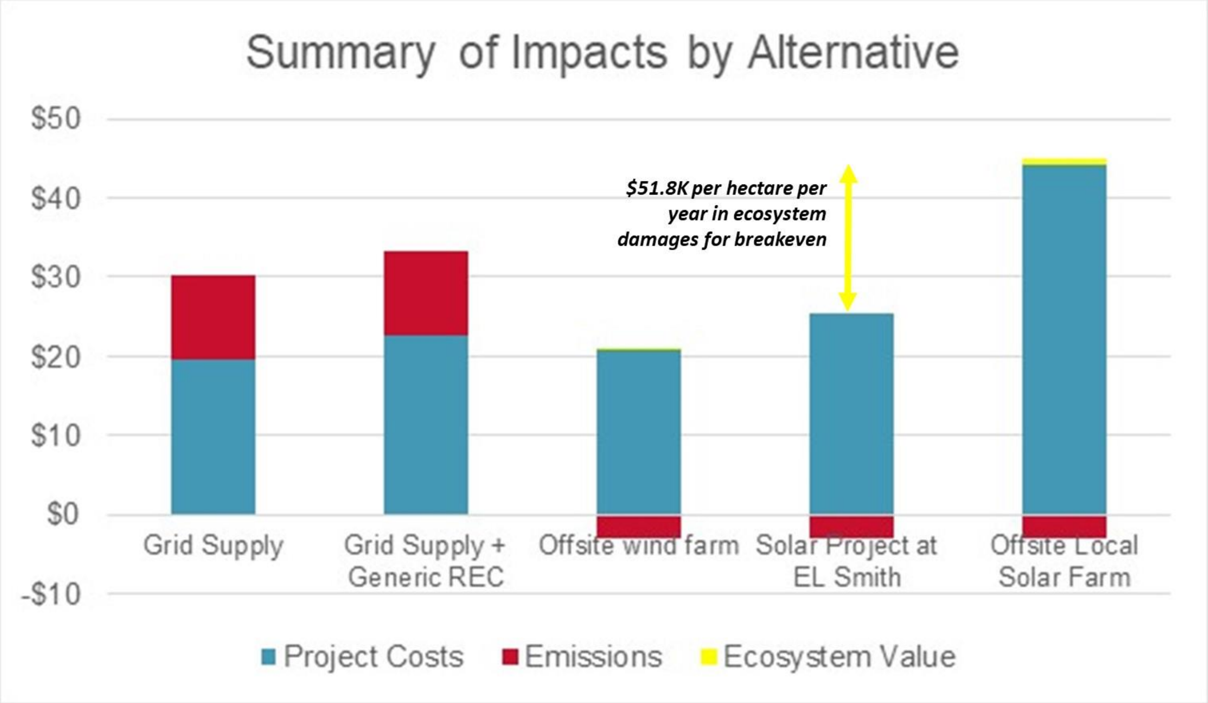

Figure 1: Break Even Analysis

Figure 2 also summarizes the differences between the ecosystem value estimates discussed previously from the TEEB database, from valuations in Greater Montreal, from valuations from the North Saskatchewan River (NSR) and from HDR[1]. There is quite a large gap between these estimates and the breakeven estimate of $51,800 per hectare per year.

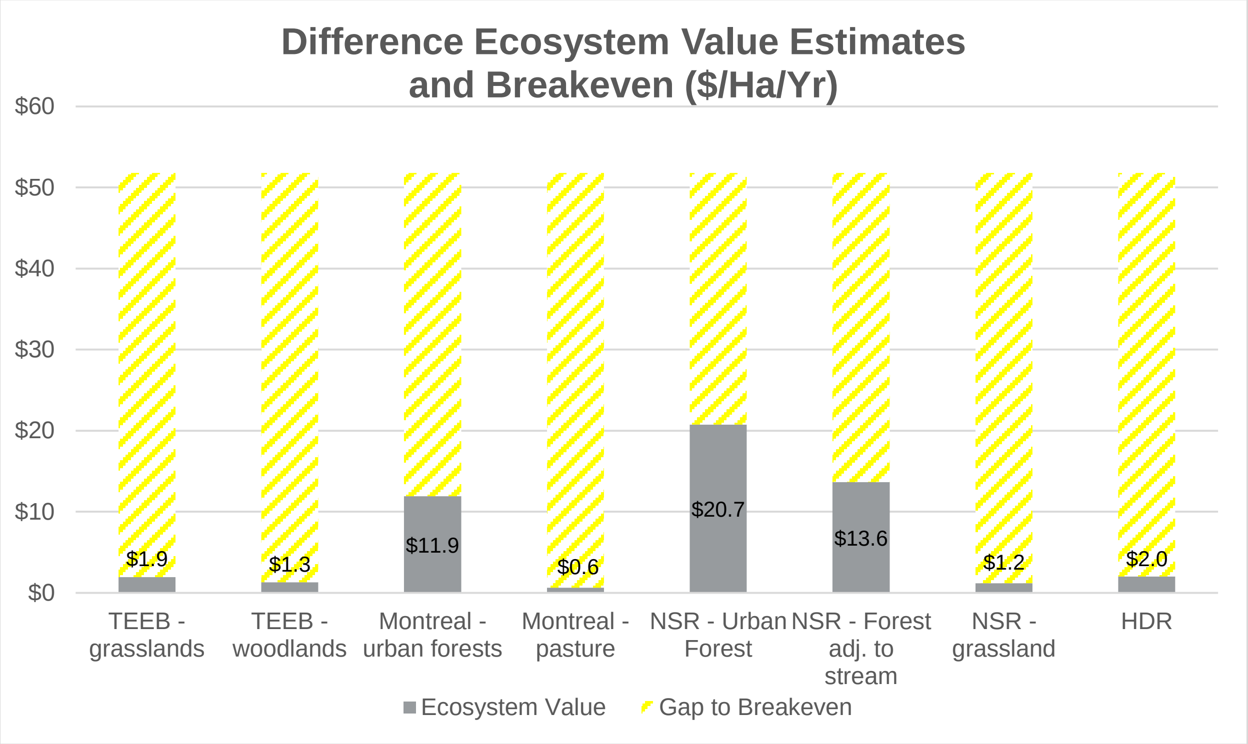

Figure 2: Difference Between Literature Estimates and the Breakeven Value

From an overall evaluation perspective, if additionality and having local generation are required, then really there are two alternatives: (i) the Solar project at E.L. Smith and (ii) the offsite local solar farm. The Solar project at E.L. Smith can be developed at a much lower financial cost with both these alternatives providing equivalent emission reduction benefits. Decision-makers will have to determine whether the project development at E.L. Smith could result in very significant ecosystem damages as highlighted in the breakeven analysis. This would seem implausible given the evidence in the economic literature and the findings of the Environmental Evaluation by Stantec Consulting.

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[1] *These estimates from the literature were escalated to represent 2018 dollar values for comparison.*

Introduction and Background

EPCOR Water Services Inc. ("EWSI") is planning to construct a solar farm on its property located at 3900 E.L. Smith Road to supply renewable energy to its E.L. Smith Water Treatment Plant ("the project"). The solar farm will have a peak generation capacity of approximately 12 megawatts ("MW"). If the solar farm produces more energy than the water treatment plant can use, any excess will be exported back to the electrical grid.

The proposed project will involve installing up to 45,000 solar panels on EWSI's property south of the E.L. Smith Water Treatment Plant and connecting the panels to the water treatment plant ("behind the meter) and EPCOR Distribution and Transmission Inc.'s ("EDTI") electrical distribution system. The existing fence at the Project site will be upgraded to safely and securely enclose the solar farm.

In its 2017-2021 Performance Based Rate (PBR) Application, which was approved by City Council in October 2016, EWSI included a Green Power Initiative which commits EWSI to obtaining approximately 10 per cent of its power volumes from locally produced renewable sources starting in 2018. The proposed Solar Farm was sized to align with the $1.9 million per year funding which was already approved by City Council to ensure no incremental rate increases relative to the purchase green power option. As the proposed project was being developed, EWSI determined that the maximum size solar farm at the E.L. Smith site would be 12MW.

Building a solar farm at E.L. Smith aligns with the objectives of the City of Edmonton's *The Way We Green: Environmental Strategic Plan* by converting a portion of EWSI's energy use to locally produced, renewable sources. The project also aligns with the City of Edmonton *Energy Transition Strategy* with objectives of generating 10% of Edmonton's electricity locally and to reduce greenhouse gas emissions. The project will also contribute toward the Government of Alberta's goal to have 30% of Alberta's energy come from renewable sources by 2030. The proposed solar farm will generate renewable energy to help power the existing E.L. Smith Water Treatment Plant, while reducing EWSI's greenhouse gas emissions[2].

After submitting the project Business Case Report "Solar Farm at E.L. Smith Water Treatment Plant Capital Business Case" dated February 23, 2018 to the City of Edmonton's Utility Committee, the City requested that EWSI undertake a triple bottom line analysis ("TBL") of the project. A triple bottom line analysis provides an overview of the economic/financial, social and environmental impacts of the project. EWSI commissioned HDR Corporation ("HDR") to undertake the triple bottom line assessment.

In the conduct of the triple bottom line analysis, HDR employed existing project information filed by EWSI with the Alberta Utilities Commission ("AUC") in March 2018 specifically:

- The Environmental Evaluation of the project (Attachment 13 to EWSI's Facility Application to the AUC).

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[2] *Direct citations from the EWSI's August 23, 2018 EL Smith Solar Project Update.*

- A report summarizing the requirements of the Participant Involvement Program (Attachment 4 to EWSI's Facility Application to the AUC).
- The Solar Glare Analysis Report – E.L. Smith Solar Farm ("Glare Study") (Attachment 7 to EWSI's Facility Application to the AUC).

In addition, HDR took as input EWSI's E.L. Smith Solar Project Financial Analysis model which measured the direct financial consequences of each of the alternatives namely, capital, expenses, revenues and taxes. HDR provided specific feedback on the model and the alternatives throughout the project.

Project Alternatives

A triple bottom line analysis of the solar farm project at E.L. Smith requires the project as defined to be compared to other specific and realistic alternatives. EWSI developed four other alternatives, as follows:

1. Grid Supply. This is the "Base Case" or "Business as Usual". In this alternative, EWSI would purchase conventional power from the electricity grid. EWSI would not purchase any green energy, or otherwise provide for any reduction in CO2 or other GHG emissions.
2. Grid Supply + Generic REC's.
3. Offsite Wind Farm.
4. Solar Project at E.L. Smith.
5. Offsite Local Solar Farm.

The assumptions underlying the alternatives are based on EWSI's August 23 EL Smith Solar Project Update report.

In the non-E.L. Smith alternatives, it is assumed that the land at E.L. Smith remains as is, undeveloped and maintained for the potential future expansion needs of the E.L. Smith Water Treatment Plant. This site is predominantly perennial pasture[3].

Table 1: Summary of Project Alternatives

Alternative	Grid Supply	Grid Supply + Generic RECs	Solar Project at E.L. Smith	Offsite Local Solar Farm	Offsite Wind Farm
Green Energy %	Grid Mix	23%	23%	23%	23%
Locally Produced	-	-	✓	✓	-
Provides Additionality	-	-	✓	✓	✓
Annual Electricity Purchased (Consumed by EL Smith) (MWh)	9,636	14,000	14,000	14,000	14,000

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[3] *Source: Environmental Evaluation for the E.L. Smith Solar Farm, Stantec Consulting Ltd., March 2018.*

Alternative	Grid Supply	Grid Supply + Generic RECs	Solar Project at E.L. Smith	Offsite Local Solar Farm	Offsite Wind Farm
Annual RECs produced by Project (MWh)	9,636	21,500	21,500	21,500	21,500

The balance of this report summarizes HDR's triple bottom line analysis of the project. The report is structured as follows: Section 2 provides a general overview of HDR's triple bottom line approach including how it was customized for evaluating the project; Section 3 provides the triple bottom line analysis including the approach, key assumptions, and outcomes; and Section 4 provides the key study conclusions.

HDR’s Triple Bottom Line Approach – Sustainable Value Assessment

Policy-makers and infrastructure-owners increasingly seek an objective case for sustainability-oriented investments. Triple bottom line approaches to public investment analysis remain a critical tool for decision makers. To not undertake TBL to support decision making would imply that the environmental and social impacts of projects are not relevant thereby limiting decision criteria to only project financials. HDR’s Sustainability Value Analysis (“SVA”) takes the broadest view possible for estimating project public value and trade-offs across a triple bottom line to compare alternatives and communicate its features to support decision making. The methods applied are based on best practices in analysis and feature a combination of transparency, adaptability to project and client needs, and a focus on communicating the results in ways that are applicable to the client and its stakeholders and/or regulators. The triple bottom line framework reflects a holistic view of the project that takes into account not just the economic and financial aspects, but social and environmental impacts as well (see Figure 3).

- **Best practices:**
  - Objective, theory-based
  - Peer-reviewed evidence
  - Monetary & non-monetary
  - Accounts for uncertainty
- **Key Features:**
  - Comprehensive, Transparent
  - Founded on 10 Principles
  - Methods tailored to client
  - Decision metrics that matter
  - Multiple-objective framework

Figure 3: Overview of Sustainability Value Analysis

SVA provides a suite of evaluation methods that adapt to different levels of data availability, types of project owners, and project characteristics but are based on a common set of analytical principles. Depending on the type of project, the availability of data availability, the type of results needed by decision makers, SVA could apply:

- **Multi-Objective Decision Analysis (“MODA”) -** a triple bottom line analysis where a group of specific economic/financial, social and environmental criteria or “accounts” are evaluated using scores and weights and scores to provide an ordinal ranking of the alternatives and to determine the preferred alternative.
  - **Advantages:** This approach gives a ranking of the alternatives and the highest scored alternative can be considered the preferred option.

  - **Limitations:** The weighting and scoring may not be aligned with decision making body's / regulator's perspective unless it is conducted directly by them.

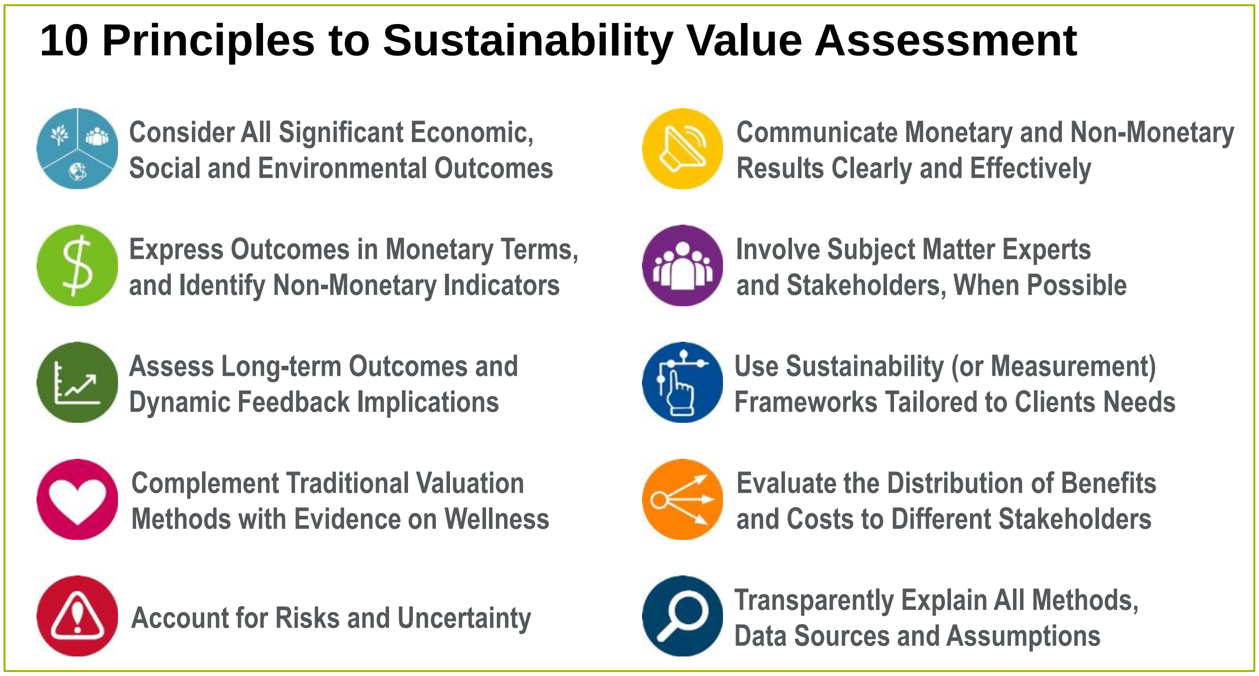
- **Multiple Account Evaluation ("MAE") –** a triple bottom line analysis where a group of specific economic/financial, social and environmental criteria or "accounts" are evaluated. There is no overall weighting or scoring but rather the relative trade-offs between alternatives are evaluated are documented. The determination of what is the preferred alternative is left to the perspective of each individual decision maker based on the information presented:
  - **Advantages:** This approach provides an understanding of trade-offs between all the options and lets the decision makers make the ultimate decision based on this information as to what is optimal.
  - **Limitations:** The approach does not specifically determine the preferred alternative.

- **Sustainable Return on Investment ("SROI") –** a triple bottom analysis where it is feasible to assign monetary values to most the critical economic/financial, social and environmental criteria or "accounts" to provide a holistic return on investment estimate. SROI is equivalent to traditional "Cost Benefit Analysis" approaches but where stakeholders are directly engaged in the evaluation process. In addition, non-monetary outcomes are summarized and presented but are not directly included in the "return on investment" quantification:
  - **Advantages:** This approach gives a ranking of the alternatives based on a monetary valuation of all of the economic/financial, environmental and social criteria.
  - **Limitations:** It may be difficult to determine a monetary valuation of some criteria that are specific to the project itself without extensive primary research.

These three main approaches to SVA – MODA, MAE and SROI are quite similar with some minor subtleties; the preferred approach is selected based on the specifics of the project, the context and the study purpose. All of these SVA methods leverage the same core principles (see Figure 4) of analysis from economics and utilize the best available data on monetary valuation. At the same time, if such data is not available with a sufficient level of accuracy, alternative methods are applied to provide a reasonable measure of a project's cost-effectiveness for comparisons against a baseline and alternative investment options.

Another key feature of SVA is the application of risk analysis techniques to account for uncertainty in key drivers of costs, benefits / value. These methods provide additional information on the upside and downside risk in the selection of a project option. The risk analysis approach utilized again depends on the project specifics and data availability and include but are not limited to:

- Probabilistic risk analysis – all SVA inputs are treated probabilistically and modeled / simulated to yield probability based outputs.
- Sensitivity analysis – key input assumptions are varied or "shocked" individually to see the impact on the output of interest.
- Scenario analysis – a group of a limited number of input assumptions are varied or "shocked" together to see the impact on the output of interest.
- Break-even or threshold analysis – when data may be missing for one key input assumption, quantitative experiments are conducted to see how high or low that input value would have to be for a output metric to "break-even".



10 Principles to Sustainability Value Assessment

Consider All Significant Economic, Social and Environmental Outcomes

Communicate Monetary and Non-Monetary Results Clearly and Effectively

Express Outcomes in Monetary Terms, and Identify Non-Monetary Indicators

Involve Subject Matter Experts and Stakeholders, When Possible

Assess Long-term Outcomes and Dynamic Feedback Implications

Use Sustainability (or Measurement) Frameworks Tailored to Clients Needs

Complement Traditional Valuation Methods with Evidence on Wellness

Evaluate the Distribution of Benefits and Costs to Different Stakeholders

Account for Risks and Uncertainty

Transparently Explain All Methods, Data Sources and Assumptions

Figure 4: SVA Principles of Analysis and Communication

Sustainability Value Analysis of Alternatives

Study Approach

The SVA study process for the evaluation of the E.L. Smith with Behind the Meter Solar project included the following steps:

1. A review of existing project documentation from the AUC and Utility Committee submissions.
2. A review of EWSI's revenue requirement financial model of the alternatives.
3. Development of an initial list of key impacts for each of the alternatives.
4. A review of literature and past studies where such impacts were considered quantitatively and / or qualitatively.
5. A workshop with representatives from the EWSI Community Advisory Panel, the Miistakis Institute, City of Edmonton, the University of Alberta, Stantec Consulting Ltd., NAIT and project subject matter experts from EWSI where HDR presented and received feedback on the proposed study approach.
6. Meetings with those that expressed opposition to the project to get their perspective on the project and to acquire their specific input. All organizations that expressed opposition to the project were given the opportunity to meet with HDR.

Based on these steps, and in consideration of the range of potential project impacts, the data available, the objective of the study, and feedback from the workshop and meetings with project opponents, HDR made a determination of the specific approach to the SVA analysis of the E.L. Smith Behind the Meter Solar project – namely, a Multiple Account Evaluation combined with breakeven analysis. The main rationale for selecting the MAE framework is provided below:

- Some of the key impacts or considerations to be included in the SVA analysis are qualitative in nature and cannot be represented in a quantitative or monetary form. It is important to note that <u>the inability to quantify or monetize a specific effect in no way implies that the effect is not as important as the other effects that can be quantified</u>.
- At least one of the potential project impacts – the impact on the land at E.L. Smith - is quite uncertain as to the specific impact itself and how to value it in monetary or other terms. Different stakeholders may have different views on its importance and how to value it. That is the main reason, the MAE approach was augmented with breakeven analysis.
- The triple bottom line analysis was requested to provide additional insight to the project trade-offs for external decision makers / regulators. To independently assign weights to various impacts, as required be certain non-MAE approaches to provide a singular

project score or ordinal ranking could very well deviate with the perspective of decision makers.

From a handling of uncertainty perspective, HDR made a determination to use sensitivity analysis for key inputs with and break-even / threshold analysis. Again, the fact that some of the key project considerations could not be monetized eliminated the potential to use probabilistic risk analysis.

In the discussion that follows in the balance of this section, some of the rationale for these determinations will become more evident.

Limitations

In the conduct of the triple bottom line analysis, HDR employed existing information from previous project studies and analysis. This includes:

1. The project financial inputs were provided by EWSI. HDR translated the “revenue requirement” analysis into a cash flow based pro forma model to reflect the overall cash flows over the project lifecycle.
2. HDR relied on existing project reports that had been provided to the AUC. HDR did not independently verify the findings of these studies. HDR did make inquiries, had discussions on the specific assumptions through the project process and visited the proposed E.L. Smith project site. Through this process, nothing encountered was unexpected or looked unreasonable. Also, it should be noted that other than the feedback from the workshop and meetings with project opponents, primary data collection was not a part of this evaluation.

MAE Framework – Project Impacts or Effects

Through the triple bottom line analysis process, a range of project impacts or effects were identified for the range of alternatives analysis that spanned financial, social and environmental considerations. These are briefly summarized in the table below (note not all impacts are applicable to each alternative):

Table 2: Multiple Account Evaluation - Effects by Alternative

#	Account	Criteria	Description
F1	Financial	Total of All Financial Costs	The present value of all financial costs by alternative. This represents the costs to EWSI and therefore its rate payers of each of the alternatives.
F2	Financial	Levelized cost of all energy	A summary representing the average cost of energy by alternative.
F3	Financial	Levelized cost of renewable energy	A summary representing the average cost of the renewable energy source by alternative. Defined as: Net Present Value of Incremental Cost of Renewable Energy / Net Present Value of Energy Demand on Site
F4	Financial	Risk Management	Qualitative assessment of whether the alternative provides a hedge against escalating grid power price increases.
E1	Environmental	GHG Emission Damage Costs	Monetized value of GHG emissions by alternative.

#	Account	Criteria	Description
E2	Environmental	GHG Emissions Volumes	Volume of GHG emissions by alternative.
E3	Environmental	Avian mortality	Qualitative assessment of the potential impact of the alternative on avian mortality.
E4	Environmental	Ecosystem value – provisioning services	Qualitative assessment of the potential impact of the alternative on the ecosystem's provisioning services.
E5	Environmental	Ecosystem value – regulating services	Qualitative assessment of the potential impact of the alternative on the ecosystem's regulating services.
E6	Environmental	Ecosystem value – habitat services	Qualitative assessment of the potential impact of the alternative on the ecosystem's habitat services.
E7	Environmental	Ecosystem value – cultural and aesthetic services	Qualitative assessment of the potential impact of the alternative on the ecosystem's cultural and aesthetic services.
E8	Environmental	Ecosystem value at risk	The dollar value of the ecosystem value at risk (ecosystem value of land at the renewable site on a present value basis).
S1	Social	CAC Emission Damage Costs	The monetized value of criteria air contaminant emissions by alternative. The damages caused by these emissions are mostly localized and mostly represent health and respiratory effects and are considered a social effect.
S2	Social	CAC Emission Volumes	The volumes of criteria air contaminant emissions by alternative.
S3	Social	Economic Development	Qualitative assessment for the alternative to have a positive economic impact within the City of Edmonton.
S4	Social	Additionality – A new renewable resource	Qualitative assessment of whether the alternative provides additionality or a new renewable generation source.
S5	Social	Strategic Alignment – Alignment with City of Edmonton objectives for local generation	Qualitative assessment of whether the alternative aligns with the City of Edmonton Energy Transition Strategy objectives for local generation.
S6	Social	Strategic Alignment – Alignment with City of Edmonton and Province of Alberta objectives for GHG reductions	Qualitative assessment of whether the alternative aligns with the City of Edmonton and Province of Alberta objectives for GHG reductions.
S7	Social	Education Potential	Qualitative assessment of whether the alternative provides educational opportunities.
S8	Social	Corporate Leadership in Renewables	Qualitative assessment of whether the alternative demonstrates corporate leadership in renewables by EWSI.
S9	Social	Precedence – development in the North Saskatchewan River Basin	Qualitative assessment of whether the alternative sets a precedent for project development within the North Saskatchewan River Basin.

Assumptions

For effects that can be quantified or monetized, there are a number of specific assumptions used to develop the estimates. These are summarized here:

General Parameters

The overall study period for the project is 2019 to 2049. This represents a construction period of 1 year in 2019 and 30 years of operations for the alternatives from 2020 to 2049. All monetized impacts are estimated annually over the entire study period. All annual monetized impacts over this period are discounted to 2018 dollars using EWSI's weighted average cost of capital of 6.83 percent.

Energy Costs

For the “hard” financial cost inputs, the EWSI revenue requirement financial model inputs were utilized in the triple bottom line analysis. The specific assumptions, rationale and sources are documented in the EWSI’s August 23 Solar Project Update report. We highlight the following assumptions that are influential to the overall analysis:

- The energy capacity price forecasts are derived from the EDC Associates Limited, Q2 2018 Average Alberta Electricity Price forecast. Prices are held constant after 2032 to 2049.
- For exports of surplus power from the solar project alternatives, EWSI receives the Grid Price plus 15% due to favourable timing of surplus power production.
- For the two solar farm project alternatives, the capital cost for developing the project is $32.4 million.
- At the end of the useful life of the solar farm project alternatives, the projects are decommissioned, the equipment is removed and salvaged, and that the land is restored. It is assumed that there is no financial effect at the end of the study period; the decommissioning costs are assumed to equal the salvage value of the equipment.
- For the Offsite Local Solar Farm alternative, additional costs are incurred relative to the EL Smith with Behind the Meter Solar alternative:
    - Transmission line to substation costs of $484,000. Of the site options identified by EWSI, the lowest cost option was assumed in the business case and this triple bottom line analysis; costs at a selection of sites ranged from $484,000 to over $8 million.
    - Substation costs of $4.6 million.
    - Land acquisition costs of $385,000. Of site options identified by EWSI, the lowest cost option was assumed in the business case and this triple bottom line analysis; costs at a selection of sites ranged from $385,000 to over $28 million.
    - Additional annual O&M costs of $200,000 per year.
    - Additional capacity costs and wire charges due to the need to purchase more energy than the Solar Project at E.L. Smith alternative.
    - Revenues from generation are taxable due to the level playing field test. A tax rate of 27 percent is assumed.
- For the Grid Supply with Generic REC’s alternative, a REC cost of $12 per MWh.
- For the Interest in a Wind Farm alternative:

- The Net Present Value (NPV) of the wind alternative is based on a long-term contract price for wind power, based on the REP 1 auction results, plus premiums to account for the small size of the project and the need for firming. The base price and size premium are inflated at REP escalator of 20% of CPI.
- Additional capacity costs and wire charges due to the need to purchase more energy.
- For exports of power, EWSI receives the Grid Price less 40% due to the timing of power production.
- Revenues from generation are taxable due to the level playing field test. A tax rate of 27 percent is assumed.

Emissions

The two solar alternatives and the wind farm alternatives displace existing power production from the grid. To determine the fuel to be displaced, the marginal grid mix by year indicates the fuel to be displaced by lower cost alternatives at the margin. In general, prior to the complete phase out of coal, the marginal fuel displaced is primarily coal. After coal is phased out, natural gas becomes primary fuel to be displaced. The marginal grid mix is provided in Table 3:

Table 3: Marginal Mix by Year, Source: 2017 AESO Long Term Outlook

Marginal Grid Mix	2020	2030	2040	2049
Coal	52%	11%	0%	0%
Combined Cycle	28%	69%	86%	86%
Simple Cycle	5%	5%	2%	2%
Coal-to-Gas	3%	4%	0%	0%
Cogen	9%	9%	9%	9%
Hydro	2%	2%	2%	2%
Wind	0%	0%	0%	0%
Other	0%	0%	0%	0%
Total	**100%**	**100%**	**100%**	**100%**

To derive volumes of emission from generation, the following emission rates were applied:

Table 4: GHG Emission Rates per KWh of energy generation

GHG Emissions	Coal	Combined Cycle	Simple Cycle	Coal-to-Gas
gCO$_2$e/kWh	1,032	380	545	624

Sources:

- *Coal Emissions: 2011 North American Power Plant Air Emissions database*
- *Natural Gas Emissions: Calculations by HDR from the 2017 AESO Long Term Outlook Data File*

Table 5: CAC Emission Rates per KWh of energy generation

CAC	NOx	$PM_{2.5}$	SO_2
Emissions Rates	**g/kWh**	**g/kWh**	**g/kWh**
Combustible Fuels	0.96	0.02	1.34

Source:

- *CAC emissions rates were calculated based on the 2016 National Pollutant Release Inventory data file*

Emissions can be estimated in volumetric and monetary terms. In general, the monetization of GHG emissions reflects the monetary value of damage to net agricultural productivity, human health, and property damages. Estimates of the social cost of carbon (SCC) provide a way to value CO_2 emission changes in cost-benefit analysis where the goal is to provide informed analysis to decision makers that quantifies the incremental mitigation benefits associated with a policy action. For GHG's, these damage estimates reflect a global effect.

Some of the monetized damages from GHG emissions may be internalized in electricity prices reflecting the carbon levy that thermal plants pay. The degree to which the carbon levy affects electricity prices is not explicitly identified or easy to isolate as there are many factors affecting prices in Alberta including the new Carbon Competitiveness Incentive Regulation ("CCIR"), the continuation of the growth in renewable generation and as well as the transition to a capacity market. From what is available in the literature on the impact of a carbon tax that reflects the social cost of carbon on electricity prices, an impact of 10 to 20 percent on electricity prices may be anticipated[4].

For criteria air contaminants, CAC emissions monetization values the negative health effects and associated healthcare costs associated with CAC emissions. These effects are more localized in nature.

Table 6: The Damage Cost Associated with the One Additional Tonne of Emissions, in 2018 dollars

Emission Type	$/tonne
CO_2e	$46.24
NOx	$1,135
$PM_{2.5}$	$385,349
SO_2	$5,356

Sources:

- *CO_2e: Environment and Climate Change Canada, Technical Update to Environment and Climate Change Canada's Social Cost of Greenhouse Gas Estimates, March 2016.*

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[4] *"Consequences of a carbon tax on household electricity use and cost, carbon emissions, and economics of household solar and wind", Ahmad F. Ghaith, Francis M. Epplin, Energy Economics, Volume 67, September 2017. Also derived from data contained in: "The Effect of Carbon Pricing on Canadian Households", prepared by Jennifer Winter, Assistant Professor, University of Calgary, for the Senate Standing Committee on Energy, the Environment and Natural Resources.*

- *NOx, PM2.5: Victoria Transport Policy Institute, Transportation Cost and Benefit Analysis II – Air Pollution Costs.*
- *SO_2: Transport Canada, Estimating the Full Costs of Transport in Canada, August 2008.*

Avian Mortality

Wind projects are known to have higher avian mortality rates than other forms of power generation. Research indicates that fatality rates range between three to five birds per MW of wind capacity per year and fatality rates for bats can be substantially higher[5]. Research on avian fatalities from solar PV power generation is more much limited. One study cited evidence of 0.23 bird fatalities per MW of solar PV capacity[6].

These effects are treated qualitatively in the SVA with wind power generation expected to result in more avian fatalities than solar power generation.

Land Value Appreciation

For the Offsite Local Solar Farm alternative, land is acquired by EWSI and has a commercial value at the end of the study period in 2049. We have assumed that the commercial value of land appreciates at a rate of 3.4 percent per year – or roughly one half of EWSI's weighted average cost of capital. This is in line with historical land value appreciation rates in Edmonton since 1981[7].

Ecosystem Value or Total Economic Value of Land

The construction and deployment of new power generation facilities will require the use of land resources – approximately 55 acres (or 23.7 hectares) for two solar project alternatives. To not consider the impact on utilizing and potentially damaging such land resources historically had been a problem in project evaluations.

> *"At the political level, poor recognition of natural capital and ES has led to decisions that contribute to the degradation of the environment and threaten the future capacity of ecosystems to offer the same level of welfare." (Millennium Ecosystem Assessment), 2005. Ecosystems and human well-being: A framework for assessment. Washington.)*

Over the recent years, economic frameworks have been developed to measure the ecosystem value or total economic value of land in monetary terms[8]. These frameworks measure various elements of the ecosystem value of land spanning for key land service functions: provisioning services, regulating services, habitat services, and cultural amenity services to provide a holistic approach to measuring value (see Figure 5 for a topology and Table 7 for the definitions by specific service category). A database of ecosystem values by biome was also developed and

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[5] *Source: Wind Turbine Interactions with Wildlife and their Habitats, American Wildlife Institute 2014*

[6] *Source: A preliminary assessment of avian mortality at utility-scale solar energy facilities in the United States, Leroy J. Walston Jr. *, Katherine E. Rollins, Kirk E. LaGory, Karen P. Smith, Stephanie A. Meyers, Renewable Energy 92 (2016) 405e414, online February 20, 2016.*

[7] *Source: Statistics Canada, Cansim Table 18-10-0205-01 new housing price index, monthly. Note that commercial land price data was not available so the land value for new home prices in Edmonton was used as a proxy.*

[8] *See Chapter 1 of The Economics of Ecosystems and Biodiversity: The Ecological and Economic Foundations, as a reference, Rudolf de Groot et al., March 2010. Link: https://www.es-partnership.org/wp-content/uploads/2016/06/TEEB-D0-Chap-1.pdf*

named the TEEB Database - The Economics of Ecosystems and Biodiversity[9]. These valuations have been developed to help improve decision making and to enable decision makers to appropriately capture the potential environmental impacts of land use.

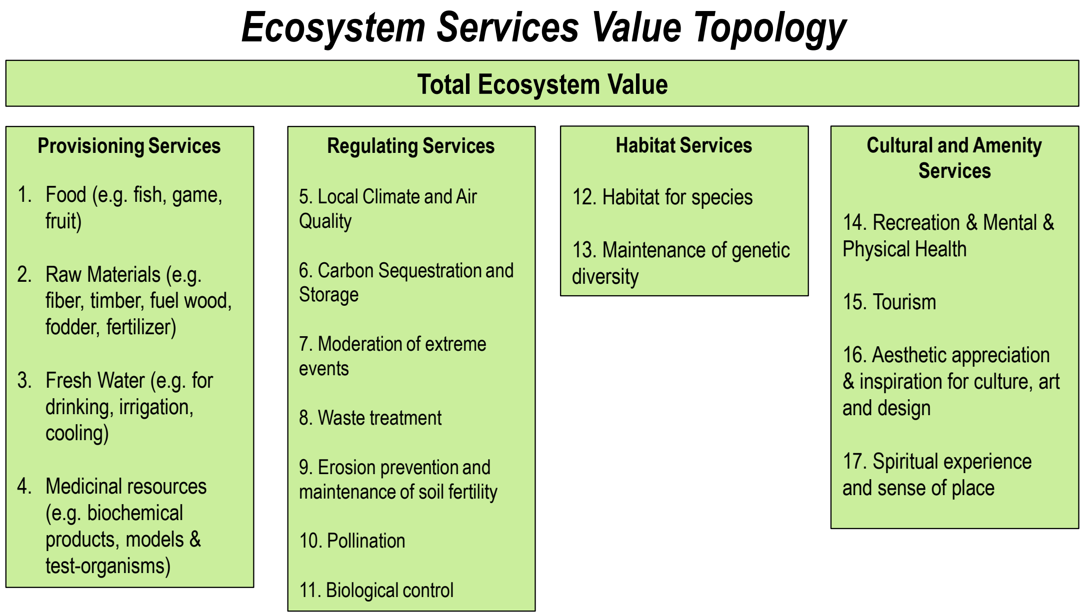

Figure 5: Topology of Ecosystem Services for Determining the Ecosystem Value of Land

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[9] *Source: The TEEB Valuation Database: overview of structure, data and results, Sander van der Ploeg, Dolf de Groot & Yafei Wang, Foundation for Sustainable Development, December 2010.*

Table 7: Definitions of Ecosystem Service Components

	Category	Definition/Explanation
PROVISIONING SERVICES		
1	Food	Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems but marine and freshwater systems or forests also provide food for human consumption. Wild foods from forests are often underestimated.
2	Raw materials	Ecosystems provide a great diversity of materials for construction and fuel including wood, biofuels and plant oils that are directly derived from wild and cultivated plant species.
3	Fresh Water	Ecosystems play a vital role in the global hydrological cycle, as they regulate the flow and purification of water. Vegetation and forests influence the quantity of water available locally.
4	Medicinal resources	Ecosystems and biodiversity provide many plants used as traditional medicines as well as providing the raw materials for the pharmaceutical industry. All ecosystems are a potential source of medicinal resources.
REGULATING SERVICES		
5	Local climate and air quality	Trees provide shade whilst forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere.
6	Carbon sequestration and storage	Ecosystems regulate the global climate by storing and sequestering greenhouse gases. As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues. In this way forest ecosystems are carbon stores. Biodiversity also plays an important role by improving the capacity of ecosystems to adapt to the effects of climate change.
7	Moderation of extreme events	Extreme weather events or natural hazards include floods, storms, tsunamis, avalanches and landslides. Ecosystems and living organisms create buffers against natural disasters, thereby preventing possible damage. For example, wetlands can soak up flood water whilst trees can stabilize slopes. Coral reefs and mangroves help protect coastlines from storm damage.
8	Waste-water treatment	Ecosystems such as wetlands filter both human and animal waste and act as a natural buffer to the surrounding environment. Through the biological activity of microorganisms in the soil, most waste is broken down. Thereby pathogens (disease causing microbes) are eliminated, and the level of nutrients and pollution is reduced.
9	Erosion prevention and maintenance of soil fertility	Soil erosion is a key factor in the process of land degradation and desertification. Vegetation cover provides a vital regulating service by preventing soil erosion. Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply the soil with nutrients required to support plant growth.
10	Pollination	Insects and wind pollinate plants and trees which is essential for the development of fruits, vegetables and seeds. Animal pollination is an ecosystem service mainly provided by insects but also by some birds and bats. Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee.
11	Biological control	Ecosystems are important for regulating pests and vector borne diseases that attack plants, animals and people. Ecosystems regulate pests and diseases through the activities of predators and parasites. Birds, bats, flies, wasps,

	Category	Definition/Explanation
		frogs and fungi all act as natural controls.
HABITAT		
12	Habitats for species	Habitats provide everything that an individual plant or animal needs to survive: food; water; and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.
13	Maintenance of genetic diversity	Genetic diversity is the variety of genes between and within species populations. Genetic diversity distinguishes different breeds or races from each other thus providing the basis for locally well-adapted cultivars and a gene pool for further developing commercial crops and livestock. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others and are known as 'biodiversity hotspots'.
CULTURAL & AMENITY SERVICES		
14	Recreation and mental and physical health	Walking and playing sports in green space is not only a good form of physical exercise but also lets people relax. The role that green space plays in maintaining mental and physical health is increasingly being recognized, despite difficulties of measurement.
15	Tourism	Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and is a vital source of income for many countries. In 2008 global earnings from tourism summed up to US$ 944 billion. Cultural and eco-tourism can also educate people about the importance of biological diversity.
16	Aesthetic appreciation and inspiration for culture, art and design	Language, knowledge and the natural environment have been intimately related throughout human history. Biodiversity, ecosystems and natural landscapes have been the source of inspiration for much of our art, culture and increasingly for science.
17	Spiritual experience and sense of place	In many parts of the world natural features such as specific forests, caves or mountains are considered sacred or have a religious meaning. Nature is a common element of all major religions and traditional knowledge, and associated customs are important for creating a sense of belonging.

Source: TEEB Database documentation.

A summary of the results of the TEEB Database is provided in Table 8 by biome. In general, a there is a wide range of estimates by biome. The values for grasslands average $1,200 per hectare per year 2007 US$ per year per hectare with a maximum of $3,100 per hectare per year derived from 25 distinct estimates.

Table 8: Ecosystem Benefits (Value) by Biome, $000, per Hectare per year

Biome	# of Estimates	Mean	Median	Maximum
Coral reefs	96	$105.1	$280.2	$1,195.6
Coastal wetlands	96	$47.5	$50.6	$213.8
Open oceans	6	$49.0	$50.0	$84.0
Coastal systems	27	$27.9	$34.6	$79.6
Inland wetlands	81	$15.8	$15.9	$45.0

Biome	# of Estimates	Mean	Median	Maximum
Tropical forest	139	$5.1	$8.3	$23.2
Lakes	12	$7.4	$7.4	$13.5
Temperate forest	40	$1.3	$2.1	$4.9
Grasslands	25	$1.2	$1.3	$3.1
Woodlands	17	$0.8	$0.6	$2.0

Source: TEEB Database.

The use of such ecosystem values has become much more mainstream in recent years. Some recent outputs from Canadian studies are provided from valuing ecosystem values of the Greater Montreal area (2014) as well as the North Saskatchewan River Basin (2010). For valuing land cover types in Greater Montreal we see maximum ecosystem values ranging between $800 per hectare per year for pasture and rangelands to $20,000 per hectare per year for urban forests.

Table 9: Total Benefits by Land Cover - $000/Ha/Year, From Dupras et al - Greater Montreal (2014)[10]

Land cover type	Minimum	Mean	Maximum
Urban forests and woodlands	$8.0	$11.2	$20.0
Rural forests and woodlands	$1.2	$4.2	$13.5
Urban wetlands	$0.1	$5.3	$18.7
Pasture and rangeland	$0.5	$0.6	$0.8

For the study of the North Saskatchewan River basin, we find estimates ranging between $1,000 per hectare per year for grasslands/pastures/hayfields to up to $17,800 per hectare per year for urban forests. Wetlands are valued $161,400 per hectare per year.

Table 10: Total Benefits by Land Cover - $000/Ha/Year, 2007, Ecosystem Services in the North Saskatchewan River Basin

Land cover type	Value
Wetlands	$161.4
Forest: urban	$17.8
Forest: suburban	$14.8
Forest:adjacent to stream	$11.7
Forest: non-urban	$4.5
Forest	$1.1

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[10] *Economic value of Greater Montreal's non-market ecosystem services in a land use management and planning perspective, Jérôme Dupras Département de géographie, Université de Montréal & Quebec Center for Biodiversity Science, Mahbubul Alam Betty & Gordon Moore Center for Science and Oceans, Conservation International Jean-Pierre Revéret École des sciences de la gestion, Université du Québec à Montréal, The Canadian Geographer / Le Géographe canadien 2014, xx(xx): 1–14*

Land cover type	Value
Grassland/pasture/hayfield	$1.0

HDR also independently looked at other recent studies from North America and the United Kingdom and found mean estimates for grasslands to average about $2,000 per hectare per year. Estimates for woodlands were about two times that of grasslands or averaged about $4,000 per hectare per year.

How to Use Ecosystem Values in Economics Evaluations

To appropriately reflect the potential consequences of development on land ecosystems, three steps are required:

1. Determine a reasoned estimate of the ecosystem value of the land in its undeveloped state.
2. Determine how the project will impact this ecosystem value (and for how long) – how much, if any, of this ecosystem value will be lost due to the development.
3. Combine (1) and (2) to develop an estimate of ecosystem damage or loss from project development.

As an illustration, Table 11 provides a summary of the Net Present Value of ecosystem damages for a project utilizing a 55 acre site for 31 years from 2019 to 2049 at varying levels of ecosystem value. *For simplicity of illustration, this analysis assumes that the project results in a total ecosystem value loss at the project site. However, in reality, the project site after development will likely retain at least some ecosystem benefits during the project period.*

A project developed on a 55 acre grasslands site with:

1) A mean ecosystem value of grasslands of $2,000/Ha/Yr; and,
2) That results in a total loss of this ecosystem value during the project period.

results in ecosystem damages valued at $0.8 million (on a present value basis). Similarly, for woodlands site with an average value of $4,000/Ha/Yr, the value of ecosystem damages for inclusion in an economic evaluation is $1.6 million. If we used the value from urban forests from the Greater Montreal study of $20,000/Ha/Yr, the value of ecosystem damages for inclusion in an economic evaluation is $7.6 million.

Table 11: Present Value of Ecosystem Damages, Millions of 2018 Dollars, Discounted at 6.83%, Inflation Assumed to be 2%

Undeveloped Ecosystem Value ($/Ha/Yr)	2019-2049
$1,000	$0.4
$2,000	$0.8
$4,000	$1.5

Undeveloped Ecosystem Value ($/Ha/Yr)	2019-2049
$10,000	$3.8
$20,000	$7.6
$30,000	$11.4
$40,000	$15.2
$50,000	$19.1

How to Use Ecosystem Values in This SVA

What is the ecosystem value of the land at potential project development sites?

For the Offsite Local Solar Farm and the Interest in a Wind Farm alternatives, ecosystem values from the literature review are utilized to capture the current ecosystem value at these two project sites:

- For the Offsite Local Solar Farm alternative, the average value from the literature review of $2,000/ha/yr is recommended[11]. The site itself is a generic grassland site within 40 km of the City of Edmonton. In the worst case scenario, if we assumed that the project resulted in total ecosystem damage over the project lifecycle, the present value of these effects over 31 years is $0.8 million.
- For the Interest in a Wind Farm alternative, an estimate lower than the average range from our literature is recommended given the more rural nature of the site. For analysis purposes, $1,000/ha/yr is recommended[12]. Wind farms use far less land directly than solar farms – about 10 percent of the solar farm[13] land use requirement so there would be less land use required here. Therefore, any ecosystem value damage impacts for this alternative would be negligible relative to other project impacts (at about $40,000 on a present value basis over 31 years).

Developing a reasonable estimate of the ecosystem value of the 55 acres of land at the E.L. Smith site is not as straightforward as that for a "generic site". Despite the range of ecosystem valuations presented above, no estimate in the literature represents a reasonable benchmark to the site. The 55 acre E.L. Smith site itself is quite unique in several ways:

1. The site itself is adjacent to an existing industrial site – the E.L. Smith Water Treatment Plant.
2. The site is adjacent to the North Saskatchewan River in the City of Edmonton.
3. While adjacent to the North Saskatchewan River, the site is not really visible from the River due to wooded areas adjacent to the River.
4. The site is visible to some (a limited number) of homes above the site and from Anthony Henday Drive.

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[11] *Note sensitivity analysis would be conducted to determine if uncertainty around these estimates are influential to outcomes.*

[12] *Ibid.*

[13] Source: Environmental Impact of Renewable Electricity Generation Technolgies: A Lifecycle Perspective, Gavin Heath, NREL, 2016..

5. The site is visible from bike paths on both sides of the river.
6. The site is grasslands in a river valley and contained within an urban forest.

Therefore, our approach is to not specifically ascribe a specific ecosystem value for the site itself. Rather, when examining the MAE analysis, we use breakeven or threshold analysis to determine:

(i) how valuable the site would have to influence the outcome of the analysis under the assumption the worst case scenario that the project would eliminate all ecosystem value during the project lifecycle; and,
(ii) whether this value is plausible given the outcomes from the literature; in other words, we ask whether the threshold value falls within the range of the literature?.

What is the impact of the solar projects on the land ecosystem at potential solar[14] project development sites?

The potential impact of the solar project on the ecosystem has many different perspectives that have been analyzed and communicated. These are summarized:

- The Stantec *Environmental Evaluation for the E.L. Smith Solar Farm* produced by Stantec Consulting Ltd. (March 2018)[15]
    - The ecosystem components: groundwater, wetlands, acquatic species and habitat, air quality and noise were not considered to have a potential project interaction.
    - Terrains and soils - Potential residual effects on terrain and soils are anticipated to be not significant.
    - Surface Water Bodies and Hydrology - Potential residual effects resulting from Project activities include an increased surface water runoff volume and flow within the Local Assessment Area ("LAA"). With the implementation of mitigation measures, potential residual effects on surface water bodies and hydrology are anticipated to be not significant.
    - Vegetation Species and Communities - With the application of recommended mitigation measures, potential residual effects to vegetation species and communities are anticipated to be limited to the loss or alteration of plant communities within the Project Development Area ("PDA"). Given these plant communities are common in the LAA, potential residual effects on vegetation species and communities are anticipated to be not significant.
    - Wildlife Species and Habitat - With the application of recommended mitigation measures, potential residual effects on wildlife species and habitat are anticipated to be not significant.

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[14] *Note, the ecosystem value of the land at the wind acquisition project site was negligible to start with so it was not a focus here due to materiality.*
[15] *Direct citations from report.*

- *Solar Glare Analysis Report – E.L. Smith Solar Farm by Solas Energy Consulting, January 2018*
  - The report stratified glare impacts by:
    - **"Green**" rated glare indicates a low potential for after-image.
    - "**Yellow**" rated glare indicates the potential for after-image exists.
    - "**Red**" rated glare indicates the potential for retinal damage.
  - The Analysis indicates that there is likely no incidence of red-grade glare.
  - Drivers using Anthony Henday Drive will not experience glare.
  - Natural obstructions that surround the project will help to completely or partially mitigate glare at most observation points.
  - Residences at higher elevations east and west of the project, and the pathway to the southwest, are predicted to be affected by limited number of minutes of glare.
  - The walking/bike path will have the most yellow-grade glare
  - Residences toward the south end of Heffernan Drive NW will experience green-grade glare.
  - The project has a low potential to result in hazardous glare conditions.

3) Participant Involvement Program – General Input (Attachment 4 to AUC Submission)

- EWSI has met the AUC's guidelines for a PIP for a power plant of 10 megawatts (MW) or greater. EWSI has notified approximately 17,400 landowners, occupants, residents, and other potentially interested parties within 2,000 metres of the edge of the project site boundary and has engaged in personal consultations with landowners, occupants, and residents located within 800 metres of the edge of the project site boundary. At the time of this filing, EWSI's Stakeholder Tracking System ("STS") includes over 890 participants, which consists of: (i) participants located within 800-metres of the edge of the project site boundary; (ii) other interested parties that EWSI identified for consultation (see section 2.1); and (iii) individuals who were not within the 800-metre boundary but opted into the consultation process.
- Of the approximately 17,400 participants that received information about the project (of which EWSI consulted with approximately 720 participants), approximately 230 participants expressed comments and/or concerns. The vast majority of parties who were consulted on the project were appreciative of the information but had little response or concern except that of a very general nature. Others provided EWSI with detailed feedback, which was used in combination with field studies and other information to reduce the project area and inform other project planning decisions.
- The following topic areas were mentioned by participants during EWSI's PIP. These are listed below from most to least frequent: project location and land use;

technical details; wildlife, environment and tree removal; regulatory; project need; visual; rates and billing; noise; cost; construction; contractor inquiries; glare; consultation; schedule; flooding; health; maintenance; water treatment plant inquiries; property value; sourcing of materials; and safety[16].

- Feedback from project opponents was also documented. Specifically,
    - The North Saskatchewan River Valley Conservation Society ("NSRVCS") expressed concern that the proposed fence will obstruct wildlife movement along the North Saskatchewan River, in particular at the southeast tip of the Project boundary where the Project is closest to the river[17].
    - The Sierra Club of Canada – Prairie Chapter - the Sierra Club expressed concerns regarding the project location and stated that they are opposed to any development within the North Saskatchewan River Valley. They advised that their main concern with the project is contextual and related to the cumulative impact of projects in the river valley[18].

3. From the workshop session, specific items were raised related to specific impacts that could affect the ecosystem value at the E.L. Smith site and other solar sites. In general:
    - The ecosystem components related to provisioning and regulating services described above were not considered to be materially impacted after the implementation of mitigation measures.
    - Regarding habitat services, the conclusion was re-enforced that the Environmental Evaluation by Stantec concluded that: "*The application of recommended mitigation measures, potential residual effects on wildlife species and habitat are anticipated to be not significant".*
    - An issue was raised that the fencing around the solar project area could impair the movement of species near the North Saskatchewan River.
    - An issue highlighted was the "lake effect" of the solar farm on birds potentially resulting in avian mortality.
    - It was noted that there was not a significant amount of concern about the project raised through the Participant Involvement Program by individuals – other than specific input from opposition groups.
    - There were comments that with the application of mitigation measures that some of the vegetation under the solar farm panels could actually improve the habitat.
    - There was discussion that EWSI has already made adjustments to the project development plan based on feedback received through the Participant Involvement Program.

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[16] *Direct citations.*
[17] *Source – PIP.*
[18] *Source – PIP.*

- There was recognition that the project site is adjacent to the North Saskatchewan River and that for some the location would raise concerns for some residents for the ecosystem components of cultural and amenity services.
- There was discussion of the solar project at EL Smith could provide an opportunity for education related to environmental sustainability and greenhouse gas reduction. Given the proximity to schools, population, etc. educational information could be developed adjacent to the site and walking trails highlighting key aspects of the project and the importance of environmental protection.
- There was discussion relating to how the project could demonstrate EWSI's commitment and leadership in sustainability.

4. Groups that had expressed opposition to the project were invited to meet with HDR to provide their feedback on the proposed solar farm at EL Smith. Two groups accepted the opportunity to participate. A representative from each of these two groups, the Edmonton River Valley Conservation Coalition and the North Saskatchewan River Valley Conservation Society, participated in a discussion. The main themes expressed during those discussions are as follows:
    - The historical importance of the North Saskatchewan River to the City of Edmonton.
    - It was highlighted that the River running through the City is a very attractive feature unique and the preservation of the River and surrounding areas from any industrial development is critical.
    - The importance of the River being a place that residents can access for recreation and relaxation within minutes of the homes in the City makes Edmonton a much more attractive place to live as well as to being an attraction for tourists.
    - There were concerns that the project would negatively impact the aesthetics of the area and that green space is going to become vitally more important in the future as the City grows and expands.
    - There was a concern raised that the project development at EL Smith is inconsistent with the goals of the North Saskatchewan River Valley Area Redevelopment Plan, Bylaw 7188. The major goals of the North Saskatchewan River Valley Area Redevelopment Plan are:
        i. *To ensure preservation of tile natural character and environment of the North Saskatchewan River Valley and its Ravine System*
        ii. *To establish a public metropolitan recreation area*
        iii. *To provide the opportunity for recreational, aesthetic and cultural activities in the Plan area for the benefit of Edmontonians and visitors of Edmonton.*

iv. *To ensure the retention and enhancement of the Rossdale and Cloverdale communities in the River Valley*[19].

- There were concerns raised that the project itself would negatively impact wildlife movement.
- There was concern that if this project is allowed to proceed it could set a precedent and lead to further industrial development near the basin.
- There was strong support for the solar farm concept within the City of Edmonton but not at the EL Smith site. The feedback was that an alternative that considered roof top solar within the City should be considered as an alternative.
- There were concerns raised that if the site is developed it could be a lost opportunity for developing trails and recreational facilities in the area.
- There was commentary that the development at the E.L. Smith site could negatively impact EWSI's corporate reputation.

Summary

From the project documentation and direct feedback, the largest area of potential risk of ecosystem value loss at the E.L. Smith site relates to cultural and aesthetic services. There is a risk that the project could negatively impact to some degree recreation, mental and physical health, tourism, aesthetic appreciation and inspiration for culture, art and design aspects of ecosystem value. While these impacts could also be realized at alternative project sites, the location of the project adjacent to the North Saskatchewan River would make the risk of a negative impact higher at EL Smith.

There may also be offsetting positive impacts to cultural and aesthetic services. Through collaboration with educational and research institutions, Indigenous communities, neighbouring residential communities, the City of Edmonton and special interest groups, EWSI will take full advantage of opportunities to design the Project and surrounding features to meet community integration objectives outlined below:

- Integrate the Project into the North Saskatchewan river valley and plan for future trails proposed in the City of Edmonton's Ribbon of Green.
- Provide educational opportunities about the history and cultural resources of the land in collaboration with Indigenous communities.
- Enhance the Project aesthetics and the overall viewscape.
- Create a multi-functional area.
- Establish long-term partnerships to support educational and research opportunities associated with solar energy generation[20].

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[19] *Citation from the North Saskatchewan River Valley Area Redevelopment Plan Office Consolidation September 2017.* https://www.edmonton.ca/residential_neighbourhoods/plans_in_effect/North_Saskatchewan_River_ARP_Consolidation.pdf

The next potential area of risk of ecosystem damage (or ecosystem value loss) relates to habitat services and the movement of wildlife near the project area. There is some potential risk of impact, however, the Environmental Evaluation by Stantec concluded that “with the application of recommended mitigation measures, potential residual effects on wildlife species and habitat are anticipated to be not significant.” It should be noted that EWSI plans to implement the mitigation measures identified in the Environmental Evaluation by Stantec Consulting.

For provisioning and regulating services, there does not appear to be risk of material impacts in general after mitigation measures.

In general, the EL Smith site would potentially have greater risk of ecosystem value loss than other solar site locations due to its proximity to the North Saskatchewan River.

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[20] *From Section 3.2 of EWSI’s August 23, 2018 EL Smith Solar Project Update.*

Outcomes – Multiple Account Evaluation

The Multiple Account Evaluation framework reports in a matrix format the impact of various project alternatives across a number of specific criteria. The intent of the MAE is to highlight the trade-offs between various project alternatives to help facilitate decision making.

Table 12: Summary of Multiple Account Evaluation by Alternative

#	Account	Criteria	Grid Supply	Grid Supply + Generic REC's	Offsite Wind Farm	Solar Project at E.L. Smith	Offsite Local Solar Farm
F1	Financial	Total of All Financial Costs (NPV, $M)	$19.6 M	$22.5 M	$20.9 M	$25.4 M	$44.1 M
F2	Financial	Levelized cost of all energy ($/MWh)	$105.83	$121.54	$112.74	$136.82	$237.85
F3	Financial	Levelized cost of renewable energy ($/MWh)	$0.00	$15.71	$6.91	$30.99	$132.02
F4	Financial	Risk Management	No effect	No effect	A new renewable resource would hedge against energy cost increases.	A new renewable resource would hedge against future energy cost increases.	A new renewable resource would hedge against energy cost increases.
E1	Environmental	GHG Emissions – Damage Costs $M	$6.2 M	$6.2 M	-$1.6 M	-$1.6 M	-$1.6 M
E2	Environmental	GHG Emissions - tonnes	217,331	217,331	-78,433	-78,429	-77,936
E3	Environmental	Avian mortality	No effect.[21]	No effect.	Wind energy has a higher avian mortality rate than other forms of generation, including solar – 3 to 5 fatalities per MW of capacity.	Solar PV energy has a lower avian mortality rate than wind energy.	Solar PV energy has a lower avian mortality rate than wind energy.
E4	Environmental	Ecosystem value –	No effect.[22]	No effect.	Less land use required.	With mitigation, no	With mitigation, no

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[21] *Note: The assumption is that in the absence of a new renewable resource to serve the EL Smith Water Treatment plant energy needs, no other new generation would be required; existing facilities would continue to serve EL Smith needs.*

#	Account	Criteria	Grid Supply	Grid Supply + Generic REC's	Offsite Wind Farm	Solar Project at E.L. Smith	Offsite Local Solar Farm
		provisioning services			With mitigation, no significant effect	significant effect as highlighted in Environmental Assessment.	significant effect.
E5	Environmental	Ecosystem value – regulating services	No effect.	No effect.	Less land use required. With mitigation, no significant effect anticipated.	With mitigation, no significant effect as highlighted in Environmental Assessment.	With mitigation, no significant effect anticipated.
E6	Environmental	Ecosystem value – habitat services	No effect.	No effect.	Less land use required. With mitigation, no significant effect anticipated.	The potential negative effect on habitat services is marginally greater than the other alternatives due to potential impacts of wildlife movement in an urban forest corridor. The Environmental Assessment concluded: *"Wildlife Species and Habitat - With the application of recommended mitigation measures, potential residual effects on wildlife species and habitat are anticipated to be not significant."*	With mitigation, no significant effect anticipated.
E7	Environmental	Ecosystem value of land – cultural and amenity services	No effect.	No effect.	Less land use required and a more rural are With mitigation, no significant effect anticipated.	The potential negative effect on cultural and amenity services is greater than the other alternatives given the proximity to population, residences, trails and the North Saskatchewan River.	The site is not as close to population or a river basin. With mitigation, no significant effect anticipated.

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[22] Note: The assumption is that in the absence of a new renewable resource to serve the EL Smith Water Treatment plant energy needs, no other new generation would be required; existing facilities would continue to serve EL Smith needs.

#	Account	Criteria	Grid Supply	Grid Supply + Generic REC's	Offsite Wind Farm	Solar Project at E.L. Smith	Offsite Local Solar Farm
						There are positive impacts of the project as well due to the demonstration site and the potential for partnerships and collaboration.	
E8	Environmental	$ Value of Ecosystem Value at Risk (ecosystem value of land at the renewable site – Present Value)	$0	$0	< $0.1 M (assumes a value per hectare per year of $1,000 & less of a land use footprint)	Greatest ecosystem value at risk. Magnitude to be evaluated through threshold analysis.	$0.8 M (assumes a value per hectare per year of $2,000)
S1	Social	CAC Emissions - $M	$4.5 M	$4.5 M	-$1.4 M	-$1.4 M	-$1.4 M
S2	Social	CAC Emissions - volumes	NOx: 559 tonnes SO_2: 774 tonnes $PM_{2.5}$: 14.4 tonnes	NOx: 559 tonnes SO_2: 774 tonnes $PM_{2.5}$: 14.4 tonnes	NOx: -241 tonnes SO_2: -344 tonnes $PM_{2.5}$: -6.2 tonnes	NOx: -241 tonnes SO_2: -344 tonnes $PM_{2.5}$: -6.2 tonnes	NOx: -241 tonnes SO_2: -344 tonnes $PM_{2.5}$: -6.2 tonnes
S3	Social	Economic Development	No effect	No effect	Wind farm site likely in rural Southern Alberta so no direct economic impact in Edmonton.	With the site in Edmonton, local economic impact from project costs.	With the site not directly in Edmonton, less economic impact per $1 of project costs. However, this option requires greater expenditure.
S4	Social	Additionality – A new renewable resource	No additionality.	No additionality.	Additionality – a new renewable resource.	Additionality – a new renewable resource.	Additionality – a new renewable resource.
S5	Social	Strategic Alignment – Alignment with City of Edmonton objectives for local generation	Not aligned.	Not aligned.	Not aligned.	Aligned with City of Edmonton Objectives.	Aligned with City of Edmonton Objectives (offsite solar project assumed to be within 40km radius of the city of Edmonton.
S6	Social	Strategic Alignment – Alignment with City of Edmonton and Province of Alberta objectives for GHG reductions	Not aligned.	Corporate alignment - EWSI offsets its carbon footprint through REC purchases. However, from a	Aligned with City of Edmonton and Province of Alberta objectives.	Aligned with City of Edmonton and Province of Alberta objectives.	Aligned with City of Edmonton and Province of Alberta objectives.

#	Account	Criteria	Grid Supply	Grid Supply + Generic REC's	Offsite Wind Farm	Solar Project at E.L. Smith	Offsite Local Solar Farm
				societal perspective, there is no incremental effect without additionality.			
S7	Social	Education Potential	No effect.	No effect.	A new renewable site has the potential to be leveraged for educating the public on environmental sustainability. However, little proximity to population would limit its potential effectiveness.	An educational and cultural demonstration site within the Edmonton river valley has the potential to be leveraged for educating the public on environmental sustainability. This alternative has the greatest access to population, schools etc. and therefore the greatest potential.	A new renewable site has the potential to be leveraged for educating the public on environmental sustainability. However, little proximity to population would limit its potential effectiveness.
S8	Social	Corporate Leadership in Renewables	No effect.	Through REC purchases, EWSI demonstrates environmental commitment.	Greatest effect with EWSI developing new renewable generation resources.	Greatest effect with EWSI developing new renewable generation resources.	Greatest effect with EWSI developing new renewable generation resources.
S9	Social	Precedence – development in the North Saskatchewan River Basin	No effect.	No effect.	No effect.	Development in the North Saskatchewan River Basin. Bylaw 7188[23] does provide for development for projects that are deemed essential. The draft Ribbon of Green report designates EL Smith lands as an "Active Working Landscape", and sets out a list of compatible uses,	No effect.

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[23] *North Saskatchewan River Valley Area Redevelopment Plan, Bylaw 7188: It is a policy of this Plan that major public facilities shall not be constructed or expanded unless their location within the River Valley is deemed essential and approved by City Council.*

#	Account	Criteria	Grid Supply	Grid Supply + Generic REC's	Offsite Wind Farm	Solar Project at E.L. Smith	Offsite Local Solar Farm
						facilities and infrastructure that may be appropriately developed at the site. Developments that improve the sustainability of existing operations, or expansions of power, water and wastewater utilities, are among the appropriate uses listed.	

Outcomes – Monetized Effects

The effects that can be monetized, namely the specific project financial impacts and the monetization of emissions, are summarized in Table 13 for each of the alternatives. On a pure financial cost basis, the least cost option is the Grid Supply alternative with net cash flows of $19.6 million. The most costly alternative is the Offsite Local Solar Farm with net cash flows of $44.1 million.

The Offsite Local Solar Farm alternative is $18.7 million more expensive than the Solar Project at EL Smith alternative primarily due to two factors:

1. There are significant incremental costs for the Offsite Local Solar Farm alternative including land acquisition, interconnection and substation costs; and,
2. The income generated form an Offsite Local Solar Farm alternative (owned by EPCOR) is taxable (at 27%). Income from the Solar Project at EL Smith owned by EPCOR would not be taxable.

The Offsite wind farm option is the lowest cost alternative for renewable energy sources with additionality, however, it does not represent a local generation resource.

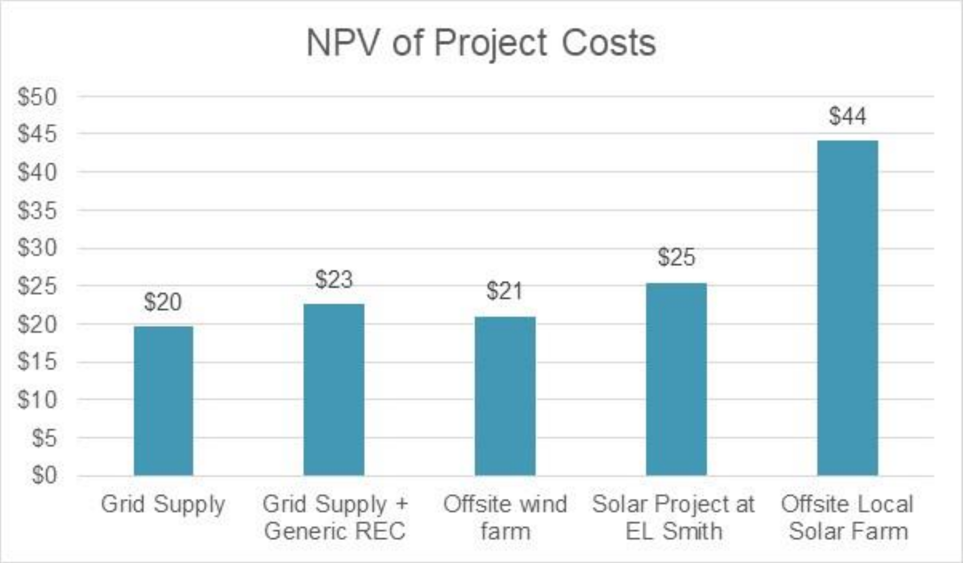

Figure 6: Net Present Value of Project Financial Costs, Millions of 2018 Dollars

Table 13: Summary of Monetized Effects to Society, Net Present Value in Millions of 2018 Dollars

	Grid Supply	Grid Supply + Generic REC	Offsite wind farm	Solar Project at EL Smith	Offsite Local Solar Farm

	Grid Supply	Grid Supply + Generic REC	Offsite wind farm	Solar Project at EL Smith	Offsite Local Solar Farm
Capital Costs	**$0.0**	**$0.0**	**$0.0**	**$27.3**	**$32.4**
12 MW System	$0.0	$0.0	$0.0	$27.3	$27.3
Land Value	$0.0	$0.0	$0.0	$0.0	$0.4
Interconnection Costs	$0.0	$0.0	$0.0	$0.0	$4.8
Salvage Value	**$0.0**	**$0.0**	**$0.0**	**$0.0**	**-$0.1**
Contract / O&M Costs	**$19.6**	**$22.5**	**$23.3**	**$3.9**	**$24.0**
Conventional Energy	$19.6	$19.6	$23.3	$1.3	$19.6
REC Purchases	$0.0	$2.9	$0.0	$0.0	$0.0
AESO Compliance	$0.0	$0.0	$0.0	$1.5	$1.5
O&M	$0.0	$0.0	$0.0	$1.1	$2.9
Net Revenues	**$0.0**	**$0.0**	**-$2.4**	**-$5.8**	**-$12.2**
Gross Revenues	$0.0	$0.0	-$3.3	-$5.8	-$16.7
Less Taxes	$0.0	$0.0	$0.9	$0.0	$4.5
Net Cash Flows	**$19.6**	**$22.5**	**$20.9**	**$25.4**	**$44.1**
Emissions Costs (damage)	**$10.7**	**$10.7**	**-$3.0**	**-$3.0**	**-$3.0**
GHGs	$6.2[24]	$6.2[25]	-$1.6	-$1.6	-$1.6
CACs	$4.5	$4.5	-$1.4	-$1.4	-$1.4
Total Monetized Effects	**$30.3**	**$33.2**	**$17.9**	**$22.4**	**$41.1**

When the monetary value of emissions are considered, the three non-REC renewable project alternatives improve relative to the grid supply alternatives. The grid supply alternatives generate emission related damages of $10.7 million[26]. In contrast, the renewable options actually generate sufficient power to both serve the needs at EL Smith and to displace additional non-renewable generation from the grid and therefore have a net positive emission effect of about $3.0 million.

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[24] *If the portion of the Alberta carbon levy that internalized in electricity rates was deducted from the monetized effects of GHG emissions, the reduction in the GHG impact could be in the $1M - $2M range.*

[25] *Ibid.*

[26] *Note while REC purchases enable EPCOR to claim the benefits of renewable generation, without additionality there is no net emission reduction effect to society.*

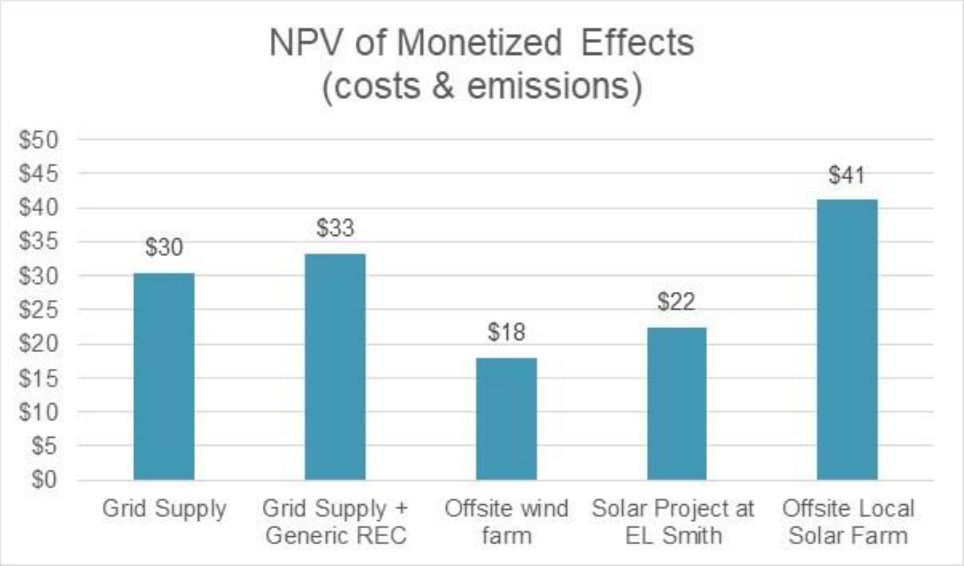

Figure 7: Net Present Value of Monetized Effects, Millions of 2018 Dollars

Without considering the other factors identified in the MAE analysis, this analysis indicates that:

1. The Solar Project at EL Smith project has a positive business case from a societal perspective relative to the grid supply alternative or the business as usual case. The emissions benefit relative to the Grid Supply option offset the additional financial costs to yield a net benefit of approximately $8 million (e.g., $22.4 million versus $30.3 in monetized costs).
2. The Offsite Local Solar Farm does not have a positive business case from a societal perspective as total monetized effects are approximately $11 million higher (e.g., $41.1 million versus $30.3 in monetized costs).
3. The Solar Project at EL Smith project is significantly less costly (e.g., almost $19 million) than the Grid Connected Local Solar project.

Outcomes – Monetized Effects and Potential Ecosystem Effects

In the analysis summarized above, effects other than financial costs and emissions were not considered. A critical limitation to this analysis is that it does not consider the potential effect on the ecosystem of using land at the two solar farm alternative sites.

For the Offsite Local Solar Farm alternative site, we have assigned an ecosystem value for the undeveloped site of $2,000/ha/yr. Due to the unique nature of the Solar Project at EL Smith alternative site, a value for the undeveloped site is not assigned. The key question becomes, if potential ecosystem damages (or loss of ecosystem value) are factored in, does the Solar Project at EL Smith alternative still appear to be preferable?

To put this question into perspective, breakeven analysis is applied to the worst case scenario. That is, we assume that the solar project alternatives result in a total eradication of all ecosystem value during the 31 year project development and operational period. For the Offsite Local Solar Farm alternative, the total monetized effects increase by the ecosystem loss of $0.8 million[27] to $41.9 million on a present value basis.

For these two solar alternatives to be equal on a total monetized cost basis, the Solar Project at EL Smith ecosystem damage would have to be $51.8 thousand per hectare per year and this entire amount would have to be completely eradicated with the project development for the two solar alternatives to equal. This is many times greater than any specific estimate we have found in the literature. For example:

- Valuations for grasslands typically averages about $2,000 per hectare per year.
- Average valuations for urban Montreal ranged from $600 per hectare per year for pasture and rangeland to $11,200 per hectare per year for urban forecasts and woodlands (see Table 9). The maximum value for urban forecasts and woodlands was $20,000 per hectare per year.
- Valuations for the North Saskatchewan River Basin was $1,000 per hectare per year for Grassland/pasture/hayfield and $17,800 per hectare per year for urban forests (see Table 10).

However, the Environmental Evaluation by Stantec did not point to any evidence of total ecosystem destruction.

In summary, if the expected damage to the ecosystem at the EL Smith site is expected to be in excess of $51.8 thousand per hectare per year, than the Offsite Local Solar Farm would be the preferred solar alternative. Otherwise, the Solar Project at EL Smith alternative is preferred (with all other factors held constant).

The breakeven analysis illustrates that to justify a solar alternative not at the EL Smith, decision makers would have to place an extraordinarily high ecosystem value on the EL Smith site and that the project development there would result in very significant ecosystem damages. Neither the literature on ecosystem valuation nor the conclusions of the Environmental Evaluation support that outcome.

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[27] *Represents 31 years of ecosystem loss of $2000/Ha/Yr.*

Conclusions

The triple bottom-line evaluation of renewable energy alternatives identifies and summarizes the trade-offs between the alternatives spanning financial, environmental and social considerations which are documented in both qualitative and quantitative terms. This Multiple Account Evaluation framework recognizes that different stakeholders will have different perspectives on the relative importance of each of these criteria as well as the impact of each alternative on these same criteria. A combination of MAE and breakeven approaches is applied for the SVA. The MAE is appropriate in circumstances such as this where there is difficulty in applying social/environmental value to the land at EL Smith because the value depends on different stakeholders views. In this triple bottom line analysis, the break-even approach is used to attempt to monetize the environmental/social (ecosystem) value the decision maker would need to assign to the land at EL Smith to make the proposed Project equivalent to the offsite solar project.

The breakeven analysis is summarized in Figure 8. The blue bars in the charts represent the financial costs of each alternative while the red bars represent the emissions costs or benefits in the renewable cases. The yellow arrow highlights how significant any ecosystem damage would have to be at the E.L. Smith site for the Offsite Local Solar Farm to be preferable; this damage would have to be on average 25 times or more greater than the average values we see in the economic literature.

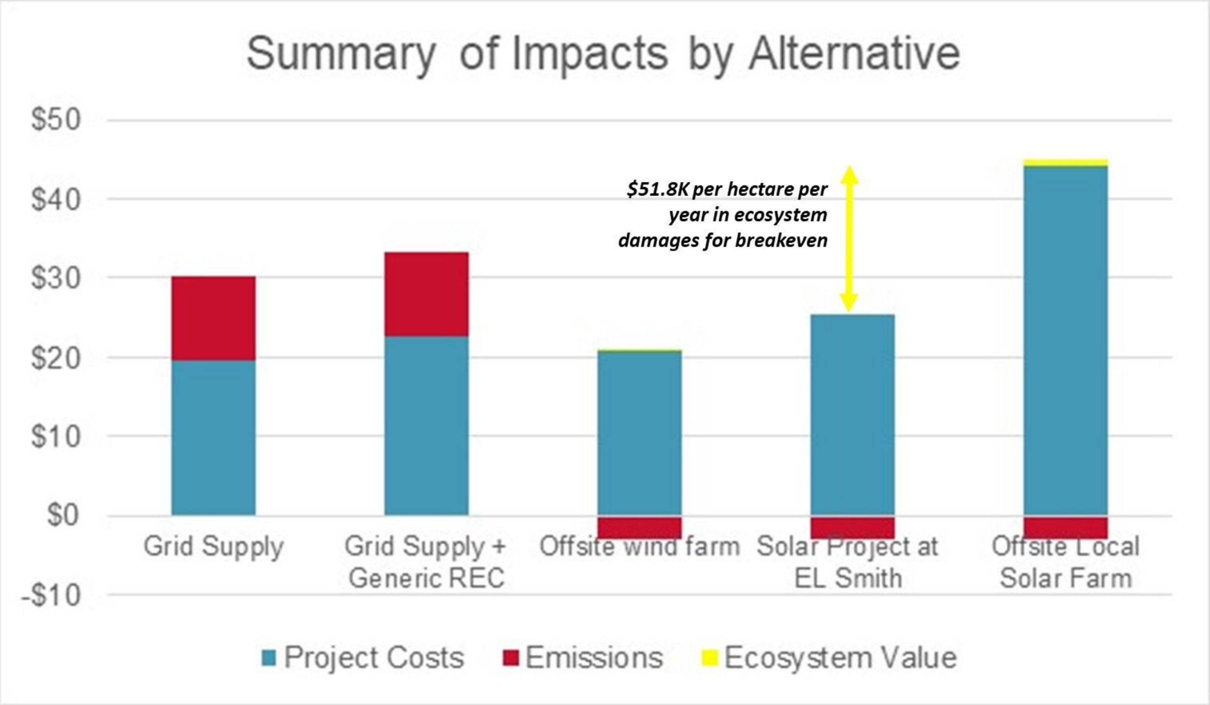

Figure 8: Break Even Analysis

Figure 9 also summarizes the differences between the ecosystem value estimates discussed previously from the TEEB database, from valuations in Greater Montreal, from valuations from the North Saskatchewan River (NSR) and from HDR[28]. There is quite a large gap between these estimates and the breakeven estimate of $51,800 per hectare per year.

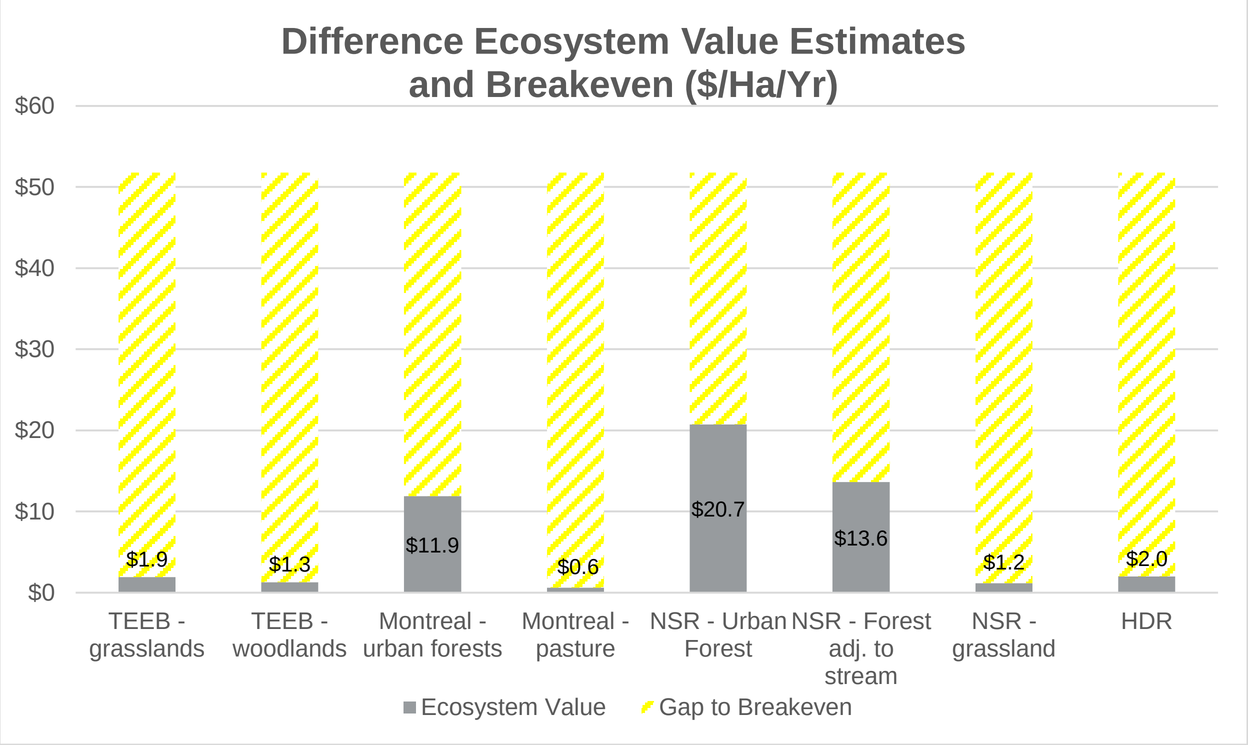

Figure 9: Difference Between Literature Estimates and the Breakeven Value

From an overall evaluation perspective, if additionality and having local generation are required, then really there are two alternatives: (i) the Solar project at E.L. Smith and (ii) the offsite local solar farm. The Solar project at E.L. Smith can be developed at a much lower financial cost with both these alternatives providing equivalent emission reduction benefits. Decision-makers will have to determine whether the project development at E.L. Smith could result in very significant ecosystem damages as highlighted in the breakeven analysis. This would seem implausible given the evidence in the economic literature and the findings of the Environmental Evaluation by Stantec Consulting.

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[28] *These estimates from the literature were escalated to represent 2018 dollar values for comparison.*

EPCOR Water Services Inc.

Sustainability Value Analysis of the E.L. Smith Solar Farm Project – Addendum Report

January 31, 2020

Table of Contents

Introduction

This report is an addendum to the August 23, 2018 HDR report titled *Sustainability Value Analysis of the E.L. Smith Solar Farm Project* ("HDR TBL Report"). The addendum provides additional guidance and clarifications on the conclusions contained in that report as well as rationale for some of the assumptions leveraged in that Triple Bottom Line analysis. In the discussion that follows, we focus on the relative impacts of the two solar alternatives that provide both local generation and additionality:

1. Solar Project at E.L. Smith.
2. Offsite Local Solar Farm. The E.L. Smith site remains as is, a restricted access, undeveloped site that is fenced and maintained for the potential future expansion needs of the E.L. Smith Water Treatment Plant.

The E.L. Smith project site itself is predominantly classified as a perennial pasture (89%) with the remaining area classified as Balsam Poplar Woodland Alliance, Tall Shrubland Alliance, Short Shrubland Alliance and Aspen Poplar Woodland Alliance[1]. Any impact on the trees and shrubs from the project itself on the site will be mitigated by a re-vegetation of native trees and shrubs resulting in a net gain of tree and shrub habitat.

The E.L. Smith site is quite unique:

- It is adjacent to an existing industrial site (the E.L. Smith Water Treatment Plant);
- It is adjacent to the North Saskatchewan River in the City of Edmonton;
- It is not really visible from the River due to wooded areas adjacent to the River;
- It is visible to some (a limited number) of homes above the site and from Anthony Henday Drive;
- It is visible from bike paths on both sides of the river; and,
- It is grasslands in a river valley and contained within an urban forest.it is on private land which is also fenced and not accessible to the public.

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[1] *Source: Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm, Stantec Consulting Ltd., February 2019.*

Ecosystem Valuation Literature

In the HDR TBL Report, the Multiple Account Evaluation identified impacts by each project alternative relative to economic/financial, social and environment accounts. To put in monetary terms the potential for adverse impacts on the ecosystem at the solar project sites, we leveraged a "total economic value" framework that has been recently applied to help incorporate a monetary value of adverse impacts of project developments on a range of different biomes.

HDR Literature Review

We conducted a literature review using the Environmental Valuation Inventory (EVRI) followed by a desktop general search engine investigation to determine a valuation for a biome comparable to that at the E.L. Smith project development site. In the literature review, valuation estimates were considered that met the following criteria:

1) The valuations must reflect that of a grasslands or pasture and not any other biome. The E.L. Smith site is predominantly (89%) perennial pasture[2] contained within an urban forest. The remaining area classified as Balsam Poplar Woodland Alliance, Tall Shrubland Alliance, Short Shrubland Alliance and Aspen Poplar Woodland Alliance. Any impact on the trees and shrubs from the project itself on the site will be mitigated by a re-vegetation of native trees and shrubs resulting in a net gain of tree and shrub habitat.

2) To provide closest ecological context, the investigation focused on studies of ecosystem services provided by grassland habitats in North America and the United Kingdom. Both primary (or original) studies and value transfer studies were taken into account.[3]

3) Valuation estimates for sites that had been developed and designated for recreational purposes (e.g., a park) were not considered. Regardless of whether or not the solar project is completed at E.L. Smith, it is assumed that the site remains as is, a restricted access, undeveloped site that is fenced and maintained for the potential future expansion needs of the E.L. Smith Water Treatment Plant. The site is assumed to remain a restricted area that is fenced and not available for recreational use[4]. Therefore, ecosystem valuations related to a site developed and designated to attract users for recreational purposes were not considered.

The literature review sources are provided in Appendix 1. The results of HDR's literature review are summarized in Table 1. The average value per hectare per year (in 2017 Cdn $) for grasslands is approximately $2,000, however, there is a wide array of estimates from the literature with some very low estimates and some as high as $14,273.

Table 1: Summary of Ecological Valuations, HDR Literature Review, Values in 2017$

Summary Statistic	Value
Number of Studies Reviewed	18
Number of Data Points	29
Oldest Study (Year)	2004

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[2] *Any wooded or shrubland areas impacted by the project are offset by re-vegetation of other areas provided an overall net gain for these biomes.*

[3] *The number of identified and readily accessible original studies was small. However, considering that the authors of the value transfer studies also were striving to derive an appropriate environmental value of similar habitats, the results reported in their studies can also be considered relevant for this study.*

[4] *Remote Camera Monitoring on the site indicates that the E.L. Smith project site is not frequently used for recreational purposes. Remote Cameras EPC09 and ECP10 indicated 7 human interactions over the monitoring period (Source: the Wildlife Addendum to the MEIA).*

Summary Statistic	Value
Most Recent Study (Year)	2015
Key Distributional Statistics, Environmental Value, $/hectare per year, 2017$	
Maximum Value	$14,273
Average	$1,961
Median	$921
90% Percentile	$4,148
95% Percentile	$5,887
99% Percentile	$12,042

The literature review also highlighted the following:

1. The development of ecosystem values for inclusion into economic analysis to reflect land use impacts is an important and relatively new area of research.

2. Most of the valuation estimates in the literature are not based on new research specific to an individual site. It would be rather rare for a primary study to be completed to determine the total economic value of an individual site. Instead, valuation estimates are usually based on a "benefits transfer" approach where ecosystem values are transferred or developed based on research from other sites. Often, these values from other research were also using values from other prior studies. Given that, the original source of an individual value is often difficult to trace to determine the degree of relevance.

3. Some valuation estimates found in the literature are also based on a literature review similar to that conducted for the HDR TBL Report.

4. To summarize, the range of ecosystem value of grasslands was from less than $1,000 per hectare per year to $14,273 per hectare per year from HDR's literature review is a representative value for grasslands. The overall average was about $2,000 per hectare per year. This is consistent with the findings of the foundational study by de Groot et al on ecosystem value. The foundational study on this approach to ecosystem valuation (the TEEB database developed by de Groot et al) applied a literature review based approach and determined a valuation for grasslands of about $2,100 per hectare per year (when translated to 2017 Canadian $).

5. Recent valuations for urban forests and woodlands in Canada range between $8,000 and $20,000 with an average of $11,200 per hectare per year (in 2014$) as identified in the HDR TBL Report[5]. Including this urban forest valuation, the range of estimates from HDR's review covers valuations from less than $1,000 to $21,310 per hectare per year (in 2018$).

Where we see the site at E.L. Smith potentially having a higher valuation than that identified in the literature review relates to its location in the North Saskatchewan River Basin. Specifically, the elements that could potentially provide higher ecosystem values relate to: (i) habitat and

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[5] *Economic value of Greater Montreal's non-market ecosystem services in a land use management and planning perspective, Jerome Dupras Département de géographie, Université de Montréal & Quebec Center for Biodiversity Science, Mahbubul Alam Betty & Gordon Moore Center for Science and Oceans, Conservation International Jean-Pierre Revéret École des sciences de la gestion, Université du Québec à Montréal, The Canadian Geographer / Le Géographe canadien 2014, xx(xx): 1–14*

wildlife; and (ii) cultural and amenity services (primarily aesthetics, existence and spiritual experience) as opposed to provisioning and regulating services.

Additional Literature

The City of Edmonton has provided additional literature sources including some that contain much higher ecosystem valuations than the range identified in HDR's literature review. This additional literature had not been initially included to derive HDR's general value for grasslands because:

1. The ecosystem valuations were not directly reflective of a grassland biome per se but were based on a valuation of a broader geographic area that included a combination of different biomes (such as forests, rivers, wetlands, grasslands). The general area itself included a grassland component but the valuation cited was not only for that of the grassland biome itself but rather for the total area or the combination of various biomes; or,

2. The ecosystem valuation was for a geographic area that was used almost exclusively for recreation or the area was designated as a "park". Parks, especially in dense urban areas where greenspace is scarce, can generate significant ecosystem value through recreational benefits derived by large numbers of users actively using recreational facilities that have already been developed for that purpose. In the HDR TBL Report, the E.L. Smith site is assumed to remains as is, a restricted access, undeveloped site that is fenced and maintained for the potential future expansion needs of the E.L. Smith Water Treatment Plant and therefore not available for recreation. Remote camera monitoring on the site indicates that the E.L. Smith project site is not currently frequently used for recreational purposes[6].

We have provided specific comments on the additional valuations from the literature that have been provided to indicate why it was initially excluded from HDR's literature review in Table 2. Supporting additional documentation is provided in Appendix 2.

However, we have included this additional literature in the economic analysis that follows.

Table 2: Summary of Additional Literature Valuation Estimates

Study	$/Ha/Yr	Basis of Value	Relation to the E.L. Smith Site
Mapping the Off-Site Benefits from Protected Areas' Ecosystem Services, Ontario Ministry of Natural Resources (OMNR, 2013)	$43,696 (2011$) *$48,616* *(in 2018$)*	The ecosystem valuation is an average of values from 3 different studies focused on the recreational values of greenspace: (i) the highest value is based on the Pennypack Park in Philadelphia that contains meadows, wetlands, treed areas as well as trials, paths and historic structures; (ii) the second highest value is based on small urban parks in in New Jersey which are primarily located in urban/suburbanized areas; and, (iii) the lowest value was a study from Georgia.	The valuation estimates reflect valuations of designated areas/parks for recreation. In some instances, the areas contain multiple biomes and developed recreational and other infrastructure.
	$31,067 (2011$) *$34,565* *(in 2018$)*	The ecosystem valuation represents an average ecosystem benefit of urban forests. Most of the individual values in the study are relatively low with the exception of one related to the recreational and mental health benefits of an urban forest in a city center.	The valuation estimates relate to recreational benefits or an urban forest.

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[6] *Remote Cameras EPC09 and ECP10 indicated 7 human interactions over the monitoring period (Source: the Wildlife Addendum to the MEIA).*

Study	$/Ha/Yr	Basis of Value	Relation to the E.L. Smith Site
Putting a Value on the Ecosystem Services Provided by Forests in Canada: Case Studies on Natural Capital and Conservation, TD Bank Group & the Nature Conservancy of Canada (TD/NCC, 2017)	$42,136 (2017$) *$43,105 (in 2018$)*	The ecosystem valuation is based on a valuation of air quality control/carbon sequestration and storage. The value is based on the Lusicich property in the Crowsnest Pass which is comprised of forests and grasslands and described as *a forested haven for wide-ranging carnivores, including the grizzly bear and the grey wolf. It also serves as a critical wildlife corridor*[7]. The study commented grasslands play a lesser role in removing atmospheric pollutants and air quality control.	The valuation estimates is a combination of ecosystem values from grasslands and forests. It is not clear the specific value used for the grasslands area.
	$5,800 (2017$) *$5,933 (in 2018$)*	The ecosystem valuation is based on a valuation of air quality control/carbon sequestration and storage. The value is based on the Maymont property in Saskatchewan. The property is along the North Saskatchewan River and is classified as an aspen parkland forest - in its native state, the aspen parkland features: trembling aspen, oak groves, mixed-tall shrubs and intermittent fescue grasslands[8].	The valuation estimates is a combination of ecosystem values from grasslands and forests. It is not clear the specific value used for the grasslands area.
Natural Capital – The Economic Value of the National Capital Commission's Green Network, National Capital Commission / David Suzuki Foundation (NCC/DSF, 2016)	$9,352 (2016$) *$9,716 (in 2018$)*	The ecosystem valuation is for an urban forest.	The valuation estimates is for an urban forest.
	$3,338 (2016$) *$3,468 (in 2018$)*	The ecosystem valuation is for prairies, pastures and grasslands. The geography covered in the study: Gatineau Park, the Greenbelt and Urban Lands - all have facilities to accommodate recreational activities (i.e. camp sites, parks and trials).	The valuation estimates is for a site that includes recreational facilities. The biome is comparable to the E.L. Smith site.
Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services, David Suzuki Foundation (DSF, 2008)	$3,652 (2008$) *$4,270 (in 2018$)*	The value cited is an average of ecosystem values from different ecosystem types, including wetland, grassland, forest, open water, etc. The ecosystem valuation used for grassland/pasture/hayfield is $354/Ha/Yr (2008$).	The valuation estimates are a combination of ecosystem values from different biomes.
HDR Literature Review	$2,000 (2017$) Maximum of about $14,000	The value cited is based on a literature review for a predominantly grassland biome. Valuations for grassland areas designated as parks are not included.	The valuation estimates are based on grassland sites not primarily used for recreational purposes.

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[7] *https://www.td.com/corporate-responsibility/td-forests/our-stories/protecting-crowsnest-pass.jsp*
[8] *http://www.natureconservancy.ca/en/where-we-work/saskatchewan/featured-projects/maymont-5.html*

Break Even Analysis

The MAE analysis from the HDR TBL Report of the two solar alternatives highlighted the trade-off between project cost and potential risk to the ecosystem at E.L. Smith. To provide decision makers with additional information and to put these two impacts in context, breakeven analysis was applied to determine how large the ecosystem damage would have to be at the E.L. Smith site to offset the $18.7 million in project cost differences. For the break even analysis, a hypothetical or absolutely worst case scenario was developed. In this hypothetical case, we assumed that the solar project alternatives result in a total eradication of all ecosystem value at the project sites during the 31 year project development and operational period. *Note this is purely illustrative as the Environmental Evaluation for the E.L. Smith Solar Farm produced by Stantec Consulting Ltd. (March 2018) and the Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm prepared by Stantec Consulting Ltd., February 2019 ("MEIA") did not conclude such an extreme impact on the ecosystem. This worst case analysis is used solely to put these potential impacts in greater context.*

The break even analysis showed that the loss in ecosystem value at the E.L. Smith project site would have to be in excess of $50,000 per hectare per year to offset the $18.7 million difference in project costs. The breakeven analysis illustrates that for the offsite solar alternative to be the preferred solar alternative, decision makers would have to (i) place a very high ecosystem value on the E.L. Smith site (relative to what found in the literature) and (ii) believe that the project development at the E.L. Smith site would result in very significant ecosystem damage which was not directly supported by the MEIA.

We have updated the analysis contained in the original report (Table 13) to reflect alternate ecosystem valuations from the combined literature review. The emission reduction benefits at both sites are comparable for both alternatives so we are comparing the difference in costs (E.L. Smith site is $18.7 million less over the project lifecycle) to the impact on the ecosystem at E.L. Smith[9]. To determine the potential ecosystem loss at the E.L. Smith site for inclusion in the analysis, we need to estimate:

(i) The existing ecosystem value of the site; and,
(ii) The value of any ecosystem loss due to potential adverse impacts of the project.

For the E.L. Smith site valuation, we use a range of estimates from the combined literature review (HDR's literature review augmented by those reports provided by the City). For the loss in ecosystem value at E.L. Smith due to potential adverse project impacts, we also use a range of scenarios:

a. A worst case – where all ecosystem value at E.L. Smith is lost due to the adverse project impacts. We acknowledge that this "worst case" is inconsistent with the MEIA outcomes, however, we provide these estimates for illustration only.

b. A middle case – where half of the ecosystem value is lost due to adverse project impacts. We recognize that is likely overstating the potential impact given the MEIA concluded that any adverse impacts were mostly in the range with some in the moderate range.

c. A lower case – where 20% of the ecosystem value is lost due to adverse project impacts.

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[9] *For pure simplicity and to be conservative, we have assumed no ecosystem loss at the offsite location.*

d. A no impact case – where the ecosystem value is not impacted. We acknowledge that this "no impact case" is inconsistent with the MEIA outcomes which identified some adverse project impacts, however, we provide these estimates for illustration only.

The results of the analysis across the range of values and impacts are presented in matrix format in Table 3. The values contained in the table represent the dollar value (in millions of dollars) over the project lifecycle of the net benefits of the project being developed at the E.L. Smith site as opposed to an offsite solar. As we see from the table, regardless of what scenario is assessed in terms of valuation and the potential negative effects on that ecosystem, the E.L. Smith site provides positive net benefits.

It is important to emphasize that several of these scenarios are based on assumptions that are inconsistent with the literature and MEIA findings, but they are still provided to provide additional context when interpreting the results.

Table 3: Summary of Monetized Effects to Society – Benefits of E.L. Smith Solar Project vs. Offsite Solar Under Various Scenarios, Net Present Value in Millions of 2018 Dollars

Basis of Ecosystem Value	Value Ha/Yr (2018$)	No Ecosystem Loss	20% Ecosystem Loss	50% Ecosystem Loss	100% Ecosystem Loss
HDR Average (grasslands)	$2,000	$18.7	$18.6	$18.4	$18.0
HDR Maximum (grasslands)	$14,558	$18.7	$17.6	$16.0	$13.3
HDR Urban Forest (maximum)	$21,310	$18.7	$17.2	$15.0	$11.2
HDR Urban Forest (average)	$11,934	$18.7	$17.9	$16.6	$14.5
OMNR (rec. value of greenspace)	$48,616	$18.7	$15.4	$10.5	$2.3
OMNR (urban forests)	$34,565	$18.7	$16.4	$12.9	$7.0
TD/NCC (Lusicich property)	$43,105	$18.7	$15.6	$10.8	$2.8
NCC (urban forest)	$9,716	$18.7	$18.0	$17.0	$15.2
TD/NCC (Maymont property)	$5,933	$18.7	$18.3	$17.7	$16.6
NSR (North Saskatchewan River)	$4,270	$18.7	$18.5	$18.1	$17.4
NCC (grasslands, Gatineau Park)	$3,468	$18.7	$18.5	$18.1	$17.5

Also, note that the estimates of the Net Benefits of developing the project at the E.L. Smith site as opposed to the offsite solar location include a number of assumptions that lower the magnitude of the estimates of net benefits:

(i) There is no adverse impact to the ecosystem at the offsite solar location;
(ii) No value is given to the educational potential at the E.L. Smith site;
(iii) No value is given for the improvement to vegetation species and communities at the E.L. Smith site; and,
(iv) No value is given to the net gain in area of native trees and shrubs after re-vegetation at the E.L. Smith site (at the 40 meter wide vegetated buffer for additional wildlife structural connectivity).

Conclusions

To conclude,

1. The August 2018 HDR Triple Bottom Line Report identified that:

   i. It would cost $18.7 million less to develop the solar project at the E.L. Smith site.
   ii. Developing the project at the E.L. Smith site would have a greater risk of potential adverse ecosystem consequences, specifically related to “habitat and wildlife” and “cultural and amenity services”.
   iii. For the offsite solar alternative to be the preferred alternative, decision makers would have to (i) place a very high ecosystem value on the E.L. Smith site (relative to what found in the literature) and (ii) believe that the project development would result in potential adverse ecosystem impacts that are high in magnitude.

2. To put into a quantitative context the potential value of any adverse ecosystem impacts due to the project at E.L. Smith, HDR conducted a literature review of ecosystem values of predominantly “grassland” sites. This review resulted in an average value of $2,000 per hectare per year and a maximum value of $14,213 per hectare per year. In this review, HDR did not consider any valuations for grassland sites that are designated as “parks” as the E.L. Smith site is a restricted fenced site that is not available for recreation. As the site is contained within an urban forest, we note that recent valuations for urban forests in Canada are as high as $21,310 (in 2018$).

3. Additional sources of literature has been provided to be considered in this triple bottom line analysis. The range of ecosystem values from this literature ranges between $3,468 per hectare per year and $48,616. The values in these additional sources of literature are broadly consistent with that reported in the original HDR report for various biomes. However, the majority of this literature were not initially included in HDR’s literature review as: (i) the review is not indicative of grassland ecosystem valuations but rather reflects a variety biomes; and (ii) the review is generally focused on parks or recreational sites.

4. HDR conducted economic analysis to determine the benefits of project development at E.L. Smith (as opposed to off-site solar) considering a wide range of assumptions including all ecosystem valuations as identified in the additional literature. Regardless of which of these assumptions are leveraged, including the high value of $48,616 per hectare per year, the CBA outcomes indicate that the E.L. Smith development provides net public benefits.

In summary, HDR’s original conclusions remain: for the offsite solar alternative to be the preferred alternative, decision makers would have to: (i) place a very high ecosystem value on the E.L. Smith site and (ii) believe that the project development at E.L. Smith would result in adverse impacts to the ecosystem that are high in magnitude. The high ecosystem valuation for the E.L. Smith project site is not supported by the literature. The potential for adverse ecosystem impacts that are high in magnitude are not supported by the MEIA.

Appendix A – HDR Literature Review Sources

The following provides the literature review sources that HDR used to create an ecosystem value for grasslands.

1. GHK Consulting, Benefits of Sites of Special Scientific Interest, 2011

2. Wilson, S. J., Lake Simcoe Basin's Natural Capital: The Value of the Watershed's Ecosystem Services, 2008

3. Thompson, J. and M. Anielski, Economic Activity and Ecosystem Services in the North Saskatchewan River Basin, 2010

4. Chadsey, M., Z. Christin and A. Fletcher, Open Space Valuation for Central Puget Sound, 2015

5. Liu, S., R. Costanza, A. Troy, J. D'Aagostino and W. Mates, Valuing New Jersey's Ecosystem Services and Natural Capital: A Spatially Explicit Benefit Transfer Approach, 2010

6. Batker, D., Z. Christin, R. Schmidt and I. de la Torre, The Economic Impact of the 2013 Rim Fire on Natural Lands: Preliminary Assessment, 2013

7. Batker, D., Z. Christin, C. Cooley, W. Graf, K. B. Jones, J. Loomis and J. Pittman, Nature's Value in the Colorado River Basin, 2015

8. Wilson, S. J., Ontario's Wealth, Canada' Future: Appreciating the Value of the Greenbelt's Eco-Services, 2008

9. Batker, D., M. Kocian, B. Lovell and J. Harrison-Cox, Flood Protection and Ecosystem Services in the Chehalis River Basin, 2010

10. Batker, D., I. De la Torre, M. Kocian and B. Lovell, The Natural Economy of the Nisqually Watershed, 2009

11. Constanza, R., M. Wilson, A. Troy, A. Voinov, S. Liu and J. D'Agostino, The Value of New Jersey's Ecosystem Services and Natural Capital, 2006

12. Anielski, M. and S. Wilson, The Real Wealth of the Mackenzie Region: Assessing the Natural Capital Values of a Northern Boreal Ecosystem, 210

13. Herrera Environmental Consultants, Inc., Northern Economics, Inc. and Spatial Informatics Group, LLC., Ecological Economic Evaluation – Maury Island, King County, Washington, 2004

14. Troy, A. and K. Bagstad, Estimating Ecosystem Services in Southern Ontario, 2009

15. Jacobs U.K. Limited, 7. Biodiversity Ecosystem Services, 2014

16. Austin D., G. Cerman, T. Heywood, R. Marshall, K. Refling, and L. Van Patter, Valuing capital and Ecosystem Services, April 2012

17. Kennedy, Mike and Jeff Wilson, Estimating the Value of Natural Capital in the Credit River Watershed, November 2009.

18. van der Ploeg, Sander, Dolf de Groot, Yafei Wang, The TEEB Valuation Database, Appendix C, June 2010

Appendix B – Additional Literature Review

Table 4: Sources of Ecosystem Values from *Mapping the Off-Site Benefits from Protected Areas' Ecosystem Services, Ontario Ministry of Natural Resources (2013)*

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Ecosystem Descriptions	Original Source
1	Urban greenspace	Recreation and mental and physical health	2004	$43,696 2011 CAD	$10,015 USD - $18,444 USD/ha/yr	Ecosystem values based on regression analysis of consumer willingness to pay for an attribute, which can be implicitly estimated by nearby real estate parameters.	Use small parks (< 50 acres) which are primarily located in urban/suburbanized areas, as a functional representative of urban greenspace.	The Value of new Jersey's Ecosystem Services and Natural Capital, 2006
2	Agricultural areas (crops/pasture land)	Recreation and mental and physical health	1982		$104 USD/ha/yr	The study estimated nonmarket values by different land uses in Georgia, using an energy analysis method. It uses the Gross Primary Production as an index of the total energy capture by each land type, and use a dollar-energy conversion factor.		Market and Nonmarket Values of the Georgia Landscape, 1988
3	Grassland/pasture/ hayfield in urban and suburban areas	Recreation and mental and physical health	2011		$34,679 CAD/ha/yr	Analyzed an urban park (Pennypack Park in Philadelphia) to evaluate per acre parkland value on property rent.	Pennypack Park includes about 1,600 acres of woodlands, meadows and wetlands. The park also has playgrounds, hiking and bike trails, bridge paths and historic structures.	The Effect of a Large Urban Park on Real Estate Value, 1974
4	Forest	Local climate and air quality; Carbon sequestration and storage	2008	$31,067 2011CAD	$68 USD/ton	The study did not directly estimate valuations for a specific ecosystem. It estimated the social cost of carbon, using meta-analysis to capture the marginal damage costs for emissions.		The Social Cost of Carbon: Trends, Outliers and Catastrophes

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Ecosystem Descriptions	Original Source
5	Forest	Waste-water treatment	2008		$474 CAD/ha/yr	The study focused on the ecosystem value of Ontario's Greenbelt (1.8 million acres) by land cover type. OMNR picked the valuations on forests, which takes up 183 thousand hectares of the Greenbelt. Value of water filtration calculated based on the negative correlation of cost of surface water treatment and per cent forest cover from a U.S. study.		Ontario’s Wealth, Canada’s Future: Appreciating the Value of the Greenbelt’s Eco-Services, 2008
6	Forest	Erosion prevention and maintenance of soil fertility	2008		$1,523 CAD/ha/yr	Value of water regulation calculated as a replacement value of water run-off control is the current forest cover was removed.		
7	Forest	Pollination	2005		$2,100 USD - $9,400 USD /ha/yr	The study focused on the valuation of seed dispersal service for oak trees by jays in the National Urban Park of Stockholm (2,700 hectares) in Sweden. Seed dispersal is valuated as the replacement cost of replacing the service through human means.		Economic valuation of a seed dispersal service in the Stockholm National Urban Park, Sweden, 2006
8	Urban forest	Recreation and mental and physical health	1995		$3,480 USD /ha/yr	The study surveyed residents' WTP for forests, specifically for its recreation benefits in Finland. WTP gives the use value per visitor per month, multiplied by total residents and proportion of active users and 12 months, gives the annual recreation value. Total value divided by total hectares is the forest recreation value per ha per year. Differences in values can be explained by residents’ WTP		Economic Valuation of Urban Forest Benefits in Finland, 2001.
9					$34,320 USD/ha/yr			
10					$6,908 USD /ha/yr			
11					$2,356 USD /ha/yr			
12					$3,915 USD/ha/yr			

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Ecosystem Descriptions	Original Source
13					$ 9,293 USD /ha/yr	on different forest areas, proportion of active users among residents as well as total hectares of different areas.		
14	Urban forest	Recreation and mental and physical health	2003		$3, 330 USD/ha/yr	The study used contingent valuation method to estimate respondents' WTP on Kwanggyo Mountain in Seoul, Korea.		Estimating the public's value for urban forest in the Seoul metropolitan area of Korea, 2003
15	Forest	Recreation and mental and physical health	2011		$1,221	The paper presents a case study valuation of public access to a woodland site in Windsor Forest.		Value of footpath provision in the countryside: A case-study of public access to urban-fringe woodland, 1995

Table 5: Sources of Ecosystem Values from *Putting a Value on the Ecosystem Services Provided by Forests in Canada: Case Studies on Natural Capital and Conservation, TD Bank Group & the Nature Conservancy of Canada (2017)*

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Ecosystem Descriptions	Original Source
1	Forest with grassland (Montane Forest Region, Alberta)	Local climate and air quality Carbon sequestration and storage	2017	$42,000 CAD /ha/yr in 2017CAD	$42,136 CAD /ha/yr	31,000 tonnes of carbon stored within the property itself provide the majority of the annual service value	The study estimated ecosystem value of the Lusicich property (106 hectares) in southeast Alberta, which is characterized by forests and grasslands.	Putting a Value on the Ecosystem Services Provided by Forests in Canada: Case Studies on Natural Capital and Conservation. TD Economics & Nature Conservancy of Canada, 2017
2	Forest with grassland and river frontage (Maymont, Saskatchewan)	Local climate and air quality		$5,800 CAD /ha/yr in 2017CAD	$5,800 CAD /ha/yr	Evaluation lower than the rest, which could be explained by the majority of grasslands in the property. Grasslands pay a lesser role in removing atmospheric pollutants.	The 55-hectare Maymont property is located along the Saskatchewan River, characterized by forests, grasslands and river frontage.	

Table 6: Sources of Ecosystem Values from *Natural Capital – The Economic Value of the National Capital Commission's Green Network, National Capital Commission / David Suzuki Foundation (2016)*

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Ecosystem Descriptions	Original Source
1	Urban forest	Carbon sequestration and storage	2016	$9,352 CAD /ha/yr in 2016CAD	$83 CAD /ha/yr	To evaluate carbon sequestration, used social cost of carbon from Environmental Climate Change of Canada ($43/tonne of CO2) and carbon sequestration from Environmental Canada.	Gatineau Park contains approximately 50 lakes and hundreds of ponds, with hiking trails and camping sites. 3/4 of the neighbouring lands are agricultural.	Natural Capital: The economic value of National Capital Commission Green Network
2		Carbon sequestration and storage	2016		$158 CAD /ha/yr	To evaluate carbon storage, it used findings by Kurz and Apps, which estimated the stock of carbon stored in cool temperate forests (220 tonnes/ha), multiplied by the total hectares of NCC forests.		
3		Erosion prevention and maintenance of soil fertility	2016		$211 CAD /ha/yr	Not specified		
4		Pollination	2016		$31 CAD /ha/yr	Used market pricing method (revenue minus cost) to determine the benefits of pollination.	75% of the Greenbelt comprises natural areas, agricultural lands and forests. 5% is taken up by roads and the remainder serves recreational, residential commercial and institutional uses.	
5		Habitats for species	2016		$2,688 CAD /ha/yr	Based on 17 different monetary estimates		
6		Moderation of extreme events	2016		$5,030 CAD /ha/yr	Not specified		
7		Biological control	2016		$42 CAD /ha/yr	Not specified		
8		Recreation and mental and physical health	2016		$75 CAD /ha/yr	Collected user fees in the NCC area from 2014 - 2015, divided by total hectares.		
9		Carbon sequestration and storage	2016		$554 CAD /ha/yr	Values retrieved from a series of independent studies (benefit transfer method with adjustment), studies not specified.		Unclear where the numbers come from
10		Waste-water treatment	2016		$340 CAD /ha/yr			

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Ecosystem Descriptions	Original Source
11		Waste-water treatment	2016		$140 CAD /ha/yr		The Urban Lands are located in Ottawa and Gatineau. 20% are conservation areas, 22% are natural areas. The remaining are comprised of agricultural land, recreational areas and various types of sites such as parkways, picnic areas and trails.	
12	Prairies, pastures and grasslands	Food	2016	$3,338 /ha/year in 2016 CAD	$116 CAD /ha/yr	Calculated an economic rent (balance between income coming from the sale of hay and the cost of production.		Natural Capital: The economic value of National Capital Commission Green Network
13		Carbon sequestration and storage	2016		$418 CAD/ha/yr	Evaluated cost of carbon from Environmental Climate Change of Canada ($43/tonne of CO2), multiplied by tonnes of carbon per grassland hectare (Smith et al. (2001)).		
14		Pollination	2016		$31 CAD/ha/yr	Used market pricing method (revenue minus cost) to determine the benefits of pollination.		
15		Biological control	2016		$42 CAD/ha/yr	Not specified		
16		Recreation and mental and physical health	2016		$75 CAD/ha/yr	Used market pricing (revenue minus cost) method to determine the benefits of recreation.		
17		Erosion prevention and maintenance of soil fertility	2016		$109 CAD/ha/yr	Values retrieved from a series of independent studies (benefit transfer method with adjustment), studies not specified.		Unclear where the numbers come from
18		Habitats for species	2016		$2,324 CAD/ha/yr			
19		Erosion prevention and maintenance of soil fertility	2016		$147 CAD/ha/yr			
20		Aesthetic appreciation and inspiration for culture, art and design	2016		$76 CAD/ha/yr			

Table 7: Sources of Ecosystem Values from *Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services, David Suzuki Foundation (2008)*

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
1	Wetland: Open Water	Carbon sequestration and storage	2016	$3,652/ha/yr in 2008 CAD	Open water: River $13,740 2008$/ha	Carbon storage determined using Canada's Soil Organic Carbon Database. Used an estimate damage cost of carbon emissions as the benefit from wetland carbon storage.	Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services, 2008
2		Carbon sequestration and storage	2016			Carbon sequestered based on the global average of sequestration rates for wetlands. Used an estimate damage cost of carbon emissions as the benefit from wetland carbon uptake.	
3	Wetland	Food (i.e. commercial fishery)	1989			Employed WTP and energy analysis based methodology. Estimated wetland valuation in Louisiana	Valuation and Management of Wetland Ecosystems
4		Raw material (i.e. fur trapping)					
5		Recreation and mental and physical health					
6		Moderation of extreme events					

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
7		Moderation of extreme events	1997			Economic analysis used to estimate the total cost of flooding protection in the absence of wetlands in Lynnwood and Renton in Washington, as the opportunity costs of losing wetland.	The Economic Value of Wetlands. Wetland's Role in Flood Protection in Western Washington
8	Wetland: Open Water	Waste-water treatment	2016			Same methodology as No.5	Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services, Wilson 2008
9		Waste-water treatment	2016			Estimated the cost of water contamination as benefit of waste treatment	
10		Habitat	2016			Estimated based on the wetland habitat restoration costs for different projects.	
11		Recreation and mental and physical health	2016			Survey asking respondents' WTP	
12	Agricultural lands	Carbon sequestration and storage	2008		Agriculture/Cropland: $291 2008$/ha	Used cost of carbon as an estimate.	
13		Recreation and mental and physical health	2007			Used travel cost model to estimate the value of providing deer hunters public access to additional agricultural lands (10 % of total private agricultural land to deer hunters). Southern lower Peninsula in Michigan was considered for the study.	Valuing deer hunting ecosystem services from farm landscapes
14		Recreation and mental and physical health	2004			Used residents' WTP for wildlife hunting in Ontario. Case study on the Grand River watershed in southern Ontario	The Value of Natural Capital in Settled Areas of Canada
15		Other Cultural	2011			Original source unavailable. Information obtained from the OMNR study.	Estimating the benefits of agri-environmental policy: econometric issues in open-ended

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
							contingent valuation studies
16		Recreation and mental and physical health	1994			Contingent valuation method to assess the nonmarket value of farmland in the Moncton area of New Brunswick.	Estimation of the Nonmarket Benefits of Agricultural Land Retention in Eastern Canada
17		Other Cultural	2011			Original source unavailable. Information obtained from the OMNR study.	Market and nonmarket values of the Georgia landscape
18		Recreation and mental and physical health	1985			Contingent valuation method to assess the amenity values of agricultural lands, in Greenville County, South Carolina.	Public Environmental Amenity Benefits of Private Land: the Case of Prime Agricultural Land
19		Pollination	2011			Original source unavailable. Information obtained from the OMNR study.	Estimating the Economic Value of Honey-Bees (Hymenoptera, Apidae) as Agricultural Pollinators in the United-States
20		Pollination	2011				The value of honey bees as pollinators of US crops
21	Grassland/pasture	Carbon sequestration and storage	2004		Grassland/pasture/hayfield $354 2008$/ha	Study region on the Mill River watershed located in western Prince Edward island	The Value of Natural Capital in Settled Areas of Canada

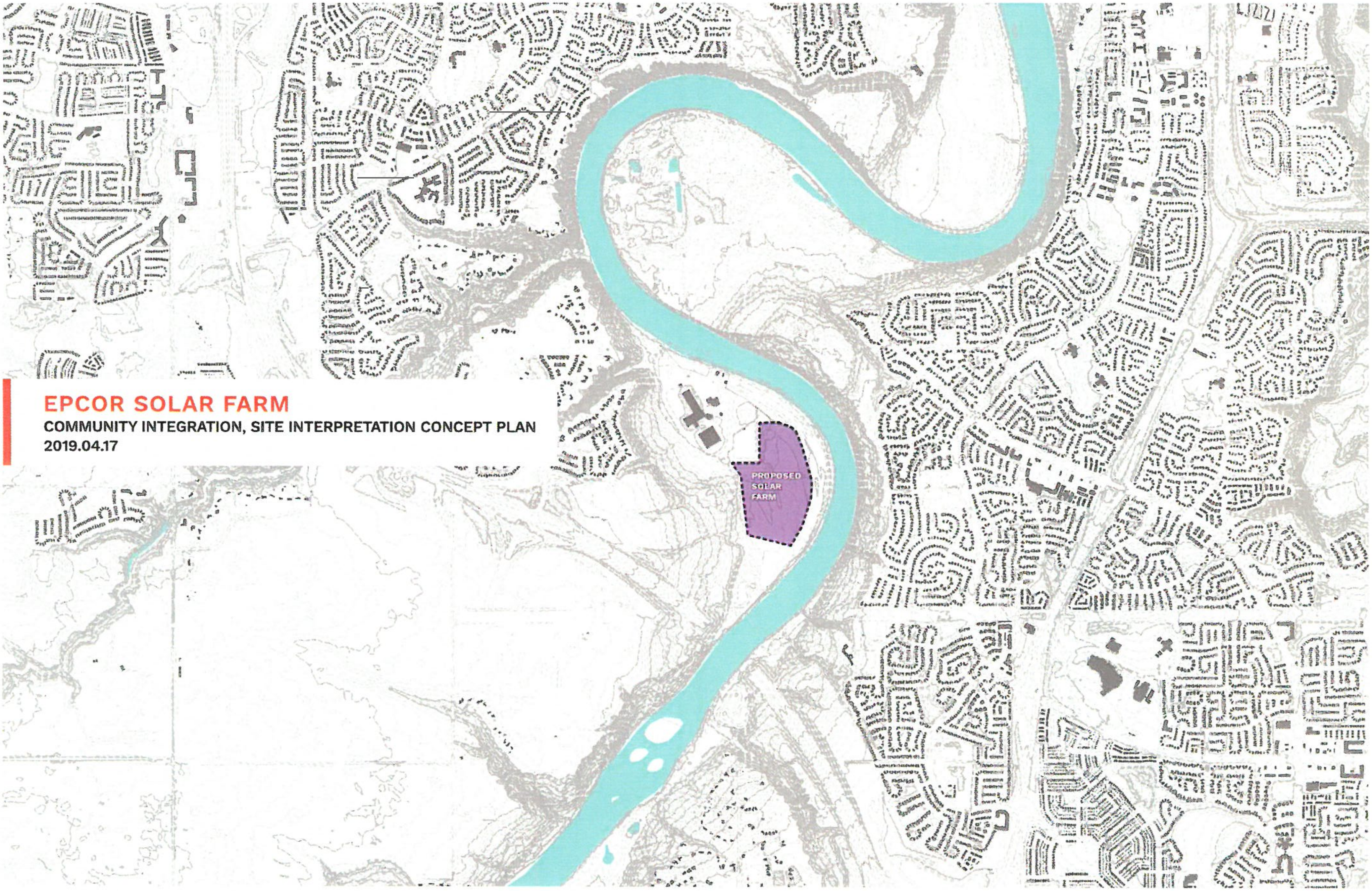
#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
22		Erosion prevention and maintenance of soil fertility	2004			Study region on the Grand River Watershed in southern Ontario	
23		Erosion prevention and maintenance of soil fertility	2004			Study region on the Grand River Watershed in southern Ontario. More than 75 percent of the watershed is agricultural land.	
24		Waste-water treatment	2004				
25		Recreation and mental and physical health	2004				
26		Habitat	2011			Original source unavailable. Information obtained from the OMNR study.	A Comparison of User Benefits and Costs of Nature Conservation at Three Nature Reserves
27							Estimation of the Passive Use Value Associated with Future Expansion of Provincial Parks and Protected Areas in Southern Ontario

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
28		Recreation and mental and physical health	1982			The study estimated nonmarket values by different land uses in Georgia, using an energy analysis method. It uses the Gross Primary Production as an index of the total energy capture by each land type, and use a dollar-energy conversion factor.	Market and Nonmarket Values of the Georgia Landscape, 1988
29		Pollination	2011			Original source unavailable. Information obtained from the OMNR study.	Pollinators provide economic incentive to preserve natural land in agro ecosystems
30	Forest	Recreation and mental and physical health	2000		Forest: non-urban $4,443 2008$/ha	Study conducted on 26 forests in Northern Ireland and Republic of Ireland, surveyed respondents' WTP for preserved forests	Valuing the recreational benefits from the creation of nature reserves in Irish forests
31		Local climate and air quality; Carbon sequestration and storage	2008			The study did not directly estimate valuations for a specific ecosystem. It estimated the social cost of carbon, using meta-analysis to capture the marginal damage costs for emissions.	The Social Cost of Carbon: Trends, Outliers and Catastrophes
32		Cultural and Amenity Services	2011			Original source unavailable. Information obtained from the OMNR study.	Regional forest resource accounting: a northern Alberta case study
33							How much primary coastal temperate rain forest should society retain? Carbon uptake, recreation, and other values
34							Economic Amenity

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
							Values of Wildlife - 6 Case-Studies in Pennsylvania
35							The Recreational Value of the Forestry Commission Estate in Great-Britain - a Clawson-Knetsch Travel Cost-Analysis
36							
37							
38							
39							
40		Habitat					Regional forest resource accounting: a northern Alberta case study
41							Analysis of "Don't know" responses to referendum contingent valuation questions
42		Cultural and Amenity Services					Estimation of the Passive Use Value Associated with Future Expansion of Provincial Parks and Protected Areas in Southern Ontario
43	Lake	Recreation and mental and physical health	1984		Open water: urban/suburban river $236,391 2008$/ha Open water: inland lake $5,050 2008$/ha	Travel cost method used. Survey conducted at St. Albans Bay in Vermont which is located on the northeastern portion of Lake Champlain. Lake Champlain is approximately 1,700 acres with maximum depth of 40 feet and mean depth of 27 feet.	The importance of sample discrimination in using the travel cost method to estimate the benefits of improved water quality

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
44	Lake	Cultural and Amenity Services	1983			Study conducted on the Okoboji Lakes region of northwest Iowa. The study compares different valuation techniques for water quality, resulting in different values.	Okoboji experiment: Comparing non-market valuation techniques in an unusually well-defined market for water quality
45	Lake	Recreation and mental and physical health	1997			The study focus on the user benefits from canoeing in wilderness parks in Ontario: Quetico, Killarney and Algonquin	Wildness canoeing in Ontario: using cumulative results to update dichotomous choice contingent valuation offer amounts
46	Reservoirs	Recreation and mental and physical health	1993			Study based on the Tennessee Valley Authority which maintains an extensive reservoir system, made up of 52 dams along the river. The study focuses the impact of flood control drawdown on the suitability of the reservoirs for recreational activities such as boating, sailing etc. Use WTP as a measurement	Comparison of recreation use values among alternative reservoir water level management scenarios
47	Lake	Cultural and Amenity Services	1979			The study focuses on the declining water quality in Pike Lake in Wisconsin, and a proposed storm sewer diversion project	Procedures in Estimating Benefits of Water Quality Change

#	Ecosystem Type	Benefit Category	Year	Value Cited ($/Ha/Yr)	Ecosystem Values	Methodology	Original Source
48	River basins	Regulating services	2004			A case study conducted on the renaturated River Jossa in Germany. Examined the benefits associated with increased nitrogen retention from reintroduction of beaver.	Valuation of ecosystem services provided by biodiversity conservation: an integrated hydrological and economic model to value the enhanced nitrogen retention in renaturated streams
49	River basins	Cultural and Amenity Services	1990			Selected river basins in Iowa and Illinois: Greenbelts - corridors of riparian wetland forest.	Greenbelts in the Cornbelt: Riparian Wetlands, Intrinsic Values and Market Failure
50	Wetlands	Cultural and Amenity Services	1996			4 types of wetlands in Ramsey County, Minnesota were examined. These types of wetlands are: forested, scrub-shrub, open water and emergent vegetation.	The Influence of wetland type and wetland proximity on residential property values
51	Hardwood forest wetlands	Cultural and Amenity Services	1991			The western Kentucky coalfield, along the lower Ohio River, contains bottomland hardwood forest wetlands. The research measured the total valuation of the Clear Creek wetland in Kentucky.	Measuring contingent values for wetlands: Effects of Information about related environmental goods



EPCOR SOLAR FARM

COMMUNITY INTEGRATION, SITE INTERPRETATION CONCEPT PLAN

2019.04.17

1.1 INTEGRATE THE SOLAR FARM WITH THE CITY OF EDMONTON'S RIBBON OF GREEN PLAN

Considerations

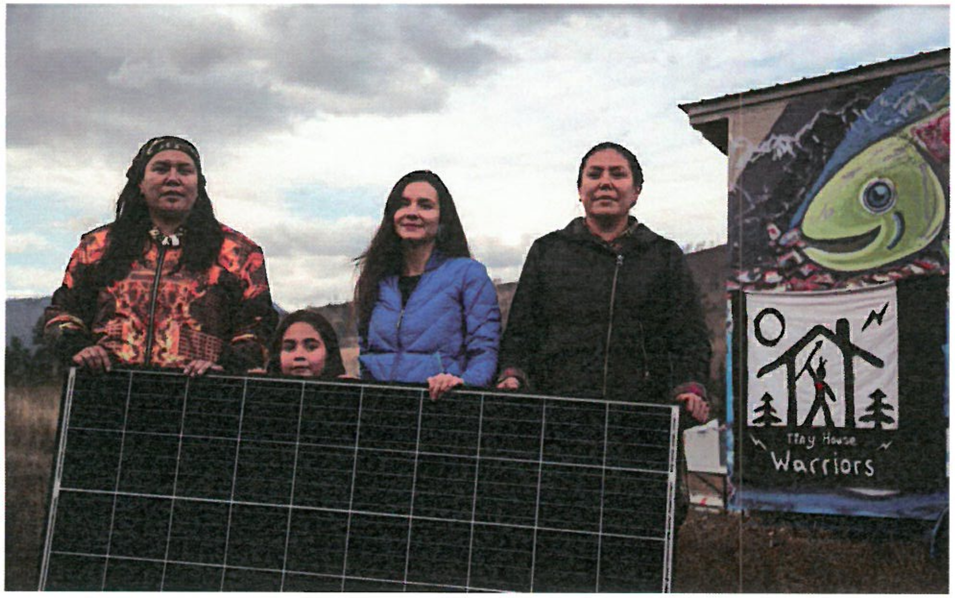
- WILDLIFE PASSAGES AS RECOMMENDED BY THE CITY OF EDMONTON'S RIBBON OF GREEN PLAN
- ENHANCED TRAILS ALONG THE SOLAR FARM THAT ALIGN WITH TRAILS PROPOSED BY RIBBON OF GREEN
- TRAIL HEAD ADJACENT TO PROPOSED SOLAR FARM LOCATION

1.2 ENHANCE THE SOLAR FARM AESTHETICS AND THE NATURAL LANDSCAPE

Considerations

- LOOK AT FENCE TYPES THAT ARE AESTHETICALLY PLEASING AND THAT ALLOWS VIEWS OF THE SOLAR FARM, OR SCREENS THEM OUT STRATEGICALLY AT LOCATIONS IN CONJUNCTION WITH SUITABLE PLANTINGS
- SETTING THE FENCE HEIGHT AT A LEVEL THAT ALLOW WILDLIFE PASSAGE UNDERNEATH
- PLANTINGS AND STRUCTURES THAT ENHANCE THE AESTHETIC AND NATURAL QUALITY OF THE SITE: NATIVE SPECIES OF FLOWERS AND GRASSES THAT PROVIDE A SCENIC EFFECT AT THE BASE OF SOLAR PANELS, BEE HOTELS OR OTHER CONSIDERATIONS THAT PROVIDE FOR POLLINATOR HABITAT, OTHER CONSIDERATIONS FOR ANIMAL HABITATS, ETC.
- POLLINATOR-FRIENDLY OR OTHER HABITAT SUPPORTING GROUND COVER FOR NATIVE BEES WHICH ARE MAINLY SOLITARY BEES AND ARE MOST EFFICIENT POLLINATORS COMPARED TO HONEY BEES

1.3 PROVIDE EDUCATIONAL OPPORTUNITIES IN COLLABORATION WITH INDIGENOUS COMMUNITIES



Considerations

- PLANT FIRST NATIONS SPECIES THAT PROVIDE FOR MEDICINAL OR SPIRITUAL USES
- POTENTIAL FOR INTERPRETATION POINTS FOR FIRST NATIONS STORIES OR ART ALONG THE POTENTIAL TRAILS AROUND THE SITE
- CELEBRATE THE SIGNIFICANCE OF THE SITE'S CULTURAL HERITAGE
- CREATE INTERPRETIVE SIGNAGE DISPLAYS THAT CAN BE ON THE PERIMETER OF THE SITE THAT CAN TELL OF PAST HISTORICAL USE OF THE LAND, POTENTIAL FUTURE USE, DETAILS ABOUT THE SOLAR FARM, ETC.

1.4 CONSTRUCT AN INTERACTIVE PUBLIC DEMONSTRATION SITE TO SHOWCASE THE SOLAR FARM

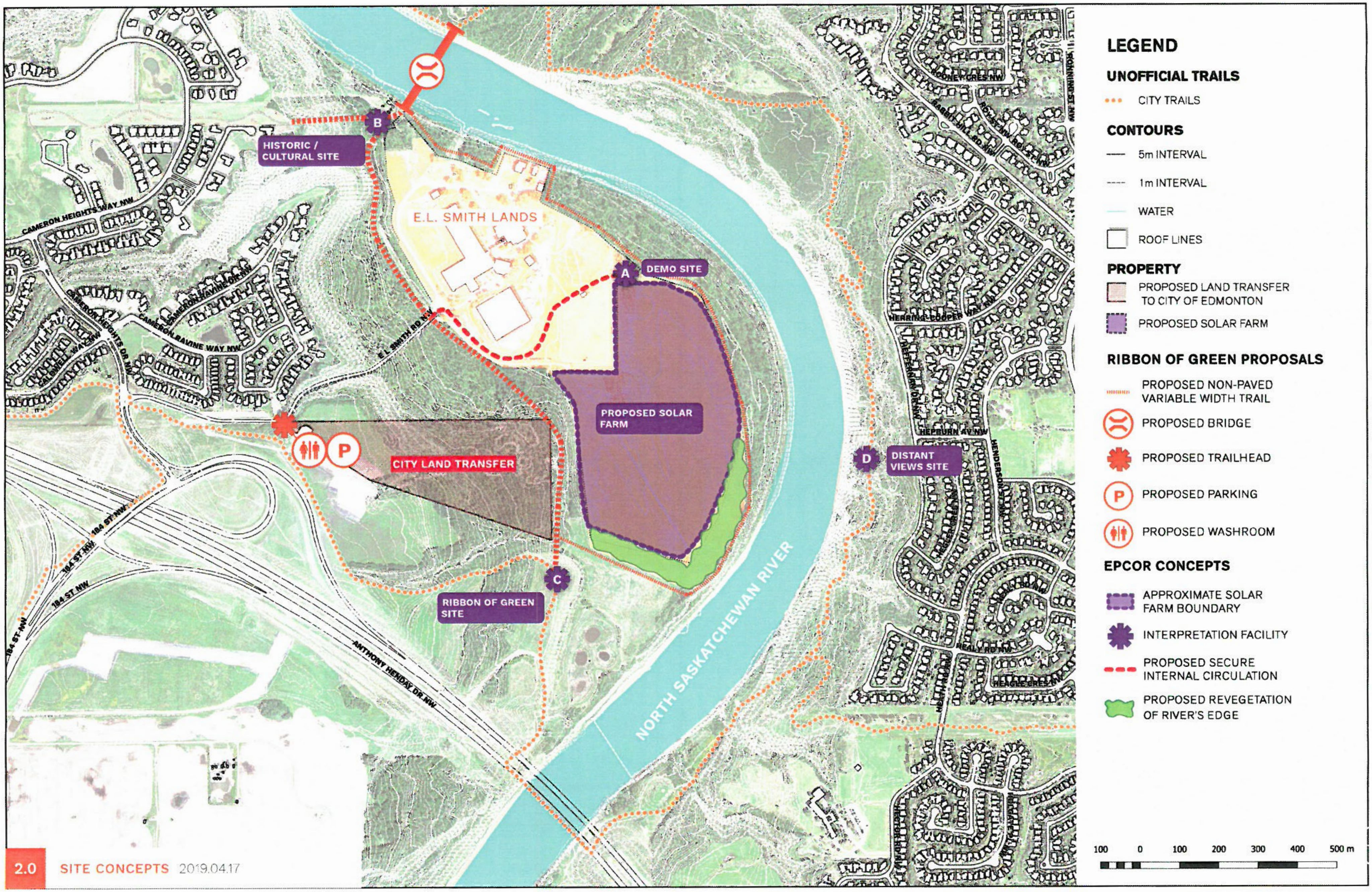
Considerations

- INTEGRATE WITH EXISTING EDUCATION INSTITUTIONS FROM KINDERGARTEN TO UNIVERSITY TO PROVIDE TOURS AND TEACHING OPPORTUNITIES
- POST REAL-TIME POWER PRODUCTION STATS OF THE SOLAR FARM ONLINE OR OTHER INTERACTIVELY INTERPRETIVE IDEAS
- INTERPRETATION OF THE SITE AT KEY POINTS ALONG THE TRAIL
- CREATE A GATHERING PLACE / PLAZA OR PICNIC AREA THAT CAN BE USED FOR TOURS OF THE SITE

1.5 ESTABLISH LONG TERM PARTNERSHIPS TO SUPPORT EDUCATIONAL & RESEARCH OPPORTUNITIES

Considerations

- OFFER PUBLIC TOURS OF THE SITE & HOST COMMUNITY EVENTS
- WORK INTO EXISTING CITY PROGRAMS SUCH AS SCHOOL TOURS ETC.
- INTERFACE WITH OTHER INSTITUTIONS SUCH AS NAIT, THE UNIVERSITY OF ALBERTA, THE PUBLIC SCHOOL SYSTEM ETC., TO ADVANCE RESEARCH AND EDUCATION ABOUT RENEWABLE ENERGY
- UNDERTAKE RESEARCH ON SOLAR FARM RELATED IMPACTS


HISTORIC / CULTURAL SITE
B
E.L. SMITH LANDS
A
DEMO SITE
PROPOSED SOLAR FARM
CITY LAND TRANSFER
P
C
RIBBON OF GREEN SITE
D
DISTANT VIEWS SITE
NORTH SASKATCHEWAN RIVER
CAMERON HEIGHTS WAY NW
CAMERON RAVINE DR NW
CAMERON RAVINE WAY NW
CAMERON HEIGHTS DR NW
E.L. SMITH RD NW
184 ST NW
ANTHONY HENDAY DR NW
ROONEY CRES NW
HERRING-COOPER WAY NW
HEPBURN AV NW
HENDERSON ST NW
HEALY RD NW
LEGEND
UNOFFICIAL TRAILS
CITY TRAILS
CONTOURS
5m INTERVAL
1m INTERVAL
WATER
ROOF LINES
PROPERTY
PROPOSED LAND TRANSFER TO CITY OF EDMONTON
PROPOSED SOLAR FARM
RIBBON OF GREEN PROPOSALS
PROPOSED NON-PAVED VARIABLE WIDTH TRAIL
PROPOSED BRIDGE
PROPOSED TRAILHEAD
PROPOSED PARKING
PROPOSED WASHROOM
EPCOR CONCEPTS
APPROXIMATE SOLAR FARM BOUNDARY
INTERPRETATION FACILITY
PROPOSED SECURE INTERNAL CIRCULATION
PROPOSED REVEGETATION OF RIVER'S EDGE
100 0 100 200 300 400 500 m
2.0 SITE CONCEPTS 2019.04.17

PHYSICAL AND PROGRAMMABLE ELEMENTS

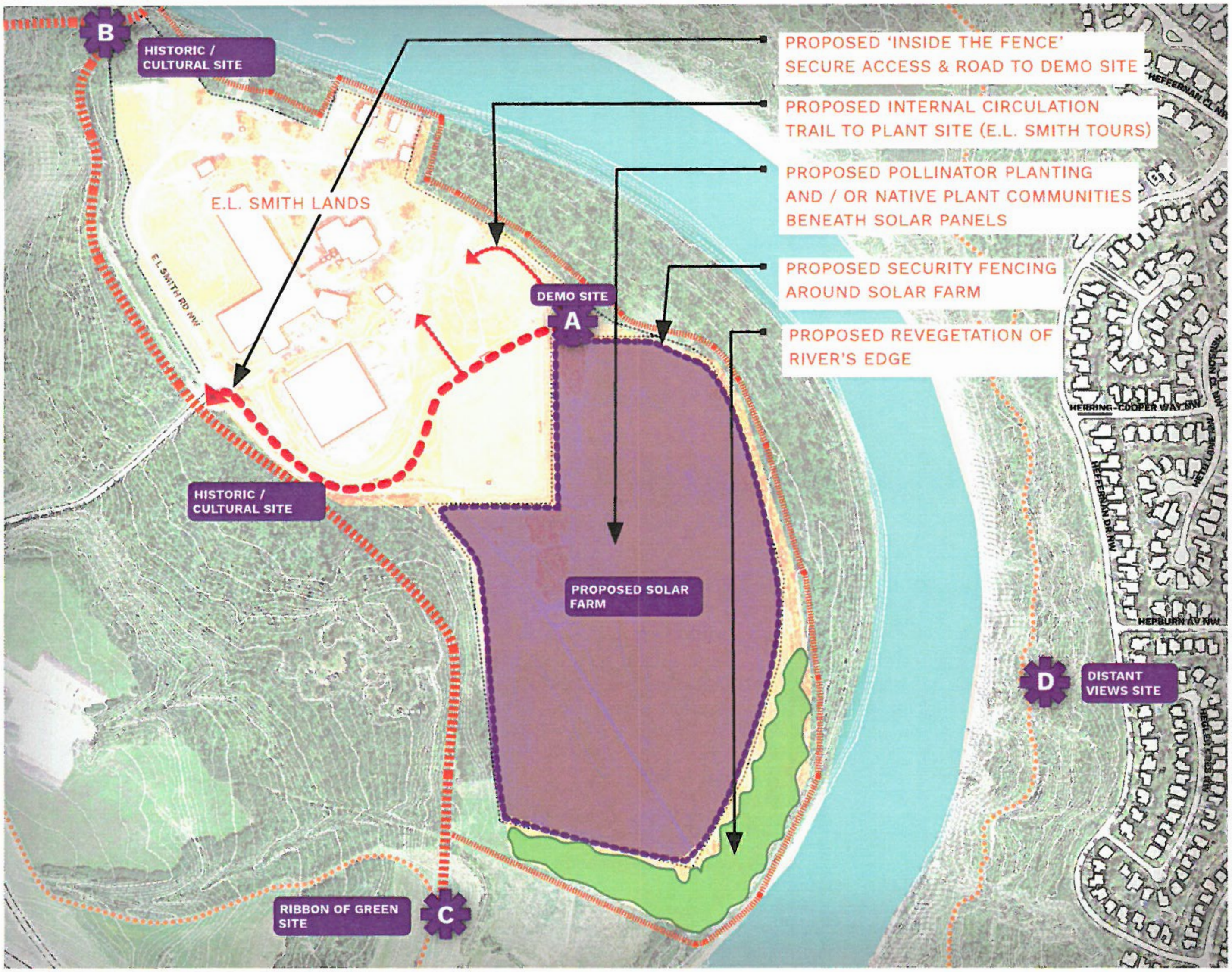
SITE	MUST HAVE	NICE TO HAVE	GREAT TO HAVE	RELEVANT PROJECT OBJECTIVES
A DEMO SITE	• INTERPRETATION PANELS • DEMONSTRATION SOLAR PANEL • PARKING / BUS TURNAROUND & DROP-OFF • ENHANCED PLANTING & LANDSCAPE TREATMENT • UPGRADE FENCING	• SITE STRUCTURE / ENCLOSURE • ELEVATED VIEW DECK / DEMONSTRATION PLATFORM • AREA TO WALK THROUGH SOLAR PANELS • APIARY: HONEY BEES, BEE HOTELS	• CLIMATE CONTROL FOR SITE STRUCTURE / ENCLOSURE • INTERPRETATION PANELS THAT ARE RESPONSIVE & INTERACTIVE • WILDLIFE INFORMATION: BIRDS, VEGETATION, ETC.	2 ENHANCE AESTHETICS & NATURAL LANDSCAPE 4 CONSTRUCT AN INTERACTIVE PUBLIC DEMONSTRATION SITE TO SHOWCASE THE SOLAR FARM 5 ESTABLISH LONG TERM PARTNERSHIPS TO SUPPORT EDUCATIONAL & RESEARCH OPPORTUNITIES
B HISTORIC / CULTURAL SITE	• FIRST NATIONS STORYTELLING & INTERPRETATION OF SITE HISTORY • SMALL PLAZA AND PUBLIC SEATING AREA • INTERPRETATION SIGNAGE WITH INDIGENOUS NAMES	• FIRST NATIONS ARTISTS PUBLIC ARTWORK • MEDICINAL AND SPIRITUALLY SIGNIFICANT PLANTINGS AND LANDSCAPE TREATMENTS • QR CODES ON INTERPRETATION SIGNAGE	• ARCHEOLOGICAL EXCAVATION SITE EXHIBIT	1 INTEGRATE WITH RIBBON OF GREEN PLAN 2 ENHANCE AESTHETICS & NATURAL LANDSCAPE 3 PROVIDE EDUCATIONAL OPPORTUNITIES IN COLLABORATION WITH INDIGENOUS COMMUNITIES 5 ESTABLISH LONG TERM PARTNERSHIPS TO SUPPORT EDUCATIONAL & RESEARCH OPPORTUNITIES
C RIBBON OF GREEN SITE	• SMALL PLAZA AND PUBLIC SEATING AREA • SOLAR FARM INTERPRETATION PANELS • ENHANCED PLANTING AND LANDSCAPE TREATMENT AREA	• WASTE RECEPTACLE • ELEVATED VIEWPOINT • SOLAR PANEL TABLE TO CHARGE SMART PHONES	• REAL TIME DATA ON SOLAR FARM OPERATION • WASHROOMS • TIE STORY INTO LARGER CITY OF EDMONTON CONTEXT	1 INTEGRATE WITH RIBBON OF GREEN PLAN 2 ENHANCE AESTHETICS & NATURAL LANDSCAPE 4 CONSTRUCT AN INTERACTIVE PUBLIC DEMONSTRATION SITE TO SHOWCASE THE SOLAR FARM
D DISTANT VIEWING SITE	• SMALL PLAZA AND PUBLIC SEATING AREA • SOLAR FARM INTERPRETATION PANELS	• ENHANCED PLANTING AND LANDSCAPE TREATMENT AREA • WASTE RECEPTACLE • QR CODES ON INTERPRETATION SIGNAGE	• REAL TIME DATA ON SOLAR FARM OPERATION • INCORPORATE SOLAR PANEL ON BENCH TO CHARGE SMART PHONE	2 ENHANCE AESTHETICS & NATURAL LANDSCAPE 4 CONSTRUCT AN INTERACTIVE PUBLIC DEMONSTRATION SITE TO SHOWCASE THE SOLAR FARM

INSIDE FENCE

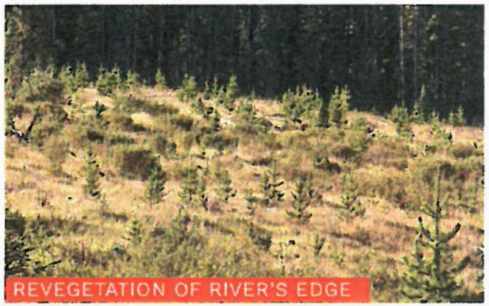
OUTSIDE FENCE

OUTSIDE FENCE

2.1 SITE CONCEPTS DEVELOPMENT FRAMEWORK



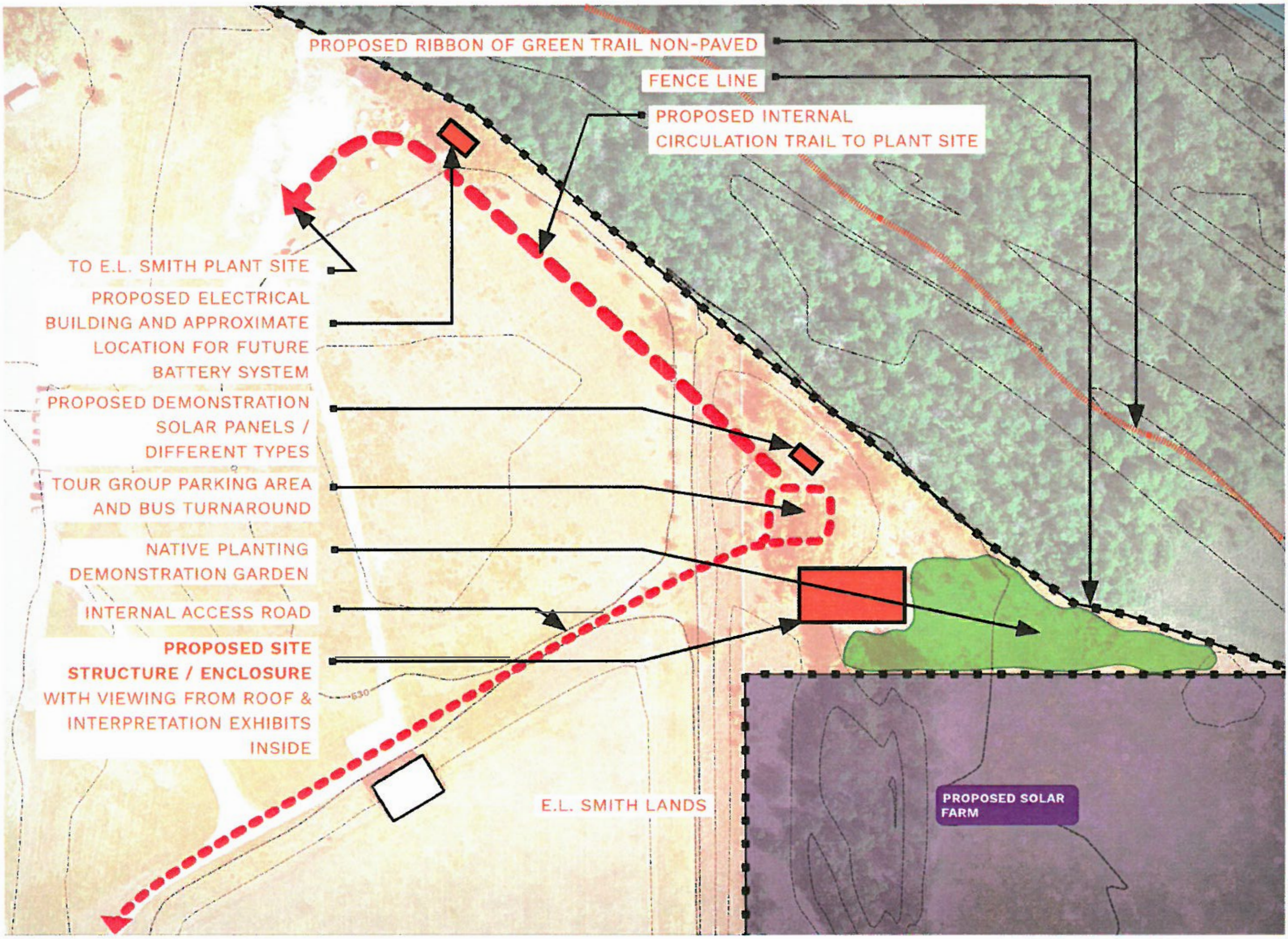
2.2 EPCOR OVERALL SITE PLAN


REVEGETATION OF RIVER'S EDGE

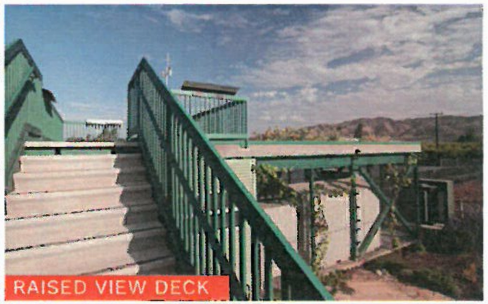

POLLINATOR PLANTING @ BASE OF PANELS

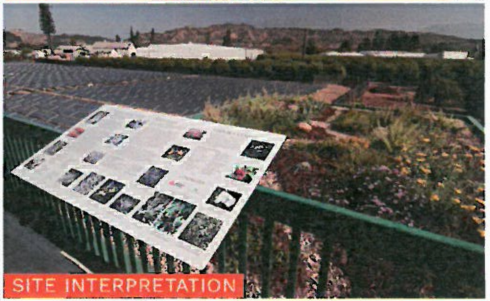

BEE HOTELS

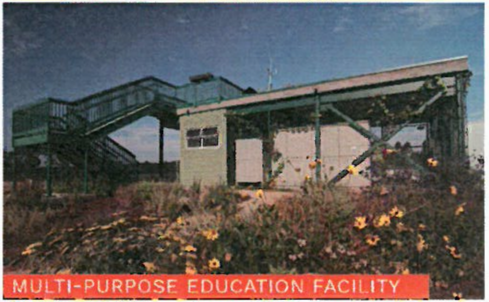

FENCING WITH VIEWS TO SOLAR FARM

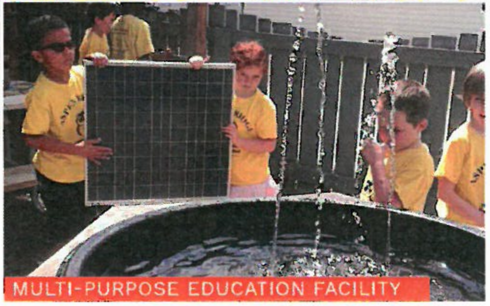


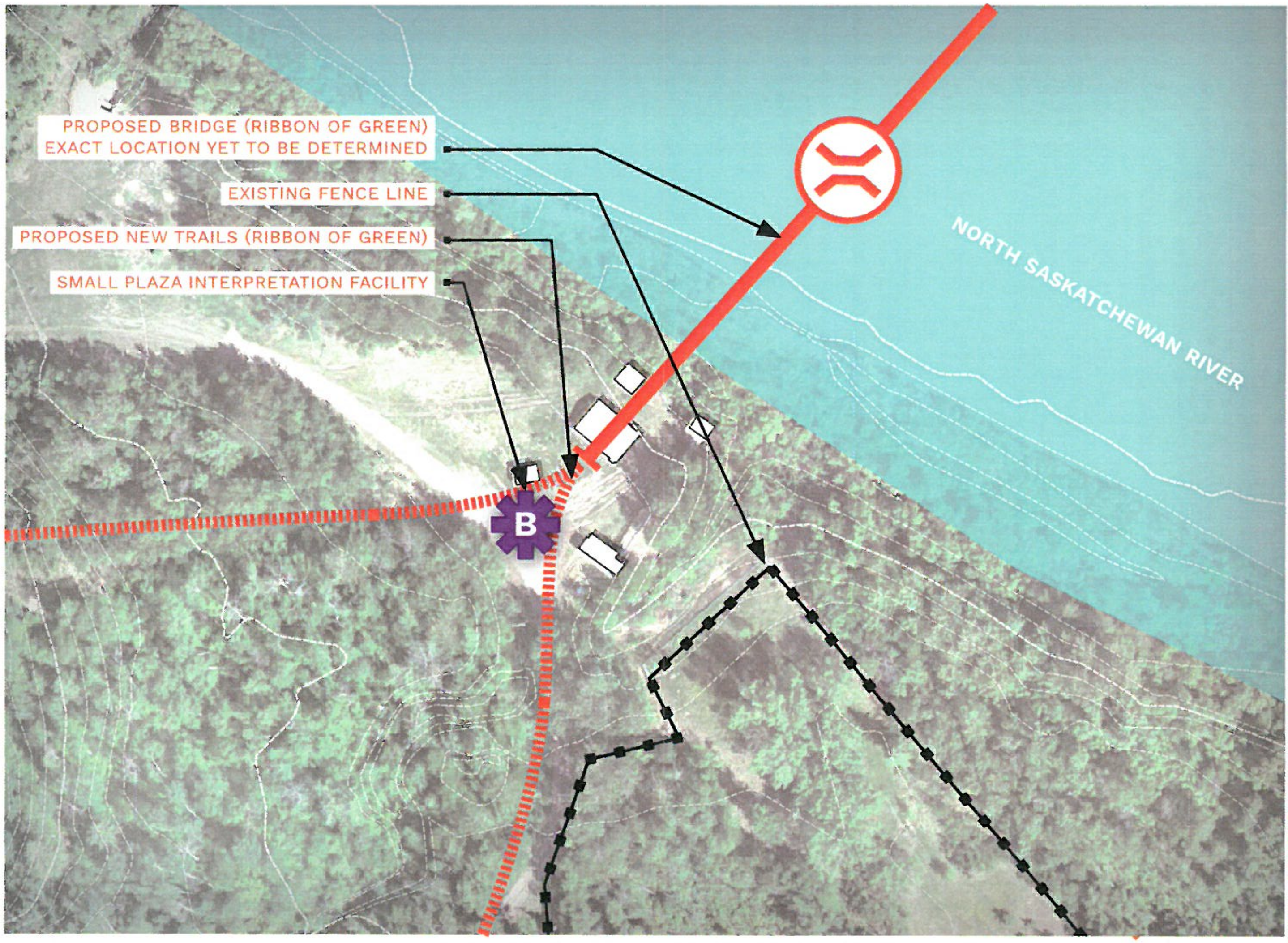
2.3 EPCOR DEMONSTRATION SITE - A

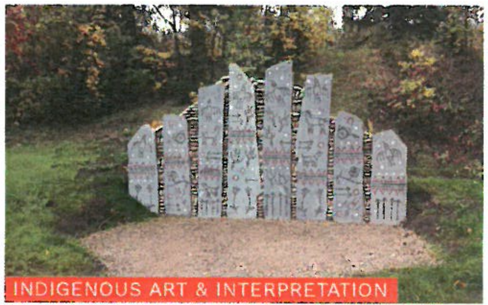

RAISED VIEW DECK


SITE INTERPRETATION


MULTI-PURPOSE EDUCATION FACILITY

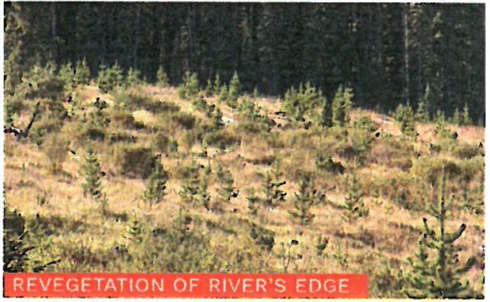

MULTI-PURPOSE EDUCATION FACILITY





INDIGENOUS ART & INTERPRETATION

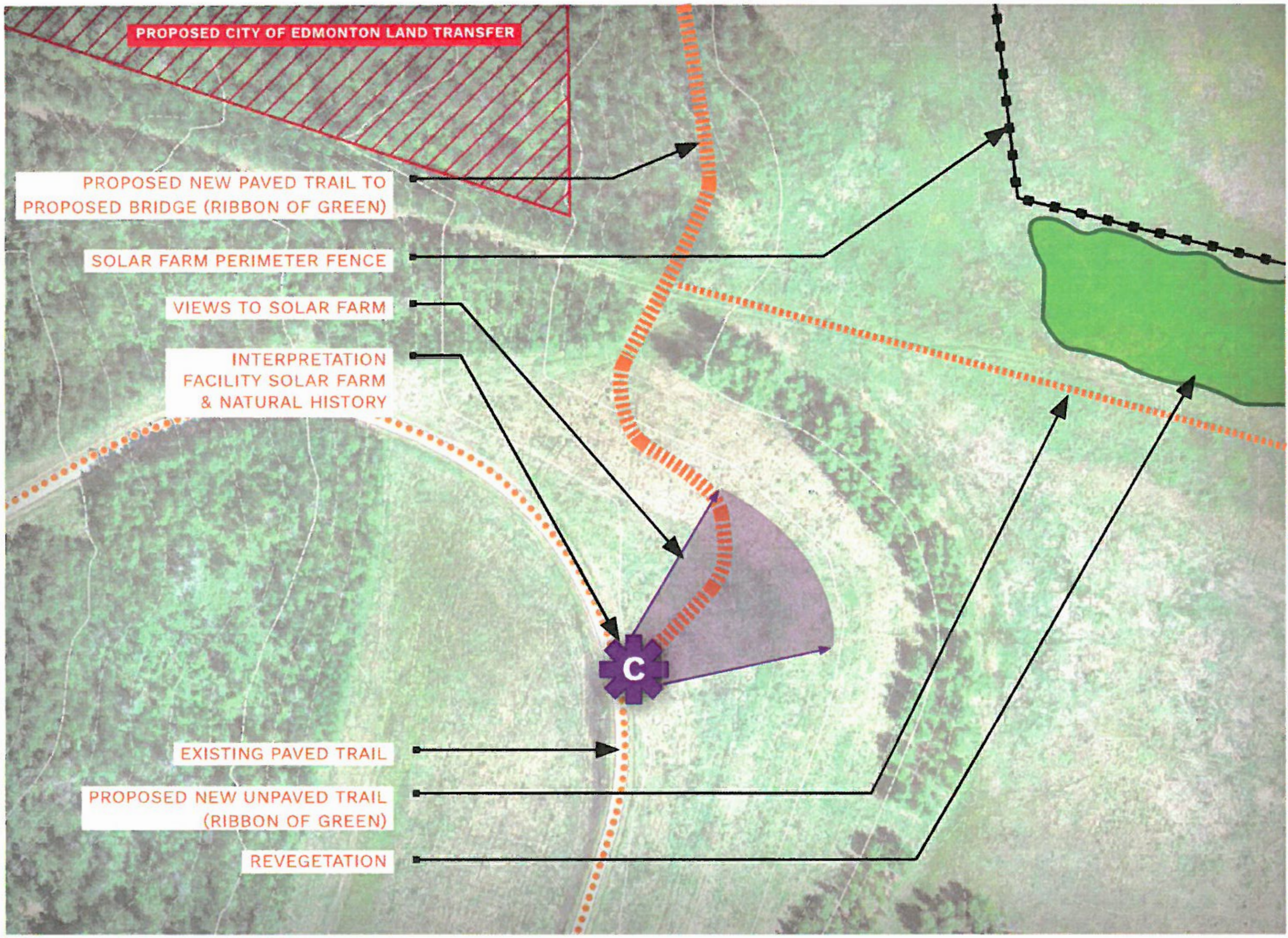
SEATING & GATHERING SPACE / PLAZA



REVEGETATION OF RIVER'S EDGE

SITE INTERPRETATION

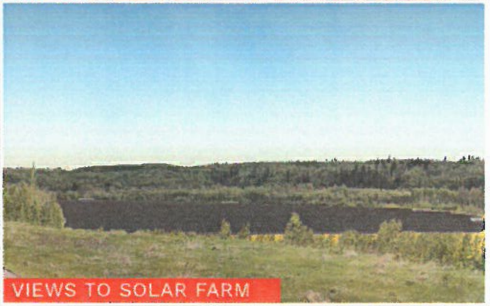
2.4 EPCOR HISTORIC / CULTURAL SITE - B

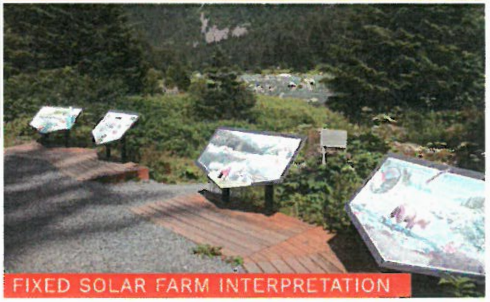


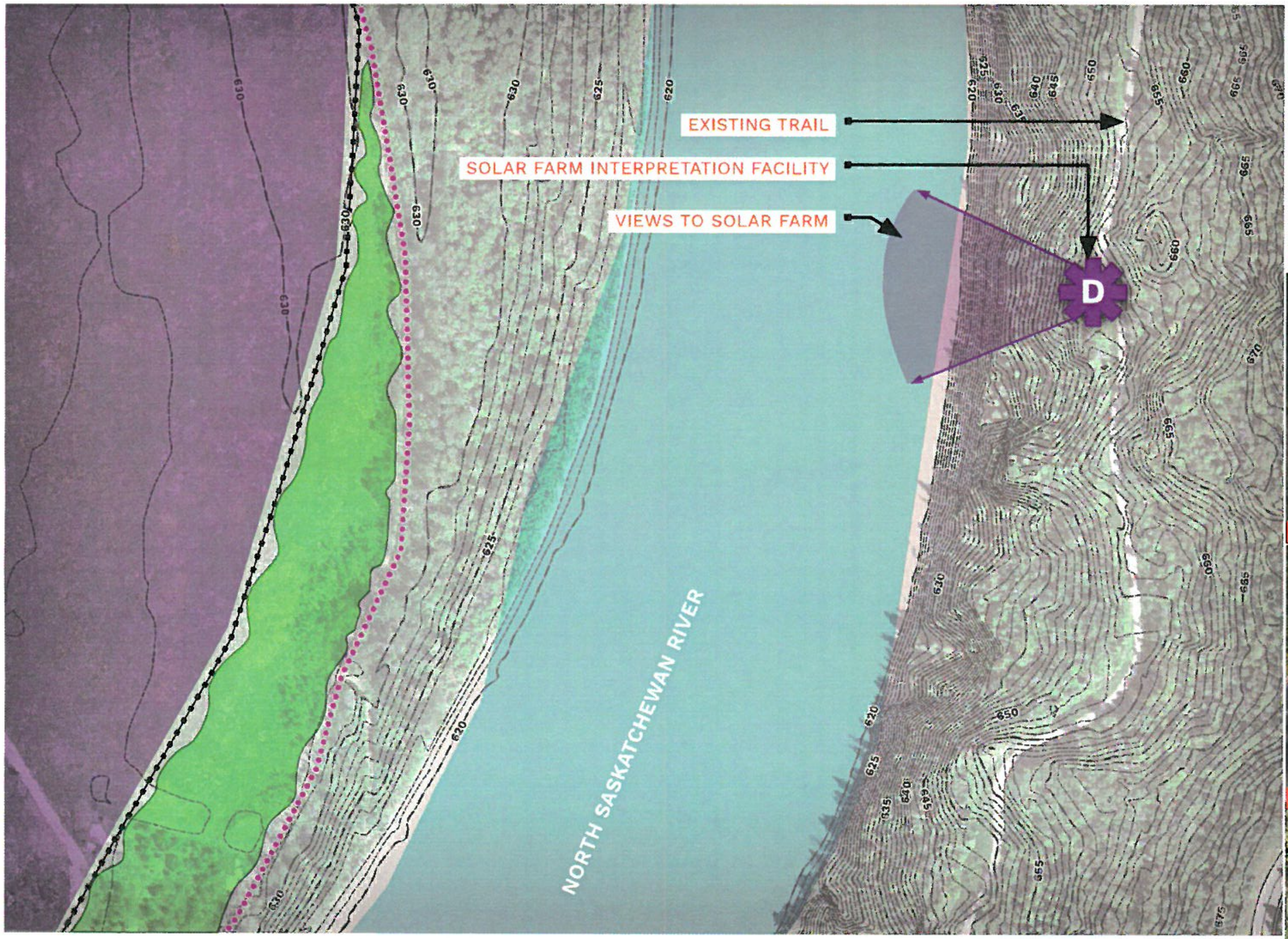
2.5 EPCOR RIBBON OF GREEN SITE - C


SEATING & GATHERING SPACE / PLAZA


QR CODE TYPICAL SIGNAGE

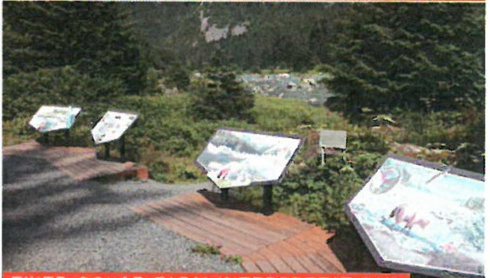

VIEWS TO SOLAR FARM

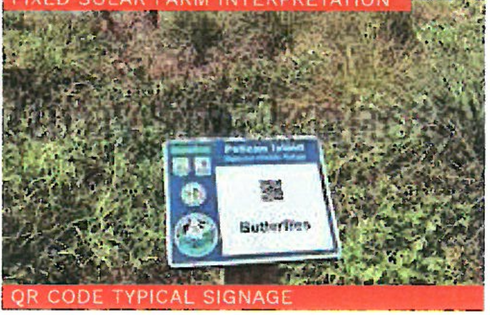

FIXED SOLAR FARM INTERPRETATION




SEATING & GATHERING SPACE / PLAZA


QR CODE TYPICAL SIGNAGE


FIXED SOLAR FARM INTERPRETATION



QR CODE TYPICAL SIGNAGE

2.6 EPCOR DISTANT VIEWS SITE - D

ENERGY TRANSITION
ADVISORY COMMITTEE

c/o City of Edmonton
9th Floor, Edmonton Tower
Attn: Barbara Daly
101110 – 104 Avenue NW
Edmonton AB T5J 0J4

Memorandum

January 22, 2019

To: Mayor Iveson and Council
From: Energy Transition Advisory Committee
Subject: E.L. Smith, Solar PV

Council acknowledged the existential threat posed by climate change when it approved Edmonton's Community Energy Transition Strategy, its Sustainable Buildings Policy, its Civic Operations Greenhouse Gas Management plan; established the Energy Transition Advisory Committee; and signed the 2018 Edmonton Declaration. These measures demonstrate leadership and offer encouragement that the necessary action to reduce emissions will be taken. The recent report from the UN Intergovernmental Panel on Climate Change shows clearly that we have around a decade to dramatically reduce emissions if we are to have any hope of maintaining a stable climate.

As such, ETAC supports the proposed E.L. Smith Solar Project. The project would contribute to a number of Edmonton's Energy Transition Goals including:

- Generating 10% of Edmonton's electricity locally by 2035,
- Accelerate the greening of Alberta's electricity grid,
- Increasing the uptake of distributed energy generation, and
- Ensuring Edmonton is an energy resilient City.

For example, E.L. Smith Solar Project offers a meaningful contribution to Edmonton's goal of generating 10% of electricity locally from renewable sources by 2035. As of November 2018, 0.08% of Edmonton's electricity was generated locally from renewable sources. This project would more than quadruple that number adding an additional 0.28% of renewable, local generation. Such a contribution is likely necessary to reach the Energy Transition goals.

Further, the commitment by Natural Resources Canada and Alberta Innovates to provide a combined $12.6 million in funding for battery storage provides an innovative opportunity to leverage outside funds to add resiliency to Alberta's energy and water treatment systems.

The committee recognizes that there can be land-use trade-offs when developing renewable energy projects. While the land is not ideally located, the proposed project site is logically situated next to the water treatment site which will utilize a portion of the electricity produced (increasing resiliency) and represents already disturbed and industrially zoned land.

E.L. Smith Solar Project's strong alignment with the City's Energy Transition Strategy and committed funds from the Federal and Provincial governments provides an essential opportunity to enable investment that that will contribute to Edmonton's goal of becoming a low carbon and energy sustainable city, aligned with the Paris 2°C goals.

Yours truly,

Energy Transition Advisory Committee

Cc:
City Council
Linda Cochrane
Linda Sahli
Paul Ross
Jeff Chase
Mark Brostrom
Mike Mellross
ETAC Members

Report to Utility Committee

August 23, 2018

EPCOR WATER SERVICES INC.

Solar Farm at E.L. Smith Water Treatment Plant

Project Update

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY

1. In its 2017-2021 Performance Based Rate ("PBR") Application, which was approved by the City of Edmonton ("City") City Council in October 2016 (Bylaw 17698), EPCOR Water Services Inc. ("EWSI") included a Green Power Initiative which commits EWSI to obtaining approximately 10 per cent of its energy consumption from locally produced renewable sources starting in 2018. The 2017-2021 PBR Application included funding of $1.9 million per year beginning in 2018 to either acquire green power, or alternatively, to build a green power facility.

2. Based on the results of analysis for methods of achieving this green power initiative in the most prudent means available, EWSI is proposing to proceed with the E.L. Smith Solar Project (the "E.L. Smith Solar Project" or the "Project"), a 12 MW solar farm on EWSI owned property at 3900 E.L. Smith Road, adjacent to the E.L. Smith Water Treatment Plant. EWSI presented the proposed E.L. Smith Project at the February 23, 2018 Utility Committee Meeting. During this meeting, Utility Committee requested that EWSI prepare a triple bottom line analysis of the Project compared to the alternatives.

3. EWSI has prepared this update on its proposed E.L. Smith Solar Project to provide the Utility Committee with: (i) background on EPCOR's broader green energy strategies; (ii) an overview of the proposed Project including project location, project details, environmental studies, plans for community integration and a summary of regulatory and stakeholder consultation processes; (iii) EWSI's alternative analysis which provides a financial evaluation of the of E.L. Smith Solar Project compared to a number of alternatives; and (iv) an independent triple bottom line evaluation prepared by HDR Corporation of the E.L. Smith Solar Project in comparison to the alternatives including quantification of the environmental and social costs and benefits. A summary of the project risks and risk mitigation plans is included in Appendix A.

4. Evaluation of the Project has included Strategic, Financial, Environmental and Social considerations. As summarized below, this evaluation demonstrates that the E.L. Smith Solar Project is a sound project and clearly the best and lowest-cost option to rate payers for making meaningful reductions to Edmonton's greenhouse gas emissions through a new large renewable energy project. The Project is an environmentally and socially responsible interim use of the E.L. Smith expansion lands and has significant potential for enhancing education and awareness of large scale renewable energy in Edmonton.

Strategic

E.L. Smith Solar Project directly aligns with the City's objective to reduce Edmonton's greenhouse gas emissions through the development of new renewable energy projects in the Edmonton Region while being consistent with land use classifications in the City's *Ribbon of Green* plan.

- Building this Project aligns with the objectives of the City's the *Way We Green: Environmental Strategic Plan* by converting a portion of EWSI's energy use to locally produced, renewable sources.
- The Project aligns with the City's *Energy Transition Strategy* objectives of generating 10% of Edmonton's electricity locally and to reduce greenhouse gas emissions in Edmonton by 35% from 2005 levels by 2035.
- The Project aligns with the City's draft *Greenhouse Gas Management Plan for Civic Operations 2019-2030* concepts of additionality, local resiliency, and a portfolio approach to greenhouse gas reductions.
- The Project is consistent with the City's April 2018 draft of the Breathe / *Ribbon of Green* classification of the E.L. Smith Water Treatment Plant site (including the Project site) as Urban Services under the broader category of "Active/Working Landscapes" which can include improvements to the sustainability of existing operations as a "Compatible Uses, Compatible Facilities + Infrastructure".

Financial

E.L. Smith Solar Project is 40% ($16.6 million net present value) lower in cost to Edmonton water ratepayers compared to an offsite solar option.

- The Project does not incur the incremental costs of acquiring land by using the available land at E.L. Smith which will not be in use for another 30 or more years for the expansion of the water treatment plant. This presents a unique opportunity for EWSI to provide a beneficial interim use for this land.
- The Project has lower operating costs due to the proximity to EWSI's water operations.

- By being behind the meter, the Project generates significant savings in the E.L. Smith Water Treatment Plant's conventional power purchase costs from the grid and associated wires costs and future capacity charges.

- Because the majority of the power generated from the Project will be consumed onsite by the E.L. Smith Water Treatment Plant (behind the meter), EWSI, as a municipally owned entity is permitted to operate the Project on a non-taxable basis under section 95(9) of the Electric Utilities Act.

Environmental

An independent, science-based, Environmental Impact Assessment ("EIA") carried out by Stantec has concluded that, with mitigation measures, potential residual effects are predicted to be not significant. The E.L. Smith Solar Project will provide significant greenhouse gas reductions and an opportunity to improve biodiversity of the Project site.

- The Project will reduce conventional power demands at EWSI's Edmonton water operations by 23% and greenhouse gas emissions by 20%[1] or approximately 14,000 tonnes of CO_2e, comparable to taking more than 2,500 vehicles off the road each year.

- The Project will help EPCOR achieve its goal of providing clean water to Edmonton and surrounding regions using clean energy.

- Independent science-based environmental studies show that "*potential adverse effects of the Project can be avoided, reduced or controlled using a combination of standard and Project-specific environmental mitigation measures. With effective planning and design of the Project and with the implementation of mitigation measures, potential residual effects of the Project on evaluated ecosystem components are predicted to be not significant.*"[2]

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[1] Project assumes EWSI will retain all renewable energy credits generated by the solar farm for the benefit of its water customers, including those from any power exports.

[2] Page 7, Environmental Evaluation for the E.L. Smith Solar Farm, completed by Stantec, dated March 2018

- There are opportunities to improve biodiversity with such enhancements as planting pollinator friendly flowers under and in-between the solar panels. EWSI's Project plan will ensure responsible and sustainable development.

Social

An independent Triple Bottom Line analysis carried out by HDR concluded that the "eco-system value" of using the EL Smith site would have to be implausibly high for the E.L. Smith Solar Project not to be preferred to an off-site solar farm. Because of its location, the Project presents a unique opportunity to enhance education and awareness of large scale renewable energy by creating a highly accessible demonstration / research site.

- As a result of Utility Committee's direction, EWSI engaged HDR Corporation ("HDR") to conduct a triple bottom line analysis (referred to as the sustainability value analysis ("SVA") or "HDR Report") comparing the E.L. Smith Solar Project to the alternatives on the basis of their financial, environmental and social impacts. The HDR Report concludes:

> …. To justify a solar alternative not at the EL Smith, decision makers would have to place an extraordinarily high ecosystem value on the EL Smith site and that the project development there would result in very significant ecosystem damages. Neither the literature on ecosystem valuation nor the conclusions of the Environmental Evaluation support that outcome.[3]

- The Project's location will present a unique opportunity enhance education and awareness of large scale renewable energy by creating a highly accessible demonstration / research site.
    - New trails on either side of Project will allow the public with up-close access to a large scale solar farm, which is unlikely to be matched at any other location.

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[3] Page 37, HDR's Sustainability Value Analysis of the E.L. Smith Solar Farm Project, August 12, 2018.

- Demonstration site for school tours of both the E.L. Smith Water Treatment Plant and the solar farm including an interpretative site for indigenous communities and archeological history of the land.
- Partnering with the University of Alberta and NAIT on research and training, providing a unique opportunity to study intermittent generation with industrial load in a *"behind the meter"* setting.
- EPCOR has applied to NRCan to fund a large 10 MW Battery Energy Storage facility *for this site*.

5. In summary, from a Strategic, Financial, Environmental and Social perspective, the E.L. Smith Solar Project is a sound project and clearly the best and lowest-cost option to rate payers for making meaningful reductions to Edmonton's greenhouse gas emissions through a new large renewable energy project. The Project is an environmentally and socially responsible interim use of the E.L. Smith expansion lands and has significant potential for enhancing education and awareness of large scale renewable energy in Edmonton.

6. EWSI is committed to ensuring all municipally, provincially and federally required regulatory approvals are obtained prior to construction.

   i. Archeological and paleontological field work is completed and Historical Resources Act clearance from Alberta Culture and Tourism is expected this fall.

   ii. EWSI expects the AUC to issue its Decision on the Project, which includes provincial review of the independent Environmental Evaluation study, by end of 2018.

   iii. EWSI will continue to move forward with the re-zoning and River Valley Bylaw amendment application for Council consideration through a public hearing process. This includes consideration of the Municipal Environmental Impact Assessment, currently under review by City Administration, and relevant land use considerations.

   iv. While no further approval from City Council / Utility Committee is required at this time, feedback from the Committee, in its capacity as EWSI's rate regulator, is critical to EWSI's decision on whether to proceed with the Project at this time. It is this context that this E.L. Smith Solar Project Update, incorporating triple bottom line analysis, is being presented to the Utility Committee for consideration and feedback.

2.0 BACKGROUND - EPCOR GREEN ENERGY STRATEGY

7. EPCOR Utilities Inc. (“EPCOR” or “EUI”) and its subsidiaries are committed to taking corporate action to reduce the impact of climate change.

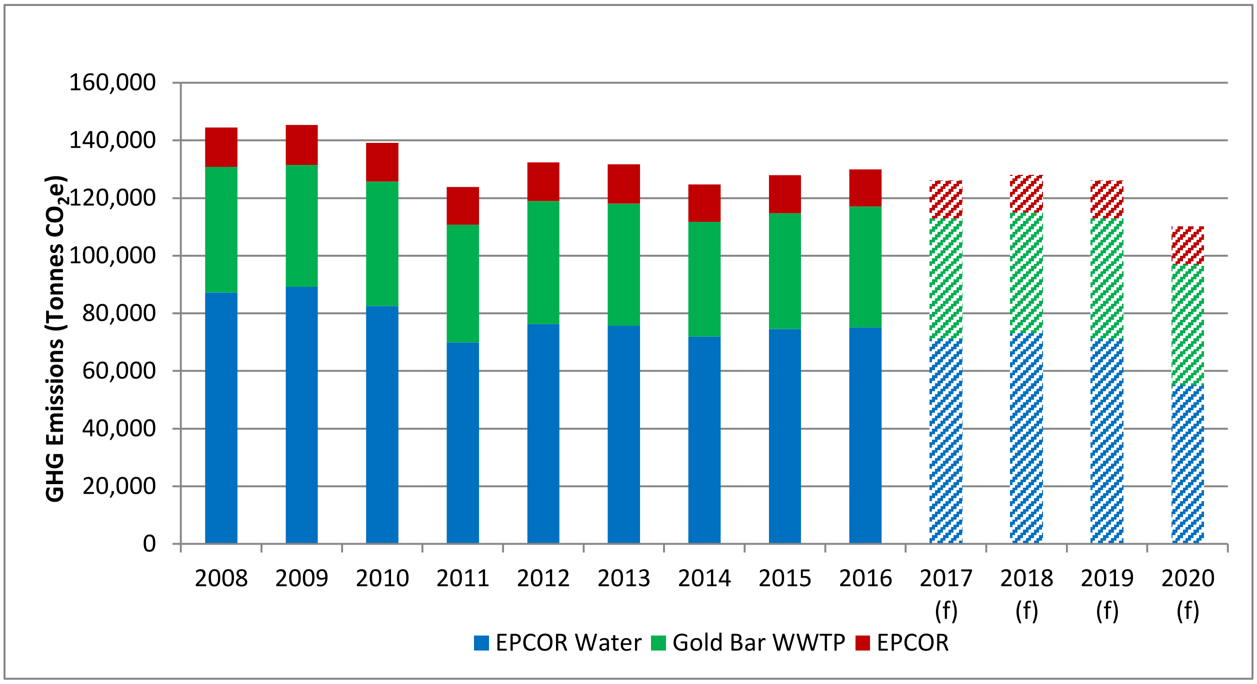
8. Like the City of Edmonton, EPCOR is responding to this commitment by taking a portfolio approach which includes actions on a number of fronts. This includes energy efficiency projects such as EWSI’s energy management plan, investing in green energy projects such as EWSI’s E.L. Smith Solar Project and engaging the community by sponsoring conferences and initiatives such as serving as title sponsor of the UN Intergovernmental Panel on Climate Change 2018 Cities and Climate Change Science Conference held in Edmonton in March of 2018. EPCOR engaged the community through the EPCOR Stage event that ran in parallel to the conference. EPCOR is also a founding member of the City’s Corporate Climate Leaders program, which encourages action against climate change by setting reduction targets and sharing success stories with the broader community to influence positive outcomes.

9. Figure 2.0-1 provides EPCOR’s total greenhouse gas emissions from Edmonton operations over the period 2008-2016 broken down by water operations, Gold Bar Wastewater Treatment Plant operations and other EPCOR operations. EPCOR’s total greenhouse gas emissions are primarily from electricity consumption used to treat and deliver water and treat wastewater, with other greenhouse gas emissions sources including natural gas and electricity in buildings, fleet vehicles, and SF6 from electrical switchgear. In 2016, greenhouse gas emissions from EPCOR’s Edmonton water operations, represented by the blue bars, account for 58% and the wastewater treatment plant operations, represented by the green bars, account for 32% of its total emissions. Therefore it makes sense for EPCOR to focus on using energy more efficiently and seeking renewable energy options for energy used at its water and wastewater treatment operations, such as developing the E.L. Smith Solar Project.

Figure 2.0-1

EPCOR GHG Emissions (2008-2020)[4]

(Tonnes of CO_2e)



2.1 EWSI Energy Management

10. EWSI's total energy costs for Edmonton water operations are significant in terms of its overall cost structure. In 2017, total energy cost for EWSI Edmonton water operations (excluding Gold Bar Wastewater Treatment Plant) was approximately $11.5 million. In terms of power consumption for the water operations, 57% is spent on large distribution pumps at the water treatment plant, 26% is spent on water treatment plant operations, 14% is spent on reservoirs, and about 3% is spent on office spaces. In the last 10 years, EWSI's total energy demand has increased by 8%. Two new water treatment processes, UV disinfection, sodium hypochlorite on-site generation accounted for the majority of the increase. In addition, meeting population growth and associated water demand, increases energy consumption as the majority of new growth occurs in the far extents of the system. These increases have been partially offset by energy efficiency initiatives discussed below.

11. In order to reduce its overall energy costs and minimize greenhouse gas emissions, EWSI relies on an effective energy management plan to provide a vision and guide the overall

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[4] Includes EWSI operations outside Edmonton

approach and means to reduce energy consumption. Currently, EWSI has completed or is in the process of implementing more than 10 other energy efficiency projects, in addition to the proposed E.L. Smith Solar Project. These projects are expected to result in an annual savings of more than 1,400 MWh of electricity, 1,200 GJ of natural gas and an emissions reduction of 1,200 tonnes of CO_2e. The projects include building energy efficiency upgrade programs that have replaced more than 1,230 lighting fixtures in the water treatment plants and reservoirs, 408 large windows for the clarifier and filter areas at the E.L. Smith Water Treatment Plant, $2.8 million in HVAC upgrades, $2.3 million in roofing upgrades to date, and the pumping efficiency upgrades at water reservoirs that resulted in annual energy savings of 250 MWh. In total, EWSI has invested $11.75 million in building and process upgrades since 2011 that have directly contributed to improving the efficiency of our operations.

12. EWSI's operational activities to reduce energy usage includes use of tools and procedures for how to operate its high lift, low lift, backwash pumps, compressors, and hypochlorite generators more efficiently, including how to shift pumping load when power prices are high. EWSI has a number of performance targets including kWh of energy usage per ML of water produced; energy per ML per capita[5]; and fuel efficiency indices. Other initiatives, including the use of intelligent systems like Artificial Neural Networks, are being explored to further facilitate the system becoming more efficient.

13. The results of EWSI's actions are shown in Figure 2.0-2 below. It provides EWSI's total annual greenhouse gas emissions from Edmonton water operations per customer account. The declining trend reflects both declining water consumption and the result of energy efficiency initiatives and is despite EPCOR serving a growing population in the City of Edmonton.

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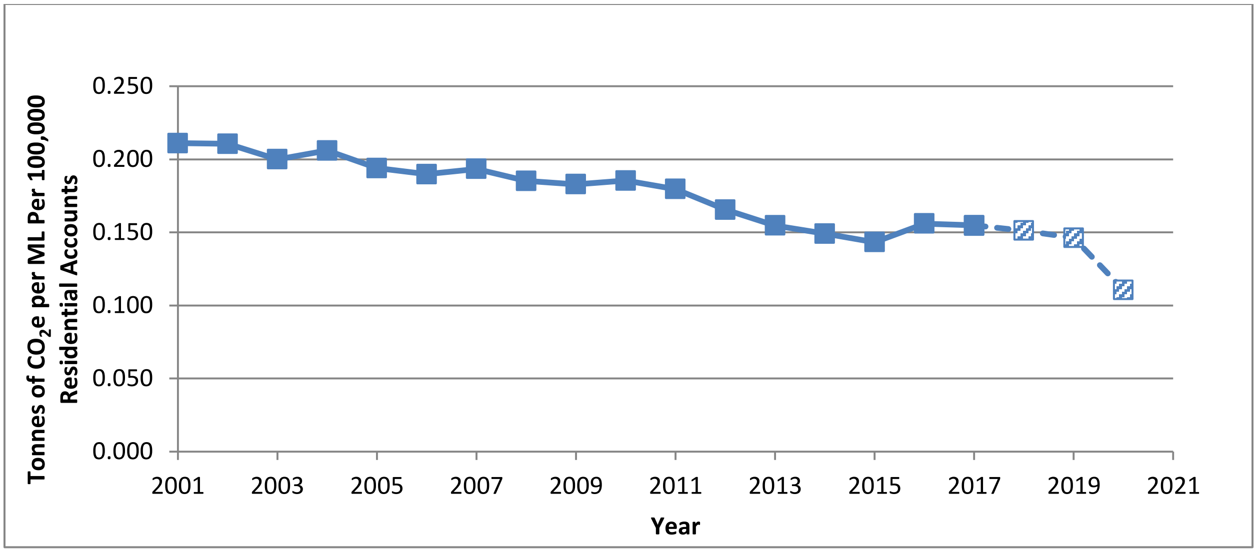
[5] New performance measure for the 2017-2021 PBR term

Figure 2.0-2

EWSI GHG Emissions per Customer Account (2001-2020)

(Tonnes of CO_2e per ML Per 100,000 Residential Accounts)



2.2 EPCOR Future Green Electricity Strategy

14. In addition to energy efficiency initiatives, EPCOR recognizes investment in new renewable energy projects for our Edmonton water treatment and distribution and wastewater treatment operations are required if we are to make meaningful reductions in our greenhouse gas emissions.

15. As EPCOR considers its approach, it is mindful of the principles approved by City Council with respect to its future Renewable Energy Credit[6] ("REC") purchases include the concepts of ***additionality, local resiliency, and a portfolio approach***[7]. EPCOR strongly endorses these principles and has adopted them in setting its own green energy goals.

16. ***Additionality*** is a term used to describe a project or activity that results in incremental GHG reductions that would not have happened without the support of the REC or offset buyer. Market purchases of RECs often do not achieve additionality because the projects the RECs are

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[6] Renewable Energy Credits (RECs) are a commodity that serves to represent the value and advantages of utilizing renewable energy sources, such as power sourced from wind turbines, biomass, or solar panels. One REC represents a megawatt-hour of electricity produced by a renewable energy facility and has a value based on market price. When a company buys RECs equivalent in value to the company's energy consumption, the company offsets the power they have sourced from traditional energy sources by contributing green energy to the shared power grid.

[7] Appendix C: Guiding Procurement Principles and Operationalization Considerations for Green Electricity; Greenhouse Gas Management Plan for Civic Operations 2019-2030, Draft presented to City Council May 29, 2018.

sourced from are already in operation and the emissions reduction is not incremental. Additionality is required to achieve real reductions in the global stock of greenhouse gases, ***Local Resiliency*** helps create more sustainable and adaptable cities, and a ***Portfolio Approach*** helps mitigate technology and market risk.

17. EPCOR's current strategy with regard to green energy procurement is to: (i) develop a portfolio of local, additional solar assets, such as the solar farm at E.L. Smith; and (ii) to supplement this supply by securing a large volume of cost-effective additional green electricity from a new wind farm to be built in southern Alberta. Solar and wind generation are complementary assets in an energy portfolio with solar peaking during the day and wind providing more energy at night. In addition, EPCOR is investigating opportunities to partner with Energy Efficiency Alberta in developing energy and heat recovery programs at the Rossdale Water Treatment Plant and the Millwood Reservoir and will continue to investigate new and innovative opportunities to save energy and reduce greenhouse emissions.

18. In March 2018, EPCOR submitted a proposal to construct and operate a smart grid system consisting of a battery energy storage system ("BESS") and grid-aware control system connected to the proposed E.L. Smith Solar Project and obtain $10.7 million in contribution funding from Natural Resources Canada ("NRCAN") under the Pan-Canadian Framework on Clean Growth and Climate Change initiative. EPCOR's proposal is subject to securing the necessary regulatory approvals for the E.L. Smith Solar Project. The combination of the proposed E.L. Smith Solar Project, BESS and the water treatment plant will be capable of operating as a "behind the meter" micro-grid, using the latest innovative technologies, providing resiliency to the distribution system and another tool for EWSI to optimize its load from the E.L. Smith Water Treatment Plant and solar power exports to the grid. If approved, this system would present a research collaboration opportunity for EPCOR and local post-secondary institutions to study the application of intermittent generation with a load and use of a significantly sized battery energy storage system.

19. The BESS will also enable EPCOR to defer by more than 12 years upgrades at its Petrolia substation and provide higher quality of service for customers by using the latest technologies. If accepted, the cost of the smart grid system would be funded through the Pan-Canadian Framework on Clean Growth and Climate Change initiative. The application of battery technology to an industrial load and an intermittent solar farm that are both behind the meter at the E.L. Smith site is a unique opportunity.

3.0 PROPOSED SOLAR PROJECT AT E.L. SMITH

20. In its 2017-2021 PBR Application, EWSI included a Green Power Initiative to increase the proportion of EWSI's energy from locally produced renewable sources. This initiative commits EWSI to obtaining approximately 10% of its total power volumes from renewable energy sources at a cost of $1.9 million per year, commencing in 2018. EWSI identified and analyzed eight alternatives (discussed in in Section 5.0) for its Green Power Initiative. Based on the results of its analysis, EWSI plans to proceed with the E.L. Smith Solar Project, a 12 MW solar farm on land owned by EWSI.

21. The Project was sized so that its impacts on EWSI's 2017-2021 revenue requirements would approximate the $1.9 million per year funding approved for the Green Power Initiative. Table 3.0-1 provides a comparison between the approved green energy initiative funding of $1.9 million per year (PBR forecast cost of local additional RECs) approved by City Council in the 2017-2021 PBR (row 1) and the impact that the E.L. Smith Solar Project will have on EWSI's revenue requirement assuming it is placed into service in the fall of 2019 (row 5). Table 3.0-1 indicates that, at current forecasts, by the end of the current PBR term the cost will be approximately $2.9 million less than the PBR forecast (row 6). Any excess funding obtained during the 2017-2021 PBR will be used by EWSI to sponsor a new wind project for the balance of its electricial load.

Table 3.0-1
Incremental Cost of Renewable Energy
($thousands)

		A 2018	B 2019	C 2020	D 2021	E 2018-2021
1	**Green Energy Initiative Funding**	**1,900**	**1,938**	**1,978**	**2,017**	**7,833**
2	**E.L. Smith Solar Project**					
3	Revenue Requirement, net of export power sales		1,628	2,936	2,833	7,397
4	Less: Purchase of conventional power			1,251	1,288	2,539
5	**Value of RECs generated by E.L. Smith Solar Project**	**-**	**1,628**	**1,685**	**1,545**	**4,858**
6	**Incremental costs (savings) of E.L. Smith Solar Project**	**1,900**	**310**	**293**	**473**	**2,975**

22. The following provides background information on the Project including: project location, project details including sizing, timing and costs; justification for the proposed Project including alignment with City goals and policies; and a discussion of EWSI's plans integrating the solar farm into the community and Edmonton river valley.

3.1 Project Location

23. The Project will be located in both NW1/4 03-052-25 W4M and SW1/4 10-052-25 W4M. The project site is located on 56 acres of land owned by EWSI, south of the E.L. Smith Water Treatment Plant at 3900 E.L. Smith Road. Figure 3.1-1 provides a view of Edmonton river valley highlighting the general location of the Project and EWSI's E.L. Smith Water Treatment Plant in the yellow rectangle.

Figure 3.1-1
Map of Solar Project Site within City of Edmonton

24. This land is being held by EWSI for future expansion of the E.L. Smith Water Treatment Plant. Based on current projections, EWSI expects that expansion into this area will not be needed until after the solar farm's expected lifetime which is 30 years.

25. Under the City's April 2018 Draft *Breathe: Edmonton's Green Network Strategy* and the *Ribbon of Green plan,* the E.L. Smith Water Treatment Plant site (including the Project site) are characterized as "Active/Working Landscapes: Urban services and city-wide attractions". According to the document, Active/Working Landscapes are located throughout the river valley, have lower levels of ecological sensitivity and accommodate the highest intensity of uses while

limiting ecological impact, when possible[8]. Active/Working Landscapes includes a sub-category of Urban Services:

> The Active/Working Landscapes: Urban services and city-wide attractions Sub-classification's intent is to acknowledge existing uses (e.g. the zoo, Edmonton Waste Centre, etc.) and allow new attractions that relate to the river valley and ravine setting. Specifically, urban services refer to existing industrial, utility and waste management uses in the System.
>
> …..
>
> This Classification also includes existing working landscapes such as the Edmonton Waste Centre and E.L. Smith Water Treatment Plant, among others. These uses are working landscapes and provide municipal services that will continue and may expand in the future. They often have limited public access but provide a valuable function to serve a growing community.
>
> Like the other Sub-classifications under Active/Working Landscapes, the intent is to maintain and improve ecological functioning, when possible. All new buildings must incorporate sustainable design features that can include on-site electricity generation, green roofs, local or recycled materials and low impact development, among others.

26. Figure 3.1-2 shows the land management classification of the Project Site from the April 2018 draft *Ribbon of Green* plan with the area in light blue (EWSI property) designated as "Active/Working Landscape". The green lines show future river valley trail development which would pass on either side of the Water Treatment Plant and new solar farm.

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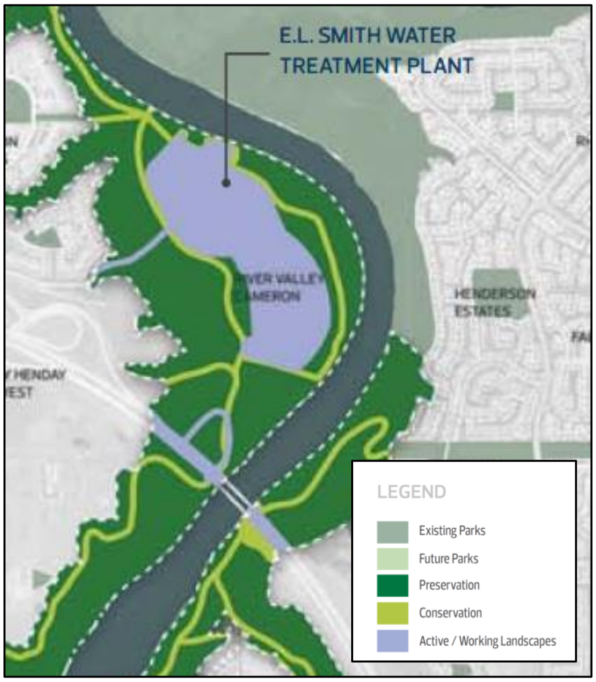
[8] Section 3.5.9 of the April 2018 draft City of Edmonton *Ribbon of Green* plan.

Figure 3.1-2[9]
City of Edmonton Ribbon of Green
Land Classification



27. To evaluate whether a particular use is appropriate within this sub-category, the report has identified ***"compatible facilities and infrastructure"***[10] which includes power plants and "compatible uses" which includes improving the sustainability of existing operations. EWSI considers that the proposed E.L. Smith Solar Project is entirely consistent with the requirements and objectives of the City's April 2018 draft Breathe / Ribbon of Green.

28. Figure 3.1-3 provides a map of the proposed Project location on EWSI's property (outlined in gray) at the E.L. Smith Water Treatment Plant. The map identifies the EPCOR property boundary, solar panel installation area, fence line, point of interconnection and rezoning area. This map was provided in EWSI's February 2018 project newsletter and is an updated version of the map used for the original public notice distributed in June 2017. The map is updated to reflect a reduced overall Project footprint in order to address suggestions by stakeholders through the Participant Involvement Program. In selecting this site for its proposed solar farm, EWSI considered a range of factors, including: proximity to the E.L. Smith

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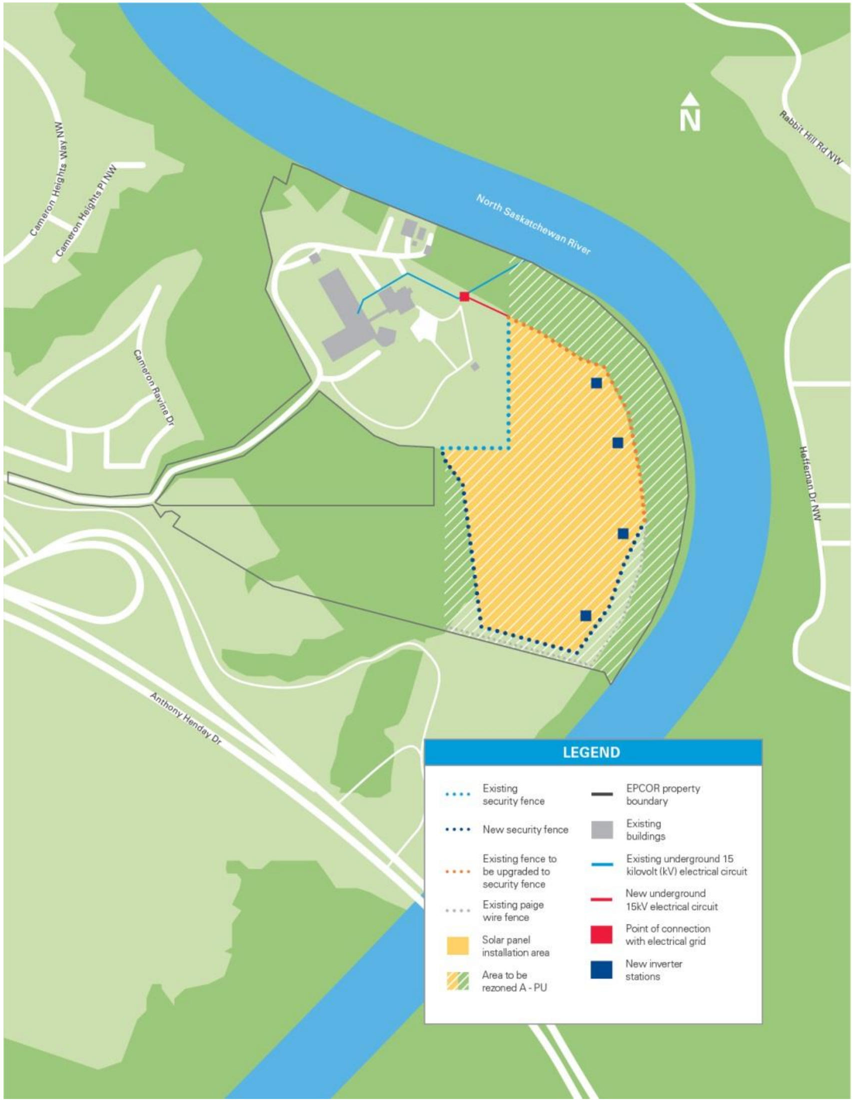
[9] Page 61 of the April 2018 draft City of Edmonton *Ribbon of Green* plan.
[10] Section 3.5.9.1 and 3.5.9.2 of the April 2018 draft City of Edmonton *Ribbon of Green* plan.

Water Treatment Plant; land size; land orientation; land ownership; legislation; operations and maintenance; environmental effects, future trail development; and cost.

Figure 3.1-3
E.L. Smith Solar Project Map



3.2 Project Details

29. The Project's solar array will consist of up to 45,000 solar panels and up to eight inverters. The solar array will be connected to the water treatment plant's existing 13.8 kV feeders, allowing bi-directional metering interconnection, so that EWSI is able to export power not consumed at the plant to the electrical grid. The existing fence at the Project site will be upgraded to safely and securely enclose the solar farm, ensuring that the enclosure fits in with the surroundings in an aesthetically pleasing and approachable manner.

30. Sizing the project at 12 MW provides for the maximum reduction in greenhouse gas emissions at the E.L. Smith site, recognizing the constraints of the available land area at the site, current estimates of the capability of solar technology, and the maximum generation capacity that could be connected to the electric distribution system without the need for costly upgrades as determined by EPCOR Distribution and Transmission Inc. (EDTI).

31. The Project is expected to generate approximately 21,500 MWh of electricity annually, (approximately 23% of EWSI Edmonton water operation's conventional power consumption[11]), with approximately 14,000 MWh expected to be consumed at E.L. Smith Water Treatment Plant and the remaining 7,500 MWh exported to the grid during hours when the full capacity of the solar farm exceeds the E.L. Smith Water Treatment Plant's power requirements. Annual power requirements at E.L. Smith Water Treatment Plant are 44,500 MWh, so the Project is expected to replace approximately 31.5%.

32. The Project's solar array includes up to 45,000 350W to 400W rack-mounted solar panels supported on piles that are 3 to 10 metres in depth, and connected to a maximum of 8 inverter/transformer stations to convert DC to AC power. If technological improvements are available prior to construction, EWSI will review the potential to integrate higher efficiency solar PV panels and improved inverters, but neither the equipment selection nor its configuration will result in changes to the Project footprint or the 12MW nameplate capacity.

33. The solar panels have an expected useful life of 30 years. Because Solar panel power generation output degrades annually, the 30 year useful life is based on the panels producing at least 80 per cent capacity in the final year as produced in the first year. The panels will be able to operate indefinitely past 30 years but at a continually reducing rate of efficiency. Towards the end of the expected useful life of the solar panels, EWSI will look at options to continue to run the solar farm, replace panels or use part of the land for expansion of the E.L. Smith Water Treatment Plant.

34. Figure 3.2-1 shows an image of an actual solar panel demonstration installed near the Project site with the E.L. Smith Water Treatment Plant in the background. The front edge of the panels will be placed approximately 1 meter above the ground to avoid snow accumulation and grass obstruction. The solar panels and associated equipment will be above the 1:100 flood level.

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[11] Approximately 15% of EWSI's Edmonton water and wastewater treatment operations.

Figure 3.2-1
Solar Panel Demonstration at E.L. Smith Site

35. The capital costs of the Project, based on Stantec's[12] Class 4 (+/-25%) estimates, are estimated to be $32.4 million[13] and the Project is expected be in service in late 2019. Table 3.2-1 summarizes the capital costs of the proposed Project.

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[12] Stantec Consulting Ltd., Feasibility Study: EPCOR E.L. Smith Solar Farm, May 19, 2017, Table 14: Class 4 Capital Cost Estimate.

[13] Current projections indicate the market costs for solar are declining.

Table 3.2-1
E.L. Smith 12 MW Solar Power Installation
Capital Costs
($ thousands)

	Cost Category	A Total
1	Feasibility Studies and Site Survey	94
2	Preliminary Design (Environmental, Regulatory, Geotech)	320
3	Historical Resources (HRIA, HRIM Stage 1 and Stage 2)	1,328
4	Public Consultation (incl. Indigenous Relations)	314
5	Detailed Design	649
6	Construction Engineering Services	100
7	Procurement and Construction	25,066
8	Contingency	2,795
9	EWSI Costs (internal labour, capital overhead, miscellaneous)	800
10	Interest during construction	936
11	**Total Project Costs**	**32,402**

3.3 Environmental Studies

36. EWSI retained the independent consultant Stantec with expertise in environmental evaluations to complete both the Environmental Evaluation required for the AUC Facility Application and the Municipal Environmental Impact Assessment of the Project site required for the Project’s Land Development Application to the City (together referred to as the “Environmental Studies”). The Environmental Studies evaluated the potential effects of Project construction activities on terrain and soils; surface water bodies and hydrology; vegetation species and communities; and wildlife species and habitat. The Municipal Environmental Impact Assessment also evaluated the potential effects of Project construction activities on viewscape and historical resources.

37. The findings of the Environmental Studies are that the potential adverse effects associated with Project activities will be mitigated by using a combination of standard and Project-specific environmental protection and avoidance measures such as timing construction outside of key breeding and wildlife movement periods; fencing of the Project development area to reduce the potential for wildlife mortality; and landscaping or other visual screening measures. The conclusion of the Environmental Studies are that, ”*with effective planning and design of the Project and implementation of mitigation and monitoring measures, potential*

*residual effects of the Project on the evaluated ecosystem components are predicted to be not significan*t"[14].

38. If the Project proceeds, EWSI will develop an environmental protection plan prior to construction that will include site-specific mitigation measures and a monitoring plan for post-construction. EWSI is committed to implementing the mitigation measures identified in the Environmental Studies, future wildlife field surveys, and any other government approvals received for the Project, while maintaining best practices and complying with applicable legislative requirements. EWSI is committed to reviewing and implementing additional mitigation measures, where practical, during operations in consultation with Alberta Environment and Parks, should ongoing monitoring identify the need for additional measures.

39. The Project will improve ecological functioning through the restoration of appropriate ground cover in the area and by increasing the distance from the river to the current fence line. Incorporating community integration objectives that are discussed below, may further improve ecological functioning by increasing compatible land use opportunities in and around ground mounted solar, such as providing pollinator habitat. Planting native plant species to attract and sustain bee, moth, beetle, wasp, fly, bird, bat and butterfly species is a local solution to help preserve pollinator populations. The Project will also include programs and initiatives to maximize the educational and demonstration potential of the project given its unique location.

3.4 Community Integration and Support

40. Through collaboration with educational and research institutions, Indigenous communities, neighbouring residential communities, the City of Edmonton and special interest groups, EWSI will take full advantage of opportunities to design the Project and surrounding features to meet community integration objectives which are outlined below.

Enhance the Project Aesthetics and Natural Landscape.

41. Fence design, natural screening features and other landscaping using natural plants and solar panel placement can be used to enhance the aesthetics of the area. Figure 3.4-1 provides a view of the current area described as "perennial cultivated non-native pasture". EWSI has committed to replace the trees and grasses removed for the Project to help improve the

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[14] Page 47, Environmental Evaluation for the E.L. Smith Solar Farm, Prepared by Stantec, dated March 2018

aesthetics and restore habitat of the area. Fencing and screens will also ensure noise emitted from the inverters to the surrounding areas is low.

Figure 3.4-1
Existing Project Site Conditions

Image Source: Google Maps

42. New ideas are being trialed in other jurisdictions to increase compatible land use opportunities in and around ground mounted solar, such as providing pollinator habitat. Planting native plant species to attract and sustain bee, moth, beetle, wasp, fly, bird, bat and butterfly species is a local solution to help preserve pollinator populations. Figure 3.4-2 below shows a solar farm with pollinator vegetation.

Figure 3.4-2
Solar Farm with Pollinator Vegetation

Integrate the Project into the North Saskatchewan River valley and plan for future trails proposed in the City of Edmonton's *Breathe / Ribbon of Green*.

43. New river valley trails proposed to be on either side of the E.L. Smith Water Treatment Plant and Project site creating an opportunity for meaningful engagement with trail users. Land adjacent to the Project and the proposed trail can be designed with this goal in mind.

Provide educational opportunities about the history and cultural resources of the land in collaboration with Indigenous communities.

44. The history of the land is unique due to the close proximity to the North Saskatchewan River and the use of the lands by Indigenous peoples. Permanent displays and art could be designed to showcase the rich history of the region. EWSI is looking for other ways to create a safe multi-functional area with a variety of benefits and is open to ideas from agencies, community groups and special interest groups.

Construct an interactive public demonstration site to showcase the Project and provide education and awareness about solar technology.

45. The urban setting provides an excellent opportunity to make the Project a public destination to see operational solar technology and learn more about climate change, the power generated by the Project and how it is used in the process of providing clean water at the E.L. Smith Water Treatment Plant.

46. By developing a solar farm that is in close proximity to schools, there are excellent opportunities to provide hands-on learning and to demonstrate how new green technologies can be used within an urban area. Tours of the solar farm can be paired with tours already given of the water treatment plant for a better understanding of how EWSI produces clean water using clean power.

Establish long-term partnerships to support educational and research opportunities associated with solar energy generation.

47. **Solar Technology Research -** Solar PV technology is changing at a rapid pace and having a solar farm behind the meter on a water treatment plant site with significant industrial load, within the city in a northern climate, will provide researchers and educators easy access to this technology to conduct research and provide a hands-on experience for learning. EWSI has entered into discussions with the U of A and NAIT to allow equipment alterations and data

monitoring for testing purposes. There is also interest in studying the use of native vegetation to attract pollinators in an urban river valley setting.

48. **Technology Acculturation -** How a new technology is acculturated has a lasting effect on future projects and technology use. Post-secondary research institutes are interested in understanding how new energy systems change social norms and the way humans interact with each other and the environment. The Project provides many ways to support the positive acculturation of solar technology, helping gain acceptance of a technology used to meet climate change targets.

49. The following provides a list of potential partners which EWSI is working with to develop innovative ideas to meet the community integration objectives listed. EWSI is actively looking for interested agencies, institutes and community groups who would like to get involved in meeting the community integration objectives of the Project.

- Indigenous communities
- City of Edmonton
- Edmonton Public and Catholic School Districts
- University of Alberta
- Northern Alberta Institute of Technology
- EPCOR’s Community Advisory Panel
- River Valley Alliance
- Pollinator Partnership
- Miistakis Institute

3.5 Regulatory Approvals

50. This Project requires the following regulatory approvals before construction can proceed:

i. approval from the Alberta Utilities Commission (“AUC”) of EWSI’s Facility Application for the Project which provides the permit and license to construct and operate the facility;
ii. clearance from Alberta Electric System Operator (“AESO”);
iii. Historical Resources Act clearance from Alberta Culture and Tourism;
iv. approval from the City of Edmonton for rezoning of EPCOR-owned land where the Project is located from a Metropolitan Recreation Zone (A) to a Direct Development Control Provision (DC1);

v. approval from the City of Edmonton for an amendment to the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188) to permit the development of a solar farm; and

vi. development permit from the City of Edmonton.

51. Edmonton City Council has approved the inclusion of $1.9 M into the PBR water revenue requirement for the procurement of green energy. EWSI is proposing the use of these funds to support the development of a new solar farm adjacent to the E.L. Smith Water Treatment Plant. In the ordinary course, EWSI will have to defend the prudence of its use of the $1.9 M at the time of the next PBR Application. This would include a review of capital expenditures for the E.L. Smith Solar Project included in opening 2022 rate base.

52. While no further approval from City Council / Utility Committee in its capacity as EWSI's rate regulator is required at this time, feedback from the Committee is critical in EWSI's decision on whether to proceed with this project at this time. It is this context that this E.L. Smith Solar Project update, incorporating triple bottom line analysis, is being presented to the Utility Committee for consideration and feedback.

53. If AUC approval of the Project is obtained, which includes provincial review of the Environmental Evaluation, EWSI will move forward with the re-zoning and River Valley Bylaw amendment application for Council consideration through a public hearing process. This will include consideration of the Municipal Environmental Impact Assessment and relevant land use considerations.

54. Table 3.5.-1 provides the key dates for the proposed Project including when the regulatory approvals are expected. The process and current status for obtaining each of these regulatory approvals is provided in Appendix B. Following receipt of the approvals from the AUC and the City of Edmonton, EWSI will finalize the detailed design, select and procure major equipment and proceed to site mobilization and construction. The expected in-service date is the fourth quarter of 2019.

Table 3.5-1
Proposed Project Schedule – Key Dates

	A	B
	Activity / Approval	**Target Completion Date**
1	Land Development Application Submission	May 2017
2	Participant Involvement Plan	June 2017 – Ongoing
3	File AUC Facility Application	Q1 2018
4	Anticipated AUC Approval	Q4 2018
5	Anticipated City Approval of Rezoning and City Bylaw Amendment	Q4 2018
6	Anticipated ACT Approval	Q4 2018
7	Anticipated Development Permit	Q1 2019
8	Construction Start Date	Q2 2019
9	In-Service Date	Q4 2019

3.6 Stakeholder Consultations

55. EWSI has also completed the public engagement on the Project which aligns with both the City of Edmonton Public Engagement Policy (C593) and the AUC’s Participant Involvement Program (“PIP”) (AUC Rule 007). Public consultation on this Project is an important part of the planning and development process and EWSI is committed to conducting an open and transparent consultation process for the Project throughout the duration of the Project.

56. EWSI’s participant involvement program included consultations with the property owners and residents, Indigenous communities, community leagues and organizations, special interest groups (e.g. River Valley Alliance, Sierra Club, North Saskatchewan River Valley Conservation Society), local businesses, elected officials, government agencies and the general public. The objectives of the PIP were to provide these parties with Project-specific information and opportunities to voice their concerns, ask questions, provide input and discussion options, alternatives and mitigation measures. EWSI undertook these activities with a commitment to work with potentially affected and other interested parties to address questions or concerns; and, where possible, resolve issues. All parties were provided Project details during the

planning process and will be advised of the construction schedule and details prior to construction.

57. In accordance with the AUC's guidelines for PIP, EWSI notified landowners, occupants, residents, and other potentially interested parties within 2,000 metres of the Project site and engaged in direct personal consultation with landowners, occupants, residents located within 800 meters of the Project site.

58. EWSI also implemented a proactive consultation program to ensure meaningful engagement and discussion with Indigenous communities. Although it was determined there was no duty for EWSI consult, EWSI has elected to implement a full program of consultation with Indigenous communities about the Project, the site and historical resources. Through site visits, active participation in archeological investigations, and presentation to Communities, EWSI continues to gather feedback from Nations. More detailed explanation of EWSI's consultations with Indigenous communities is provided in Appendix C.

59. EWSI's public engagement activities to date are summarized in Table 3.6-1 below.

Table 3.6-1
Public Engagement Activities

	A	B
	Activity / Approval	**Date**
1	Initial Project Newsletter	July 2017
2	Door Knocking and Phone Campaign	June 2017 – January 2018
3	Key Stakeholder Meetings & Site Tours	July 2017 - Ongoing
4	Indigenous Engagement	September 2017 – Ongoing
5	EWSI-hosted open house	July 2017
6	Southwest Farmer's Market booth	September & October 2017
7	Project Update Newsletter	February 2018
8	City of Edmonton-hosted open house	February 2018
9	Triple Bottom Line Stakeholder Workshops	June 2018
10	Edmonton Environmental Advisory Committee	June 2018

60. Through this process, EWSI consulted with approximately 850 stakeholders. Of these stakeholders, less than 1% expressed opposition to the Project and approximately 6% declared their support. The majority of stakeholders did not express support or opposition to the Project. The key topic areas for comments included: location, financing/cost, technical inquiries, need, visual impact, environmental impact, noise and construction. Although EWSI endeavored to respond to all concerns, outstanding concerns remain among some stakeholders. EWSI will continue consultations in an effort to address and/or resolve these issues where practicable.

61. A number of stakeholders expressed that a larger separation was needed between the proposed solar farm and the river for wildlife movement. Others felt that the site should be used for recreational use due to its close proximity to Edmonton's river valley trail system. Based on this feedback, EWSI evaluated its Project plan and is proposing to reduce the overall footprint in an effort to address concerns relating to aesthetics, land reclamation, environment and wildlife. At the narrowest point, the fence line will be set back at least 100 metres (previously 30 metres) from the river. The revised boundary will increase the amount of natural area along the river than compared to EWSI's previous plan as set out in the original public

notice distributed in July 2017. EWSI has also agreed to provide the City of Edmonton with access through its property (outside the solar farm fence line) for future recreational trails to ensure connectivity of the surrounding trail system on either side of the E.L. Smith Water Treatment Plant and adjacent E.L. Smith Solar Project.

4.0 EVALUATION OF ALTERNATIVES

62. EWSI identified the following eight alternatives: the cost of grid supply only, which has no renewable energy component and the next seven for meeting its green energy initiative commitment under PBR. These alternatives, discussed in greater detail in Appendix D, include:

1. **Grid Supply** – purchase of conventional power from the grid

2. **Grid Supply + Generic Market RECs** – purchase of conventional power from the grid and generic (non-additional) RECs available in the market

3. **Offsite Wind Farm** – cost to build and operate (or contract to purchase power from[15]) an offsite wind farm in southern Alberta. This would meet the "Additional" criteria but not "Local".
4. **E.L. Smith Solar Project** – cost to build and operate the proposed E.L. Smith Solar Project.
5. **Offsite Local Solar Farm** – cost to build and operate (or contract to purchase power from a third party[16]) an offsite solar farm within 40 kilometers of the city of Edmonton (meeting the "local" criteria) and connect to the grid, but not tied directly to any of EWSI's operating sites.
6. **Commercial Rooftop Solar –** cost of a program to build and operate 100kW to 250kW solar power systems on the rooftops of 104 commercial buildings in Edmonton.
7. **Residential Rooftop Solar –** cost of a program to build and operate 3,268 small scale (3kW to 9kW) solar panels on residential rooftops within Edmonton.
8. **EWSI Rooftop Solar** – cost to build and operate solar panels on the rooftops of EWSI buildings and reservoirs including Rossdale clarifiers, the Rossdale reservoirs, the E.L. Smith reservoirs and three field reservoirs.

63. These alternatives have been updated from the February 23, 2018 report to the Utility Committee to provide a more complete analysis and to address the commercial and residential rooftop alternatives. To provide an "apples to apples" comparison where possible, the alternatives have been sized to produce 21,500 MWhs of power and 21,500 RECs annually. As

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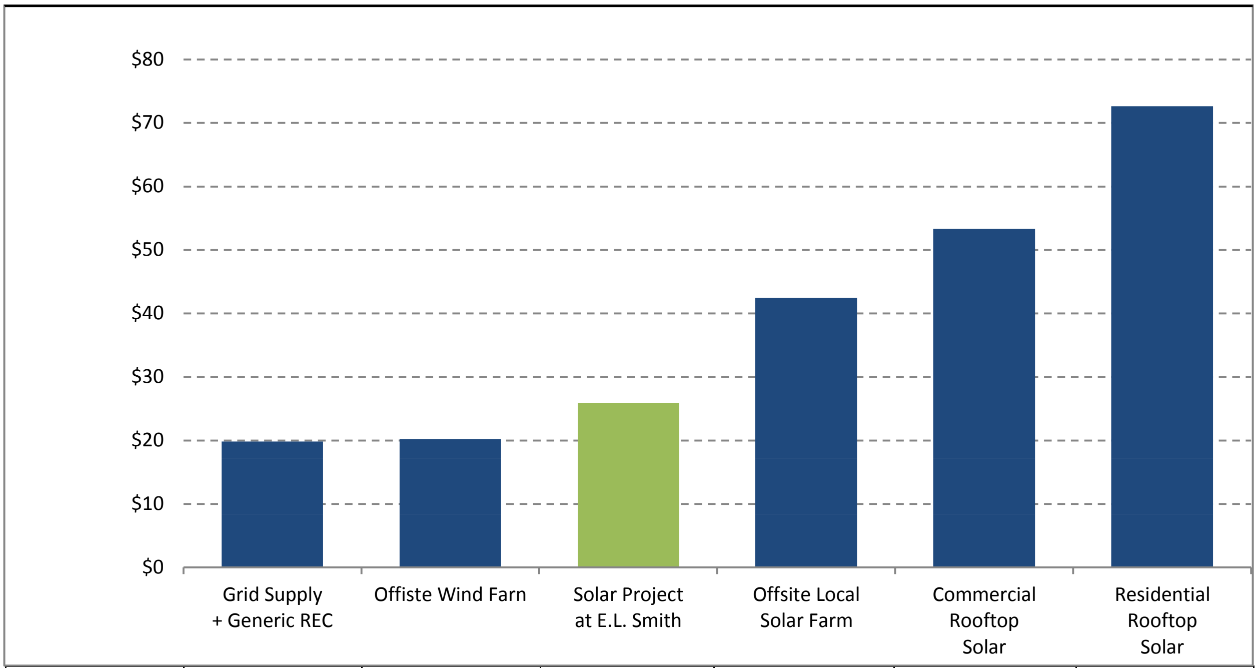
[15] Whether the offsite wind farm is owned or operated by EWSI or power and RECs from such a project is purchased a third party contract, the annual financial impacts to EWSI ratepayers is assumed to be equivalent.

[16] Whether the offsite local solar farm is owned or operated by EWSI or power and RECs from such a project is purchased under a third party contract, the annual financial impacts to EWSI ratepayers is assumed to be equivalent.

noted above, the E.L. Smith Solar Project is expected to produce 21,500 MWh of power annually, with approximately 14,000 MWh expected to be consumed at E.L. Smith Water Treatment Plant and the remaining 7,500 MWh exported to the grid during hours when the full capacity of the solar farm exceeds the E.L. Smith Water Treatment Plant's power requirements.

64. Figure 4.0-1 below provides as summary of EWSI`s financial analysis comparing the net present value of the financial cost of providing an equivalent supply of renewable power as the E.L. Smith Solar Project. The Grid Supply alternative was excluded because it does not provide renewable power supply and the EWSI Rooftop Solar alternative was excluded because, due to space constraints on EWSI buildings, it can only produce 5,000 MWh of renewable electricity annually.

Figure 4.0-1
Financial Cost of Renewable Energy
($million NPV)



Green Energy	**23%**	**23%**	**23%**	**23%**	**23%**	**23%**
Additional	**X**	✓	✓	✓	✓	✓
Local	**X**	**X**	✓	✓	✓	✓

65. Figure 4.0-1 clearly shows that the proposed E.L. Smith Solar Project has the lowest cost to rate payers (net present value) of any the alternatives meeting the additionality and local criteria. As will be detailed below, the E.L. Smith Solar Project benefits from significant cost savings owing to the project location being "behind the meter" at the site of the E.L. Smith Water Treatment Plant. These "behind the meter" cost savings relative to the offsite projects

include reductions in the electrical distribution and transmission costs and capacity payments that would otherwise be incurred at the E.L. Smith Water Treatment Plant; no costs to acquire or lease land; no costs to interconnect to the grid; and no taxes due to the Project maintaining its non-taxable status. These items reflect real costs incurred by EWSI for the offsite alternatives.

4.1 EWSI Financial Analysis Methodology and Assumptions

66. Table 4.1-1 below provides a summary of the net present value over a 30-year period (based on life of the solar project) of the cost impact on EWSI's revenue requirement of each of the eight alternatives compared to the 2017-2021 PBR Forecast. The first five alternatives were also included in the HDR Report as discussed in section 5.2.

In column A of Table 4.1-1, the PBR forecast is provided for comparison. The PBR forecast represents the Green Energy Initiative in the 2017-2021 PBR Application where EWSI planned to replace approximately 10% of its conventional energy (9,636 MWh) with locally produced renewable power, commencing in 2018. The PBR forecast cost has been extrapolated over the 30 year life of the Project (to the year 2049). The incremental cost of green energy (based on cost of local additional RECs) was estimated at $1.9 million annually until 2021. Subsequent to 2021, since the PBR forecast requires both local energy generation and additionality, the notional REC price from the Offsite Local Solar Farm has been used as the green energy premium.

Table 4.1-1
Financial Summary of Alternatives ($million NPV)

		A	B	C	D	E	F	G	H	I
	Alternative	**PBR Forecast**	**1: Grid Supply**	**2: Grid Supply + Generic REC**	**3: Offsite Wind Farm**	**4: E.L. Smith Solar Project**	**5: Offsite Local Solar Farm**	**6: Commercial Rooftop Solar**	**7: Residential Rooftop Solar**	**8: EWSI Rooftop Solar**
1	**HDR Sustainability Value Analysis**		I	II	V	III	IV			
2	**MWh Power purchased/produced**	9,636	21,500	21,500	21,500	21,500	21,500	21,500	21,500	5,000
	Project Benefits:									
3	Green Energy %	10%	0%	23%	23%	23%	23%	23%	23%	5%
4	Additionality	✓	**X**	**X**	✓	✓	✓	✓	✓	✓
5	Local	✓	**X**	**X**	**X**	✓	✓	✓	✓	✓
	NPV Revenue Requirement:									
6	**Grid Supply to EL Smith Sub-total**	7.83	8.86	8.86	8.86		8.86	8.86	8.86	5.66
7	Capacity payments	1.48	2.03	2.03	2.03		2.03	2.03	2.03	1.30
8	Distribution lines losses	0.13	0.18	0.18	0.18		0.18	0.18	0.18	0.11
9	Wires charges	6.06	6.06	6.06	6.06		6.06	6.06	6.06	4.68
10	**Wires and Capacity Cost Sub-total**	7.67	8.27	8.27	8.27		8.27	8.27	8.27	6.09
11	PBR Green Energy Premium	16.83								
12	Generic RECs (non-additional)			2.73						
13	**Green Energy Premium Sub-total**	16.83		2.73						
14	Offsite Wind Project				12.29					
15	Local Solar Project					31.35	31.35			
16	Rooftop Solar							32.01	47.02	14.96
17	Incremental O&M Expenses						1.72	4.19	8.50	
18	Incremental Grid Costs						4.46			
19	Incremental Land Costs						0.30	15.61	15.61	
20	Income taxes						3.14			
21	**Project Costs Sub-total**					31.35	40.96	51.82	71.13	14.96
22	**Less: Export Power Sales**				(8.82)	(5.43)	(15.61)	(15.61)	(15.61)	
23	**Total NPV Revenue Requirement**	**32.34**	**17.12**	**19.85**	**20.59**	**25.92**	**42.48**	**53.32**	**72.64**	**26.71**
24	**Incremental NPV of Green Energy**	16.83	**N/A**	2.73	3.47	8.80	25.35	36.20	55.52	9.59
25	**Notional price per REC ($ per REC)**	**$135.70**	**N/A**	**$12.00**	**$15.27**	**$38.71**	**$111.58**	**$159.34**	**$244.35**	**$179.45**

67. EWSI determined the net present value of the revenue requirement impacts to its ratepayers for each of the alternatives in Table 4.1-1. The total net present value of the revenue requirement impacts (row 23) is comprised of the sum of the following components:

- **Grid Supply to EL Smith (row 6) -** $8.86 million is the net present value of purchasing 14,000 MWh of conventional power from the grid. This is the "delta" between the conventional power purchases by E.L. Smith water treatment plant under all of the grid supply alternatives and the conventional power purchases in the E.L. Smith Solar Project case). In the PBR Forecast (column A), $7.83 million represents the PBR forecast cost to purchase 9,636 MWh of conventional power (higher than current forecasts for conventional power prices). In EWSI Rooftop Solar alternative (column I), $5.66 million represents the cost of 9,000 MWh of conventional power, since the EWSI rooftop solar produces only 5,000 MWh per year.

- **Wire and Capacity costs (rows 7-10)** - $8.27 million is the net present value of the wires and capacity charges associated with the 14,000 MWh of conventional power from the grid. In the PBR (column A), $7.67 million reflects wires costs associated with 9,636 MWh conventional power purchases. In the EWSI Rooftop Solar alternative (column I), $6.09 million reflects the wires costs for conventional power purchases of 9,000 MWh.

- **Green Energy Premium (rows 11-13)** - the $16.83 million PBR Green Energy Premium (column A) is the net present value of the $1.9 million annual green energy premium over conventional power prices which was included in the 2017-2021 PBR Forecast and, subsequent to 2021, the cost of additional local RECs (equivalent to the cost of RECs from the Offsite Local Solar farm). The $2.73 million Generic RECs (column C) is the cost of non-additional generic RECs.

- **Project Costs (rows 14-21) –** includes the net present value of the revenue requirement impacts of the capital and operating costs for the Offsite Wind Farm (column D); the E.L. Smith Solar Project (column E); and the rooftop solar projects (columns G, H, I); and incremental capital costs for grid connection and land acquisition, operating costs and income taxes for the Offsite Local Solar Farm (column F rows 17-20); and incremental operating costs for the commercial and residential rooftop solar projects including the costs of leasing roof space (columns G and H).

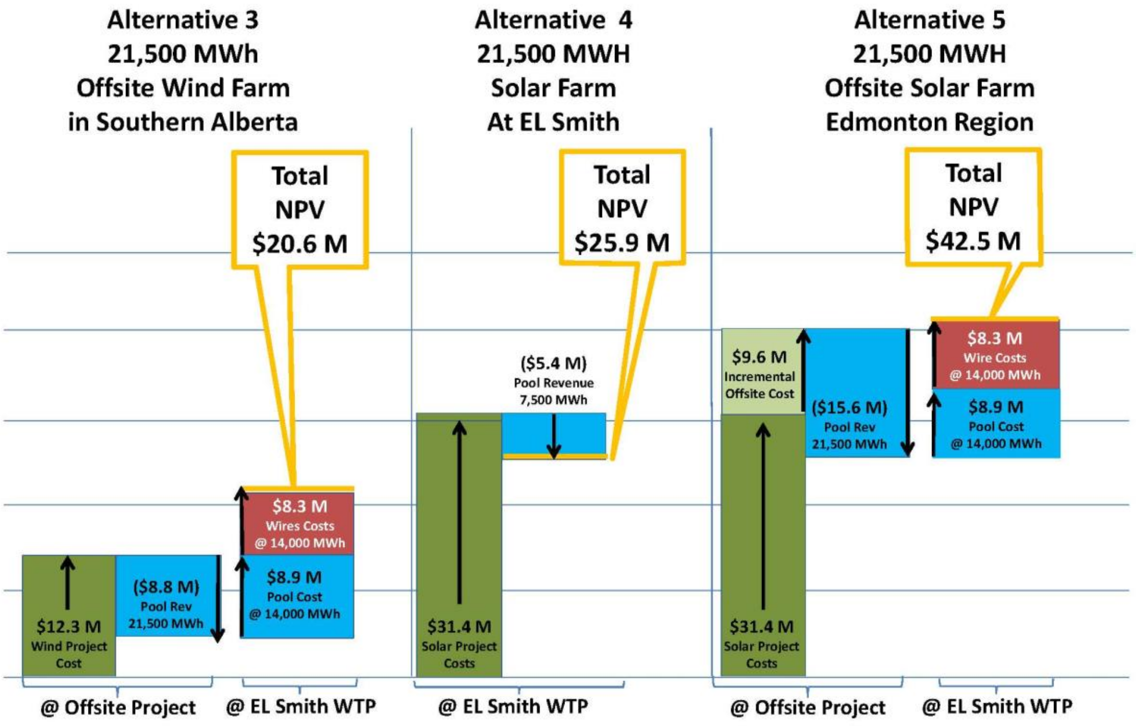
- **Export Power Sales (row 22) –** the net present value of additional revenues obtained from export power sales of 7,500 MWh for the E.L. Smith Solar Project and 21,500 MWh for the Offsite Wind Farm, the Offsite Local Solar Project and the roof top solar projects.

68. The **"notional price per REC" (row 25)** provides a measure of the relative cost per MWh of generating a REC for each alternative. This notional price per REC is based on the incremental cost of renewable energy (row 24), which is calculated as the difference between net present value of the alternative and the net present value of purchasing grid power only.

69. As is clear from row 23 of the Table, the NPV cost of the EL Smith Solar project at $25.92 million is $16.56 million or 38.9% less expensive than the Off-Site Solar project at $42.28 million.

70. Figure 4.1.1 provides an illustration of the costs and revenues for the E.L. Smith Solar Project, the Offsite Wind Project and the Offsite Solar Project.

Figure 4.1-1
Alternative Cost Comparison



71. As illustrated in Figure 4.1-1, for the Offsite Wind Project, the $20.6 million net present value is comprised of (i) $12.3 million cost for a southern Alberta Wind project which produces 21,500 MWh of power annually and provides EWSI with 21,500 MWh of RECs; (ii) $8.8 million in revenues from selling 21,500 MWh of wind power back to the grid; (iii) $8.9 million cost for 14,000 MWh conventional power purchases for the E.L. Smith Water Treatment Plant; and (iv) $8.3 million associated wires costs.

72. For the E.L. Smith Solar Project, the $25.9 million net present value is comprised of (i) $31.4 million cost for the Project; and (ii) $5.4 million revenues from the sale of 7,500 MWh power back to the grid during hours when the full capacity of the solar farm exceeds the E.L. Smith Water Treatment Plant's power requirements.

73. For the Offsite Solar Project, the $42.5 million net present value is comprised of (i) $31.4 million cost for a solar project (base costs as for E.L. Smith Solar Project); (ii) $9.6 million

incremental costs for an offsite solar project including grid connection, land acquisition, operating costs and income taxes; (iii) $15.6 million revenues from the sale of 21,500 MWh power back to the grid; (iv) $8.9 million cost for 14,000 MWh conventional power purchases for the E.L. Smith Water Treatment Plant; and (v) $8.3 million associated wires costs.

74. A summary of each of the alternatives evaluated is included in Appendix D.

4.2 HDR Sustainability Value Analysis

75. EWSI engaged HDR Corporation to analyze these alternatives on a "triple bottom line" basis, so that the environmental and social costs and benefits of each alternative are fully considered in the analysis along with the financial costs and benefits. HDR is a consultancy with specialization in providing decision support services for infrastructure investment analysis. HDR is a leader in providing triple bottom line analysis reflecting the environmental, social and financial consequences of alternative investments. HDR has completed a report entitled "Sustainability Value Analysis of the E.L. Smith Solar Farm Project" which compares the financial, environmental and social impacts of five alternatives including the E.L. Smith Solar Project (alternatives I, II, III, and IV in Table 4.1-1 above[17]). The results of HDR's sustainability value analysis ("SVA") are summarized below.

76. As part of completing the SVA, HDR hosted workshops on June 13, 2018 and June 14, 2018 to gather feedback on the triple bottom line methodology and assessment of the Project's effects. The workshops were led by HDR Corporation and included attendees representing EWSI, EDTI, City of Edmonton, EPCOR's Community Advisory Panel, North Saskatchewan River Valley Conservation Society, Edmonton River Valley Conservation Coalition, University of Alberta, Miistakis Institute, Northern Alberta Institute of Technology, and Stantec Consulting. Invitations were also sent to Sierra Club and Edmonton Area Land Trust. No response was received from the Sierra Club and the Edmonton Area Land Trust declined to attend.

77. The workshops discussed the project background, the SVA process, the proposed Project and alternatives considered; how the SVA results will be derived quantitatively; evidence supporting specific data assumptions; and next steps. In the SVA evaluation, the attendees assessed the SVA study approach and relative costs and benefits of alternatives: (I)

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[17] Given the relatively high cost of the rooftop options and complexity of the residential/commercial rooftop business model, these options were not included in the triple bottom line analysis.

Grid Supply; (II) Grid Supply + Generic REC's; (III) Offsite Wind Farm: (IV) Solar Project at E.L. Smith; and (V) Offsite Local Solar Farm.

78. The triple bottom line framework reflects a holistic view of the Project that takes into account not just the economic and financial aspects, but social and environmental impacts as well.[18] HDR relied on project information and financial analysis from EWSI, third party land values from a 2018-Q2 analysis of land prices within a 40 km radius of Edmonton, independent Environmental Studies completed for the Project, results of EWSI's participant involvement program, review of literature and other studies and feedback from the June 2018 workshop participants.

79. A combination of Multiple Account Evaluation and Break-Even Approaches is applied for the SVA. Under the Multiple Account Evaluation framework, there is no overall weighting or scoring but rather the relative trade-offs between alternatives are evaluated and documented. The determination of what is the preferred alternative is left to the perspective of each individual decision maker recognizing that different stakeholders will have different perspectives on the relative importance of each of the criteria. The Multiple Account Evaluation is appropriate in applying social/environmental value to the land at E.L. Smith as the value is highly dependent on different stakeholders' views. The Multiple Account Evaluation Approach is summarized in Table 12 of HDR's report.

80. The Break-Even Approach is also used to attempt to monetize the environmental/social (ecosystem) value the decision maker would need to assign to the land at E.L. Smith to make the proposed Project equivalent to the Offsite Local Solar Farm. The breakeven analysis is summarized in Figure 4.2-1 where the blue bars in the charts represent the most conservative[19] estimated financial costs of each alternative while the red bars represent the emissions costs or surplus electricity emissions benefits in the renewable cases. The yellow arrow highlights how significant any ecosystem damage would need to be at the Project site for the Offsite Local Solar Farm to be preferable.

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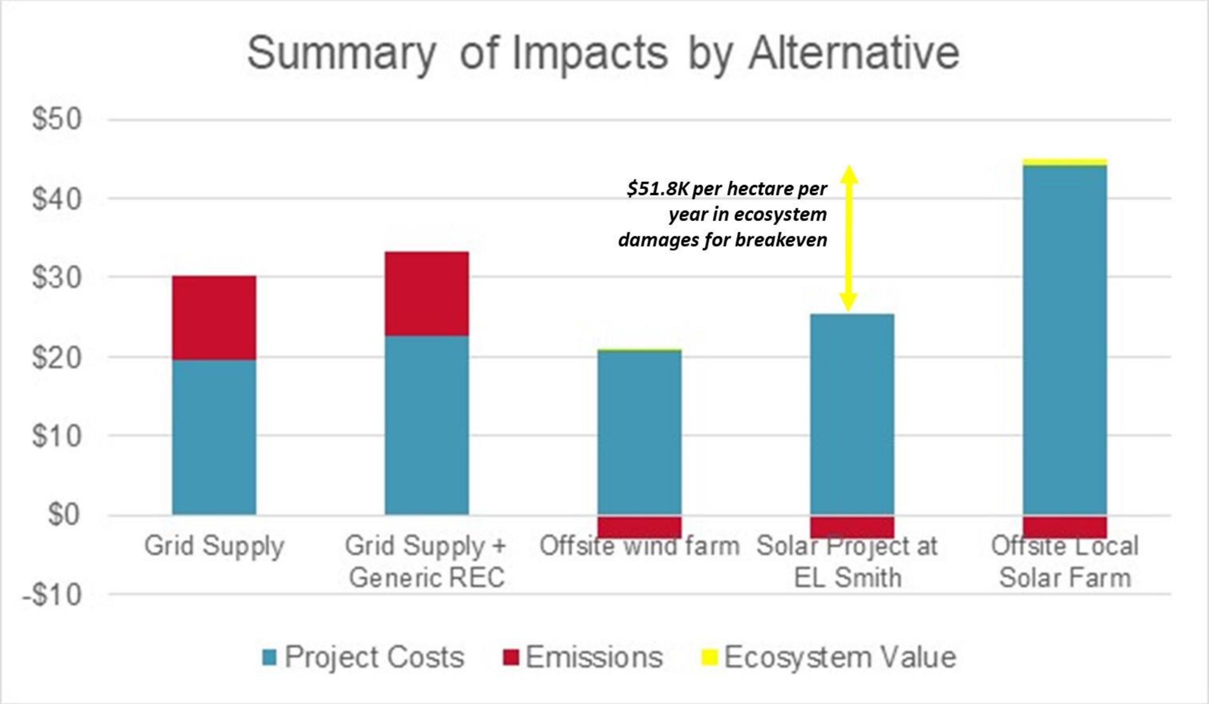
[18] Page 7 of HDR's Sustainability Value Analysis of the E.L. Smith Solar Farm Project, August 12, 2018.

[19] A key and conservative assumption in this alternative is that EWSI would be able to purchase a 55 acre parcel of land for $0.4 million or $7,000 per acre. The land costs for each off-site location are representative values from a 2018-Q2 analysis of land prices within a 40 km radius of Edmonton prepared by an external consulting firm. This analysis showed average land prices in the Woodbend area, most closely representing the Project Site, range between $20,000 to $70,000/acre. Rental values for similar land ranges between $70 and $110 per acre per year for agricultural purposes.

Figure 4.2-1[20]
Summary of Impacts by Alternative
($million)



81. The break-even analysis on a total monetized cost basis, as illustrated by the yellow arrow in Figure 4.2-1, illustrates that in order to justify a solar alternative not located at the E.L. Smith site, "*decision makers would have to place an extraordinarily high ecosystem value on the E.L. Smith site and that the project development there would result in very significant ecosystem damages*"[21]. In other words, the ecosystem value of the undeveloped site at E.L. Smith would have to be $51.8 thousand per hectare per year (25 times greater than the average land values seen in the economic literature) and this entire amount would have to be completely eradicated with the project development for the two solar alternatives to be equal in value.

82. As illustrated in Figure 4.2-2, such an ecosystem valuation exceeds by far any specific estimate found in the economic literature. The Economics of Ecosystems and Biodiversity (TEEB) database and HDR calculated valuations for grasslands used in the offsite alternative evaluation typically average $2 thousand per hectare per year, with North Saskatchewan River (NSR) estimates ranging between $1 thousand per hectare per year for

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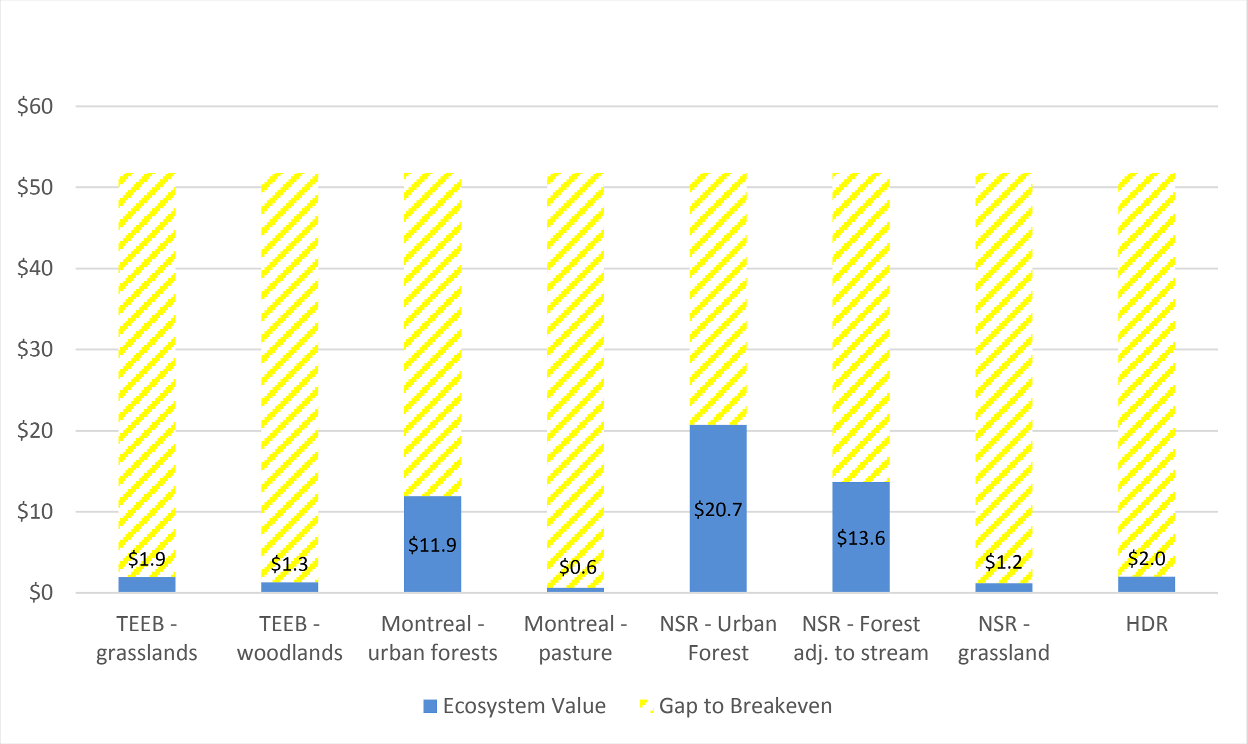
[20] Figure 1 of HDR's Sustainability Value Analysis of the E.L. Smith Solar Farm Project, August 12, 2018.
[21] Page 37 of HDR's Sustainability Value Analysis of the E.L. Smith Solar Farm Project, August 12, 2018.

grasslands/pastures/hayfields to up to $21 thousand per hectare per year for urban forests[22]. These values from economic literature are shown in the blue bars in Figure 4.2-2. The yellow bars present the gap between these ecosystem values and the break-even value of $51.8 thousand per hectare per year and highlight how significant any ecosystem damage would have to be at the E.L. Smith site for the Offsite Local Solar Farm to be preferable. The damages at E.L. Smith would have to be on average 25 times or more greater than the average values seen in the economic literature.

Figure 4.2-2

Difference Ecosystem Value Estimates and Breakeven ($/Ha/Yr)[23]



83. From an overall evaluation perspective the HDR report concludes :

> …. if additionality and having local generation are required, then really there are two alternatives: (i) the Solar project at E.L. Smith and (ii) the offsite local solar farm. The Solar project at E.L. Smith can be developed at a much lower financial cost with both these alternatives providing equivalent emission reduction benefits. Decision-makers will have to determine whether the project development at E.L. Smith could result in very significant ecosystem damages as highlighted in the breakeven analysis. This

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[22] Escalated to 2018 dollars for comparison.

[23] Figure 2 of HDR's Sustainability Value Analysis of the E.L. Smith Solar Farm Project, August 12, 2018.

> would seem implausible given the evidence in the economic literature and the findings of the Environmental Evaluation by Stantec Consulting.[24]

84. The full SVA analysis is provided in the report entitled Sustainability Value Analysis of the E.L. Smith Solar Farm Project included as Attachment 1 to this report.

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[24] Page 3 of HDR's Sustainability Value Analysis of the E.L. Smith Solar Farm Project, August 12, 2018.

APPENDIX A - PROJECT RISK AND RISK MITIGATION

85. Table 1 summarizes key Project risks EWSI has identified along with comments on each of these risks and planned mitigation strategies. Risks have been classified as financial, environmental, social and regulatory.

86. Environmental risks and recommendations for mitigation have been assessed in further detail in the Municipal Environmental Impact Assessment Report prepared by Stantec and included in EWSI's LDA to the City. To address potential environmental risks, EWSI intends to adopt the risk mitigation strategies recommended in Municipal Environmental Impact Assessment Report prepared by Stantec to ensure any effects to the environment are not significant.

87. As determined in HDR's SVA, the largest area of potential risk of ecosystem value loss at the Project site relates to cultural and aesthetic services (risk of negative impacts to recreation, mental and physical health, tourism, aesthetic appreciation and inspiration for culture, art and design aspects of ecosystem value)[25]. However, the SVA concludes that, based on ecosystem values obtained from economic literature, the potential loss in ecosystem value at the Project site would not be sufficient to justify an offsite solar alternative. Furthermore, EWSI is proposing to mitigate any potential negative social impacts through the various community integration and support plans described in section 3.4 which will serve to develop positive social benefits including cultural and educational benefits.

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[25] Page 24 of HDR Report.

Table 1
Risks and Risk Mitigation

	A	B
	Project Risk	**EWSI Mitigation Plans**
	Financial Risks	
1	**Capital Costs -** Risk Project capital costs increase beyond the forecast $32 million.	The $32m capital cost estimate for the Project is based on preliminary design drawings in the Stantec report. Based on the current trend of rapid solar technology development with falling prices, if anything, EWSI expects to see a reduction in capital costs as the design progresses. EWSI has initiated a request for proposal process to competitively bid the design and construction of the Project. This process will allow EWSI to obtain the best value offer for completing the Project design and construction. Cost estimates will be evaluated at several stages through design to mitigate potential cost increases.
	Environmental Risks	
2	**Birds and Wildlife -** Risk of bird and wildlife mortality / disturbances.	In the pre-construction phase, EWSI will survey bird nests and conduct wildlife sweeps in the project development area. If nests or dens are found, it will consult with a wildlife specialist to determine appropriate mitigation actions. EWSI adjusted the project site to allow a minimum 100m setback of the project development area from the river. During construction, the project development area will be fenced in an effort to keep out wildlife. A wildlife resource specialist will be consulted for species identification and implementation of appropriate mitigation measures, as necessary. Post construction, EWSI will develop a Project-specific wildlife mortality monitoring plan and consult with the AEP to identify additional mitigation measures.
3	**Soil Contamination -** Risk of soil contamination due to spills from electrical equipment.	Inverter stations may be mounted on concrete foundations and any fluid-filled electrical equipment will be fitted with secondary containment to prevent contamination from potential spills. Fluid levels and equipment temperatures will be monitored though EWSI's SCADA system and trained maintenance personnel will be immediately dispatched to respond to alarms. It is EWSI's policy to have emergency response plans in place for all operating sites.
4	**Stormwater Risks -** Risk of soil disturbances causing erosion or storm water storage capacity issues.	Pre-construction detailed site grading plans will be developed during the detailed design phase of the project. During construction, topsoil temporarily disturbed will be replaced and uniformly feathered out across the areas and disturbed areas will be seeded with a City approved native seed mix. EWSI will implement an Erosion and Sediment Control Plan and storm water management plan. Post-construction monitoring of the areas disturbed by the project will include semi-annual inspections with a focus on identifying vegetation reestablishment, compaction or other soils related concerns, the formation of erosive gullies, isolated pooling, and sediment build-up. Additional mitigation measures will be implemented where required.

	A	B
	Project Risk	**EWSI Mitigation Plans**
5	**Noise -** Risk of noise impact to nearby residents.	A noise study was conducted to ensure proposed equipment will meet Alberta Utilities Commission (AUC) Rule 012 for Noise Control and the City of Edmonton's Community Standards Bylaw for Noise Control. Based on preliminary designs, the cumulative sound level is below the permissible level specified by the AUC at all receptor test locations. To mitigate sound from inverters, EWSI is planning to house the inverters within enclosures.
6	**Viewscape** – Risk of change in aesthetic visual quality of the River Valley.	According to third party environmental studies completed for the Project, "viewpoints outside of the (Project site) are limited due to the existing topography, infrastructure and vegetation (even in winter months). Additionally, the existing nature of the WTP (water treatment plant) doesn't lend to a high aesthetic value in pre-project condition"[26]. . Landscaping or other visual screening measures (e.g. slats in fencing) are being considered to screen the Project from observation points along the southern boundary as well as from a potential future trail along the eastern boundary. EWSI will evaluate the potential for landscaping or other screening options along the southern boundary of the fence line during the detailed design process. EWSI plans to offset these risks with positive social benefits obtained through integration of the Project into the River Valley and plan for future City trail system. Further, EWSI plans to create a multi-functional area at the Project site and develop long-term partnerships to support education and research opportunities associated with solar energy generation.
	Social Risks	
7	**Historical Resources -** Risk of unauthorized disturbance or destruction of part or all of a historic resource.	All *Historical Resource Act* requirements for the Project are being completed as required. All construction works will comply with any conditions identified in the *Historic Resources Act* authorization. In the event historical resources are encountered during construction, activities will be halted and Alberta Culture and Tourism (ACT) notified. EWSI plans to offset these risks with positive social benefits obtained by enhancing the Project through creation of a demonstration site providing education of culture and history of the land in collaboration with Indigenous communities.
8	**Glare** – Risk of glare to community and drivers on Anthony Henday.	A Glare Study was completed to evaluate potential issues with glare from the solar panels and results indicate the Project is expected to have either no glare or low levels of glare at most locations, including the residences along the east and west ridges of the North Saskatchewan river valley and for drivers using Anthony Henday Drive.
	Regulatory Risks	

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[26] Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm , Stantec July 2018

	A	B
	Project Risk	**EWSI Mitigation Plans**
9	**Regulatory Approvals** – Risk of Project delays due to delay in obtaining any of AUC approval, City approval of the LDA or ACT Clearance.	If regulatory approvals are not obtained in anticipated timeframes, the project start-up will be delayed and EWSI will not be able to meet its commitments under the 2017-2021 PBR approval. To mitigate this risk, EWSI will purchase RECs available on the market to meet its commitment to replace at least 10% of its conventional power consumption with green energy during the 2017-2021 PBR term.

APPENDIX B – REGULATORY APPROVALS

1. The following provides a summary of the regulatory approvals process and status for the AUC facility application, the City of Edmonton's zoning application, Historical Resources Act clearance and AESO Connection clearance.

1.0 AUC Facility Application

2. On March 14, 2018, EWSI filed a Facility Application with the AUC for approval to build and operate the new solar farm under section 11 of the Hydro and Electric Energy Act. The AUC regulates, among other things, the construction and operation of power generation facilities in the province.

3. To support its Facility Application, EWSI has complied with AUC Rule 007 requirements (rules for power plant applications with a capacity of more than 10 megawatts): Rules Respecting Applications for Power Plants, Substations, Transmission Lines, and Industrial System Designations. The Facility Application includes some key components such as:

- **Environmental Evaluation** – prepared independently by Stantec on behalf of EWSI, which examines the potential effects of construction and operation of the Project on specific ecosystem components including: terrain and soils; vegetation species and communities; and wildlife species and habitat. The Environmental Evaluation includes a description of existing conditions and predicts residual effects of the Project, considering the mitigation measures that will be implemented.
- **Participant Involvement Program (PIP)** – which summarizes EWSI's comprehensive consultation with landowners, occupants, residents, agencies, and other interested parties. All stakeholder information, communications and commitments are recorded in the PIP. The PIP is further explained in section 2.4 below.
- **Noise Impact Assessment -** conducted to ensure that the proposed equipment will meet Alberta Utilities Commission (AUC) Rule 012 for Noise Control and the City of Edmonton's Community Standards Bylaw for Noise Control. Based on EWSI's preliminary design, the cumulative sound level (including the ambient

sound level of the site, third party facilities in the area and the proposed solar farm) is below the permissible level specified by the AUC at all receptor test locations and thus the Project noise effect is in compliance with the AUC Rule 012 requirements. EWSI does not anticipate an increased level of noise in the area as a result of this Project. The inverter stations that will be located throughout the Project area are the only equipment that will generate sound. To mitigate this issue, EWSI is planning to house the inverters within enclosures. No noise is expected to be generated from the solar panels themselves.

- **Glare Study** - to evaluate potential issues with glare from the solar panels. The results of the Glare Study indicate that the Project is expected to have either no glare or low levels of glare at most locations, including the residences along the east and west ridges of the North Saskatchewan river valley. The Glare Study also identified that drivers using Anthony Henday Drive should not experience glare from the solar farm.

4. On April 23, 2018, the AUC requested additional information from EWSI. Responses to the request were sent to the AUC on May 16, 2018. The Alberta Utilities Commission Act directs the AUC to hold a public hearing in the event application may directly and adversely affect the rights of a person.[27] To date, seven parties registered to participate in the proceeding. Two of these participants expressed their support for the Project and five have expressed opposition generally concerning the social, environmental and visual effects of the solar farm in the Edmonton River Valley. Two of these parties declined to participate in a hearing process. Of the three parties who indicated intent to participate in a hearing process, the AUC has determined that one participant is granted standing which means they have demonstrated to the AUC that they have rights which may be directly and adversely affected by the proposed Project. This participant withdrew their participation in the proceeding on July 17, 2018. Four participants were granted limited participation rights, meaning they may submit a brief submission further outlining the matters that they wish the Commission to consider no later than August 7, 2017. EWSI will be provided an opportunity to respond participant submissions by August 14, 2018.

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[27] Section 9(2) of the Alberta Utilities Commission Act, Chapter A-37.2

2.0 City of Edmonton Rezoning Process

5. The proposed Project is located within the municipal jurisdiction of the City of Edmonton on land owned by EWSI. In addition to seeking the AUC approval, EWSI's proposed Project requires approval of its Land Development Application (LDA) from the City. In May 2017, EWSI submitted the LDA to the City. The purpose of the LDA is to i) apply for re-zoning of the EPCOR-owned land where the Project is located from a Metropolitan Recreation Zone (A) to a Direct Development Control Provision (DC1) and ii) apply for an amendment to the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188) to permit the development of the solar farm. The Bylaw currently lists "Public Utilities" as an acceptable use at the site. The term "Public Utilities" as used in the bylaw includes "such uses as water treatment plants, power stations, snow disposal sites, and sewage treatment plants". While a solar farm likely falls within the scope of the term "power stations" and is similar in nature to the other types of public utility uses contemplated in the bylaw, EWSI has applied for an amendment to the Bylaw to more clearly contemplate the development of a solar farm at the existing E.L. Smith Water Treatment Plant site.

6. In support of the bylaw amendment application, in March 2018 EWSI submitted an Environmental Impact Assessment (EIA) prepared by Stantec which includes an evaluation of the existing environmental conditions and predicts residual effects of the Project, considering proposed mitigation measures that will be implemented.

7. Following submission of the LDA in May 2017, the City undertook a technical review and held discussions with EWSI regarding future public trail access on the Project site. The City and EWSI then entered into a memorandum of understanding to allow for a public trail on EWSI lands at E.L. Smith outside of the new security fence proposed around the Project. At a later date, the City will determine the exact location of these trails and an access easement or right of way will be registered by the City on these lands. EWSI is committed to addressing Breathe / *Ribbon of Green's* education and trail principles by ensuring that recreational trail connectivity through the site is facilitated by providing the aforementioned access and by including an educational component to the Project to inform the public about water treatment, renewable energy and history of the site. Recently, in May 2018, EWSI initiated a meeting with the City to discuss the draft Breathe / *Ribbon of Green* plan that was released in April 2018. The meeting was to share feedback and exchange ideas on the plan in the context of not only the Project, but the E.L. Smith Water Treatment Plant itself. EWSI re-affirmed its intention to partner with

the City on the portion of trail network around the E.L. Smith Water Treatment Plant and proposed E.L. Smith Solar Project.

8. The City completed consultations with the public on the LDA which included holding an open house on February 13, 2018 which EWSI participated in. EWSI was asked to revise the LDA to rezone from Metropolitan Recreation Zone to Direct Control Provision (DC1). This will limit the development rights to only solar power infrastructure or the future expansion of the water treatment plant.

9. Following the submission of the EIA to the City at the end of March 2018, the City reviewed the submission and provided comments back to EWSI at the beginning of June, 2018. Currently, EWSI is preparing an updated report to satisfy the City’s requests for additional information. Once the LDA is finalized, the City will issue public notice of a Council Meeting to be held to review the proposed rezoning application and proposed amendments to Bylaw 7188. EWSI expects that the City will consider approval of the re-zoning and proposed amendments to Bylaw 7188 in the fourth quarter of 2018.

10. In the event that City Council approves the rezoning and Bylaw 7188 amendments, EWSI will submit a development permit application to the City. EWSI is developing the detailed design documentation to support its development permit application. EWSI anticipates receiving the development permit approval from the City after the re-zoning process is completed.

3.0 Historical Resources Act Clearance

11. Historical resources in Alberta are protected under the Historical Resources Act (“HRA”) and include archaeological, historic and palaeontological sites, artifacts and fossils. Under the HRA, no historical resources site can be disturbed without approval of the Minister of Alberta Culture and Tourism (“ACT”). ACT determines and issues the requirements for Historical Resource Impact Assessment (“HRIA”) studies and for mitigation measures for each archaeological and paleontological resource site. ACT also issues HRA clearance for projects to proceed.

12. The Project is situated on lands with designated high potential for both archaeological and paleontological sites. As such, the E.L. Smith Solar Project requires HRA clearance from ACT. EWSI retained Stantec to consult with ACT and meet the requirements under the HRA.

EWSI and Stantec have been working with ACT to complete required work towards obtaining HRA approval. The following describes the process EWSI is undertaking to meet ACT's requirements.

13. In April 2017, EWSI submitted a Historical Resource Application to the Minister of ACT. On the direction of ACT, EWSI completed both archaeological and palaeontological HRIA studies. Based on the preliminary findings of the HRIA's, an area on the Project site is a newly designated archaeological site by ACT, recorded as site # FiPj-176. This site can be described as a multicomponent pre-contact period campsite which consists of a series of undisturbed cultural occupations from below the plough zone (approximately 30 centimetres below surface) to approximately four metres below ground surface.

As a result of these findings, ACT issued further requirements under the HRA which consisted of two stages of Historical Resources Impact Mitigation ("HRIM") field studies. The two phases of HRIM field studies involve controlled excavation to locate and recover archaeological resources and to determine and mitigate the effects of proposed developments. Stage one is complete and stage two is currently underway with the field studies completed and only final reporting remaining. Given the potential significance of the archaeological finds from the field studies, ACT highly recommended EWSI initiate the process of engagement with local Indigenous communities who have expressed previous interest in projects within the City of Edmonton regarding the nature of these discoveries, the scope of ongoing field investigations and the level of sensitivity associated with future development activities across the immediate area. A discussion of EWSI's consultation and engagement with Indigenous communities is provided below. EWSI expects to receive HRA clearance in the fourth quarter of 2018 following completion of ACT requirements. EWSI is committed to meeting all of ACT's requirements and recommendations.

4.0 AESO Connection

14. The proposed Project has been categorized by the Alberta Electric System Operator (AESO) as "behind the fence", as it does not require any physical changes or upgrades to the transmission system. The assigned AESO project number is 1982 and the name of EPCOR WSI DG Solar. EWSI needs to receive acceptance from AESO to connect the Project to the electrical grid and join the power pool market as a participant. The Project has met Stage 1 and 2 requirements of the behind the fence connection process and is currently in Stage 3. Stage 4

through 6 will proceed concurrently with the design, construction and commissioning of the Project, respectively.

APPENDIX C – INDIGENOUS CONSULTATIONS

1. EWSI's objective is to ensure Indigenous rights-holders are included as an audience of consideration during the planning stages of the Project. EWSI looked to agencies such as the provincial Aboriginal Consultation Office ("ACO") and ACT to provide guidance on the duty of EWSI to ensure Treaty rights are respected and Indigenous groups included in the consultation and planning phase of the Project. The ACO reviewed EWSI's Project and determined there was no duty to consult based on geographic location and that no First Nations or Metis Nations would experience an impact to Treaty rights based on the geographic location of the Project consequently requiring no further action from EWSI. ACT determined there is historical and cultural relevance to the proposed Project area due to the historical uses of Edmonton's river and river valley system and recommended EWSI to notify local Indigenous communities who have a recognized connection to previous projects within the city of Edmonton.

2. Although it was determined there was no duty for EWSI consult, EWSI has elected to implement a full program of consultation with Indigenous communities about the Project, the site and historical resources. EWSI has notified 21 First Nations communities and for those that expressed interest, EWSI is continuing consultation efforts and engagement activities. To date:

- 13 Nations/communities expressed some level of interest in the Project;
- two Nations asked to be kept informed as the Project progressed;
- six Nations requested community presentations in front of their Consultation Departments and/or Chief and Council,
- one requested a sit-down meeting with EWSI to review project materials;
- four requested the opportunity to have Elders and field technicians visit the site and
- seven participated alongside archaeologists on the site in completing the stage two HRIM field study requirements involving controlled hand excavations to locate and recover artifacts;
- one expressed interest in the Project much later than the others and EWSI continues to look for ways to meet and accommodate this Nation to ensure, to the extent possible, their inclusion in the dialogue regarding the significance of this site.

3. Through site visits, active participation in archeological investigations, and presentation to Communities, EWSI continues to gather feedback from Nations. While each Nation was able

to express their own thoughts and pose questions, there were some common questions that resonated with all the Nations involved: protection of animals, protection of vegetation and acknowledgement/protection of any artifacts found. EWSI responded to these concerns by explaining the various mitigation efforts planned for the Project. For example, by detailing how changes to the Project site plan had been made to widen movement corridors for animals and minimize tree removal and vegetation disturbances, Nations learned of the care and planning that EWSI was putting into the Project and seemed to be reasonably satisfied with the efforts taken.

4. Continued conversations with some Nations revealed that there was a belief that the area could contain plant species with specific cultural and medicinal value. EWSI has begun investigating how these plant species can be harvested now and protected/replanted for potential future use. EWSI is committed to working with experts/Elders inside these Nations to develop mitigation strategies that protect and promote these culturally significant plant species. EWSI also took the opportunity to discuss with Nations that came for site visits how other ideas, such as the inclusion of native pollinator habitat, were being discussed. The Nations were seemingly appreciative of the thought and holistic approach that EWSI was taking to planning and exploring the balance that this Project could represent.

5. As part of stage 2 of the Historical Resource Act work identified in Section 4.3, seven Nations have had the opportunity to be directly involved, discover artifacts as they excavated areas by hand, have direct access to the archaeologists and the ability to ask questions and share knowledge of the site. EWSI intends to conclude this work by developing a one-day information sharing workshop wherein representatives from the different Nations can return to the site, review the findings and artifacts and learn about the entirety of what was discovered. Transparency will demonstrate that EWSI is committed to sharing knowledge and is interested in approaching this knowledge from both the perspectives of western science and Traditional knowledge. Cooperation and share knowledge amongst Nations and EWSI has been viewed as a positive outcome. EWSI also recognizes that beyond the academic pursuit of protecting flora, fauna and historically/culturally significant artifacts, that there is a spiritual connection that must be recognized. Throughout the site visits EWSI has looked to provide prayer opportunities and observe spiritual protocol as directed and lead by Nations. EWSI continues to have open conversations with Nations and explore ideas that can be incorporated later in the project execution that would allow for a greater level of spiritual inclusion and recognition.

APPENDIX D - ALTERNATIVE ANALYSIS METHODOLOGY AND ASSUMPTIONS

1. The following provides more detailed explanation of EWSI's alternative analysis methodology and assumptions including more detailed explanations of the alternatives, assumptions, calculation methods and sources of financial information.

1.0 Methodology and Assumptions

2. EWSI evaluated the net present value of the impact on EWSI's revenue requirement under each alternative based on a 30-year analysis which represents the expected life of the solar farm. The key assumptions supporting the net present value analysis include:

- **Discount rate**. Net present values are calculated using a 6.83% discount rate, equal to EWSI's weighted average cost of capital, based on a capital structure of 60% debt/40% equity, and a 4.60% cost of debt and 10.175% cost of equity.
- **Inflation (CPI)** is assumed to be 2.1% and is held constant for the study period.
- **Grid purchase volumes** are equal to the 14,000 MWh of energy produced and consumed on site at E.L. Smith. These volumes decline at 0.5% annually, consistent with decrease in solar power production resulting from the degradation of the solar panels over time.
- **Grid prices** for both purchases and export for 2018 to 2032 are based on average Alberta electricity prices from EDC Associates Ltd.'s Q2-2018 Quarterly Forecast Update. Post-2032 electricity prices are assumed to be equal to 2032 prices.
- **Capacity charges** are also based on EDC's Q2-2018 Quarterly Forecast Update, with the capacity market introduced in November 2021.
- **Wire charges** are based on forecast from EDTI. Wire charges also include distribution lines losses, equal to 2% of power purchases.

2.0 PBR Forecast

3. The PBR forecast represents the Green Energy Initiative in the 2017-2021 PBR Application. Under this initiative, EWSI will replace approximately 10% of its conventional energy (9,636 MWh) with locally produced renewable power, commencing in 2018.

4. The net present value of the PBR Forecast in row 23 of Table 4.1-1 above is $32.3 million and is comprised of the following:

- **Grid Supply -** the $7.83 million cost of purchasing 9,636 MWh of conventional energy at E.L. Smith water treatment plant at the PBR power price forecast.
- **Wire and Capacity Costs -** the $7.67 million cost of wires and capacity payments[28] associated with the 9,636 MWh of conventional power purchases.
- **Green Power Premium** - the $16.83 million incremental cost of green energy based on EWSI's forecast of building or purchasing 9,636 (10% of conventional power consumption) local additional RECs. This was estimated at $1.9 million annually in the 2017-2021 PBR. Post-2021, the cost of local additional RECs is assumed to be equivalent to the cost of the Offsite Local Solar Farm.

3.0 Alternative 1: Grid Supply

5. In the Grid Supply alternative, EWSI would not purchase green energy, or otherwise provide for reductions in CO2 or GHG emissions, but would simply purchase conventional power from the electricity grid ("grid supply").

6. The net present value of the Grid Supply alternative of $17.1 million in row 23 of Table 4.1-1 is comprised of the following:

- **Grid Supply -** the $8.86 million cost of purchasing 14,000 MWh of conventional energy at E.L. Smith.
- **Wire and Capacity Costs -** the $8.27 million cost of wires and capacity payments associated with the 14,000 MWh of conventional power purchases.

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[28] Currently, EWSI utilizes grid provided power for its energy supplies. Alberta's electricity market is an "energy only" market, meaning the market relies on the volatility of the market to send price signals to encourage new investment. In November 2016, the Alberta government announced a transition to a "capacity market" by 2021 in an effort to provide energy price stability and to support Alberta's transition from goal generation to renewable energy. Under capacity market, electricity consumers will pay energy, wires and capacity charges. The capacity charges used in the financial analysis are based on a Q2-2018 forecast developed by an independent Alberta-based energy forecasting group, using the same assumptions as were used to develop the energy price forecast.

7. This alternative is provided only to establish the net present value of conventional power, with the aim of consistently calculating the incremental net present value of green energy for the other alternatives. This alternative will not be pursued further as it is not aligned with either the City of Edmonton or EPCOR's strategies around sustainability and environmental stewardship.

4.0 Alternative 2: Grid Supply + Generic RECs

8. In this alternative, EWSI would continue to purchase electricity from the grid at grid-mix prices and would enter into a separate contract to purchase unbundled generic RECs at their current estimated market price of $12 per MWh. As the REC market in Alberta is still relatively immature, EWSI estimated the market price for RECs through review of recent transactions with existing renewable energy facilities, noting that, in no case, did any transactions include RECs associated with locally produced renewable power.

9. The net present value of the Grid Supply + Generic RECs alternative of $19.8 million in row 23 of Table 4.1-1 is comprised of the following:

- **Grid Supply -** the $8.86 million cost of purchasing 14,000 MWh of conventional energy at E.L. Smith.
- **Wire and Capacity Costs –** the $8.27 million cost of wires and capacity payments associated with the 14,000 MWh of conventional power purchases.
- **Generic REC purchases** - the $2.73 million cost of generic RECs equivalent to the 21,500 MWh of renewable energy generated by the E.L. Smith Solar Project.

Although this alternative has the lowest net present value of the green energy alternatives, generic RECs available in the market do not provide additionality since they represent greenhouse gas emissions reductions that have already occurred. According to the City's Energy Transition Strategy, offsetting is often not pursued until a community has done everything it can to avoid, reduce, and replace energy sources. The City recommends a portfolio of locally sourced RECs that demonstrate additionality to the electricity grid rather than purchasing credits from existing renewable energy facilities in order to show the City's leadership and commitment to greening the electricity grid[29].

5.0 Alternative 3: Offsite Wind Farm

10. In this alternative, EWSI would enter into a third-party contract for an interest in a larger scale wind project in southern Alberta. The contract would provide EWSI with 21,500 MWh of wind power, which EWSI would sell onto the grid at pool prices, enabling EWSI to retain 21,500 MWh RECs. The 21,500 MWh wind exports to the grid are assumed to be sold at discounted off-peak pool prices given wind projects tend to generate power during off-peak hours.

11. The net present value of the Interest in a Wind Farm Alternative of $20.59 million in row 23 of Table 4.1-1 is comprised of the following:

- **Grid Supply -** the $8.86 million cost of purchasing 14,000 MWh of conventional energy at E.L. Smith.
- **Wire and Capacity Costs -** the $8.27 million cost of wires and capacity payments associated with the 14,000 MWh of conventional power purchases.
- **Wind Project Costs –** the $12.29 million cost of procuring or developing 21,500 MWh of wind generated electricity. EWSI has based these costs on the results of the REP 1 auction. This assumption recognizes that the best (lowest cost) sites for wind would have been included in REP 1, so REP 2 and 3 prices should not be lower than the highest price from REP 1. Accordingly, EWSI has assumed that the contract price for wind would be equal to the highest price from the REP 1 auction, plus a 20% premium to account for the small scale of EWSI's power purchases, which would only account for power generated by about 1.5 wind turbines.
- **Export Power –** the $8.82 million in revenues from the sale 21,500 MWh of renewable power onto the grid. Since wind power is typically generated at off-peak hours, EWSI has assumed that export power sales would be made at a 35% discount to average grid supply prices.

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[29] Page 27, Edmonton's Greenhouse Gas Reduction Management Plan: City Operations 2019-2030.

12. Although the interest in a large scale wind farm in Southern Alberta is the most cost effective approach to providing additional greenhouse gas emission reductions in the province, it does not align with the City's *Energy Transition Strategy* or EPCOR's goals to reduce its own greenhouse gas emissions nor does it support the many community integration opportunities identified in section 3.2 above from having a local renewable supply of electricity. There are some key differences between Southern Alberta wind projects and the solar alternatives which account for the average cost per MWh difference:

- higher scale economies for the southern Alberta wind power (12MW capacity for E.L. Smith Solar compared to 50 to 400MW capacity for wind projects);
- lower capital costs for wind farms compared to solar farms in general;
- higher capacity factor for wind farms in general compared to solar farms which only produce during daylight;
- lower development costs (regulatory, stakeholder consultation costs) in rural southern Alberta compared to developing in an urban area such as the city of Edmonton;
- wind projects generate electricity during low pool price times and solar during high pool price times; and
- under the Alberta REP auction, the commodity risk is borne by AESO whereas for the proposed alternatives, the commodity risk is borne by EWSI.

13. While EWSI does not consider wind to be a viable alternative to E.L. Smith Solar as it is not from a local renewable source, wind power is being investigated as part of EPCOR's overall energy management and emissions reduction strategy as discussed in section 2.2 of this report. As noted in section 2.2, EPCOR's strategy with regard to green energy procurement is to combine a portfolio of local, additional solar assets, such as the solar farm at E.L. Smith with a large volume of cost-effective additional green electricity from a new wind farm to be built in southern Alberta. This strategy provide significant portfolio benefits because solar and wind are complementary assets in an energy portfolio with solar peaking during the day and wind providing more energy at night. Without the solar component, these portfolio benefits could not be achieved. Furthermore, it may not be possible to obtain a small interest in a new large-scale wind farm as other off-takers would be required to provide the wind developer with revenue certainty to build a new project. EWSI is not aware of any such opportunities available today.

6.0 Alternative 4: E.L. Smith Solar Project

14. The E.L. Solar Project is forecast to produce approximately 21,500 MWh of electricity (23% of EWSI water services' conventional power consumption), with 14,000 MWh consumed directly by the E.L. Smith Water Treatment Plant and the remainder exported to the grid during hours when the full capacity of the solar farm exceeds the power requirements at E.L. Smith.

15. Power generation, consumption and export volumes in the first year of the Project at P50 (average year) volumes developed by Stantec[30] and EWSI, based on comprehensive modeling incorporating loss factors, snow and temperature data, and historical typical mean year meteorological data. In EWSI's analysis, forecast volumes are assumed to decline by 0.5% annually as the solar panels degrade over time.

16. The net present value of the revenue requirement impact of the proposed E.L. Smith Solar Project of $25.9 million Grid in row 23 of Table 4.1-1 is comprised of the following:

- **Project Costs -** the $31.35 million revenue requirement impact of the capital and operating cost forecasts for the E.L. Smith Solar Project (producing 21,500 MWh of renewable energy annually) including operations and maintenance costs, depreciation and debt and equity returns. The costs of constructing and operating the solar facility are based on estimates from Stantec's feasibility study, plus additional costs incurred by EWSI for project management, internal labour and capital overheads. ;
- **Export Power Sales –** the $5.43 million in revenues from the sale of approximately 7,500 MWh of renewable power onto the grid at the forecast pool price (21,500 MWh total production less 14,000 MWh power consumed at the E.L. Smith Water Treatment Plant). This exported power is produced during hours when the full capacity of the Project exceeds the energy requirements at the water treatment plant.

17. The E.L. Smith Solar Project meets the City's Energy Transition Strategy goals of criteria for both additionality and local renewable power production at a notional price per REC that is lower than that of the 30 year notional PBR alternative.

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[30] Stantec, Feasibility Study: E.L. Smith WTP Solar, May 19, 2017, Section 3.0 Production Forecast Review, P50/P90/P99 Analysis.

7.0 Alternative 5: Offsite Local Solar Farm

18. Currently, a locally produced renewable power supply is not available in the quantities EWSI requires to meet its 10% green energy commitment. Accordingly, EWSI has estimated the cost to build and operate an offsite solar farm within 40 kilometers of the City of Edmonton (which EWSI understands to meet the City's "local" criteria) and connected to the distribution or transmission grid, but not necessarily tied directly to any of EWSI's operating sites.

19. The costs of building and operating an offsite solar farm are significantly greater than at E.L. Smith, primarily because of the incremental capital and operating costs of locating the solar farm offsite rather than behind the meter. EWSI identified nine potential locations within a 40km radius of Edmonton. The land prices used in this alternative are representative values from a 2018-Q2 analysis of land prices prepared by an external consulting firm and ranged from $7,000 to $800,000 per acre. EWSI conservatively used the location with the lowest land value in its financial evaluation, meaning a key assumption in this alternative is that EWSI would be able to purchase a 55 acre parcel of land for $0.4 million. The additional capital costs at the selected location include the costs of a substation ($4.6 million), transmission lines to the substation ($1.1 million per km for a 0.44 km line), estimates developed by EDTI, and the cost of a 55 acre parcel of land ($7 thousand per acre) where the solar farm would be situated. Coincidentally, the site with the lowest land value also required the lowest transmission costs.

20. Operating and maintenance costs for the offsite solar farm have been estimated by EWSI at higher levels than for an on-site solar farm to account for travel to the off-site location. As well, income taxes, at statutory rates of 27% are applicable to the offsite solar farm as it would not meet the level playing field test set out under the Electric Utilities Act, section 95 for municipal ownership of electrical generation[31].

21. In this alternative, since the offsite solar farm would not be directly connected to EWSI's facilities, the entire 21,500 MWh of energy generated at the offsite solar farm would be exported to the grid. EWSI estimates export prices would be at a 15% premium to the average

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[31] Section 95 of the Electric Utilities Act, S.A. 2003, c. E-5.1 restricts the ways in which a subsidiary of a municipality, such as EWSI, may hold an interest in a generating unit, in order to eliminate any competitive advantages that may accrue by virtue of municipal ownership and ensure a "level playing field" among participants in the electricity market. At a minimum, EWSI expects that the offsite solar farm alternative would need to incur income taxes. However, it is also possible that EWSI would not be allowed to own and operate such a facility and recover the costs through regulated rates. In this case, EWSI would need to contract out to a third party to provide offsite local solar power. Regardless of whether EWSI owns and operates the offsite solar farm or obtains local solar power from through a third party, the economics are assumed to be equivalent for purposes of this analysis.

grid price, as solar power is typically generated during peak hours where pool prices are higher. EWSI would purchase 14,000 MWh of energy for E.L. Smith, and would also require incremental wires and capacity charges at E.L. Smith.

22. The net present value of the Offsite Local Solar Farm alternative is $42.5 million in row 23 of Table 4.1-1 and is comprised of the following:

- **Grid Supply -** the $8.86 million cost of purchasing 14,000 MWh of conventional energy at E.L. Smith.
- **Wire and Capacity Costs -** the $8.27 million cost of wires and capacity payments associated with the 14,000 MWh of conventional power purchases.
- **Project Costs -** the $40.96 million capital and operating cost forecasts for the E.L. Smith Solar Project (producing 21,500 MWh of renewable energy annually), including the incremental operating and maintenance costs for the offsite project, additional capital costs for land and interconnection, and income taxes.
- **Export Power –** $15.61 million in revenues from the sale of entire production of 21,500 MWh of renewable power onto the grid. Since this production is at peak hours, the forecast price of export power has been increased by 15% from the forecast average pool price. This price differential is consistent with the price differentials included in EDC Associates Ltd.'s Q2-2018 Quarterly Forecast Update.

8.0 Alternative 6: Commercial Rooftop Solar

23. EWSI also explored the possibility of acquiring local solar RECs from residential and commercial rooftops within the City of Edmonton. Power production, configurations and quantities of roof-top solar power installations, capital and operating costs for commercial and residential rooftop solar power alternatives are based on a July 2018 report prepared for EWSI by Skyfire Solar Energy Systems ("Skyfire")[32].

24. For the commercial rooftop alternative, Skyfire calculated that a mix of 100 kW and 250 KW solar power systems installed on 104 large (Home Depot-sized) commercial rooftops could provide 21,500 RECs, equivalent to the REC volumes generated by the proposed E.L. Smith Solar

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[32] SkyFire Energy Systems, EPCOR Distributed Rooftop Solar Study (DRAFT), July 11, 2018.

Project. In this alternative, EWSI would rent roof space from the commercial building owner under a long term lease and would install and maintain the solar power systems for their 30 year lives. Solar generation would be metered with EWSI retaining the RECs, and selling the electricity onto the grid.

25. The net present value of the Commercial / Residential Rooftop Solar alternative of $53.3 million in row 23 of Table 4.1-1 is comprised of the following:

- **Grid Supply -** the $8.86 million cost of purchasing 14,000 MWh of conventional energy at E.L. Smith.
- **Wire and Capacity Costs -** the $8.27 million cost of wires and capacity payments associated with the 14,000 MWh of conventional power purchases.
- **Project Costs -** the $51.82 million capital and operating cost forecasts for the 104 commercial roof top solar installations needed to produce 21,500 MWh of renewable energy annually. The capital costs of this project include the costs provided by Skyfire, plus additional EWSI costs for internal labour, capital overheads and capitalized interest. Operating costs include inspections, repairs and maintenance, marketing and administration. Because of the large number of installations, these costs are significantly greater than the operating and maintenance costs of the E.L. Smith Solar farm. In addition, this alternative also includes rent paid to the building owner for the use of the roof. The annual lease payments are assumed to be equal to the value of the electricity at grid supply peak prices, which equates to an annual lease rate of $2.60 per ft^2. Marketing studies would need to be conducted to determine if this lease rate would be sufficient to entice building owners with suitable rooftop space to participate.
- **Export Power –** $15.61 million in revenues from the sale of entire production of 21,500 MWh of renewable power onto the grid. Since this production is at peak hours, the forecast price of export power has been increased by 15% from the forecast average pool price.

26. A key assumption for this alternative is that EWSI would be able to find 104 suitable properties and that EWSI would be able negotiate leases and install all systems in one year. Realistically, this could take many years to assemble. Even assuming that EWSI could deal with these practical challenges, the cost per REC of this alternative would be $159.34, 64% more

expensive that building a utility scale grid connected solar farm and more than four times the cost of RECs generated by the proposed E.L. Smith Solar Project. Accordingly, EWSI does not consider it necessary to further pursue this alternative.

9.0 Alternative 7: Residential Rooftop Solar

27. EWSI also considered the costs and benefits of installing solar panels on residential rooftops. For residential rooftops, a combination of 3kW, 5kW, 7kW, and 9kW systems were assumed and production profiles were based on an aggregation of actual production achieved by residential PV systems in the City of Edmonton.

28. Skyfire calculated that 3,268 residential rooftop installations would be required to match the generation of the E.L. Smith Solar Project. This alternative has significant short-comings. The costs of this alternative are significantly greater than those of all other alternatives, resulting in a notional REC value of $244.35, more than six times greater than the E.L. Smith option. Besides the high costs, it is extremely unlikely that EWSI would be able to identify 3,268 suitable properties and install all the solar systems in a reasonable timeframe. This is a very different business model from building a utility scale solar farm and likely more complicated than pursuing a commercial roof top offering. Owing to the high cost, complexity and inherent risks, EWSI does not consider it necessary to further pursue this alternative further.

10.0 Alternative 8: EWSI Roof-top Solar

29. EWSI assessed opportunities to place roof-top solar panels on EWSI buildings and reservoirs situated in predominantly commercial/industrial areas. Based on the roof size and location, renewable power generation would be maximized with installation of solar panels on the roofs of the Rossdale clarifiers, the Rossdale reservoirs, the E.L. Smith reservoirs and three field reservoirs (North Jasper Place, Millwoods and Papaschase). The total renewable power generated by these installations would be 5,000 MWh annually, all of which would be consumed on-site, providing “behind the meter” benefits similar to those provided by the E.L. Smith Solar Project, but on a much smaller scale.

30. The net present value of the EWSI Roof Mount Solar alternative of $26.7 million in row 23 of Table 4.1-1 is $26.7 million and is comprised of the following:

- **Grid Supply** – the $5.66 million cost is the difference between the approximately 5,000 MWh of renewable energy produced and consumed on-site and 14,000 MWh of power needed to provide comparability with the other alternatives.,

- **Wire and Capacity Costs -** the $6.09 million cost of wires and capacity payments associated with the incremental grid supply.

- **Project Costs -** the $14.96 million cost of capital and operating cost forecasts for the rooftop which are based on estimates from CIMA+, as well as costs of structural enhancements to EWSI facilities to support the additional weight of the solar panels.

31. EWSI's available rooftops provide less than one-quarter of the reduction in greenhouse gas emissions of the E.L. Smith Solar Project, with the net result that the REC value of $179.45 per MWh is more than four times as much as the REC value of $38.71 from the proposed E.L. Smith Solar Project. Not only does the small scale of the installation fail to achieve economies of scale, but the capital costs are much higher because of the required improvements to the roofing structures to facilitate the panels and additional operating costs associated with maintaining solar equipment at several locations. Based on these results, EWSI does not believe that there would be any value provided from pursuing this option.

AUC
Alberta Utilities Commission

July 24, 2019

EPCOR Water Services Inc.
2000, 10423 101 Street N.W.
Edmonton, Alta. T5H 0E8

Attention: Carmen Piercey
Senior Manager, Regulatory and Strategic Planning

E.L. Smith 12-Megawatt Solar Farm and Interconnection
Proceeding 23418
Applications 23418-A001 and 23418-A002

Confirmation of compliance

1. The Alberta Utilities Commission acknowledges receipt of the direction response submissions filed by EPCOR Water Services Inc. on June 21, 2019, in Proceeding 23418 with respect to Condition 4 in Order 23418-D03-2019,[1] which stated:

> As of the interconnection date of the project, EPCOR Water is required to file a compliance plan, endorsed by its chief executive officer, consisting of a written confirmation of statutory compliance and a detailed written description of the mechanism it is using to ensure compliance with the statutory scheme.

2. In its submissions, EPCOR Water stated that it will rely on the provisions of the *Municipal Own-Use Generation Regulation*, and confirmed that the electric energy produced by the solar farm at the E.L. Smith site in each hour will not exceed the energy consumed by EPCOR Water on the E.L. Smith site and at other EPCOR Water sites located within the boundaries of the city of Edmonton. EPCOR Water also confirmed that, as part of the compliance plan required under the *Municipal Own-Use Generation Regulation*, it would file annual submissions with the Market Surveillance Administrator. EPCOR Water provided a letter from the Market Surveillance Administrator that approved its compliance plan as required by the *Municipal Own-Use Generation Regulation*.

3. The Commission has reviewed the submissions and is satisfied that EPCOR Water has demonstrated how its operation of the E.L. Smith plant will comply with the statutory scheme. It therefore concludes that EPCOR Water's compliance plan satisfies Direction 23418-D03-2019-0001.

Sincerely yours,

Anne Michaud
Vice-Chair

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[1] Connection Order 23418-D03-2019, Proceeding 23418, Application 23418-A002, February 20, 2019.

Alberta Culture and Tourism

HRA Number: 4941-17-0008-005
September 13, 2018

Historical Resources Act Approval with Conditions

Proponent: EPCOR Water Services Inc.
Rossdale Water Treatment Plant, 9469 Rossdale Rd NW, Edmonton, AB T5K 3B1
Contact: Nathaniel Papay

Agent: Stantec Consulting Ltd.
Contact: Jean-Paul Foster

Project Name: **E.L. Smith Water Treatment Plant Solar Power System**

Project Components: Solar Power

Application Purpose: Requesting HRA Approval / Requirements

Historical Resources Act approval is granted for the activities described in this application and its attached plan(s)/sketch(es) subject to the following conditions.

David Link
Assistant Deputy Minister

SCHEDULE OF CONDITIONS

ARCHAEOLOGICAL RESOURCES

Historical Resources Act approval is granted in relation to archaeological resources, subject to the conditions outlined below.

1. The following *Historical Resources Act* conditions are based on the results of Historic Resources Impact Mitigation studies carried out by Stantec Consulting Ltd. under Archaeological Research Permit No. 18-026 and reported to Alberta Culture and Tourism in an interim report dated August 23, 2018.
2. Development constraints and/or additional studies are required at archaeological site FiPj-176, as outlined below.

SITE	HRV	SITE DESCRIPTION	CONDITIONS/APPROVAL
FiPj-176	4	Campsite	Backfilling of Stage I and II excavation blocks can proceed with no further concerns for archaeological resources provided that backsloping of vertical walls is not required and care is taken to prevent excavation wall collapse. If vertical walls are liable to collapse or must be backsloped prior to backfilling, then a professional archaeologist must be present to monitor all backfilling

SCHEDULE OF CONDITIONS (continued)

activities to identify, collect and record any archaeological deposits that are uncovered.

Should significant archaeological resources be encountered during the conduct of the monitoring program, the Archaeological Survey, Historic Resources Management Branch must be contacted. It may then be necessary for Alberta Culture and Tourism to issue further instructions regarding these resources.

Construction activities in the site area must not result in the addition of more than 200 cm of overburden above the present land surface. Subsurface impacts resulting from localized construction activities including helical pile installation and geotechnical testing may proceed as planned without further concerns for archaeological resources. All remaining construction activities including, but not limited to, topsoil stripping, trenching and grading must avoid disturbance beyond a maximum depth of 100 cm below the present land surface or obtain *Historical Resources Act* approval in advance of the onset of development activities through submission of a Historic Resources Application to Alberta Culture and Tourism's Online Permitting and Clearance (OPaC) system.

PALAEONTOLOGICAL RESOURCES

There are no *Historical Resources Act* requirements associated with palaeontological resources; however, the proponent must comply with Standard Requirements under the *Historical Resources Act*: Reporting the Discovery of Historic Resources, which are applicable to all land surface disturbance activities in the Province.

ABORIGINAL TRADITIONAL USE SITES

There are no *Historical Resources Act* requirements associated with Aboriginal traditional use sites of a historic resource nature; however, the proponent must comply with Standard Requirements under the *Historical Resources Act*: Reporting the Discovery of Historic Resources, which are applicable to all land surface disturbance activities in the Province.

HISTORIC STRUCTURES

There are no *Historical Resources Act* requirements associated with historic structures; however, the proponent must comply with Standard Requirements under the *Historical Resources Act*: Reporting the Discovery of Historic Resources, which are applicable to all land surface disturbance activities in the Province.

SCHEDULE OF CONDITIONS (continued)

PROVINCIALLY DESIGNATED HISTORIC RESOURCES

There are no *Historical Resources Act* requirements associated with Provincially Designated Historic Resources; however, the proponent must comply with Standard Requirements under the *Historical Resources Act*: Reporting the Discovery of Historic Resources, which are applicable to all land surface disturbance activities in the Province.

ADDITIONAL COMMENTS

1. In addition to any specific conditions detailed above, the proponent must abide by all Standard Conditions under the *Historical Resources Act*.

Lands Affected: All New Lands

Proposed Development Area:

MER	RGE	TWP	SEC	LSD List
4	25	52	9	1,8
4	25	52	10	3-5
4	25	52	3	13-14

Documents Attached:

Document Name	Document Type
Conceptual Project Plan	Illustrative Material

Alberta Environment and Parks

Wildlife Management
Operations Division
4920 - 51 Street
Provincial Building
Red Deer, AB T4N 6K8, Canada
Telephone: 403-755-1496

April 30, 2018

Dave Slubik, M.Sc.
Environment Manager
EPCOR Water Services
2000 - 10423 101 Street NW
Edmonton, AB T5H 0E8
Office: 780-412-3767
Cell: 780-916-7722
dslubik@epcor.com

RE: Alberta Environment and Parks review of the E.L. Smith Solar Farm Project

This letter is to advise that Alberta Environment and Parks Wildlife Management (AEP – WM) Staff have reviewed the project information provided for the E.L. Smith Solar Farm Project and have determined that a review and referral letter provided by an AEP-WM Wildlife Biologist is not required for this project.

As stated in the *Wildlife Directive for Alberta Solar Energy Projects (2017)*, "Review by an AEP Wildlife Biologist is not required when solar energy projects are small-scale (i.e. less than 1MW) or within urban areas." Since this solar project is located within the city limits of Edmonton, a review by an AEP-WM Wildlife Biologist is not required, as defined by the Solar Directive. AEP-WM supports the siting and development of solar projects within urban limits because urban solar projects have limited impact to wildlife and wildlife habitat, have reduced requirements for transmission infrastructure, and reduce the pressure of development on locations with higher quality wildlife habitat value. Since the Solar Directive does not pertain to solar projects located within urban areas, AEP-WM does not require post-construction monitoring to be conducted for the E.L. Smith Solar Farm Project.

However, AEP-WM supports EPCOR in applying the standards and best management practices of the Solar Directive as much as possible in the construction and operation of the E.L. Smith Solar Farm Project. Furthermore, in the development and operation of the E.L. Smith Solar Farm Project, EPCOR is responsible for following all applicable provincial and federal wildlife legislation, including but not limited to the Alberta *Wildlife Act* and the federal *Migratory Birds Convention Act* and *Species at Risk Act*. This includes conducting surveys to ensure the house, den or nest of prescribed wildlife species are not disturbed by project related activity. AEP-WM also requires that construction occurs outside of the restricted breeding bird season (April 1 to July 15), and that pre-construction nest sweeps are conducted if development occurs inside this restricted timing period.

Alberta Environment and Parks

Wildlife Management
Operations Division
4920 - 51 Street
Provincial Building
Red Deer, AB T4N 6K8, Canada
Telephone: 403-755-1496

Sincerely,

Jason Un

Jason Unruh
Wildlife Biologist, Renewable Energy Projects

cc: Brandy Downey, AEP Renewable Energy Committee Chair
Delaney Frame, Wildlife Biologist, Red Deer-North Saskatchewan Region
Scott Stevens, Senior Wildlife Biologist, Red Deer-North Saskatchewan Region

Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm

Environmental Impact
Assessment – Revision 03

Prepared for:
EPCOR Water Services Inc.

Prepared by:
Stantec Consulting Ltd.
Edmonton, AB

February 2019

Sign-off Sheet

This document entitled Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm was prepared by Stantec Consulting Ltd. ("Stantec") for the account of EPCOR Water Services Inc. (the "Client"). Any reliance on this document by any third party is strictly prohibited. The material in it reflects Stantec's professional judgment in light of the scope, schedule and other limitations stated in the document and in the contract between Stantec and the Client. The opinions in the document are based on conditions and information existing at the time the document was published and do not take into account any subsequent changes. In preparing the document, Stantec did not verify information supplied to it by others. Any use which a third party makes of this document is the responsibility of such third party. Such third party agrees that Stantec shall not be responsible for costs or damages of any kind, if any, suffered by it or any other third party as a result of decisions made or actions taken based on this document.

S Ruddy

Prepared by ________________________________
(signature)

Sheila Ruddy, P.Eng.
Environmental Engineer

Prepared by: ________________________________
(signature)

Stephanie Grossman, M.Sc., P.Biol.
Senior Wildlife Biologist

Reviewed by ________________________________
(signature)

Derek Ebner, M.Sc., P.Biol.
Principal, Environmental Services

Reviewed by: ________________________________
(signature)

Elaine Little, B.Sc.
Associate

Reviewed by ________________________________
(signature)

Kurtis Fouquette, P.Biol.
Environmental Scientist

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LIST OF APPENDICES

Executive Summary

EPCOR Water Services Inc. (EPCOR) has retained Stantec Consulting Ltd. (Stantec) to complete a Municipal Environmental Impact Assessment (MEIA) for the proposed E.L. Smith Solar Farm (the Project) within NW 3-52-25 W4M and SW 10-52-25 W4M, Edmonton, Alberta. The Project includes permitting, constructing and operating a 12 Megawatt (MW) solar farm to supply power to the E.L. Smith Water Treatment Plant (WTP). The Project will include: the installation of solar panels, inverter stations, and new underground electrical circuits; fence upgrades/extensions; the construction of an access road; and revegetation.

The Project Development Area (PDA) is currently zoned as a Metropolitan Recreation Zone (A). A Land Development Application has been submitted to rezone the area to a Direct Development Control Provision (DC1) for the Project (LDA17-0283) and a MEIA is required to support this application.

This MEIA examines the potential effects of construction and operation of the Project on specific valued ecosystem components (VECs) including: terrain and soils; surface water bodies and hydrology; vegetation species and communities; wildlife species and habitat; viewscape; and heritage resources. This MEIA includes a description of the existing conditions and predicts the potential residual effects of the Project, considering the mitigation measures that will be implemented. Monitoring commitments are included to evaluate the effectiveness of and to adapt mitigation measures, as required.

With the implementation of mitigation measures, the majority of potential adverse residual effects on the VECs are considered to be low in magnitude, aside from potential residual effects associated with wildlife mortality (during operation) and viewscape (largely subjective in nature) which are considered to be moderate. Potential residual effects on vegetation species and communities are also considered adverse in direction of low magnitude, however the introduction of an approved native seed mix throughout the PDA and the planting of native trees and shrubs along the south and southeast of the PDA will result in a net gain of these vegetation communities which will have a positive effect on vegetation species and communities. It is not anticipated that any of the potential residual effects will extend beyond the Local Assessment Area (LAA) and all of the potential residual effects are considered reversible.

Both construction and operation effects associated with terrain and soils, surface water bodies and hydrology, vegetation species and communities, and wildlife habitat are well known, well documented in literature, and/or relevant mitigation measures have been proven effective. As such, there is a high degree of confidence regarding the assessment of the potential effects associated with these VECs. The degree of confidence for estimation of project residual effects on viewscape is moderate due to the level of uncertainty regarding the visibility of the solar farm within (or just outside the LAA) and due to the subjectivity regarding the presence of the solar farm being considered a negative effect. In addition, there is considerable information on the effects of infrastructure on wildlife movement, however the information pertaining specifically to solar facilities is limited. As such, the degree of confidence regarding the assessment of the potential effects associated with wildlife movement is moderate.

Given that solar is a relatively new technology, potential effects and the effectiveness of mitigation measures relating to wildlife mortality are not fully understood for solar facilities. Currently, there is limited documentation on bird mortalities at photo-voltaic (PV) solar facilities similar to the proposed Project in North America. Based on available literature, there is a lack of empirical data on bird mortalities at solar facilities world-wide, jurisdictions generally don't routinely monitor bird or bat mortalities at solar farms, and the actual effect of PV solar farms is unquantified. Bird mortality at operational solar farms has been documented to include primarily impact trauma and predation trauma (that may or may not be directly connected to solar farm operations). These effects to birds are relatively recently documented (primarily in desert environments) and mitigation measures to reduce these have not been tested. However, existing mitigation measures that are known to be effective for ancillary structures (e.g., guy wires, fencing) do exist and may be applied to this Project. As such, the effects on wildlife mortality, after the implementation of mitigation measures, are anticipated to be moderate with a low degree of prediction confidence.

The findings of this MEIA are that the potential adverse effects of the Project can be avoided, reduced or controlled using a combination of standard and Project-specific environmental mitigation measures.

Monitoring during and post construction will be implemented to evaluate the effectiveness of and to adapt mitigation measures as required. This includes the monitoring of soil handling, erosion and sedimentation control measures, temporary storage, weed growth, trapped wildlife, wildlife mortality, and any monitoring conditions required in the *Historic Resources Act* Authorization. In addition, post-construction monitoring will be conducted. Semi-annual inspections will be conducted for the first two years following construction to identify bare soil, vegetation establishment, the formation of erosion gullies, isolated ponding, and sediment build-up. A post-construction wildlife monitoring program will be developed in consultation with regulatory agencies and will include wildlife mortality monitoring as per the Wildlife Directive for Alberta Solar Energy Projects (GOA 2017) and potential monitoring programs as identified by regulators (e.g., wildlife movement monitoring). Results of the monitoring will be provided to Alberta Environment and Parks and the City of Edmonton.

1.0 INTRODUCTION

EPCOR Water Services Inc. (EPCOR) has retained Stantec Consulting Ltd. (Stantec) to complete a Municipal Environmental Impact Assessment (MEIA) for the proposed E.L. Smith Solar Farm (the Project) within NW 3-52-25 W4M and SW 10-52-25 W4M, Edmonton, Alberta (Figure 1.0, Appendix A). The Project includes permitting, constructing and operating a 12 Megawatt (MW) solar farm to supply power to the E.L. Smith Water Treatment Plant (WTP). If the solar farm produces more power than the E.L. Smith WTP can use, any excess will be exported back to the electrical grid. The Project will include: the installation of solar panels, inverter stations, and new underground electrical circuits; fence upgrades/extensions; the construction of an internal access road; and revegetation.

1.1 APPLICABLE LEGISLATION

1.1.1 Bylaw 7188

The Project Development Area (PDA) is currently zoned as a Metropolitan Recreation Zone (A). A Land Development Application has been submitted to rezone the area to a Direct Development Control Provision (DC1) for the Project (LDA17-0283).

In consultation with Brittany Davey and Corey Churchill of the City of Edmonton (COE), it was determined that the an MEIA would be required to support the Land Development Application. In accordance with the requirements of the *North Saskatchewan River Valley Area Redevelopment Plan* (NSRVARP, Bylaw 7188, COE 2017a) and the *Guide to Environmental Review Requirements in the North Saskatchewan River Valley and Ravine System* (COE 2000), the scope of the MEIA is to:

- To identify the potential effects on the physical and biological environment resulting from the Project
- To evaluate the feasibility of mitigating or preventing adverse impacts, and to predict the potential residual effects (if any) associated with the Project after mitigation
- To develop a mitigation plan to prevent potential significant adverse effects to the environment from the construction and operation of the Project

This report provides the results of the MEIA.

1.1.2 Other Applicable Legislation

Various federal, provincial, and municipal acts, regulations, and bylaws were considered for the Project, in the selection of valued ecosystem components (VECs), and in the assessment of potential environmental effects. Table 1-2 outlines the pieces of legislation that are applicable to the Project and provide the regulatory setting for the Project.

Table 1-1 Applicable Legislation and Policy Guidance

Legislation or Policy	Requirements or Guidance Provided
Federal	
Canadian Environmental Assessment Act (CEAA), 2012, S.C. 2012, c. 19, s. 52	In correspondence with the Canadian Environmental Assessment Agency, it was determined that the Project does not require an environmental assessment under the CEAA as it is not an activity listed in the Regulations Designating Physical Activities.
Species at Risk Act (SARA), S.C. 2002, c. 29	Protects species listed as extirpated, endangered and threatened on federally regulated land or designated critical habitat. Species regulated under the *Species at Risk Act* (e.g., Barn Swallow) may occur within the PDA; however, no critical habitat or federally regulated lands were identified within the LAA.
Migratory Birds Convention Act (*MBCA*), 1994, S.C. 1994, c. 22 and Migratory Bird Regulations, C.R.C., c. 1035	Protects and conserves migratory bird populations and individuals and their nests and eggs in Canada. Section 6 of the Migratory Birds Regulations prohibits the disturbance, destruction, or taking of a nest, egg, nest shelter, eider duck shelter, or duck box of a migratory bird, or possession of a migratory bird, carcass, skin, nest, or egg of a migratory bird without authorization. As there are no authorizations to allow construction-related effects on migratory birds and their nests, best management practices (BMPs; see Section 6.4.2) will be followed to comply with the *MBCA*.
Provincial	
Alberta Utilities Commission (AUC) Rule 007: Applications for Power Plants, Substations, Transmission Lines, Industrial System Designations and Hydro Developments	The AUC regulates Alberta's investor-owned electric, gas and water utilities as well as select municipally-owned electric utilities. The AUC also provide regulatory oversight for issues relating to the electrical and natural gas markets in Alberta. AUC's Rule 007 outlines application requirements to construct, alter, operate, discontinue, dismantle and remove power plants, substations, transmission lines, industrial systems designations and hydro developments (AUC 2017a). Under Rule 007, an application is required for the Project and has been submitted to the AUC under separate cover.
AUC Rule 012: Noise Control	AUC's Rule 012 outlines permissible sound levels and noise impact assessment requirements for energy-related facilities. Under Rule 012, a noise impact assessment summary form is required for the Project and has been submitted to AUC under separate cover.
Environmental Protection and Enhancement Act (*EPEA*), R.S.A. 2000, c. E-12	EPCOR consulted with AEP and it was determined approval under *EPEA* (including the requirement for a provincial Environmental Impact Assessment) was not required for the Project.
Alberta *Public Lands Act,* R.S.A. 2000, c. P-40	Governs activities occurring on public land to ensure they occur in a safe, sustainable, orderly, and environmentally responsible manner. No public land is crossed by the Project.
Alberta *Soil Conservation Act*, R.S.A. 2000, c. S-15	In Alberta, the *Soil Conservation Act* requires landowners or occupants to prevent soil loss or deterioration from taking place, and to stop any identified the loss or deterioration from continuing.
Alberta *Weed Control Act*, S.A. 2008, c. W-5.1	In Alberta, the *Weed Control Act* requires landowners or occupants to: • Destroy plants listed as *prohibited noxious* upon discovery • Control populations of plants listed as *noxious* to prevent their spread
Alberta *Water Act*, R.S.A. 2000, c. W-3	In Alberta, works in and around watercourses are regulated under the Alberta *Water Act* by AEP. This includes construction of storm water outfalls on water bodies, as well as other works such as infilling or alteration of waterbodies. No storm water outfalls or other works will be constructed or undertaken as part of this project and therefore approval under this legislation is not deemed to be required.

Legislation or Policy	Requirements or Guidance Provided
Alberta *Wildlife Act*, R.S.A. 2000, c. W-10 and the Alberta Wildlife Regulation, A.R. 143/1997 a. A.R. 93/2017	The Alberta *Wildlife Act* protects species listed as endangered or threatened and the Alberta Wildlife Regulation provides a list of species considered endangered or threatened. Additionally, the Act prohibits the disturbance or destruction of the house, nest, or den of wildlife. Where applicable, BMPs (see Section 6.4.2) will be employed and consultation with AEP will be conducted as necessary.
Historical Resources Act, R.S.A. 2000, c. H-9	Historical resources in Alberta are protected under the *Historical Resources Act* and include archaeological, historic and palaeontological sites, artifacts and fossils. Under the Act, no historical resources site can be disturbed without approval of the Minister of Alberta Culture and Tourism (ACT). ACT determines and issues the requirements for Historical Resources Impact Assessment (HRIA) studies and for mitigation measures for each archaeological and palaeontological resource site. ACT also issues Historical Resources Act (HRA)clearance for projects to proceed. The Project is situated on lands with designated high potential for both archaeological and palaeontological sites. ACT issued HRA requirements for the Project which included the completion of an archaeological HRIA and a palaeontological HRIA and mitigative excavations for archaeological resources. Based on the results of these studies, ACT has issued HRA clearance for the project.
Alberta *Land Stewardship Act*, S.A. 2009, A-26.8	In Alberta, land-use planning is guided by the Land-use Framework (LUF). The LUF established seven land use regions and called for the development of a regional plan for each. The Alberta Land Stewardship Act established the legal basis for the development of regional plans under the LUF and the Alberta Land Stewardship Regulation provides the rules for implementing regional plans under the LUF. The development of a regional plan is typically a phased approach, with an extensive planning phase and consultation phase prior to the approval phase. The Project is within the boundaries of the North Saskatchewan Region. Phase 1 consultation with respect to the North Saskatchewan Region Plan (NSRP) has been completed and the Regional Advisory Council is currently preparing the Recommendation to Government report. Therefore, the NSRP has not yet been finalized or approved by AEP. As such, the PDA does not occur within the boundaries of an approved regional land use plan.
Municipal	
North Saskatchewan River Valley Area Redevelopment Plan (NSRVARP) (Bylaw 7188)	EPCOR is in the process of requesting an amendment to the NSRVARP to re-designate the project lands from Metropolitan Recreation Zone (A) to Direct Development Control Provision (DC1).
Zoning Bylaw (Bylaw 12800)	The COE Zoning Bylaw outlines the requirements regarding the development of land based on zones. The PDA is currently zoned as a Metropolitan Recreation Zone (A). A Land Development Application has been submitted to rezone the area to a Direct Development Control Provision (DC1) for the Project.
Community Standards Bylaw (Bylaw C14600)	The COE Community Standards Bylaw regulates the conduct and activities of people on privately owned property and immediately adjacent areas in order to promote the safe, enjoyable and reasonable use of such property for the benefit of all citizens of the City. The bylaw defines the allowable times for construction on private property and BMPs will be followed to comply with these requirements.

Legislation or Policy	Requirements or Guidance Provided
Drainage Bylaw (Bylaw 18093)	The COE Drainage Bylaw regulates the surface drainage on public and private land. Drainage within the Project area will be managed through the completion of a drainage assessment and the development of a storm water management plan which will identify Project specific drainage features designed to meet the requirements within this bylaw.
Development Setbacks from River Valley/Ravine Crests (Policy C542)	This policy outlines the development setback areas required within the NSR Valley and Ravine System. This policy does not apply to existing river valley communities where development has already occurred on the slope or the floodplain of the river valley and ravine system therefore this policy does not apply to the Project.
Corporate Tree Management Policy (Policy C456A)	The purpose of the Corporate Tree Management Policy is to ensure that all trees on City owned property are adequately protected from destruction, loss or damage. There are no City owned trees within the PDA therefore this policy does not apply.
Other Guidance	
Terrain and Soils	• City of Edmonton Erosion and Sedimentation Control Guidelines (COE 2005a) • City of Edmonton Erosion and Sedimentation Control Field Manual (COE 2005b)
Wildlife	• Wildlife Directive for Alberta Solar Energy Projects (GOA 2017). While the directive does not apply to this Project in an urban environment (confirmed during consultation with AEP – see Appendix B), standards and BMPs noted in this document have been incorporated where feasible. See Appendix C for how the Project aligns with the standards and BMPs from Stage 1: Site Selection of the Alberta Wildlife Directive.

2.0 ENVIRONMENTAL EVALUATION APPROACH

This MEIA considers the potential effects on VECs resulting from the construction and operation of the Project. Section 2.1 through 2.5 outline the methods used to identify and evaluate potential environmental effects. A rationale for choosing this methodology has also been provided.

2.1 SCOPE OF ASSESSMENT

VECs are defined as an "environmental element of an ecosystem that is identified as having scientific, social, cultural, economic, historic, archaeological or aesthetic importance. The value of an ecosystem component may be determined on the basis of cultural ideals or scientific concern" (GOA 2010). VECs for the Project were selected with the objective of scoping the effects assessment to Project interactions that are of interest to the COE, the public, and the scientific community. The selection criteria for VECs include consideration of legislative or policy drivers, presence in the Project vicinity, and likelihood of interactions with the Project.

While not all biophysical components were selected as VECs, some aspects of the physical environment may be discussed under other VECs (e.g., noise may occur under sensory disturbance for wildlife). VECs were not carried forward in the effects assessment if Project interactions were considered negligible or if they were not expected to result in a measurable change to the VEC with the application of BMPs or standard practices. Items that are not considered VECs are scoped out of the effects assessment and are only discussed in the context of baseline conditions. Details outlining selected and scoped out VECs are provided in Section 5.0.

2.2 SPATIAL AND TEMPORAL BOUNDARIES

Consideration of potential environmental effects is conceptually bound in space and time, more commonly known as spatial and temporal boundaries of the assessment. The spatial boundaries reflect the geographic area over which the Project's potential environmental effects may occur. The temporal boundaries identify when a potential environmental effect may occur in relation to specific Project components and/or activities. Spatial and temporal boundaries are developed in consideration of:

- timing/scheduling of Project activities
- understanding natural variations of each VEC
- the time required for recovery from a potential environmental effect

The spatial boundaries for the Project are defined below with respect to Project components and activities:

- The Project Development Area (PDA): The PDA is defined as the area in which Project activities and components may occur, and as such represents the area within which direct physical disturbance may occur as a result of the Project, both temporary and permanent. The PDA of 25.7 hectares (ha) includes the permanent footprint of the solar farm (approximately 22.3 ha) and the temporary (construction) footprint (i.e., limit of construction) within EPCOR lands (Figure 2, Appendix A). It should be noted that while the Project does not fall under the *Wildlife Directive for Alberta Solar Energy Projects* (GOA 2017) due to its location in an urban environment, the permanent boundary was revised to align with Standard 100.1.3 (i.e., reducing the footprint within the Key Wildlife Biodiversity Zone (KWBZ)) and with Standard 100.1.10 (i.e., a 100 m buffer from the NSR) of the directive.
- The Local Assessment Area (LAA): The LAA is a one kilometre (km) buffer surrounding the PDA. The LAA represents the area in which potential environmental effects from Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. The LAA is the same for all VECs and covers approximately 572 ha.

The temporal boundaries for the Project encompass all Project activities. Construction is anticipated to begin in 2019 and is expected to take approximately six months. The Project is anticipated to be operational by 2020.

2.3 MITIGATION OF POTENTIAL PROJECT EFFECTS

Mitigation is the implementation of preventative, corrective or alternative measures to avoid, reduce or control a potential undesirable effect on a VEC resulting from Project activities. Mitigation measures may be influenced by industry standard practices, legislative requirements, or corporate practices.

2.4 EVALUATION OF POTENTIAL RESIDUAL EFFECTS

Potential residual effects are defined as “an effect that remains after mitigation has been applied” (GOA 2010). Residual effects are described for each potential negative effect on a VEC after the implementation of the recommended mitigation measures. Potential residual effects have been characterized by direction, magnitude, geographic extent, frequency, duration, reversibility, and ecological and social context. Environmental effect characterization definitions are based upon generally accepted knowledge and professional judgment and are defined in each ecosystem component section (Section 6.0).

2.4.1 Prediction Confidence

The purpose of an MEIA is to predict future environmental conditions that result from the Project, in conjunction with operational, approved and planned developments and activities. The predictive nature of the MEIA means there is a level of confidence that needs to be considered. Prediction confidence is addressed in different ways depending on the VEC. However, prediction confidence is generally determined qualitatively based on the following criteria:

- quantity and quality of baseline data used in the assessment
- confidence in measurements and analytical techniques (e.g., modelling)
- confidence in the success of mitigation
- potential changes in future environmental conditions (as applicable)

3.0 PROJECT DESCRIPTION

E.L. Smith is one of two WTP's in Edmonton and has been in operation since 1976. The WTP collects and treats water from the NSR and provides clean drinking water to the region. EPCOR is a regulated utility provider, and therefore EPCORs water rates, which are established under a performance-based regulation (PBR) regime, are approved by the COE every five years. The rates for 2017 – 2021 were approved by City Council in October 2016. Included in the application approved on October 2016, and in alignment with The Way We Green: the COE's Environmental Strategic Plan (COE 2011), was a Green Power Initiative which has been set to increase the proportion of EPCOR's energy from locally produced, renewable sources. As such, EPCOR is looking to generate a clean source of renewable energy from a solar farm to help power the water treatment and distribution processes, which will reduce conventional power demands by 24% and reduce greenhouse gas (GHG) emissions by approximately 14,000 T CO2e.

3.1 PROJECT LOCATION AND LAND USE

The proposed location for the Project is within NW 3-52-25 W4M and SW 10-52-25 W4M, Edmonton, Alberta. The PDA, located southeast of the E.L. Smith WTP, is approximately 25.7 ha and is situated within the NSR Valley, below the valley crest and top of bank, adjacent to the community of Cameron Heights. Henderson Estates is located to the east of the PDA on the east side of the NSR. The PDA is located on previously disturbed, EPCOR owned lands. Currently there is no recreational use of the area permitted and this land is not intended to be used for recreational nor agricultural purposes. The NSR Valley is a provincially significant natural area and regional biological corridor (COE 2008), and although areas along the NSR south of the Anthony Henday and on the other side of the NSR are considered a 'regional biodiversity core area' and/or 'biodiversity core areas', the PDA is not identified as a 'regional biodiversity core area' or a 'biodiversity core area' (COE 2007a).The PDA is currently zoned as a Metropolitan Recreation Zone (A). A Land Development Application has been submitted to rezone the area to a Direct Development Control Provision (DC1) for the Project.

Select historical aerial photographs were reviewed for the site spanning from 1950 to 2015. Since 1950, the PDA has consisted of undeveloped agricultural land. The first sign of the E.L. Smith WTP, located to the north of the PDA, appears in the 1977 photograph with development continuing in the subsequent photographs. The first sign of residential development to the west of the PDA (Cameron Heights) appears in the 2008 photograph.

The COE's November 2018 draft of the Ribbon of Green has classified the E.L. Smith WTP site (including the PDA) as Urban Services under the broader category of "Active/Working Landscapes" (COE 2018). According to this document, Active/Working Landscapes are located throughout the NSR Valley, have lower levels of ecological sensitivity and accommodate the highest intensity of uses while limiting ecological impact, when possible. To evaluate whether a particular use is appropriate within this sub-category, this document has identified a number of "compatible facilities and infrastructure" and "compatible uses". Developments that improve the sustainability of existing operations, or expansions of power, water and wastewater utilities, are among the appropriate uses listed.

3.2 PROJECT COMPONENTS AND ACTIVITIES

3.2.1 Construction and Operation

The solar farm will be designed, constructed and operated according to applicable legislation and EPCOR's Health, Safety and Environmental Policy.

The Project will consist of a ground-mount solar power system with installation of parallel rows of solar panels mounted on racking and anchored to the ground using an embedded pile system. Each solar panel will be approximately one metre wide and two metres in length, and are designed to absorb sunlight instead of reflecting it, therefore minimal glare is expected. Each row of solar panels will be up to three panels high and multiple panels long. Solar panels will be raised approximately one metre above ground and rows will likely be spaced five to ten metres apart. The rows will span the width of the PDA, face south at a fixed angle and will be supported by a racking system that is secured to the ground using embedded piles. The average pile depth is approximately five metres but may vary depending on the soil conditions across the PDA.

The Project will include approximately four inverter stations to house electrical infrastructure for electrical connector systems. New underground AC cables, installed using open trench methodology, will run from the inverter stations to a new interconnection point building located on the north side of the PDA (Drawing PCL-1, Appendix A). The interconnection point will include electrical switchgear to connect the Project's AC cables to existing electric distribution power circuits that provide power to the WTP.

The design of the solar farm will consider historical meteorological data for the PDA. Based on typical mean year (TMY) collated meteorological data from 1971-1998, the preliminary solar forecast horizontal global irradiation value for the PDA is approximately 1282 kWh/m² (Meteonorm 7.1). During detailed design, the final meteorological data will be confirmed by the consultant. This data will also be supplemented by EPCOR with historical meteorological data available from the existing weather station at the E.L. Smith WTP.

The E.L.Smith WTP is currently fenced with an eight-foot-high chain link fence topped with barbed wire and the proposed location for the solar farm is currently enclosed by a paige wire fence approximately 1.5 m high. For public safety and security measures, the entire perimeter of the solar farm (i.e., the permanent footprint) will be surrounded by an upgraded security fence of similar height to the existing fence around the WTP. In addition to consideration for safety and security, the design of the new fence will also consider small animal movement and ways to enhance the aesthetics and overall viewscape. The new fencing required for the solar farm will tie in to the existing fence line surrounding the WTP, and follow the existing paige wire fence except along the south portion of the PDA, where the new fencing will will be installed approximately 20 metres north of the paige wire fence to accommodate revegetation of the area to the south of the (Figure 2.0 and Drawing PCL-1, Appendix A).

An approximately six-metre-wide access road will be constructed within the fenced boundary for vehicle access for solar farm maintenance and operational activities. The access road will be constructed at grade, finished with gravel, and will be allowed to revegetate (Drawing PCL-1, Appendix A).

A future demonstration area will also be incorporated at the north end of the PDA (Figure 2.0, Appendix A). The demo area will be an educational feature allowing visitors to have a close-up view of the solar farm and may consist of an elevated viewing deck, a rack of demo panels, and other educational components (details will be confirmed during detailed design).

Activities associated with the Project are outlined in Table 3-1.

Table 3-1 Project Activities

Project Phase	Activity	Description of Activity
Construction	Vegetation Clearing and Site Preparation	Vegetation clearing of grass, small bushes and scattered trees will be required. Temporary fencing will be installed around PDA, including the temporary (construction) footprint. Temporary erosion and sediment control (ESC) measures (e.g. silt fences, entrance features, swales/control berms) will be installed.
Construction	Construction Access and Laydown Area	Construction vehicles and equipment will access the PDA using public roads and existing access roads (Anthony Henday Drive, Cameron Heights Drive NW and E.L. Smith Road NW). Site access will be from the access located just before the main gate to the E.L. Smith WTP. The temporary and permanent footprints within the PDA will be used for Project staging and laydown.
Construction	New Infrastructure Installation	Installation of utilities (electrical), pilings, panels, inverters, permanent access road, fencing and other associated infrastructure (Drawing PCL-1, Appendix A).
Construction	Site Restoration	Temporary fencing will be removed, debris from the PDA will be cleaned up, and the site will be revegetated (disturbed area will be reseeded using an approved native seed mix and trees/shrubs will be planted in the area to the south and southeast of the PDA). Grading will only be conducted where required to facilitate construction and to maintain existing drainage patterns. Recommendations from the Storm Water Management Plan, based on the drainage analysis, will be implemented. Any other areas disturbed as a result of the Project, including the temporary construction boundary, will be restored to COE specifications.
To be determined	LAA Enhancement	Plant pollinator species; install bat houses and bird boxes. These enhancements will likely be incporated into the LAA but will be strategically located such that they do not attract wildlife to the PDA.
Operation	Power Generation	Initiation of solar power generation.

The Project is still in the process of detailed design and it has been assumed that the final design details regarding the infrastructure will not change the evaluation of environmental impacts. Should this assumption prove not to be true, a revised MEIA or addendum will be prepared to address any changes.

3.2.2 Decommissioning and Site Restoration

The Project is anticipated to have an operational lifespan of 30 years or more. Once the solar farm has reached the end of its useful life, it is expected to be decommissioned. Components that will require decommissioning and wastes that are expected to be generated as a result of decommissioning activities, are outlined in Table 3-2, below. Following decommissioning, the PDA will be restored to a state required to support the future intended land use (e.g., expansion of the E.L. Smith WTP). Prior to decommissioning, the Project economics and future land use needs may be evaluated to determine whether the solar farm can continue to operate for an extended period.

All decommissioning and site restoration activities will be done in accordance with applicable legislation as well as best management practices in place when the solar farm is decommissioned. Waste materials that can be recycled or reused, will be; waste materials that cannot be recycled or reused will be transported to appropriate disposal facilities. EPCOR will work with manufacturers, contractors and waste disposal facilities on the handling, dismantling and/or segregating of materials to be disposed of, recycled and/or reused, with an objective to maximize recycling and reuse.

Table 3-2 Decommissioning Activities

Component Being Decommissioned	Description	Waste Expected to be Generated
Solar panels	After the electrical components have been disconnected, the panels will be removed from the racking units. If there is no possibility of reuse, the panels (or panel components) will be returned to the manufacturer for appropriate recycling/disposal or will be transported to an approved disposal and/or recycling facility where glass, metal and semiconductor materials will be separated and recycled. The solar panels will be managed as per best management practices that are in effect at the time of decommissioning.	• Glass • Metal
Invertor stations and electrical components	All electrical components will be disconnected and removed from service. Depending on the use of the PDA subsequent to the solar farm, underground electrical infrastructure may be left in place. Components that are no longer required, will be transported to an approved disposal and/or recycling facility.	• Waste oil • Metal
Racking	Racking will be dismantled and transported to an approved disposal and/or recycling facility.	• Metal
Pilings	Where possible, pilings will be removed from the ground and transported to an approved disposal and/or recycling facility. In the event that pilings cannot be completely removed from site, they will be left in place at a depth that is appropriate for the use of the PDA subsequent to the solar farm.	• Concrete • Steel
Access road	Considering that the PDA has been designated for the expansion of the E.L. Smith WTP, there is a possibility that the access road may be left in place. In the event that the access road is decommissioned, the road materials will be removed and transported to an approved disposal and/or recycling facility.	• Granular materials

It is anticipated that potential environmental and socio-economic effects associated with decommissioning and site restoration will be similar to those identified for construction. As such, mitigation measures such as temporary fencing, temporary ESC measures, setbacks, weed management practices, periodic maintenance and inspections, etc., will likely apply.

3.3 PROJECT ALTERNATIVES

The Green Power Initiative was developed based on The Way We Green: the COE's Environmental Strategic Plan (COE 2011). This strategic plan contains goals and objectives relating to energy and climate change, including Objective 6.4 requiring that "a significant and increasing proportion of Edmonton's energy comes from renewable sources, with as much as reasonably possible produced local." To meet the objectives of this strategic plan and the Green Power Initiative, EPCOR must increase a proportion of their energy from local, renewable sources.

In addition to the proposed Solar Farm, EPCOR evaluated several other alternatives in developing a plan to align with both the COEs Way We Green Strategy and Edmonton Energy Transition Strategy. The alternatives evaluated were developed to meet EPCOR's commitment to the COE to replace at least 10% of its conventional power consumption with locally produced renewable energy. Three of the alternatives considered are summarized below. The rooftop solar options are not discussed below since they were not considered in as much detail as the other alternatives due to their space requirements, low power generation potential, high cost, and implementation complexity (EPCOR 2018). A Site Location Analysis and Justification (SLAJ) was prepared for the Project and was submitted under separate cover. The SLAJ outlines the alternatives that were considered for the Project (EPCOR 2018). Additionally, a Sustainable Return on Investment (SROI) or Triple Bottom Line (TBL) document was developed and submitted to the COE Utility Committee through a separate regulatory process. This document provided an overview of the economic/financial, social, and environmental impacts of the Project and the alternatives.

The first alternative considered was to purchase renewable energy certificates (RECs) from an existing renewable power source. This alternative was considered more of an accounting exercise and does not guarantee that the energy consumed by EPCOR is provided by a local (municipal or even provincial) source. Additionally, this process does not result in additional renewable energy being generated since no new facility is being constructed and the RECs represent GHG emission reductions that have already occurred.

Currently, there is no locally produced renewable power supply available in the quantities EPCOR requires to meet its green power commitment. As such, the second alternative considered was for EPCOR to construct and operate an offsite (i.e., not on the E.L. Smith WTP property) solar farm, capable of generating enough renewable energy to supply E.L. Smith WTP. This offsite facility (located within 40 kilometres of the City in order to meet the 'local' criteria) would require connection to the grid and would not be connected directly to EPCOR's operating sites. Although this alternative provides additionality (i.e., additional renewable energy is generated), EPCOR would have to purchase land, would still be required to purchase renewable power from the grid, and would be subjected to applicable premiums.

The third alternative considered was to purchase wind power through a third-party contract for an interest in a larger scale wind project in Southern Alberta. The analysis shows that a large scale wind farm in Southern Alberta is a cost-effective approach to providing additional GHG emission reductions in the province. However, this alternative does not align with the COE's *Energy Transition Strategy,* does not provide a local source of renewable energy, and does not align with EPCOR's goals to reduce its own GHG emissions.

After consideration of alternatives, EPCOR proposes the E.L. Smith Solar Farm Project as prudent, in the public interest and in alignment with the City's The Way We Green strategy.

4.0 BASELINE CONDITIONS

This section provides the pre-Project environmental conditions. The intent of the desktop and field assessments outlined in the sections below is to describe baseline conditions and to set the context for the effects assessment. This information is used to evaluate Project interactions and assess the potential effects based on the identified interactions.

4.1 SURFACE WATER, GROUNDWATER AND FISH HABITAT

The PDA is situated along a relatively flat terrace on the west bank of the NSR, a Class C watercourse with a Restricted Activity Period (RAP) of September 16 to July 31. The regional slope is northeast (Kathol and McPherson, 1975) and the PDA is generally sloped from flat to 5% with depression areas occurring throughout. The natural low points within the PDA store runoff during storm events and the area east of the ridgeline running along the east portion of the PDA currently directs overland drainage directly to the NSR (Stantec 2018). Based on borehole records, infiltration characteristics are expected to be that of clay (Stantec 2018). As identified in Section 4.3.4 below, no wetlands were identified in the PDA. A copy of the Municipal Stormwater Management Plan containing additional details regarding the predevelopment conditions can be found in Appendix D.

In 2016, the Government of Alberta (GOA) summarized a 1995 Flood Hazard Study completed along 27 km of the NSR, upstream of the High Level Bridge (GOA 2016). The Flood Hazard Study was completed as part of an Alberta Flood Hazard Identification Program (FHIP) and a flood hazard map was published identifying flood hazard areas, a combination of the flood fringe and floodway, along the NSR. The FHIP defines flood fringe and floodway as follows:

- Flood Fringe – The portion of the flood hazard area outside of the floodway. Water in the flood fringe is generally shallower and flows more slowly than in the floodway. New development in the flood fringe may be permitted in some communities and should be flood-proofed (GOA 2014).
- Floodway – The portion of the flood hazard area where flows are deepest, fastest and most destructive. The floodway typically includes the main channel of a stream and a portion of the adjacent overbank area. New development is discouraged in the floodway (GOA 2014).

Based on the flood hazard map, the PDA is not located within the flood fringe or the floodway (AEP 2016). In addition, the PDA is also located outside of the Floodplain Protection Overlay (COE 2017b).

From a regional perspective, lateral groundwater appears to flow north, and vertical groundwater flow of the unconsolidated sediment is downwards (Bibby, 1974). In 2017, Stantec conducted a geotechnical investigation within the PDA to support the design of the Project. During the investigation 15 piezometers were installed and the groundwater levels varied from 3.1 metres to 8.7 metres below ground surface (Stantec 2017).

A search of the Fish and Wildlife Information Management System on January 9, 2018 indicated 22 fish species have been recorded within the LAA (AEP 2017a), one of which is identified as *At Risk* (lake sturgeon - *Acipenser fulvescens*), one as *May Be at Risk* (spoonhead sculpin - *Cottus ricei*) and one as *Sensitive* (sauger - *Sander canadensis*) (AEP 2017b).

4.2 GEOLOGY, GEOMORPHOLOGY AND SOILS

Located within the Eastern Alberta Plains, the primary geomorphological elements in the LAA parallel the preglacial landscape, with near-surface sediments largely deposited in glacial and postglacial times (Kathol and McPherson, 1975). Regionally, the surface material is primarily Glacial Lake Edmonton sediments and NSR alluvium composed of silts, sands and gravels overlaying glaciolacustrine sand/silt/clay, glaciofluvial sand/gravel and glacial till with lenses of sand and gravel (Bayrock and Berg, 1966). Underlying the glaciolacustrine deposits is preglacial Saskatchewan gravel and sands followed by bedrock consisting of bentonitic shales and sandstones, coal seams and bentonite beds of the Edmonton Formation (Bayrock and Berg, 1966).

During the 2017 geotechnical investigation, 55 boreholes and eight test pits were completed within the PDA (Appendix E). Subsurface conditions noted during the geotechnical investigation were similar to conditions found in previous investigations conducted for the WTP and generally consisted of topsoil overlying clay fill over an upper alluvial deposit (consisting of soft to firm clay and loose silt with sand layers) and lower alluvial deposits (consisting of compact to very dense coarse-grained sand and gravels) (Stantec 2017). The alluvial deposits were underlain by gravel and sand overlying bedrock (Stantec 2017) (Appendix E). A copy of the geotechnical assessment report containing additional details regarding the geology, geomorphology and soils within the PDA can be found in Appendix E.

A review of the Alberta Energy Regulator (AER) Coal Mine Map Viewer identified that the Project location does not intersect any known coal mines (AER 2017).

The Project is located on previously disturbed lands owned by EPCOR. This land is not intended to be used for recreational nor agricultural purposes, and soils in this area are “capable of producing perennial crops only, and improvement practices are not feasible” (EC 1976).

4.3 VEGETATION

4.3.1 Methods

A desktop and field assessment were conducted to assess upland and wetland plant communities within the LAA and PDA, respectively. The desktop assessment included a search of the Alberta Conservation and Information Management System (ACIMS) for historical occurrences of rare plant and ecological communities within one km of the PDA and review of recent and historical aerial imagery to map upland and wetland plant communities. The following years of aerial imagery was reviewed: 1950, 1975, 2001, 2005, 2007, 2010, 2012, 2013, 2014 and 2015. A one km radius was selected based in the ecology of species that have the potential to occur within the PDA as well as the surrounding land use. Vegetation and wetland plant communities were classified using a Central Parkland Classification System derived from the following sources:

- *A Preliminary Classification of Plant Communities in the Central Parkland Natural Subregion of Alberta* (Wheatly and Bentz 2002) for uplands
- *Alberta Wetland Classification System (*Alberta Environment and Sustainable Resource Development 2015a) for wetlands
- *Alberta Vegetation Inventory Standards Manual* (Alberta Environmental Protection1991) for agricultural, industrial and settled lands

Within the PDA, a total of 27 survey locations were assessed on June 14 and 15, 2017 and August 9, 2017. Field assessments included mapping and classification of upland and wetland plant communities and two survey intervals of rare plant and rare ecological community surveys. During these surveys information was also gathered on *prohibited noxious* and *noxious* weed occurrences, if observed.

4.3.2 Regional Vegetation

The Project is located within the Central Parkland Natural Subregion of the Parkland Natural Region of Alberta (Natural Regions Committee [NRC] 2006). The Central Parkland is a large subregion that forms a band across the central and west-central parts of the province and is a transitional zone between the Boreal Forest Natural Region to the north and the Grassland Natural Region to the south. Due to heavy pressure from agriculture and development, only a small portion of this subregion remains in a natural condition. The Central Parkland is dominated by undulating till plains and hummocky uplands, and the native remnants are a mosaic of aspen (*Populus tremuloides*) dominated forest stands on moist sites intermixed with prairie vegetation on drier sites. Stands of aspen dominated forest are found throughout the Central Parkland and have understories dominated by saskatoon (*Amelanchier alnifolia*), prickly rose (*Rosa acicularis*), and beaked hazelnut (*Corylus cornuta*). Stands dominated by balsam poplar (*Populus balsamifera*) occur on moist, nutrient rich sites, and often have aspen and white spruce (*Picea glauca*) intermixed within the stand (NRC 2006). The Project is also located within the NSR Valley, which is a provincially significant natural area and regional biological corridor (COE 2008).

4.3.3 Local Assessment Area

The LAA comprises 57% anthropogenic land units (residential, green space, perennial pasture, etc.), 33 % native plant communities and 11% open water (NSR) (Table 4-1). Most of the native plant community area is Aspen Poplar Woodland Alliance (142.9 ha), which is consistent with plant communities along the NSR Valley. Small amounts of Aspen, Balsam Poplar, Mixed Deciduous and Evergreen, and White Spruce Woodland Alliance exist in patches within the intact Aspen Poplar Woodland Alliance (Figure 3.0, Appendix A). Tall Shrubland and Short Shrubland Alliance mostly occur along the banks of the NSR. A general description of plant communities and land units in the LAA is provided in Table 1 of Appendix F.

Table 4-1 Plant Communities within the Local Assessment Area

Plant Community/Land Unit	Area (ha)	Percent of LAA
Aspen Poplar Woodland Alliance	142.9	25
Aspen Woodland Alliance	24.5	4
Balsam Poplar Woodland Alliance	4.2	1
Mixed Deciduous and Evergreen Woodland Alliance	4.2	1
White Spruce Woodland Alliance	2.6	0
Tall Shrubland Alliance	5.6	1
Short Shrubland Alliance	3.5	1
Upland Subtotal	**187.5**	**33**
Open Water	60.3	11
Water Subtotal	**60.3**	**11**
Perennial Pasture	38.5	7
Residential	140.0	24
Transportation	24.0	4
Cultivated Land	7.3	1
Industrial Development	23.6	4
Green Space	90.5	16
Anthropogenic Subtotal	**323.9**	**56**
Grand Total	**571.7**	**100**

4.3.4 Project Development Area

4.3.4.1 Plant Communities

Most of the PDA (23.0 ha, 89%) was classified as perennial pasture (Figure 3.0, Appendix A), which was dominated by alfalfa (*Medicago sativa*), alsike clover (*Trifolium hybridum*), black medick (*Medicago lupulina*), dandelion (*Taraxacum officinale*), Kentucky bluegrass (*Poa pratensis*) slender wheatgrass (*Elymus trachycaulus*), tall goldenrod (*Solidago altissima*), white sweet-clover (*Melilotus alba*) and yellow sweet-clover (*Melilotus officinalis*). This vegetation community is identified as natural vegetation and High Value in the COE Environmental Sensitivity Mapping (Solstice 2017).

Balsam Poplar Woodland Alliance comprised 1.2 ha (5%) of the PDA followed by Tall Shrubland Alliance (0.6 ha, 2%), Short Shrubland Alliance (0.5 ha, 2%) and Aspen Poplar Woodland Alliance (0.01 ha, <1%).

The Balsam Poplar Woodland Alliance communities were dominated by balsam poplar (*Populus balsamifera*) in the overstory, with Canada buffaloberry (*Shepherdia canadensis*), choke cherry (*Prunus virginiana*), prickly rose, western mountain-ash (*Sorbus scopulina*), in the shrub layer *and* Kentucky bluegrass, Lindley's aster (*Symphyotrichum ciliolatum*), and slender wheatgrass in the herb layer.

Dominant plant species observed in the Tall and Short Shrubland Alliance were very similar and were dominated by aspen in the shrub layer and bluejoint (*Calamagrostis canadensis*), Kentucky bluegrass and slender wheatgrass in the herb layer. The difference between these two plant communities is the aspen in the Tall Shrubland Alliance is greater than 1.5 m tall.

The Aspen Poplar Woodland Alliance border the PDA to the east (Figure 3.0, Appendix A) and was dominated by aspen and balsam poplar in the overstory, choke cherry, prickly rose, snowberry (*Symphoricarpos albus*) and low-bush cranberry (*Viburnum edule*) in the shrub layer with bluejoint, Lindley's aster, slender wheatgrass and wild lily-of-the-valley (*Maianthemum canadense*) in the herb layer. These native vegetation communities were identified as Very High Value in the COE Environmental Sensitivity Mapping (Solstice 2017). The City of Edmonton’s Natural Connections Strategic Plan (COE 2007b) and State of the Natural Areas Report (Spencer 2006) do not identify the PDA as part of the ecological network; however, surrounding areas within the LAA along the NSR and the valley slope above the PDA are identified as ‘natural linkages’ (COE 2007a) and habitat patches. The PDA is ranked as having the lowest level of functional connectivity with the overall Ecological Network (Spencer 2006). ‘Regional biodiversity core areas’ and ’biodiversity core areas’ are identified along the NSR south of the Anthony Henday and on the other side of the NSR within the LAA, however the PDA is not identified as a ‘regional biodiversity core area’ or a ‘biodiversity core area’ (COE 2007a).

No wetlands were found within the PDA.

A comprehensive list of species observed during field surveys is provided in Table 2 of Appendix F.

4.3.4.2 Rare Plants

No historical occurrences of rare plant communities were identified by ACIMS within the LAA; however, there were two historical occurrences of S3 tracked (uncommon, known from between 21 and 100 locations in Alberta) rare plants species identified. One occurrence of flat-topped white aster (*Doellingeria umbellata* var. *pubens*) and one occurrence of smooth sweet cicely (*Osmorhiza longistylis*) were identified by ACIMS (ACIMS 2017) within the LAA. Both occurrences were located in the northeast area of the LAA (Figure 3.0, Appendix A). One occurrence of smooth sweet cicely was observed during rare plant surveys of the PDA. This species was found within an Aspen Woodland Alliance, approximately 20 m to the west of the PDA (Figure 3.0, Appendix A). This species is not protected by the Alberta *Wildlife Act* or the federal *Species at Risk Act* and does not have any required setback or mitigation.

4.3.4.3 Weeds

Five species designated as *noxious* by the Alberta Weed Control Regulation were observed during field surveys.

- common tansy (*Tanacetum vulgare*), six observations
- common toadflax (*Linaria vulgaris*), three observations
- creeping thistle (*Cirsium arvense*), sixteen observations

- perennial sow-thistle (*Sonchus arvensis*), twelve observations
- scentless chamomile (*Tripleurospermum inodorum*), six observations

4.4 WILDLIFE

The PDA is comprised primarily of tame pasture, with small areas of deciduous trees. These vegetation communities generally provide low suitability habitat for wildlife species. The LAA includes approximately 33% native vegetation, primarily deciduous dominated woodland alliances. These vegetation communities associated with the NSR provide moderate to high suitability habitat for wildlife species and connect woodland vegetation communities to the north and south of the LAA along the NSR. The NSR includes riparian and aquatic habitat for waterbirds and shorebirds and semi-aquatic mammals (e.g., beaver).

The COE lists 232 species that may reside in the NSR Valley; comprising 178 birds, 47 mammals, and seven herptiles. Approximately 20% of these species are species of management concern (SOMC) federally and/or provincially (COE 2008). Few species of management concern are likely to occur in the PDA as there is limited habitat to support SOMCs; however, they may be present in the adjacent riparian and aquatic habitats. The City of Edmonton is also within the central North American flyway, an are acovering more than 2.5 million square kilometres covering most of Alberta, Saskatchewan, and midwestern United States (US FWS 2019).

Environmental Sensitivity Mapping by the COE (Solstice 2017) indicates that the NSR Valley is the City's primary area of environmental sensitivity, with areas of native vegetation, unique landforms, and terrestrial and arboreal habitat connectivity for wildlife. The PDA includes primarily terrestrial habitat connectivity, with little arboreal connectivity; however, areas adjacent to the PDA are identified as arboreal corridors. Based on the vegetation communities identified above, the PDA is expected to provide habitat primarily for wildlife adapted to tame grass vegetation communities. The adjacent forested areas of the NSR Valley are expected to have higher diversity of wildlife and may be used as both arboreal and terrestrial habitat connectivity for wildlife. Additionally, the provincially designated KWBZ associated with the NSR intersects the LAA and PDA. See Figure 4.0, Appendix A, for a map of environmental sensitivity ranges that overlap with the LAA/PDA.

Stantec completed a nocturnal acoustic amphibian survey, breeding bird survey and migratory waterbird survey in 2017 in the LAA. The scope of the wildlife assessment was developed in consultation with AEP as per the Wildlife Directive for Alberta Solar Energy Projects (GOA 2017) and the COE. The findings of the surveys are described in the following sub-sections (see Figure 4.0, Appendix A).

4.4.1 Amphibian Survey

Amphibian surveys were conducted on three dates between mid-May and mid-June following provincial Sensitive Species Inventory Guidelines (GOA 2013). No amphibians were observed during the amphibian surveys.

Incidental wildlife observations during the amphibian surveys included moose (*Alces alces*), deer (*Odocoileus sp.)*, coyote (*Canis latrans*), beaver (*Castor canadensis*), savannah sparrow (*Passerculus sandwichensis*), clay-colored sparrow (*Spizella pallida*), white-throated sparrow (*Zonotrichia albicollis*), black-capped chickadee (*Poecile atricapillus*), and American robin (*Turdus migratorius*).

4.4.2 Breeding Bird Survey

Thirteen bird species were detected during two breeding bird surveys conducted in June 2017 following provincial Sensitive Species Inventory Guidelines (GOA 2013); three of the species detected are SOMC (listed as *sensitive* in Alberta): Baltimore oriole (*Icterus galbula*), alder flycatcher (*Empidonax alnorum*), and least flycatcher (*Empidonax minimus*) (Table 4-2), all were detected in the Aspen Poplar Woodland Alliance vegetation community along the NSR. The remainder of the bird species detected are commonly-occurring, urban-adapted species that typically occupy tame pasture or non-native urban habitats. It is assumed that any of the species present could be using the LAA for breeding. A red-tailed hawk (*Buteo jamaicensis*) was also observed flying over the forested area northeast of the PDA. Clay-colored sparrows were the most commonly observed species in the PDA, followed by savannah sparrows. Forest birds, including Baltimore oriole, red-eyed vireo (*Vireo olivaceus*), and ruby-crowned kinglet (*Regulus calendula*) were only observed in areas outside of the PDA in the Aspen Poplar Woodland Alliance vegetation community adjacent to the NSR.

Within the perennial pasture vegetation community that makes up the bulk of the PDA, there were seven species detected, with savannah sparrows being the most abundant species observed in this vegetation community, comprising half of the individuals observed. Twleve species were detected in the Aspen Poplar Woodland Alliance, with least flycatcher being the most commonly observed species, followed by yellow warbler and black-capped chickadee.

Table 4-2 Breeding Birds Detected in the LAA

Species		**Conservation Status**		
Scientific Name	**Common Name**	**Alberta Wild Species Rank**[1]	**Wildlife Act**[2]	**SARA**[3]
Regulus calendula	ruby-crowned kinglet	*secure*	N/A	*Not assessed*
Empidonax alnorum	alder flycatcher	*sensitive*	N/A	*Not assessed*
Empidonax minimus	least flycatcher	*sensitive*	N/A	*Not assessed*
Turdus migratorius	American robin	*secure*	N/A	*Not assessed*
Bombycilla cedrorum	cedar waxwing	*secure*	N/A	*Not assessed*
Vireo olivaceus	red-eyed vireo	*secure*	N/A	*Not assessed*
Dendroica petechia	yellow warbler	*secure*	N/A	*Not assessed*
Spizella pallida	clay-colored sparrow	*secure*	N/A	*Not assessed*
Pooecetes gramineus	vesper sparrow	*secure*	N/A	*Not assessed*
Passerculus sandwichensis	savannah sparrow	*secure*	N/A	*Not assessed*
Zonotrichia albicollis	white-throated sparrow	*secure*	N/A	*Not assessed*
Icterus galbula	Baltimore oriole	*sensitive*	N/A	*Not assessed*
Spinus tristis	American goldfinch	*secure*	N/A	*Not assessed*

NOTES:
[1] AEP 2017b; [2] Alberta Wildlife Regulation 143/1997; [3] GOC 2017a

4.4.3 Migratory Waterbird Survey

Migratory waterbird surveys were conducted during the spring and fall migration period in the LAA; including the NSR, where visibility was accessible, to assess use of the adjacent river by waterfowl during migration. During spring migration surveys, Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), and ring-billed gull (*Larus delawarensis*) were observed flying over the LAA. Other waterfowl observed loafing on the NSR included blue-winged teal (*Anas discors*) and common goldeneye (*Bucephala clangula*). Other wildlife observations included several migratory songbirds and evidence of beaver.

During fall migratory waterbird surveys Canada goose, American white pelican, and mallard were observed flying over the LAA (see Table 4-3). A bald eagle (*Haliaeetus leucocephalus*) was also observed flying over the NSR, as well as several migratory songbirds.

Table 4-3 Migratory Birds Detected in the LAA During Spring and Fall Migratory Bird Surveys

Scientific Name	Common Name	Spring (April/May) Observations	Fall (Sept/Oct) Observations
Pica hudsonia	black-billed magpie	0	3
Coruvus brachyrhynchos	American crow	1	3
Corvus corax	common raven	0	1
Poecile atricapillus	black-capped chickadee	0	3
Pelecanus erythrorynchos	American white pelican	0	3
Branta canadensis	Canada goose	17	239
Anas platyrhynchos	mallard	17	4
Anas discors	blue-winged teal	2	0
Bucephala clangula	common goldeneye	4	0
Haliaeetus leucocephalus	bald eagle	0	1
Charadrius vociferus	killdeer	1	0
Larus delawarensis	ring-billed gull	4	0
Empidonax minimus	least flycatcher	1	0
Turdus migratorius	American robin	1	86
Bombycilla cedrorum	cedar waxwing	0	40
Dendroica petechia	yellow warbler	1	1
Geothlypis trichas	common yellowthroat	1	0
Spizella pallida	clay-colored sparrow	2	0
Passerculus sandwichensis	savannah sparrow	3	3
Zonotrichia albicollis	white-throated sparrow	2	0
Agelaius phoeniceus	red-winged blackbird	1	0
Spinus tristis	American goldfinch	0	2
Total		**58**	**389**

4.4.4 Species of Management Concern (SOMC)

Within the Parkland Natural Region there are several SOMC with provincially recommended land use guidelines, including restricted activity dates and setback distances (GOA 2011b). Of these species, the Project falls within the range for sharp-tailed grouse, peregrine falcon, bald eagle, colonial nesting birds (e.g., American white pelican, great blue heron), short-eared owl, and Sprague's pipit. Only American white pelican, great-blue heron, peregrine falcon, and bald eagle are known to occur in Edmonton (COE 2008). American white pelicans are ground-nesting waterbirds that primarily nest in remote, shallow lakes, often on islands. Nesting colonies are occasionally found in rivers. No suitable nesting habitat for American white pelican was observed within the LAA. Great blue herons may nest in the LAA; however, the LAA does not fall within the mapped management area and associated RAPs and buffers as identified by AEP (AEP 2017a).

Peregrine falcons are known to nest on buildings and other infrastructure within the City of Edmonton; however, these nests are not identified in the mapped management area with associated RAPs and buffers as identified by AEP (AEP 2017a). Bald eagles may nest in mature trees within the deciduous woodland alliance communities identified in the LAA. A bald eagle was observed flying over the LAA during fall migratory bird surveys, but no evidence of bald eagle nests were observed during multiple site visits in 2017.

Portions of the PDA and LAA are also part of the KWBZ associated with the NSR and its tributaries. The KWBZs are areas identified by AEP as having high biodiversity potential and/or being key ungulate winter habitat. Major river valleys, where KWBZ are typically identified, typically provide the necessary topographic variability and productivity to support high biodiversity and abundant winter browse for ungulates (ESRD 2015b).

The FWIMT database search confirmed the historical record of eight SOMC, comprised of seven birds and one amphibian (AEP 2017a). Three of these species were observed during field assessments, as well as three additional species (American white pelican, bald eagle, and common yellowthroat). See Table 4-4 for a list of SOMC and their potential to occur in the LAA.

Table 4-4. Species of Management Concern and Their Potential to Occur in the LAA

Species		Conservation Status			Potential to Occur in the LAA
Scientific Name	**Common Name**	**Alberta Wild Species Rank[1]**	**Wildlife Act[2]**	**SARA[3]**	
Anaxyrus hemiophrys	Canadian toad	*May be at risk*	N/A	*Not assessed*	May breed in the NSR or nearby adjacent wetlands. Canadian toads are known to occur near Terwillegar Park.
Riparia riparia	bank swallow	*Sensitive*	N/A	*No schedule, no status*	May breed on banks of the NSR.
Hirundo rustica	barn swallow	*Sensitive*	N/A	*No schedule, no status*	No suitable habitat in the LAA

Species		Conservation Status			Potential to Occur in the LAA
Scientific Name	**Common Name**	**Alberta Wild Species Rank**[1]	**Wildlife Act**[2]	**SARA**[3]	
Pelecanus erythrorynchos	American white pelican	*Sensitive*	N/A	*Not at Risk*	Observed flying over the LAA during migration. No suitable nesting habitat.
Pandion haliaetus	osprey	*Sensitive*	*N/A*	*Not assessed*	May nest/forage in adjacent NSR and riparian areas.
Haliaeetus leucocephalus	bald eagle	*Sensitive*	*N/A*	*Not at Risk*	Observed flying over the LAA, potentially suitable nesting habitat in deciduous woodland alliances but no nests observed.
Porzana carolina	sora	*Sensitive*	*N/A*	*Not assessed*	No suitable wetlands in the LAA.
Empidonax minimus	least flycatcher	*Sensitive*	*N/A*	*Not assessed*	Observed in the Aspen Poplar Woodland Alliance in the LAA, suitable nesting habitat is available in the LAA
Empidonax alnorum	alder flycatcher	*Sensitive*	N/A	*Not assessed*	Observed in the Aspen Poplar Woodland Alliance in the LAA, suitable nesting habitat is available in the LAA
Geothlypis trichas	common yellowthroat	*Sensitive*	N/A	*Not assessed*	Observed in the Aspen Poplar Woodland Alliance in the LAA, suitable nesting habitat is available in the LAA
Icterus galbula	Baltimore oriole	*Sensitive*	N/A	*Not assessed*	Observed in the Aspen Poplar Woodland Alliance in the LAA, suitable nesting habitat is available in the LAA

NOTES:
[1] AEP 2017b; [2] Alberta Wildlife Regulations 143/1997; [3] GOC 2017a

4.4.5 Environmental Sensitivity Mapping and Areas of Wildlife Habitat Sensitivity Mapping

Based on field data collected during vegetation and wetland assessments of the PDA, a verification of the City of Edmonton's Environmental Sensitivity Mapping (Solstice 2017) was conducted. This included verification of all environmental asset categories for each polygon that overlaps the PDA. Using field collected data, mapping was updated where appropriate and field verified environmental sensitivity mapping for the PDA is presented in Figure 5.0. Table 4-5, below, summarizes changes made to Environmental Sensitivity Mapping by hectares of change, and total Environmental Sensitivity Score based on the City's original mapping and the field verified mapping. Changes in mapping were also cross checked with the recently released Urban Primary Land and Vegetation Inventory (COE 2016). Field data collection confirmed that approximately 90% of the PDA is perennial pasture, dominated by non-native vegetation (see Section 4.3.4), and include five species of noxious weeds (see Section 4.3.4.3). Based on this field verified information, environmental sensitivity rankings for vegetation were modified from 'natural vegetation' to 'non-natural vegetation', reducing the sensitivity score by one for most of the PDA. Additionally, areas of wetland and riparian vegetation were identified in the Environmental Sensitivity Mapping, and field verification confirmed that these communities were not present. These changes to also reduced sensitivity scores by a value of one.

Table 4-5 Field Verification of Environmental Sensitivity Mapping

Environmental Sensitivity Mapping		Field Verified Mapping		Change in Area (ha)
Sensitivity Ranking	**Area (ha)**	**Sensitivity Ranking**	**Area (ha)**	
Very High Value	3.9	Very High Value	0.2	-3.7
High Value	25.6	High Value	7.3	-18.3
Moderate Value	0.3	Moderate Value	22.2	22.0
Total	**29.8**		**29.8**	

Within the LAA, Environmental Sensitivity Mapping does not identify any summer terrestrial or arboreal pinch points. A winter terrestrial pinch point is identified in the LAA at the Anthony Henday crossing of the NSR on both sides of the river. Additionally, field visits identified another potential pinch point at the E.L. Smith WTP lower pump house to the northwest of the PDA. The PDA is identified as a potential corridor enhancement site based on its lower to moderate sensitivity (though this is not reflected in the City's mapping of the PDA as high sensitivity) and proximity to high sensitivity assets. Within the LAA, a coyote corridor is identified as extending on both sides of the river from the NSR up to the edge of residential developments, with the exception of the E.L. Smith WTP and the Anthony Henday Drive, which are identified as non-coyote corridor. This mapping suggests that in the summer coyote may travel around the PDA both along the NSR and along the slopes to the west of the PDA, and in winter may cross the river to access habitat on the east side of the NSR. No terrestrial pinch points are evident from this mapping. However, the mapping does not account for existing fencing around the E.L. Smith WTP, which will limit use of the WTP property for wildlife movement, specifically around the northern boundary the E.L. Smith WTP.

AEP recently released *Areas of Wildlife Habitat Sensitivity* mapping as well as a guide to interpreting the mapping as it relates to the Wildlife Directive for Alberta Solar Energy Projects (AEP 2017c). The directive is not applicable to urban areas, including the City of Edmonton, and hence no sensitivity mapping is identified within the boundaries of the City. However, of the wildlife sensitivity layers that were assessed, only the KWBZ is relevant to the Project. In the mapping, the KWBZ is identified as High Risk and this zone is identified for its contribution to ungulate winter range and wildlife migration corridors (primarily bats and birds). The zones are intended to prevent loss and fragmentation of habitat, maintain migration corridors, prevent vehicle access, prevent sensory disturbance during energetically stressful periods for wildlife, and prevent barriers to wildlife corridors. See Sections 6.4 for an assessment of the potential effects of the Project on wildlife habitat, wildlife movement, and wildlife mortality risk.

4.4.6 Wildlife Habitat Connectivity

Baseline wildlife habitat connectivity was reviewed using available desktop information and incidental observations, where available. Incidental wildlife observations include porcupine, coyote and deer observed in the PDA and LAA during wildlife and vegetation assessments, as well as during archeological investigations. Additionally, one moose was observed along the northeast corner of the PDA. Deer were observed in both the perennial pasture in the PDA as well as in the aspen poplar and aspen woodland alliances to the east and west of the PDA. Coyote were observed in the perennial pasture in the PDA.

Porcupine were observed in the tall shrubland alliance and perennial pasture in the southeastern corner of the PDA and adjacent areas of the LAA. These observations suggest that medium and large mammals are currently using the PDA and LAA for portions of their life cycle.

Using the mapping from the Solstice (2017) Environmental Sensitivity Mapping the existing E.L. Smith WTP, the Project PDA, and the vegetated areas along the NSR and the slope to the east of the PDA are within the mapped coyote movement corridor. The adjacent vegetated park land, including Terwillegar Park, are also identified as coyote movement corridor, suggesting that during the winter (when the river is frozen and passable) the river and non-urbanized river valley is available for coyote and other medium to large wildlife for movement. When the river is not in frozen condition, movement would be restricted to either side of the river. The model does not account for the existing chain link fence around the existing E.L. Smith property, therefore, this area is functionally unavailable to medium and large wildlife, but would be passable to small mammals. The existing chain link fence has mesh of approximately 5 cm. Small mammals (including voles, mice, shrews, ground squirrels, chipmunks) have skull sizes of approximately 1 to 3 cms and are expected to be able to pass through the existing (and planned future) fence.

4.5 VIEWSCAPE

The viewscape is dominated by the NSR Valley, Terwillegar Park on the adjacent bank of the river, the existing E.L. Smith WTP, overhead transmission lines, and manicured areas and infrastructure associated with Anthony Henday Drive. The majority of the PDA is dominated by previously disturbed/cultivated perennial pasture.

The Project is located adjacent to the existing E.L. Smith WTP, along the NSR. There are two neighborhoods (Cameron Heights and Henderson Estates) that have observation points with views of the PDA; however, most of these observation points are obstructed by existing vegetation. Anthony Henday Drive is located to the south of the PDA and users of Anthony Henday Drive will have observation points with views of the PDA. Recreational users of areas around the PDA, including formal and informal trails will also have observation points with views of the PDA. Currently, there are formal trails to the south and west of the PDA; there are no formal recreational trails between the PDA and the NSR.

4.6 HISTORICAL RESOURCES

A *Historical Resources Act* (HRA) Application (HRA# 4941-17-0008) was submitted to ACT on April 19, 2017 providing project details and requesting clearance and any/or requirements. In response, ACT issued HRA requirements on June 6, 2017, requiring both an archaeological and a palaeontological Historical Resources Impact Assessment (HRIA). These were completed under Archaeological Permit 17-094 (issued June 20, 2017) and Palaeontological Permit 17-047 (issued June 27, 2017). Additional mitigation work was requested and completed as a result of these studies, and ACT has issued HRA clearance for the project.

5.0 SELECTION OF VALUED ECOSYSTEM COMPONENTS

Based on the scoping of potential effects during the construction and operation phases of the Project, six VECs were carried forward in the assessment of potential environmental effects for the Project. VECs were not carried forward in the effects assessment if Project interactions were considered negligible or if they did not result in an adverse measurable change to the VEC with the application of BMPs or standard practices. The VECs that were considered, and a rationale for including or excluding them in the effects assessment are provided in Table 5-1.

Table 5-1 Selection of Valued Ecosystem Components

Valued Ecosystem Component	Potential Project Interaction	Included in Assessment	Rationale for Inclusion/Exclusion
Terrain and Soils	✓	Section 6.1	Soils are included because the Project could have an effect on soil quality and quantity during construction. Compaction, rutting, erosion, and admixing of soils are possible wherever vehicles and equipment are used. Direct disturbance of soils will result from panel installation and access road development. Temporary disturbance will be associated with utility installation and stripped or graded areas. No effects on terrain are anticipated.
Surface Water Bodies and Hydrology	✓	Section 6.2	Project activities have the potential to effect water quality and quantity due to the introduction of impervious surfaces (i.e., access road) and the grading required to accommodate the infrastructure. As such, interactions with surface water bodies and hydrology have been included.
Groundwater	-	-	Interactions with groundwater were considered based on the potential for the Project to change groundwater quality or quantity . Dewatering is not anticipated, and construction and operational activities are not expected to have an adverse negative effect on groundwater. One old water well record was noted in the vicinity of the Project however information on the well is un-validated. Project activities are not anticipated to result in a change to groundwater quality or quantity for groundwater users. As a result, Project interactions with groundwater have been excluded.
Wetlands	-	-	A wetland assessment was completed for the Project. Wetlands were not identified within the PDA and therefore have not been included in the MEIA.
Vegetation Species and Communities	✓	Section 6.3	Project activities require clearing of trees and plant communities within the PDA. Vegetation species and communities has been included because vegetation clearing and ground disturbance will result in the change in vegetation species and may affect community diversity.

Valued Ecosystem Component	Potential Project Interaction	Included in Assessment	Rationale for Inclusion/Exclusion
Wildlife Species and Habitat	✓	Section 6.4	The Project will result in the loss of wildlife habitat during construction and potential direct mortality during construction and operation. Based on consultation with the regional wildlife biologist at AEP and the COE, wildlife assessments were undertaken for the Project. As a result, Project interactions with wildlife have been included.
Aquatic Species and Habitat	-	-	Aquatic species and habitat are excluded because no major watercourses will be crossed by the Project and no new surface disturbance is planned within 100 metres of a watercourse. Terrain in the PDA is relatively flat, and erosion and sedimentation controls will be implemented. As a result, interactions between the Project and aquatic species and habitat are not predicted.
Air Quality	-	-	Air emissions, including GHG emissions, are not evaluated further as the Project will not result in notable increases in air contaminants or GHG emissions. Construction activities will be short term in duration, with relatively few vehicles being required. In addition, the operation of the solar farm will not interact with air quality. As a result, with the application of standard mitigation measures, including maintaining vehicles and reducing idling of equipment, limited potential for residual effects is predicted.
Noise	-	-	Use of vehicles and equipment during Project activities will generate noise; however, the amount of vehicle use is limited, short term, and is unlikely to cause specific noise concerns (especially in the context of an urban environment). Mitigation measures requiring maintenance of vehicles and equipment and timing of specific activities will address noise issues. The Proponent will adhere to the COE Community Standards Bylaw 14600 that sets noise limits and timing rest restrictions for construction. A Noise Impact Assessment (NIA) was completed for the Project as a required under AUC Rule 012: Noise Control (AUC 2017b) and was submitted under a separate cover. Noise is not evaluated further as the results of the NIA indicate that the Project is in compliance with AUC Rule 012: Noise Control (AUC 2017b).
Viewscape	✓	Section 6.5	The Project will result in temporary and permanent changes to the viewscape from adjacent communities (Cameron Heights and Henderson Estates). As a result of these changes, viewscape has been included in the assessment.
Heritage Resources	✓	Section 6.6	Project activities may result in effects on heritage resources within the PDA during construction, including effects to unknown resources of cultural, archaeological, historical and/or paleontological significance. As such, Project interactions with heritage resources have been included.

6.0 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

6.1 TERRAIN AND SOILS

6.1.1 Potential Environmental Effects

The Project's potential interactions with soils include a change in soil quality and quantity during construction resulting from soil loss through wind and/or water erosion following vegetation removal and soil stripping; compaction, rutting or loss of soil structure through vehicle or equipment movement; admixing during soil stripping activities; and contamination from fuel or chemical spills (COE 2005a).

No interactions between soils is anticipated during operation since vegetation will be re-established, access to the solar panels will be along developed access roads, and vehicle/equipment activity within the solar farm during operation will be limited.

6.1.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on soil quality and quantity. See Table 6-1 for proposed mitigation measures for reducing potential effects to terrain and soils.

Table 6-1 Proposed Mitigation for Reducing Potential Effects to Terrain and Soils

Potential Effect	Effect Pathway	Proposed Mitigation
Change in soil quality and quantity	Soil loss and changes to soil quality through admixing during soil stripping/replacement, wind and/or water erosion following vegetation removal and soil stripping	• Implement recommendations outlined in the storm water management plan (Stantec 2018) - install silt fences along the downstream side of the PDA - provide construction entrance feature to minimize the transport of sediment on vehicles and equipment - direct runoff through swales and erosion control berms such that untreated runoff is not discharged from the PDA - install temporary rock check dams, straw swale barriers and/or filter cloth barriers in swales (where appropriate) - stabilize all disturbed areas not subject to construction activities within 30 days • Minimize disturbance to existing vegetation (COE 2005a) • Minimize time exposure of un-vegetated/exposed soils (COE 2005a) • Strip topsoil and subsoil separately, stored topsoil and subsoil in separate stockpiles at least one metre apart • Re-vegetate disturbed areas as soon as conditions allow • Topsoil salvage and/or replacement will be avoided during heavy precipitation or extremely windy conditions • Develop and implement an ESC plan (COE 2005a) • Monitor ESC measures during construction and rectify deficiencies as soon as possible (COE 2005a)

Potential Effect	Effect Pathway	Proposed Mitigation
	Compaction, rutting or loss of soil structure through vehicle and equipment movement	• In the event of adverse weather that could result in rutting and/or compaction, mitigation measures (i.e., limiting vehicle traffic, utilizing tracked equipment or stripping topsoil) will be considered. If mitigation measures fail, Project activities may be suspended until adverse weather conditions abate • Traffic will be confined to workspace areas, access roads identified and marked by surveyors in order to reduce compaction • Working during and immediately after intense rainfall events or spring thaw when soils are wet will be avoided to the extent practical in order to reduce soil compaction • Installation of plywood sheets or rig matting (if required)
	Contamination from fuel or chemical spills	• Road vehicles will be refueled and maintained off site • Fueling and equipment maintenance (e.g., greasing, oil changes) will not occur within 100 metres of a water body • Construction equipment will be inspected at the beginning and end of each shift, and any leaks noted will be repaired immediately upon detection or equipment will be removed from site • Emergency response materials will be maintained on site and construction equipment will be equipped with a fire extinguisher, spill kits and will be operated by personnel trained in their use

6.1.3 Potential Residual Effects

6.1.3.1 Potential Residual Effects Description Criteria

Criteria used to assess potential residual effects on terrain and soils are provided in Table 6-2.

Table 6-2 Characterization of Potential Residual Effects on Terrain and Soils

Parameter	Definition
Direction	**Positive –** a potential residual effect that moves the parameters in a direction beneficial to the VEC relative to baseline **Adverse –** a potential residual effect that moves the parameters in a direction detrimental to the VEC relative to baseline **Neutral** – no net change in the parameters for the VEC relative to baseline
Magnitude	**Negligible** – no measurable change **Low** – a change in soil parameters with no measurable change in soil quality **Moderate** – a measurable change in soil parameters which is unlikely to affect soil quality (i.e. there is no change in quality class) **High –** a measurable change in soil parameters which results in a change in soil quality
Geographic Extent	**PDA –** potential residual effects are restricted to the PDA **LAA –** potential residual effects extend into the LAA

Parameter	Definition
Frequency	**Single Event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	**Short** – direct effect is measurable for 1-5 years **Medium** – direct effect is measurable for 6-15 years **Long** – direct effect is measurable for 16+ years
Reversibility	**Reversible –** the potential residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the potential residual effect is unlikely to be reversed
Ecological and Socio-economic Context	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

6.1.3.2 Summary of Potential Residual Effects on Terrain and Soils

Project mitigation measures are expected to prevent measurable changes in soil quality and quantity. These changes include BMPs for soil handling procedures, supervision of ground disturbance, and the implementation of an ESC and storm water management plan. The "preparation and implementation of an ESC Plan is one of the key components of the Drainage Services ESC Framework and is a crucial step in managing erosion and sedimentation" (COE 2005a). Vegetation cover is a highly effective erosion control measure and is valuable in its ability to act as a buffer and filter pollutants from storm water runoff (GOA 2011a and IDEM 2007). As detailed in Section 6.3.3, below, research on native vegetation growth under solar panels in Colorado indicates that seedling density of native vegetation ranged from 91.4% to 61.8% cover of native vegetation with less than 7% noxious weeds after three years (NREL 2017). In addition, mitigation measures to limit the exposure of fuel or chemicals to the PDA will lower the risk of contamination from fuel or chemical spills. In the event of an unplanned release of fuel or chemicals, all impacted areas will be remediated to applicable guidelines (e.g., Alberta Tier 1 Soil Remediation Guidelines, CCME Soil Quality Guidelines for the Protection of Environmental and Human Health).

With the implementation of mitigation measures, potential residual effects on terrain and soils will be neutral, limited to the PDA, low in magnitude, occurring at a single event frequency, short term in duration, and reversible following post-construction remediation of the workspace.

6.1.4 Prediction Confidence

Overall, prediction confidence for change in soil quality and quantity is high. Effects to soil during construction are well known and mitigation effectiveness is high because they are standard and proven (COE 2005a, SQI 2000 and GOA 2011a). No effects to soils during operation are anticipated since vegetation will be re-established, access to the solar panels will be along developed access roads, and vehicle/equipment activity within the solar farm during operation will be limited. ESC plans and the establishment of vegetation, including native seed mixes, underneath solar panels (see Section 6.3.4 for more details) is well documented in literature and is proven to be an effective mitigation in controlling erosion. With the well-known effects and effective mitigation measures, there is a high degree of confidence for estimation of project residual effects on soil quality and quantity.

6.2 SURFACE WATER BODIES AND HYDROLOGY

6.2.1 Potential Environmental Effects

The Project’s potential interactions with surface water bodies and hydrology could result in a change in water quality and quantity.

Grading is required to accommodate the Project infrastructure. Post development conditions will likely reduce slopes to a maximum of 3% and reduce undulating terrain under the solar panels. In addition, the existing access road will be removed (ground returned to permeable), and an impermeable, gravel access road (which will be allowed to revegetate) will be constructed elsewhere within the PDA (see Section 3.2.1 for additional details regarding the new access road). This new access road may have a larger footprint then the existing access road therefore there is a potential increase in the impervious surface area. The introduction of an impervious surface and the grading will decrease the storage capacity within the PDA; therefore, increasing the peak runoff flow and the volume of runoff leaving the PDA which could also increase the erosion potential (IDEM 2007 and Stantec 2018, Appendix D).

6.2.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on water quality and quantity. See Table 6-3 for proposed mitigation measures for reducing potential effects to surface water bodies and hydrology.

Table 6-3 Proposed Mitigation for Reducing Potential Effects to Surface Water Bodies and Hydrology

Potential Effect	Effect Pathway	Proposed Mitigation
Change in water quality and quantity	• Increased offsite volumes and flows due to introduction of impervious surfaces and grading • Increased erosion potential resulting from increased flows	• Maintain the 100 m setback from the NSR • Minimize disturbance to existing vegetation • Minimize time exposure of un-vegetated/exposed soils • Re-vegetate disturbed areas as soon as conditions allow • Develop and implement an ESC plan • Monitor ESC measures during construction and rectify deficiencies as soon as possible (COE 2005a) • Implement construction recommendations outlined in the storm water management plan (Stantec 2018, Appendix D) - install silt fences along the downstream side of the PDA - provide construction entrance feature to minimize the transport of sediment on vehicles and equipment - direct runoff through swales and erosion control berms such that untreated runoff is not discharged from the PDA - install temporary rock check dams, straw swale barriers and/or filter cloth barriers in swales (where appropriate) - stabilize all disturbed areas not subject to construction activities within 30 days • Conduct semi-annual inspections for the first two years following construction (identifying and addressing bare soil, erosive gullies, isolated pooling and sediment build-up)

6.2.3 Potential Residual Effects

6.2.3.1 Potential Residual Effects Description Criteria

Criteria used to assess potential residual effects on surface water bodies and hydrology are provided in Table 6-4.

Table 6-4 Characterization of Residual Effects on Surface Water Bodies and Hydrology

Parameter	Definition
Direction	**Positive –** a potential residual effect that moves the parameters in a direction beneficial to the VEC relative to baseline **Adverse –** a potential residual effect that moves the parameters in a direction detrimental to the VEC relative to baseline **Neutral** – no net change in the parameters for the VEC relative to baseline
Magnitude	**Negligible** – no measurable change **Low** – minor loss or alteration to measurable surface water flow patterns or change of water volume and/or minimal decrease in water quality during/post-construction **Moderate** – partial loss or alteration to measurable surface water flow patterns or change of water volume and/or partial decrease in water quality during/postconstruction

Parameter	Definition
	High – total loss or alteration of measurable surface water flow patterns or change of water volume and/or substantial decrease in water quality during/post construction
Geographic Extent	**PDA –** potential residual effects are restricted to the PDA **LAA –** potential residual effects extend into the LAA
Frequency	**Single Event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	**Short** – direct effect is measurable for 1-5 years **Medium** – direct effect is measurable for 6-15 years **Long** – direct effect is measurable for 16+ years
Reversibility	**Reversible –** the potential residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the potential residual effect is unlikely to be reversed
Ecological and Socio-economic Context	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

6.2.3.2 Summary of Potential Residual Effects on Surface Water Bodies and Hydrology

The PDA has been strategically setback from the NSR which allows for major overland drainage tip-over elevations and locations, as well as major overland drainage patterns and paths to be maintained (Stantec 2018). Project mitigation measures to control surface water runoff including: the implementation of an ESC, the implementation of storm water management plan, and construction/post-construction inspections, are expected to mitigate potential Project effects relating to erosion (Stantec 2018; COE 2005a). Vegetation reduces runoff and slows storm water runoff velocities, allowing the runoff to infiltrate into the underlying soil and post-construction impacts can be reduced through planning that utilizes natural site features and vegetation (IDEM 2007). In addition, ”vegetation cover is probably the most important factor in terms of prevent erosion” and “is valuable in its ability to act as a buffer and filter pollutants from storm water runoff” (IDEM 2007).

Potential residual effects resulting from Project activities include an increased surface water runoff volume and flow within the LAA. With the implementation of mitigation measures, potential residual effects on surface water bodies and hydrology will be adverse, limited to the LAA, low in magnitude, occurring at multiple irregular events, long term in duration, and reversible.

6.2.4 Prediction Confidence

Overall, prediction confidence for change in water quality and quantity is high. The effects on hydrology from construction involving earthworks and on impermeable infrastructure are generally known (based on available literature and site-specific modeling) and the mitigation measures are well established. The establishment of vegetation, including native seed mixes, underneath solar panels is documented in literature and is proven to be an effective mitigation in controlling runoff. With the well-known effects and effective mitigation measures, there is a high degree of confidence for estimation of project residual effects on water quality and quantity.

6.3 VEGETATION SPECIES AND COMMUNITIES

6.3.1 Potential Environmental Effects

Construction activities (i.e., vegetation removal and soil stripping) may result in adverse effects on vegetation through direct loss or alteration of plant communities or through potential introduction or spread of weeds listed in the Alberta *Weed Control Act* (i.e., exotic vegetation invasion). The Project's potential interactions with vegetation species and communities (during construction and operation) include change in species composition and community diversity. Fragmentation of natural habitats can affect plant population by reducing genetic variation (from loss of individual plants) and increasing the distance between populations as they become geographically isolated, ultimately resulting in species loss. However, any potential effects associated with fragmentation would've likely occurred when the PDA was originally disturbed (i.e., cultivated for agricultural purposes) and no additional fragmentation would be expected as a result of the Project.

6.3.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or avoid potential effects to vegetation. See Table 6-5 for proposed mitigation measures for reducing potential effects to vegetation species and communities.

Table 6-5 Proposed Mitigation for Reducing Potential Effects to Vegetation Species and Communities

Potential Effect	Effect Pathway	Proposed Mitigation
Change in species and community diversity	• Direct loss or alteration of plant communities and diversity • Introduction or spread of weeds listed in the Alberta *Weed Control Act* (i.e., exotic vegetation invasion)	• Reduce clearing of native plant communities, where possible • Ensure all equipment arrives on-site clean and free of soil or vegetative debris • Ensure all equipment remains within the PDA and designated travel lanes • Avoid grading except where required for safe construction of the Project • Reseed disturbed area using an approved native seed mix; resulting in no change to natural vegetation value relative to existing conditions as ranked in Solstice (2017) • Revegetation of approximately 3.0 ha of native trees and shrubs along the south and southeast of the PDA resulting in a net gain of 0.7 ha of these vegetation communities • Incorporate cleared trees and shrubs into biodiversity offset revegetation areas as ground

		cover to provide diverse micro climate conditions for native seed growth • Monitor topsoil piles for weed growth during construction and implement corrective measures (i.e. spraying, mowing or hand pulling) to avoid the spread of weeds, as required • Weed control will be conducted in accordance with the Alberta *Weed Control Act* and *Regulations* • If conducting herbicide weed control application within 100 m of the NSR, use hand application only • Vegetation management may be required as part of operation activities including weed management and or mowing of vegetation to avoid interference with solar panel operation

6.3.3 Potential Residual Effects

6.3.3.1 Potential Residual Effects Description Criteria

Criteria used to assess potential residual effects on vegetation species and communities are provided in Table 6-6.

Table 6-6 Characterization of Potential Residual Effects on Vegetation Species and Communities

Parameter	Definition
Direction	**Positive –** a potential residual effect that moves the parameters in a direction beneficial to the VEC relative to baseline **Adverse –** a potential residual effect that moves the parameters in a direction detrimental to the VEC relative to baseline **Neutral** – no net change in the parameters for the VEC relative to baseline
Magnitude	**Low** – distribution and abundance of native plant communities are not reduced in the LAA beyond natural variation **Moderate** – distribution and abundance of native plant communities are reduced, but not lost, in the LAA **High** – native plant communities are completely removed from the LAA
Geographic Extent	**PDA –** potential residual effects are restricted to the PDA **LAA –** potential residual effects extend into the LAA
Frequency	**Single Event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	**Short** – direct effect is measurable for 1-5 years **Medium** – direct effect is measurable for 6-15 years **Long** – direct effect is measurable for 16+ years

Parameter	Definition
Reversibility	**Reversible –** the potential residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the potential residual effect is unlikely to be reversed
Ecological and Socio-economic Context	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

6.3.3.2 Summary of Potential Residual Effects on Vegetation Species and Communities

Potential residual effects on vegetation species and communities may result from direct loss or alteration of plant communities and diversity, and introduction or spread of weeds listed in the Alberta *Weed Control Act*. The PDA is situated in a highly modified site that is 89% perennial pasture, with low plant diversity and comprised primarily of non-native species as well as numerous noxious weeds. Native plant communities make up 2.3 ha of the PDA. While a portion of the ground cover will be used for piling locations for the solar panels as well as associated infrastructure, most of the non-native vegetation will be replaced with an approved native seed mix, a net gain of native vegetation in the PDA. Additionally, 3 ha of the PDA will be revegetated with native trees and shrubs along the south and southeast edge of the PDA as a biodiversity offset, resulting in a net gain of 0.7 ha of native trees and shrubs and no net loss of these native vegetation communities. No loss of native species is expected in the LAA as all native communities in the PDA are found elsewhere in the LAA and throughout the NSR in Edmonton and beyond. In addition, the native plant materials will assist in the management of noxious weeds (Strathcona County 2016).

Research on native vegetation growth under solar panels in Colorado (on the eastern edge of the Central Rocky Mountains, average annual temperature of 10 degrees Celsius) indicates that seedling density of native vegetation ranged from 91.4% to 61.8% cover of native vegetation with less than 7% noxious weeds after three years (NREL 2017). The most effective vegetation cover in this region was warm-season grasses (including buffalograss and blue grama, both of which occurred onsite prior to disturbance). The State of Minnesota recently passed a law requiring pollinator habitat to be planted under solar facilities and provides technical guidance on establishment and maintenance for these facilities (Minnesota Department of Natural Resources 2018). The State of Minnesota suggests that low growing shade tolerant, drought-resistant species are acceptable for planting under solar farms and areas between panels or along margins of the facility as they may be less susceptible to shading.

Additionally, some research suggest that the cooling effect of vegetation under solar panels may increase the efficiency of the panels (because efficiency is generally reduced as temperatures increase; Kande et al. 2016).

Habitat fragmentation effects are not expected as minimal disturbance to native vegetation is anticipated. Overall, gene flow of desired native plant species is expected to improve following construction with a reduction in gene flow of non-native and noxious weeds. Gene flow from adjacent forested habitats is not expected to change substantially as minimal change to these habitats is anticipated during construction;

however, the addition of revegetated areas of native trees and shrubs along the south and southeast portion of the PDA may facilitate improved gene flow between forested habitats to the east and west of the PDA (Christie and Knowles 2015).

With the implementation of mitigation measures, and due to the permanent loss in vegetation from Project components (e.g., access road, pilings, inverter stations), potential residual effects on vegetation and species communities are predicted to be adverse in direction, low in magnitude. Potential residual effects will be limited to the PDA, will occur once, will be long term and are reversible. However, the introduction of an approved native seed mix throughout the PDA and the planting of approximately 3.0 ha of native trees and shrubs along the south and southeast of the PDA will result in a net gain of these vegetation communities and is considered a positive residual effect.

6.3.4 Prediction Confidence

Overall, prediction confidence for change in vegetation species and community diversity is high. There will be a direct loss of vegetation, however minimal disturbance to native vegetation is anticipated (based on the PDA) and all of the disturbed, non-native vegetation will be replaced with an approved native seed mix. The establishment of vegetation, including native seed mixes, underneath solar panels is well documented in literature (NREL 2017) and mitigation effectiveness is high because the measures are standard and proven (see Section 6.3.3.2 for more details). With the well-known effects and effective mitigation measures, there is a high degree of confidence for estimation of project residual effects on vegetation species and community diversity.

6.4 WILDLIFE SPECIES AND HABITAT

6.4.1 Potential Environmental Effects

The Project’s potential interactions with wildlife species and habitat include change in wildlife habitat availability and suitability, change in wildlife movement, and change in wildlife mortality risk.

Construction activities (e.g., vegetation removal, ground disturbance) have the potential to result in the direct and indirect loss and fragmentation of wildlife habitat. Indirect loss of habitat or reduced habitat effectiveness may occur in adjacent areas due to sensory disturbances associated with Project construction activities and operations.

Fencing of the permanent footprint within the PDA will exclude many medium and large wildlife species from the PDA and may result in changes to wildlife movements through the LAA.

During construction, vehicles and other equipment have the potential to change mortality risk for wildlife in the PDA. Vegetation removal may result in the physical destruction of key habitat features (e.g., nests, dens, roosts, hibernacula). Equipment may also result in the direct mortality of small, less mobile species or individuals (e.g., amphibians, juvenile birds).

During operations of the Project some birds may be drawn to the solar panels, resulting in collisions and increased risk of mortality. This may be particularly relevant for waterbirds; which can be drawn to solar panels due to the reflected light off the panel mimicking water (i.e., the 'lake effect'; GOA, 2017).

6.4.2 Mitigation Measures

Standard industry practices and avoidance measures (Bernardino et al. 2018; BLM 2018; GOA 2017; Walston et al. 2015), along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on wildlife habitat availability and mortality risk. Where applicable standards and BMPs from the Wildlife Directive for Alberta Solar Energy Projects (GOA 2017) have been incorporated.

See Table 6-7 for proposed mitigation measures for eliminating or reducing potential effects to wildlife habitat availability and suitability, movement, and risk of mortality.

Table 6-7 Proposed Mitigation for Reducing Potential Effects to Wildlife Species and Habitat

Potential Effect	Effect Pathway	Proposed Mitigation
Change in wildlife habitat availability and suitability	• Direct loss or alteration of wildlife habitat due to fencing, vegetation removal and ground disturbance • Indirect loss or reduced effectiveness of wildlife habitat through sensory disturbance due to human activity and vehicle traffic • Indirect loss or reduced effectiveness of wildlife habitat through sensory disturbance from operation of the solar Project	• Restrict all construction activities to the approved Project boundaries and do not clear vegetation beyond Project boundaries • Maintain noise abatement equipment on machinery in good working order to reduce potential sensory disturbance to wildlife • Adhere to all recommended setbacks and timing restrictions for identified wildlife habitat features (e.g. nests, dens) • Restore vegetation to approved native seed mix as soon as practical • Lighting will be minimized throughout the PDA with all lighting directed downward, fully-shielded, and will be equipped with automatic sensors or timers to minimize operating time when not needed. Lighting is restricted to building infrastructure, where necessary to reduce indirect effects to wildlife • Revegetation of 3.0 ha of native trees and shrubs as a biodiversity offset within the PDA, resulting in a net gain of 0.7 ha of native tree and shrub habitat • Addition of bat and bird boxes in the forested slope west the existing E.L. Smith WTP to provide additional habitat enhancement structures • Retain cleared trees and incorporate the woody debris into biodiversity offset revegetation areas to provide ground cover for small mammals and other wildlife

Potential Effect	Effect Pathway	Proposed Mitigation
Change in wildlife movement	• Direct loss or alteration of wildlife habitat due to fencing, vegetation removal, ground disturbance, and fencing • Indirect loss or reduced effectiveness of wildlife habitat through sensory disturbance due to human activity and vehicle traffic • Indirect loss or reduced effectiveness of wildlife habitat through sensory disturbance from operation of the solar Project	• Restrict all construction activities to the approved Project boundaries and do not clear vegetation beyond Project boundaries • Fencing will be designed such that it is permeable to small mammals (e.g. mice, voles) with mesh or similar gaps of approximately 5 cm. • Fencing will be designed and sited to minimize impediment of existing wildlife movement around the PDA, while reducing the chance of collision and/or entrapment of wildlife in Project infrastructure • Schedule construction activities outside of the RAP for KWBZs (Jan 15 – April 30) or discuss with a regional AEP biologist • Maintain noise abatement equipment on machinery in good working order to reduce potential sensory disturbance to wildlife • Adhere to all recommended setbacks and timing restrictions for wildlife habitat features (e.g. nests, dens) • Revegetation of 3.0 ha of native trees and shrubs along the south and southeast portion of the PDA will be implemented as a biodiversity offset, resulting in a net gain of 0.7 ha of native tree and shrub habitat for wildlife and providing structural connectivity between the east and west forested areas • Revegetation of the south edge of PDA with approximately 40 m vegetated buffer will be implemented to provide structural connectivity between forested areas on either side of the PDA

Change in wildlife mortality risk	• Direct mortality from ground disturbance and vegetation removal (e.g. destruction of nests or dens) • Direct mortality from collisions with Project vehicles and equipment • Direct mortality from collisions with or entrapment in solar panels and other Project infrastructure	• Schedule the commencement of construction activities outside of the RAP for nesting migratory birds for Nesting Zone B4 (April 10 – August 31; GOC 2017b), the general raptor nesting period (March 15 to July 15: ESRD 2015b). If avoidance of the RAP is not possible, conduct nest searches and implement appropriate setbacks and/or mitigation measures to reduce the risk of incidental take and implement bird management plans, as required • All construction personnel will receive environmental orientation at project start up, including education on avoiding the harassment and feeding of wildlife, mitigations to reduce potential for wildlife mortality, and other key environmental concerns. • Prior to construction at any time of year, nest surveys for bald eagles will be conducted within 1 km of the PDA. If nests are identified, a mitigation and management plan will be developed in consultation with a regional AEP biologist • Schedule construction activities outside of the RAP for KWBZs (Jan 15 – April 30) where this management zone overlaps the PDA, develop a mitigation plan to reduce effects to wildlife in the KWBZ in consultation with a regional AEP biologist • During construction vehicle traffic will be limited to the approved PDA and low speeds will be maintained • Monitor the construction area for trapped wildlife. Should any wildlife be identified, the Construction Manager will be contacted. In consultation with a professional wildlife biologist and AEP, appropriate corrective actions will be implemented • Fencing will be designed to reducing the chance of collision with and/or entrapment of wildlife in Project infrastructure • Fencing may reduce the potential for predator related mortality of birds from medium-bodied generalist predators (e.g. fox and coyote) by excluding them from the PDA • Panels have been designed to reduce glare and will be installed at an angle (non-vertical) to reduce the potential for aerial wildlife (e.g. bats and birds) to be attracted to the panels (Kagen et al. 2014) • Use of guy-wires will be avoided to prevent bird collisions (Bernardino et al. 2018) • Power lines will be below-ground to avoid collision and electrocution of birds (Bernardino et al. 2018) • A post-construction wildlife mortality monitoring plan will be developed in consultation with the COE and AEP to assess wildlife mortality rates

Potential Effect	Effect Pathway	Proposed Mitigation
		associated with the Project. Should unacceptable risks to wildlife be identified during monitoring, additional mitigation measures will be developed and implemented in consultation with regulatory agencies

6.4.3 Potential Residual Effects

6.4.3.1 Potential Residual Effects Description Criteria

Criteria used to assess potential residual effects on wildlife species and habitat are provided in Table 6-8.

Table 6-8 Characterization of Residual Effects on Wildlife Species and Habitat

Parameter	Definition
Direction	**Positive –** a potential residual effect that moves the parameters in a direction beneficial to the VEC relative to baseline **Adverse –** a potential residual effect that moves the parameters in a direction detrimental to the VEC relative to baseline **Neutral** – no net change in the parameters for the VEC relative to baseline
Magnitude	**Low** – no change to wildlife habitat, wildlife movements, or mortality risk **Moderate** – change to wildlife habitat, wildlife movements, or mortality risk may occur, but no loss of species diversity or wildlife movement corridors are anticipated. Change in wildlife mortality is not anticipated to impact local wildlife populations. **High** – change to wildlife habitat, wildlife movements, or mortality risk such that changes to species diversity and mortality risk, or loss of wildlife movement corridors, are anticipated
Geographic Extent	**PDA –** potential residual effects are restricted to the PDA **LAA –** potential residual effects extend into the LAA
Frequency	**Single Event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	**Short** – direct effect is measurable for 1-5 years **Medium** – direct effect is measurable for 6-15 years **Long** – direct effect is measurable for 16+ years
Reversibility	**Reversible –** the potential residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the potential residual effect is unlikely to be reversed
Ecological and Socio-economic Context	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

6.4.3.2 Summary of Potential Residual Effects on Wildlife Species and Habitat

This section summarizes the potential residual effects of the Project on wildlife habitat availability and suitability, wildlife movement, and wildlife mortality risk.

CHANGE IN WILDLIFE HABITAT AVAILABILITY AND SUITABILITY

Construction

During construction, vegetation removal and ground disturbance will result in the direct and indirect loss of primarily perennial pasture vegetation dominated by non-native vegetation with a high percentage of weedy species; which provides low suitability habitat for wildlife. Field verification of Environmentally Sensitivity Mapping (Solstice 2017) identifies 74.7% of the PDA as Moderate Sensitivity, this score includes asset scores for modified vegetation, unique landform and potential coyote corridor. Fencing of the PDA (permanent and temporary fencing) will exclude most wildlife from the area. These changes to wildlife habitat will result in the displacement of many wildlife species from the PDA. Wildlife may avoid areas adjacent to the PDA during construction due to noise and light associated with construction activities (Benitez-Lopez et al. 2010; Francis et al. 2011; California Department of Transportation 2016). The extent of potential avoidance outside of the PDA will vary by wildlife species.

Disturbance to wildlife habitat during construction activities will largely be avoided by siting the Project in areas of low suitability and moderate sensitivity habitat (e.g., tame pasture) and scheduling construction activities to occur outside of sensitive wildlife periods (e.g., primary nesting periods for migratory birds and KWBZ RAPs).

During construction, potential residual effects on wildlife habitat are predicted to be adverse as there will be direct loss of low suitability wildlife habitat and temporary indirect loss of adjacent higher suitability habitats. The magnitude of the potential effect is predicted to be low, because it is unlikely to have a measurable effect on wildlife abundance in the LAA. Although most changes in habitat will be limited to the PDA, sensory disturbance will extend into portions of the LAA, which may result in temporary local shifts in wildlife distribution. Potential effects on wildlife from direct habitat loss will occur from a single event (i.e., during vegetation removal and construction) and will extend beyond the operations phase. Potential indirect effects from sensory disturbance during construction will be short-term. Overall, the change in habitat is considered reversible because the residual loss or alteration of habitat can be reversed through habitat reclamation following decommissioning.

Operations

The permanent footprint of the Project will be fenced and therefore unavailable for many wildlife species. This 22.3 ha area is comprised of approximately 80% Moderate Sensitivity habitat and 20% High or Very High Sensitivity Habitat. This habitat will be unavailable for medium and large terrestrial wildlife that cannot move through the fencing. Habitat for small mammals is expected to be improved as the non-native grass will be reseeded to a native seed mix. Habitat suitability for grassland birds may be improved with native grass mix; however, the effect of the solar panels in deterring birds from effective habitat is unknown. Approximately 3.0 ha of the PDA will be revegetated with native trees and shrubs along the south and southeast corner and outside of the fenced Project boundary. This biodiversity offset will be outside of the fenced permanent Project footprint and will result in a net gain of 0.7 ha of native trees and shrubs providing suitable habitat for a variety of wildlife species. Bird and bat boxes will be installed within the forested valley slope to the west of existing E.L. Smith WTP. This habitat enhancement is expected to provide additional nesting and roosting habitat for birds and bats to the LAA while reducing the potential for these species to be attracted to the Project and potentially increasing mortality risk by spatially separating the enhancements from the PDA. See the section below on Wildlife Mortality Risk in Operations for a detailed discussion about the potential for some birds to be both attracted to PV solar panels or deterred from them.

Project operation and maintenance activities are expected to result in reduced habitat effectiveness for wildlife outside of the permanent footprint within the LAA due to potential sensory disturbance to wildlife associated with infrastructure, noise and human activity in the permanent footprint of the PDA. The extent of potential indirect effects will vary by wildlife species. Overall, wildlife in the area are likely habituated to some degree of human activity associated with urban environments; some birds, amphibians, and small mammals will likely still have access to the PDA, while medium and large mammals will be excluded by the fence. The potential indirect effects on wildlife habitat are predicted to be adverse and extend into the LAA, throughout the operations phase. The magnitude of the potential effect is predicted to be low because there will be a net gain of tree and shrub habitat and restoration to a native seed mix in the PDA. Fencing will result in some loss of habitat for medium and large bodied terrestrial wildlife. Overall, the change to wildlife habitat availability and suitability from sensory disturbance is reversible and expected to return to baseline conditions after decommissioning.

CHANGE IN WILDLIFE MOVEMENT

Construction

During construction, noise, lights, and human activity may result in changes to movement around the PDA. At the commencement of construction, the entire PDA will be fenced to exclude most wildlife from the PDA and will result in local movements of wildlife to occur outside of the PDA. The PDA is currently fenced between the tame pasture and riparian areas of the NSR with approximately 1.5 m page wire, and on the west side with three strand barbed wire fencing and existing movements of wildlife through the PDA may be limited.

Sensory disturbance in adjacent wildlife habitats (e.g., riparian habitats along the NSR) may result in wildlife temporarily avoiding areas adjacent to the PDA during construction (Benitez-Lopez et al. 2010; Francis et al. 2011; California Department of Transportation 2016). The extent of potential avoidance outside of the PDA will vary by wildlife species. Existing unfenced areas of suitable wildlife movement habitat (i.e., riparian forested habitats associated with the NSR) narrow considerably at the southern edge of the PDA. This area is not predicted to change with Project activities, however, potential wildlife avoidance of area adjacent to the PDA may result in changes to some wildlife movement through the area. Wildlife are anticipated to habituate to the change in habitat over time and normal wildlife movement will resume during operations. Wildlife passage through the LAA is most effectively facilitated along the valley slope to the north and west of the PDA. Limited effects to this movement corridor are expected during construction as noise and other sensory disturbances to wildlife are not expected to exceed disturbances already in place from residential development and noise from the Anthony Henday. Some wildlife species may be deflected from crossing adjacent to the PDA along the NSR due to sensory disturbance. These individuals may deflect back and not cross the PDA at all or may be directed up the valley slope and pass over the PDA to meet up with the NSR Valley on the other side of the existing E.L. Smith WTP. However, existing barriers to movement, including the Anthony Henday crossing of the NSR and the lower pump house north of the PDA at E.L. Smith WTP likely limit movement of wildlife along the NSR currently.

Disturbance to wildlife movements during construction activities will largely be avoided by siting the Project in areas of low suitability habitat (e.g., tame pasture). During construction, potential effects on wildlife movements are predicted to be adverse and extend into the LAA (primarily at the 100 m buffer along the NSR). The magnitude of the potential effect is predicted to be low, because it is unlikely to have a measurable effect on local wildlife movements in the LAA. Although most changes in wildlife movement will be limited to the PDA, sensory disturbance will extend into the LAA, which may result in temporary local shifts in wildlife distribution. Potential effects on wildlife will occur from a single event (i.e., construction) and will extend beyond the operations phase. Potential indirect effects from sensory disturbance during construction will be short-term. Overall, the change in wildlife movement is considered reversible because the residual loss or alteration of habitat can be reversed through habitat reclamation following decommissioning.

Operations

Project operation and maintenance activities are expected to result in reduced habitat effectiveness due to potential sensory disturbance to wildlife associated with infrastructure, noise and human activity in the PDA. The extent of potential indirect effects will vary by wildlife species. Solar panels, and supporting infrastructure, emit negligible amounts of noise and no lighting will be added in the PDA. Overall, wildlife in the area are likely habituated to some degree of human activity associated with urban environments (e.g., the adjacent WTP, Anthony Henday Drive, residential neighborhoods).

Within the LAA, Environmental Sensitivity Mapping (Solstice 2017) identified the majority of the NSR river valley below the top of bank as potential coyote corridor. Coyotes and other urban adapted wildlife are expected to successfully move through the river valley within and around the permanent footprint of the PDA both at the 100 m vegetated buffer along the NSR and above the PDA along the treed valley slope. Additionally, with the identified revegetation mitigation measures planned along the south and southeast edges of the PDA, the forested margin of the NSR will be widened to 100 m at the existing narrow spot at the southeast corner of the PDA. This revegetation is expected to provide additional cover to wildlife to support multiple life stages for a variety of forest dwelling wildlife species. Approximately 40 m of native trees and shrubs will be revegetated along the south edge of the PDA, providing structural connectivity between the NSR and the valley slope as well as providing a visual and noise buffer for the Project, reducing potential indirect effects of infrastructure on wildlife movement. The desktop Environmental Sensitivities Project (Solstice 2017) identifies the E.L. Smith WTP, proposed Project, north and west valley slope, and the area long the NSR as effective coyote corridor. Movement along the valley slope to the north and west of the PDA is not anticipated to be affected by Project activities. This area is identified as having a slope of less than 15 degrees (Solstice 2017) and is between 100 m and 400 m wide. This desktop model does include an evaluation of slope in its assessment of potential wildlife movement corridor. Recent guidance on wildlife corridor design in the Bow Valley indicated that slopes of less than 25 degrees are effective for wildlife corridors, although wildlife in the Bow Valley do use steeper slopes (Golder Associates 2017).

Both deer and coyote are known to coexist near urban and suburban infrastructure and in a study of urban deer behavior, deer were routinely found in wooded habitats within 50 m of residential developments (Swihart et al. 1993). Residential developments are expected to have higher sensory disturbance than the Project during operations given the presence of human activity and cars in residential areas that will be mostly absent during Project operations, so this data is considered a relevant conservative estimate of deer habituation to infrastructure. Additionally, during key winter foraging periods deer were found to browse more often than expected near residences due to the high availability of preferred browse species, suggesting that they were not deterred by infrastructure or human activity during this sensitive time of year (Swihart et al. 1993). Coyotes are also known to use urban and suburban habitats effectively by selecting natural habitat patches within their home range and becoming more nocturnal to avoid times of peak human activity (Gese et al. 2012; Riley et al. 2003). In Denver, urban and suburban coyote home ranges included 44% developed areas, suggesting they routinely traverse in and around development; though were found most often in riparian areas; possibly because most undeveloped areas in the urban matrix are around water (Poessel 2015). This data suggests that corridors of 100 m or more are sufficient to facilitate wildlife movement between habitat patches.

The intersection of the Anthony Henday and the NSR is identified as a potential coyote movement corridor in Solstice 2017, and the narrow passage underneath the highway may effectively prohibit many wildlife species from crossing under the Anthony Henday. Another potential pinch point identified during site visits exists at the E.L. Smith WTP lower pump house to the north of the PDA, where there is approximately 20 to 30 m of vegetated bank between the E.L. Smith WTP and the NSR. Based on these two pinch point locations it is unlikely that many wildlife are successfully using the NSR as effective passage through the LAA. Wildlife passage through the LAA is most effectively facilitated along the valley slope to the north and west of the PDA. Changes to wildlife movements from Project activities are not expected to extend beyond the LAA as the movement corridor along the valley slope within the LAA will remain intact for wildlife.

Wildlife passage through the LAA is most effectively facilitated along the valley slope to the north and west of the PDA. This movement corridor is not expected to be affected by Project operations. Operations of the Project are not expected to result in changes to this movement corridor through sensory disturbance. Noise modelling of the Anthony Henday Drive in 2013 indicates that noise level from the highway range from 45 to 50 dBA (weighted decibels at human range of hearing) within portions of the LAA along the valley slope and overlapping the PDA (Acoustical Consultants Inc. 2013; Figure 45a). The cumulative sound level of the Project within 1.5 km of the PDA is 48.1 dBA Leq (equivalent continuous level), within the current estimated range of ambient noise in the LAA. Wildlife currently using this wildlife corridor, even with the existing pinch points around the E.L. Smith WTP, are expected to be habituated to existing noise and human activity associated with the E.L. Smith WTP and associated infrastructure (e.g., access road), residential development, and the Anthony Henday. Brown et al. (2012) found that even in relatively remote locations such as Teton National Park, Wyoming, USA, ungulates exhibited habituation over time to noise associated with roads and other anthropogenic disturbances and did not exhibit heightened flight responses to these stimuli. During operations, it is not anticipated that the Project will contribute measurably to ambient noise.

Small mammals (e.g., mice, voles, shrews) are generally less mobile than coyote or deer and have small home ranges, limiting their ability to cross around the fenced permanent footprint of the PDA. Fencing of the permanent footprint of the PDA is not expected to create a barrier to movement to most small mammals. Fencing is anticipated to be standard 5 cm (2 inch) chain link fencing, which is adequate to allow passage of small mammals such as mice, voles, and shrews; which have body sizes of approximately 2 to 3 cm width. The removal of perennial pasture and replacement with approved native seed mix may increase habitat function and species diversity for small mammals during operations.

The potential indirect effects on wildlife movements are predicted to be adverse and extend into the LAA (primarily at the 100 m buffer along the NSR), throughout the operations phase. Given that wildlife movement will be facilitated throughout the LAA no barrier to gene flow is expected. No native wildlife species are expected to be lost from the LAA as there will be a net gain of native tree and shrub habitats in the PDA and these habitats are also available elsewhere in the LAA and throughout Edmonton and the Central Parkland Region. Non-native vegetation will be replaced with native seed mix, effectively increasing potential habitat values for small mammals and birds. The magnitude of the potential effect is predicted to be low as there will be no obstructions to wildlife movement outside the PDA and sensory disturbance during operations is anticipated to be minimal; passage through the LAA will continue to be facilitated along the valley slope. Overall, the change to wildlife movement from sensory disturbance is reversible and expected to return to baseline conditions after decommissioning.

CHANGE IN WILDLIFE MORTALITY RISK

Construction

During construction, vegetation removal and site grading, as well as increased human activity (i.e., traffic volume and use of heavy equipment) has the potential to result in increased mortality risk to wildlife in the LAA (AWWI 2017). Wildlife mortality (e.g., for ground nesting birds or amphibians and reptiles) due to ground disturbance and vegetation clearing might occur during excavation for Project infrastructure installation. At the commencement of construction, the entire PDA will be fenced to exclude medium and large bodied wildlife (e.g., coyote, deer, fox). During fencing activities, the area will be monitored to for wildlife to reduce the likelihood of entrapment in the fenced area. All construction activities will be within the fenced PDA, limiting the potential for adverse effects to wildlife mortality risk for medium and large bodied wildlife.

The siting of Project infrastructure on tame pasture will reduce mortality risk to wildlife as it provides low suitability habitat for most wildlife species. Adherence to migratory bird and raptor RAPs will reduce mortality risk to birds during construction. Where this is not possible, pre-construction surveys (i.e., nest searches) will be conducted to reduce mortality risk to birds.

The potential residual effect of Project construction related to mortality risk is considered low because the Project is unlikely to have a measurable effect on wildlife abundance in the LAA. The increase in mortality is largely limited to the PDA and is short-term (i.e., construction phase only).

Operations

During operations, the Project has the potential to increase the risk of mortality primarily due to the potential for birds to collide with solar panels or become entrapped underneath the solar panels (Kagan et al. 2014, Huso et al. 2016, Horvath et al. 2009, Walston Jr. et al. 2015). Mortality from collisions with or entrapment under solar panels (resulting in predation) have been documented in arid environments in Southern California at a variety of solar facility types (photovoltaic facility, parabolic mirror, and power tower; Kagan et al. 2014). There are a number of hypotheses on the mechanisms for bird mortalities at solar farms, these include bird attraction to sites due to adjacent habitats (Kagen et al. 2014), glare and polarized light which attracts insects and consequently insectivorous birds (Horvath et al. 2009), and that some birds are attracted to the reflective surface of solar panels that may appear to be lakes (Kagen et al. 2014). The latter phenomenon is referred to as the 'lake effect', whereby birds are drawn to solar panels because the light reflected off them is similar to that from a body of water (Horvath et al 2009, 2010, Kagan et al. 2014). Waterbirds may be particularly susceptible to this effect (GOA 2017). Some diving waterbirds (i.e., grebes, loons) require larger open areas of land or water to take flight and may become stranded underneath the panels. None of these hypotheses have been empirically validated; therefore, the mechanism for mortalities is currently unknown.

Currently, there is limited documentation on bird mortalities at photo-voltaic (PV) solar facilities like the proposed Project in North America. Recent documentation of mortalities from the Desert Sunlight facility in California, U.S.A (1,554 ha with 550 MW generation) documented 61 mortalities in 2013 (Kagan et al. 2014). Of these 61 mortalities, most were migrant birds that forage on land or over water (i.e., not aerial foragers). Causes of death, where it could be determined, was identified to be both impact trauma and predation trauma. Forty four percent of mortalities at the Desert Sunlight facility were waterbirds (e.g., grebes, coots, and comorants), and the authors postulate that the 'desert environment punctuated by a large expanse of reflective, blue panels may mimic large bodies of water and attract waterbirds; however, there is little evidence of this phenomenon.

Walston et al. (2016) reviewed bird mortality data at utility scale solar farms across the United States and found that information on bird mortalities only existed for solar farms (only one of which is PV) in southern California, and that there is a lack of empirical data on bird mortalities at solar facilities world-wide. They estimated 0.23 birds/MW/year mortality rate for known solar farm related mortality at the PV solar farm, and 4.08 birds/MW/year for all mortalities (including those with unknown causes found on project sites). In comparing bird mortalities at solar farms in California relative to wind, fossil fuels, communication towers, vehicle collisions and building collisions, solar farms are estimated to be considerably lower than these other evaluated human activities (Walston et al. 2016).

A 2014 review of bird use of solar photovoltaic installations at US airports (DeVault et al. 2014) observed five solar farms in airport grasslands in Arizona, Colorado, and Ohio and conducted bird surveys between March 2011 through February 2012. Bird community composition and abundance was lower than at adjacent airfields, suggesting that birds were not attracted to polarized light reflected by the PV panels or the increased abundance or availability of insects attracted to the panels. They also did not observe bird mortalities that were obviously caused by stranding or collision with panels.

A recent review of solar energy impacts on birds and bats in England highlights the lack of information on this topic (Harrison et al. 2016). Similarly, Learned and Kinas (2017) conducted a jurisdictional review of solar energy focused on California, Ontario and British Columbia for AEP. They found that none of the jurisdictions assessed routinely monitor bird or bat mortalities at solar farms and the actual effect of PV solar farms is unquantified and requires more study to confirm potential effects. The potential for this effect to occur in Alberta is currently unknown.

Lighting and heat from the solar panels can also increase the presence of insects, thereby resulting in the increased presence of insectivorous birds and/or bats; which may also collide with the panels, increasing the risk of mortality (Kagan et al. 2014).

Solar panels are designed to be non-reflective and emit limited amounts of heat to reduce the potential for wildlife to be attracted to the panels. Wildlife surveys in the LAA did not detect any diving waterbirds in the NSR or flying over the LAA, therefore, presence is expected to be low. Insectivorous birds (e.g. flycatchers) were also not observed in the PDA but were observed in the adjacent forested habitats and they may be drawn to the PDA.

Bird mortality at operational solar farms has been documented to include primarily impact trauma and predation trauma (that may or may not be directly connected to solar farm operations). These effects to birds are relatively recently documented and mitigation measures to reduce these have not been tested. However, existing mitigation measures that are known to be effective do exist and may be applied to this Project. Additional mitigation measures will be considered following the results of post-construction wildlife monitoring in consultation with AEP and COE if mortalities are documented to be above acceptable limits, as determined in consultation with AEP and COE. Potential mitigations could include, but are not limited to:

- Visual markers spaced out every 28 cm or less have been shown to reduce window strikes with glass buildings (City of Toronto 2007)
- White outline or white gridlines on solar panels may reduce attractiveness to insects, however, there is no evidence this is effective for birds.

EPCOR is committed to reviewing and implementing additional mitigation measures, where practical during operations in consultation with AEP and COE.

The potential for a change in the mortality risk for wildlife during operations is predicted to be adverse and moderate (i.e., a measurable change in wildlife mortality risk is possible, but it is unlikely to change local wildlife populations) as the Project is in proximity to waterfowl breeding and loafing habitat. Potential residual effects will largely be limited to the PDA and occur continuously through the life of the Project. Mortality risk is expected to return to baseline levels following Project decommissioning.

6.4.4 Prediction Confidence

Prediction confidence for change in wildlife habitat availability and suitability is high. Wildlife communities and their habitat associations in central Alberta, and within the City of Edmonton, are well documented. While there is relatively little information on the indirect effects of solar facilities on habitat suitability the primary effect to terrestrial wildlife will be a result of direct habitat loss from fencing of the PDA, and this effect and potential mitigation measures are well known.

Prediction confidence for change in wildlife movement is moderate. While there is limited information about the effect of solar facilities specifically related to wildlife movement, there is considerable information on interactions of urban wildlife and infrastructure. Mitigation measures to reduce potential indirect effects of infrastructure on wildlife movement are well known.

Prediction confidence for change in wildlife mortality risk is low as there is limited information on the potential for bird strikes or wildlife mortality associated with collisions or through other mechanisms at the solar farm. Most of the publicly available information on the potential for bird mortality at solar facilities comes from facilities located in southwest United States (Walston et al. 2016), primarily in desert environments. These sites have higher overall daily and annual temperatures relative to Alberta. At the time of publication, no publicly available literature on this effect could be found for solar facilities in similar northern locations in either North America or Europe. Additionally, of the systemically collected data that is available, only a portion of these datasets are from PV sites, the remaining are concentrated solar power (CSP); these facilities employ a different technology that concentrate heat and have a documented impact on bird mortality that is not known to be associated with PV facilities (Walston et al. 2016). Overall, existing information on the potential for bird mortalities associated with solar facilities is extremely limited. Of the data that does exist, none of it is in a similar ecological context to Edmonton, and therefore the applicability of the data to a PV solar facility in Edmonton is unknown. Because the potential for bird mortality associated with solar facilities is relatively new and poorly understood, there are few mitigation measures that have been tested and shown to be effective. Some standard mitigation measures, such as reducing/avoiding above-ground wires and facilities are well known to reduce potential bird mortalities. Section 7.0 details a planned monitoring program to identify the actual bird mortality at the Solar Farm and implementation of additional mitigations, as necessary.

6.5 VIEWSCAPE

6.5.1 Potential Environmental Effects

The Project's potential interactions with the viewscape includes the change in visual quality for adjacent neighborhoods and other potential users of the LAA.

During construction, the visual quality of the LAA may be negatively affected by the loss of vegetation, presence of machinery and construction vehicles, presence of construction materials, and temporary construction fencing, which may be visible from unobstructed observation points within adjacent communities (Cameron Heights and Henderson Estates).

Upon completion of construction, some may consider the visual quality of the LAA to be negatively impacted by the loss of vegetation (due to the addition of the access road) and the presence of the solar farm, including the potential for the reflection of sunlight off the panels (i.e., glare). The solar farm may be visible from unobstructed observation points from surrounding/adjacent communities (specifically Henderson Estates), existing recreational trails and from Anthony Henday Drive within the LAA. Renderings were developed based on observation points where the solar farm may be visible (Figure 6.0, 7.0 and 8.0, Appendix A).

6.5.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on the alteration to the viewscape. See Table 6-9 for proposed mitigation measures for reducing potential effects to the visual quality.

Table 6-9 Proposed Mitigation for Reducing Potential Effects to Viewscape

Potential Effect	Effect Pathway	Proposed Mitigation
Change in visual quality	Direct alteration to viewscape in the NSR Valley	• Disturbances to the PDA will be limited as much as possible and will be delineated prior to construction to reduce the potential accidental removal of vegetation • Construction activities should be completed within the proposed timeframe and the impacted areas restored and revegetated as soon as possible • All temporary staging areas and fencing will be removed upon completion of construction • Solar panels are designed to absorb light and are constructed with anti-reflection coating • EPCOR retained a consultant to conduct solar glare analysis as a result of the solar farm (Appendix G). The analysis was conducted for residential properties, non-residential facilities, major roadways, interchanges and recreational points near the Project • Landscaping or other visual screening measures (e.g. slats in fencing, natural vegetation screening) will be considered during detailed design to enhance the Project aesthetics from observation points along the southern boundary as well as from a potential future COE constructed trail along the east and west side of the PDA

6.5.3 Potential Residual Effects

6.5.3.1 Potential Residual Effects Description Criteria

Criteria used to assess potential residual effects on viewscape are provided in Table 6-10.

Table 6-10 Characterization of Potential Residual Effects on Viewscape

Parameter	Definition
Direction	**Positive –** a potential residual effect that moves the parameters in a direction beneficial to the VEC relative to baseline **Adverse –** a potential residual effect that moves the parameters in a direction detrimental to the VEC relative to baseline **Neutral** – no net change in the parameters for the VEC relative to baseline
Magnitude	**Low** – minor loss or alteration to key elements/features/characteristics of view, and/or may not be uncharacteristic of the broader area **Moderate** – partial loss or alteration to key elements/features/characteristics of view, and/or may be somewhat uncharacteristic of the broader area **High** – total loss or alteration to key elements/features/characteristics of view, and/or totally uncharacteristic of the broader area
Geographic Extent	**PDA –** potential residual effects are restricted to the PDA **LAA –** potential residual effects extend into the LAA
Frequency	**Single Event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	**Short** – direct effect is measurable for 1-5 years **Medium** – direct effect is measurable for 6-15 years **Long** – direct effect is measurable for 16+ years
Reversibility	**Reversible –** the potential residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the potential residual effect is unlikely to be reversed
Ecological and Socio-economic Context	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

6.5.3.2 Summary of Potential Residual Effects on Viewscape

The 2017 glare analysis (see Appendix G) indicated that the Project is expected to have either no glare or low levels of glare at most locations (based on the design of solar panels), including the residences along the east and west ridges of the NSR Valley. The glare study also identified that up to 45 minutes of glare per day may occur on clear, sunny mornings between March and September at the recreational trail located south and west of the PDA, and that drivers using Anthony Henday Drive should not experience glare from the solar farm. Currently, there are no formal trails between the PDA and the NSR; however, the COE's draft Ribbon of Green Plan (November 2018) includes recreational trails on both the east and west sides of the PDA, through EPCOR property. EPCOR is committed to working with the COE to provide access to the land for future trails and is committed to including an educational component to inform future trail users about water treatment, renewable energy and history of the site. In consideration of viewscapes from current observations points as well as those from potential future trails near the

Project, EPCOR will enhance the aesthetics and overall viewscape through fence design, screening features and other landscaping during detailed design.

As such, potential residual effects on the viewscape may result from the alteration of visual quality in the LAA. As indicated in Section 2.2, the LAA represents the area in which potential environmental effects from Project activities and components can be predicted or measured with a reasonable degree of accuracy and confidence. Therefore, it is possible, for residual effects to occur outside of the LAA however this is unlikely considering that viewpoints points outside of the LAA are limited due to the existing topography, infrastructure and vegetation (even in winter months). Additionally, the existing nature of the WTP doesn’t lend to a high aesthetic value in pre-project condition, the PDA is limited to EPCOR lands and recreational use within the PDA is not permitted.

With the implementation of mitigation measures, potential effects on the viewscape are predicted to be adverse in direction, moderate in magnitude, reversible, and limited to the LAA (or just outside of the LAA) in geographic extent. The duration of the potential effects during construction and operation are considered to be short term and long term, respectively.

6.5.4 Prediction Confidence

There is a moderate degree of confidence in the assessment of adverse effects on viewscape. Although a solar glare analysis was conducted and renderings were made from known observation points, there is a level of uncertainty regarding the visibility of the solar farm within (or just outside) the LAA. In addition, the presence of the solar farm being considered a negative effect with respect to viewscape is subjective (i.e., the presence of the solar farm may alter the viewscape, but this alternation may not always be considered a negative effect). As such, there is a moderate degree of confidence for estimation of project residual effects on viewscape.

6.6 HERITAGE RESOURCES

6.6.1 Potential Environmental Effects

Any Project activity that includes surface or subsurface ground disturbance has the potential for interaction with historical resources which could result in the direct loss or damage to resources of cultural, archaeological, historical and/or paleontological significance.

6.6.2 Mitigation Measures

Standard industry practices and avoidance measures, along with Project-specific mitigation measures will be implemented during construction of the Project to reduce or eliminate potential Project effects on the loss or damage to historical sites, artifacts or fossils. See Table 6-11 for proposed mitigation measures for reducing potential effects to heritage resources.

Table 6-11 Proposed Mitigation for Reducing Potential Effects to Heritage Resources

Potential Effect	Effect Pathway	Proposed Mitigation
Unauthorized disturbance or destruction of part or all of a historic resource	Removal or disturbance of historical resource through vegetation removal or surface/subsurface disturbance	• HRA requirements for the Project, including an archaeological HRIA, a paleontological HRIA and a HRIM will be completed as required • All construction works will comply with any conditions identified in the Historic Resources Act authorization • In the event that historical resources are encountered during construction, activities will be halted and ACT will be notified

6.6.3 Potential Residual Effects

6.6.3.1 Potential Residual Effects Description Criteria

Criteria used to assess potential residual effects on heritage resources are provided in Table 6-12.

Table 6-12 Characterization of Potential Residual Effects on Heritage Resources

Parameter	Definition
Direction	**Positive –** a potential residual effect that moves the parameters in a direction beneficial to the VEC relative to baseline **Adverse –** a potential residual effect that moves the parameters in a direction detrimental to the VEC relative to baseline **Neutral** – no net change in the parameters for the VEC relative to baseline
Magnitude	**Low** – no potential to disturb archaeological or paleontological sites or sites with archaeological or paleontological potential **Moderate** – some potential to disturb archaeological or paleontological sites or sites with archaeological or paleontological potential **High** – substantial potential to disturb archaeological or paleontological sites or sites with archaeological or paleontological potential
Geographic Extent	**PDA –** potential residual effects are restricted to the PDA **LAA –** potential residual effects extend into the LAA
Frequency	**Single Event** **Multiple irregular event –** occurs at no set schedule **Multiple regular event –** occurs at regular intervals **Continuous –** occurs continuously
Duration	**Short** – direct effect is measurable for 1-5 years **Medium** – direct effect is measurable for 6-15 years **Long** – direct effect is measurable for 16+ years
Reversibility	**Reversible –** the potential residual effect is likely to be reversed after activity completion and reclamation **Irreversible –** the potential residual effect is unlikely to be reversed
Ecological and Socio-economic Context	**Undisturbed –** area is relatively undisturbed or not adversely affected by human activity **Disturbed –** area has been substantially previously disturbed by human development or human development is still present

6.6.3.2 Summary of Potential Residual Effects on Heritage Resources

As project specific effects on heritage resources are mitigated to the standards set by the regulatory agency, after implementation of the mitigation measures, there will be no residual environmental effects.

7.0 MONITORING

Monitoring during Project construction will be completed following the development of an ESC plan to determine if proposed mitigation measures outlined in this MEIA are followed and effective. Soil handling and temporary storage during the construction phase of the Project will also be monitored to assess the effectiveness of and adapt mitigation measures to protect soil quality and quantity. Additional construction monitoring will include monitoring for trapped wildlife within the fenced Project construction area.

A post-construction wildlife monitoring program will be developed in consultation with regulatory agencies (e.g., AUC, AEP, COE) and will include a wildlife mortality monitoring as per the Wildlife Directive for Alberta Solar Energy Projects (GOA 2017) and potential monitoring programs as identified by regulators (e.g., wildlife movement monitoring). Results of the monitoring will be provided to AEP and the COE. Should unacceptable levels of mortality (or other effects to wildlife) be identified (in consultation with regulatory agencies) additional mitigations will be evaluated and implemented.

Semi-annual inspections will be conducted for the first two years following construction with a focus on identifying bare soil, vegetation establishment, the formation of erosive gullies, isolated pooling and sediment build-up.

8.0 PUBLIC CONSULTATION

EPCOR developed and is in the process of implementing a comprehensive Participant Involvement Program (PIP) for the Project. The PIP formed an important part of the planning and development process for this Project. Through meaningful discussions with organizations, communities and individuals, EPCOR acquired valuable feedback about the Project.

Of the approximate 17,400 participants who received information about the Project (of which 720 were directly consulted), approximately 230 participants expressed comments and/or concerns. EPCOR was able to address many of the concerns voiced by participants through information sharing and through the incorporation of this feedback into Project planning and design. This feedback was carefully reviewed and, while some outstanding concerns remain, the vast majority of participants consulted as part of the PIP had no concerns aside from questions of a very general nature or expressed support for the initiative. Others provided EPCOR with detailed feedback, which was used in combination with field studies and other information to reduce the Project area and inform other Project planning decisions.

EPCOR filed a detailed summary of their PIP with the AUC on March 14, 2018. Since filing this application, EPCOR continues to consult with residents, special interest groups and Indigenous communities including a two-part, Community Integration Workshop series. The first of these workshops was conducted on December 5, 2018. Several stakeholder groups were invited to provide feedback on a range of topics with EPCOR and their design consultants including ultimate planting/revegetation plans, means of communicating the cultural values of the site, educational opportunities related to the project, etc. A second workshop was held on January 23, 2019, where participants were invited back to see concepts that EPCOR and the design team were able to generate from what they heard in the first workshop and provide additional feedback. EPCOR is committed to engaging with participants throughout the regulatory process and during construction of the solar farm, if approved.

See Table 8-1 below for a summary of key PIP activities/milestones and corresponding timelines.

Table 8-1 Public Consultation Summary

Timing	Consultation Activity/Milestone
May 2017 – Ongoing	Project Initiation – Participant identification activities began and will continue until the Project is commissioned.
June 2017 – March 2018	Consultations – Personal consultations about the Project were conducted with over 720 landowners, occupants, residents, agencies, municipalities, industry and other interested parties located within 800 metres of the PDA.
June 2017 – Ongoing	Resolution of concerns – Consultations to resolve outstanding issues will continue until the Project is commissioned.
July 2017	Public Notification – Project information packages (Project Newsletter #1) were mailed to landowners, occupants, residents, agencies, municipalities, industry and other interested parties located within 2,000 metres of the PDA and/or identified by EPCOR to contact. Project details were also published on EPCOR's website.

Timing	Consultation Activity/Milestone
July 19, 2017	EPCOR Open House – Approximately 83 attendees
August – October 2017	Community Events – EPCOR attended the Cameron Heights Summer Fun Day (August 20, 2017) and the South West Edmonton Farmers Market (September 13 and October 4, 2017).
September 2017 – Ongoing	Engagement with Indigenous communities
February 2018	Public Notification – Project update packages (Project Newsletter #2) were mailed to landowners, occupants, residents, agencies, municipalities, industry and other interested parties who were located within 2,000 m of the PDA, identified by EPCOR to contact and/or those who opted into EPCOR's consultation process. Project updates were also published on EPCOR's website.
February 13, 2018	COE Open House (related to land rezoning for the Project) – Approximately 25 attendees
February 25, 2018	Community Event – EPCOR attended the Cameron Heights Winter Fun Day
2019 (anticipated)	Public Notification – If the Project is approved, Project information packages (Project Newsletter #3) notifying of upcoming construction timelines will be mailed to landowners, occupants, residents, agencies, municipalities, industry and other interested parties located within 2,000 m of the PDA and those included in EPCOR's stakeholder tracking system. Project details on website will also be updated.
2020 (anticipated)	Public Notification – If the Project is approved, Project information packages (Project Newsletter #4) notifying of Project completion will be mailed to landowners, occupants, residents, agencies, municipalities, industry and other interested parties located within 2,000 m of the PDA and those included in EPCOR's stakeholder tracking system. Project details on website will also be updated.
TBD	Post-Construction, EPCOR will continue engagement which will be planned in more detail, pending Project approval, and executed as the Project progresses.

9.0 SUMMARY AND CONCLUSION

This MEIA examined the potential effects of construction and operation the Project on specific ecosystem components including: terrain and soils; surface water bodies and hydrology; vegetation species and communities; wildlife species and habitat; viewscape; and heritage resources.

Terrain and Soils

The Project's potential effects on terrain and soils include a change in soil quality and quantity during construction resulting from soil loss through wind and/or water erosion following vegetation removal and soil stripping; compaction, rutting or loss of soil structure through vehicle or equipment movement; admixing during soil stripping activities; and contamination from fuel or chemical spills. Project-specific mitigation measures will be implemented to reduce or eliminate potential Project effects on soil quality and quantity. Examples of mitigation measures that will be implemented include (but are not limited to):

- Implement recommendations outlined in the storm water management plan (install silt fences, provide construction entrance, direct runoff through swales and erosion control berms, install temporary rock check dams, straw swale barriers and/or filter cloth barriers in swales, and stabilize all disturbed areas not subject to construction activities within 30 days)
- Minimize disturbance to existing vegetation, minimize time exposure of un-vegetated/exposed soils, and re-vegetate disturbed areas as soon as conditions allow
- Strip topsoil and subsoil separately, stored topsoil and subsoil in separate stockpiles at least one metre apart
- Develop and implement an ESC plan, monitor ESC measures during construction
- Traffic will be confined to workspace areas, access roads identified and marked by surveyors
- Road vehicles will be refueled and maintained off site

With the implementation of mitigation measures, potential residual effects on terrain and soils will be neutral, limited to the PDA, low in magnitude, occurring at a single event frequency, short term in duration, and reversible following post-construction remediation of the workspace. Overall, prediction confidence for change in soil quality and quantity is high.

Surface Water Bodies and Hydrology

The Project's potential effects on surface water bodies and hydrology could result in a change in water quality and quantity due to the decreased stormwater storage capacity within the PDA. Project-specific mitigation measures will be implemented to reduce or eliminate potential Project effects on water quality and quantity. Examples of mitigation measures that will be implemented include (but are not limited to):

- Maintain the 100 m setback from the NSR

- Implement recommendations outlined in the storm water management plan (install silt fences, provide construction entrance, direct runoff through swales and erosion control berms, install temporary rock check dams, straw swale barriers and/or filter cloth barriers in swales, and stabilize all disturbed areas not subject to construction activities within 30 days)
- Minimize disturbance to existing vegetation, minimize time exposure of un-vegetated/exposed soils, and re-vegetate disturbed areas as soon as conditions allow
- Develop and implement an ESC plan, monitor ESC measures during construction
- Conduct semi-annual inspections for the first two years following construction (identifying and addressing bare soil, erosive gullies, isolated pooling and sediment build-up)

With the implementation of mitigation measures, potential residual effects on surface water bodies and hydrology will be adverse, limited to the LAA, low in magnitude, occurring at multiple irregular events, long term in duration, and reversible. Overall, prediction confidence for change in water quality and quantity is high.

Vegetation Species and Communities

The Project's potential effects on vegetation species and communities could result in a change to the existing species and communities (i.e., previously disturbed perennial pasture) through the direct loss or alteration of plant communities and diversity, or through the introduction or spread of weeds listed in the Alberta *Weed Control Act*. Project-specific mitigation measures will be implemented to reduce or eliminate potential Project effects on vegetation species and community diversity. Examples of mitigation measures that will be implemented include (but are not limited to):

- Reduce clearing of native plant communities and avoid grading, where possible
- Reseed disturbed area using an approved native seed mix
- Revegetation of approximately 3.0 ha of native trees and shrubs along the south and southeast of the PDA resulting in a net gain of 0.7 ha of these vegetation communities
- Incorporate cleared trees and shrubs into biodiversity offset revegetation areas as ground cover to provide diverse micro climate conditions for native seed growth
- Weed control will be conducted in accordance with the Alberta *Weed Control Act* and Regulations
- Vegetation management may be required as part of operation activities including weed management and or mowing of vegetation to avoid interference with solar panel operation

With the implementation of mitigation measures, potential residual effects on vegetation and species communities are predicted to be adverse in direction, low in magnitude, but will still result in permanent vegetation removal. Potential residual effects will be limited to the PDA, will occur once, will be long term and are reversible. However, the introduction of an approved native seed mix throughout the PDA and the planting of approximately 3.0 ha of native trees and shrubs along the south and southeast of the PDA will result in a net gain of these vegetation communities and is considered a positive effect on vegetation species and communities. Overall, prediction confidence for change in vegetation species and community diversity is high.

Wildlife Species and Habitat

The Project's potential effects on wildlife species and habitat include change in wildlife habitat availability and suitability, change in wildlife movement, and change in wildlife mortality risk. Changes to wildlife habitat are anticipated to be limited due to the location of the PDA on previously disturbed perennial pasture. Project-specific mitigation measures will be implemented to reduce or eliminate potential Project effects on habitat availability and suitability, movement, and risk of mortality. Examples of mitigation measures that will be implemented include (but are not limited to):

- Revegetation of the south edge of PDA with approximately 40 m vegetated buffer will be implemented to provide structural connectivity between forested areas on either side of the PDA
- Revegetation of 3.0 ha of native trees and shrubs along the south and southeast portion of the PDA will be implemented as a biodiversity offset, resulting in a net gain of 0.7 ha of native tree and shrub habitat for wildlife and providing structural connectivity between the east and west forested areas
- Maintenance of a 100 m vegetated buffer along the NSR
- Retain cleared trees and incorporate the woody debris into biodiversity offset revegetation areas to provide ground cover for small mammals and other wildlife
- Addition of bat and bird boxes in the forested slope west the existing E.L. Smith WTP to provide additional habitat enhancement structures
- Timing construction outside of key breeding and wildlife movement periods
- Prior to construction at any time of year, nest surveys for bald eagles will be conducted within 1 km of the PDA. If nests are identified, a mitigation and management plan will be developed in consultation with a regional AEP biologist
- Fencing will be designed such that it is permeable to small mammals and sited to minimize impediment of existing wildlife movement around the PDA, while reducing the chance of collision and/or entrapment of wildlife in Project infrastructure
- Monitor the construction area for trapped wildlife. Should any wildlife be identified, the Construction Manager will be contacted. In consultation with a professional wildlife biologist and AEP, appropriate corrective actions will be implemented
- A post-construction wildlife mortality monitoring plan will be developed in consultation with the COE and AEP to assess wildlife mortality rates associated with the Project. Should unacceptable risks to wildlife be identified during monitoring, additional mitigation measures will be developed and implemented in consultation with regulatory agencies

With the implementation of mitigation measures, potential effects on wildlife habitat availability and suitability is expected to low within the LAA with a high prediction confidence as these effects and their mitigations are well understood. Effects on wildlife movement are expected to be low within the LAA and are reversible; prediction confidence is moderate as there is considerable information on the effects of infrastructure on wildlife but limited information on solar facilities specifically. Effects on wildlife mortality are anticipated to be moderate with a low degree of prediction confidence as both the potential for the effect and the effectiveness of mitigations are poorly understood for solar facilities in Alberta.

Viewscape

The Project's potential effects on the viewscape include a change in visual quality (which is largely subjective in nature) resulting from both the construction and operation of the solar farm. Project-specific mitigation measures will be implemented to reduce or eliminate potential Project effects on viewscape. Examples of mitigation measures that will be implemented include (but are not limited to):

- Disturbances to the PDA will be limited as much as possible and will be delineated prior to construction to reduce the potential accidental removal of vegetation
- Construction activities should be completed within the proposed timeframe and the impacted areas restored and revegetated as soon as possible
- All temporary staging areas and fencing will be removed upon completion of construction
- Solar panels are designed to absorb light and are constructed with anti-reflection coating (Project is expected to have either no glare or low levels of glare at most locations)
- Landscaping or other visual screening measures (e.g.. slats in fencing, natural vegetation screening) will be considered during detailed design to enhance the Project aesthetics from observation points along the southern boundary as well as from a potential future COE constructed trail along the east and west side of the PDA

With the implementation of mitigation measures, potential residual effects on the viewscape are predicted to be adverse in direction, moderate in magnitude, reversible, and limited to the LAA (or just outside of the LAA) in geographic extent. The duration of the potential effects during construction and operation are considered to be short term and long term, respectively. The presence of the solar farm being considered a negative effect with respect to viewscape is subjective (i.e., the presence of the solar farm may alter the viewscape, but this alternation may not always be considered a negative effect). As such, there is a moderate degree of confidence in the assessment of adverse effects on viewscape.

Heritage Resources

The Project's potential effects on heritage resources include the loss or damaging of archaeological and historic resources within the PDA during construction. Project-specific mitigation measures will be implemented to reduce or eliminate potential Project effects on heritage resources which include:

- HRA requirements for the Project, including an archaeological HRIA, a paleontological HRIA and a HRIM will be completed as required

- All construction works will comply with any conditions identified in the *Historic Resources Act* authorization
- In the event that historical resources are encountered during construction, activities will be halted and ACT will be notified

As project specific environmental effects on heritage resources are mitigated to the standards set by the regulatory agency, after implementation of the mitigation measures, it is anticipated that there will be no residual project effects on heritage resources.

Conclusion

The findings of this MEIA are that the potential adverse effects of the Project can be avoided, reduced or controlled using a combination of standard and Project-specific environmental mitigation measures. Monitoring during and post construction will be implemented to evaluate the effectiveness of and adapt mitigation measures as required.

10.0 LIMITATIONS AND QUALIFICATIONS

In conducting the investigation and rendering our conclusions, Stantec gives the benefit of its best judgment based on its experience and in accordance with generally accepted professional standards for this type of investigation. This report was submitted with the best information to date and on the information provided. The conclusions made within this report are a professional opinion, not a certification of the PDA's environmental condition, and no other warranty, expressed or implied, is made. This report has been prepared for the exclusive use of EPCOR for the purposes of assessing the potential environmental effects on the PDA of the proposed Project and recommending measures to mitigate potential effects. Stantec accepts no responsibility for damages, if any, suffered by any other third party as a result of decisions made or actions based on this report. Our conclusions are limited by the following:

- Vegetation and wildlife surveys were completed during the dates specified and conditions may vary outside those times
- Field surveys to verify the presence of species listed within ACIMS and/or FWMIS databases were conducted on the dates specified and presence or absence of said species outside of the survey dates cannot be verified
- Some of the information contained within this report was provided by agencies and organizations external to Stantec. While Stantec cannot guarantee the information provided by external parties, this information has been assumed to be correct
- The information contained within this report is based on the design available at the time of report preparation. Design drawings may continue to be modified and added as the detailed design process continues but are intended to not depart significantly from the information presented in this report. Should significant changes to the drawings be made in the future, an amendment to this report may be required
- The investigation was limited to those parameters specifically outlined in this report

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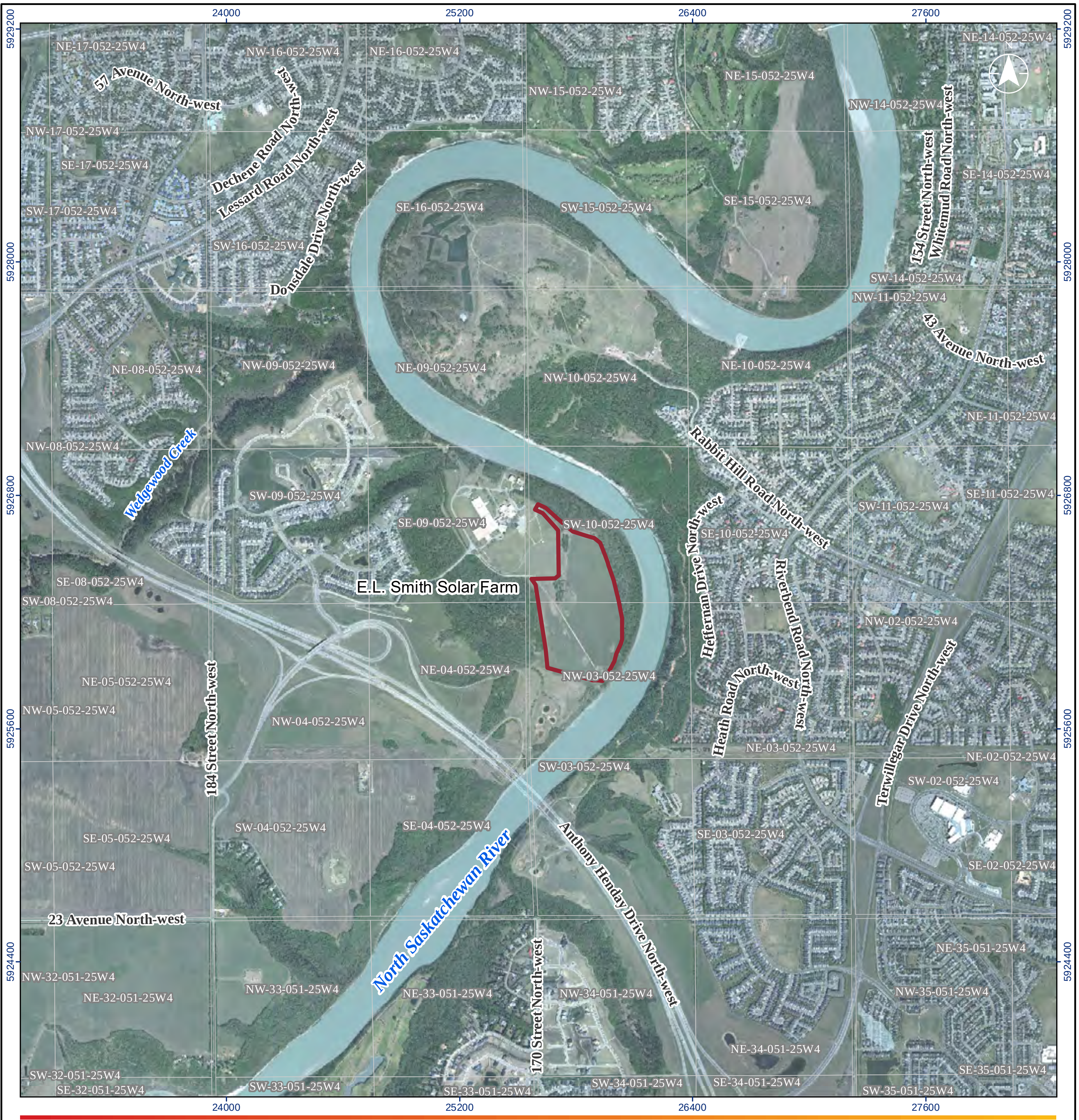
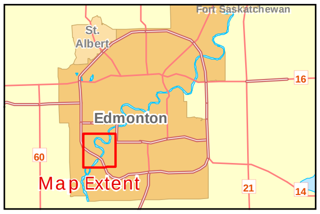
APPENDIX A

Figures, Photos and Drawings





🟥 Project Development Area

Waterbody

☐ Quarter Section

0 500 1,000 metres

1:30,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 10-52-25 W4M and
NW¼ 03-52-25 W4M
Edmonton, Alberta

110219883
Prepared by MK on 2017-10-20
Quality Review by MG on 2017-10-20
Approved by JR on 2017-10-20

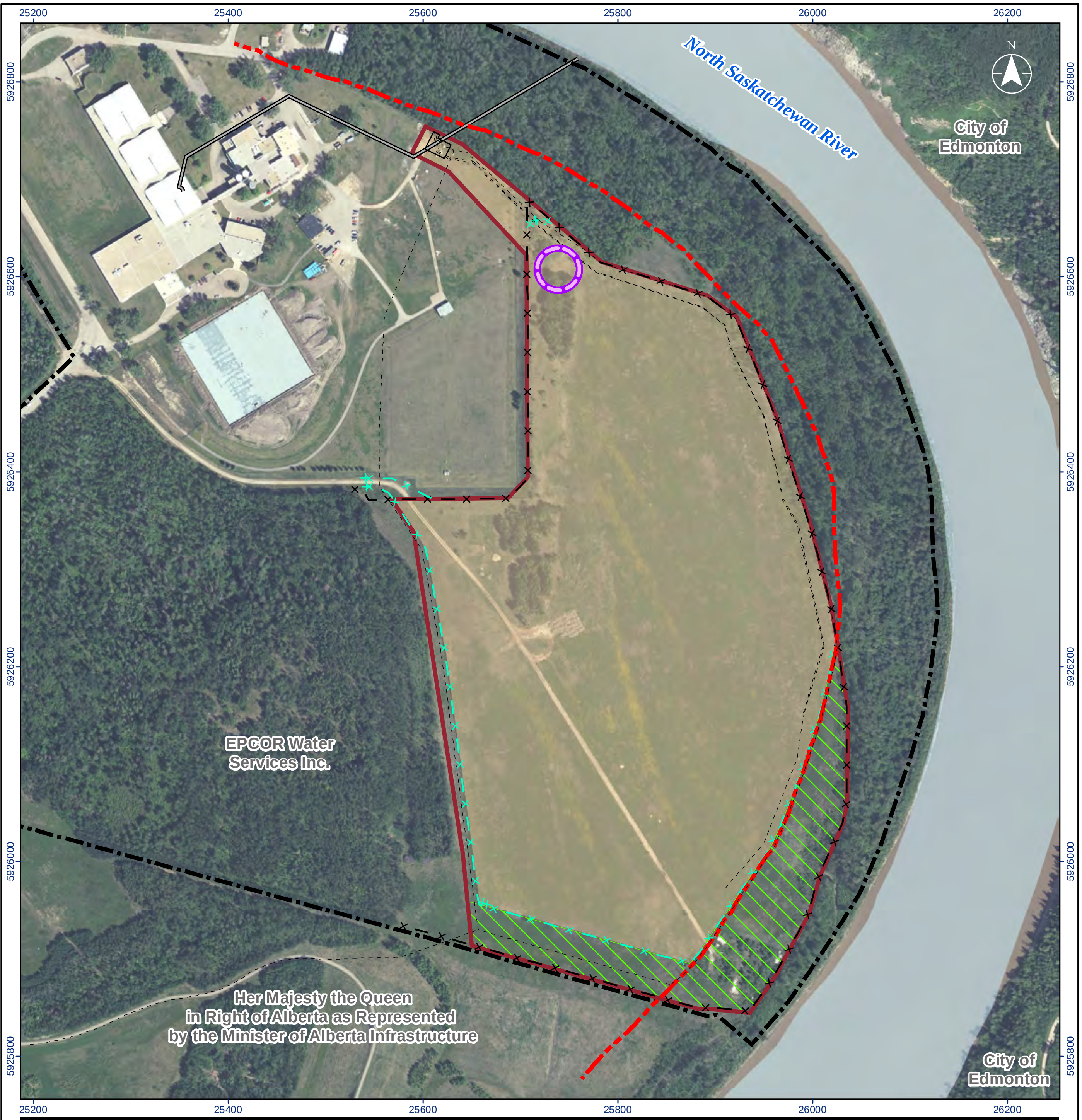
Client/Project
E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

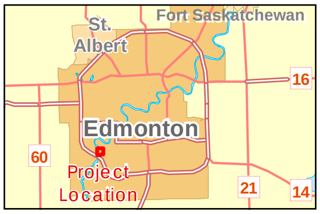
Figure No.
1.0

Title
Project Location Plan

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2015.

V:\1102\active\110219883\gis\figures\eia\fig_2_0_project_layout.mxd Revised: 2019-02-21 By: MKuhl





- ▭ Project Development Area
- 🟧 Permanent Footprint
- ▨ Revegetation Area
- ━ ━ EPCOR Property Boundary
- ═ Existing Underground 15kV Electrical Circuits
- × — Existing Fence
- × — New Fence
- ━ ━ 100 m Offset from Edge of River
- - - - E-Power Trench
- — New Switchgear Building
- 🟦 Waterbody
- ◎ Future Solar Demo Area

0 100 200 metres

1:6,000 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2017.
4. Site Features: Redrawn from EPCOR Site Location Plan (Received October 2017)

Stantec

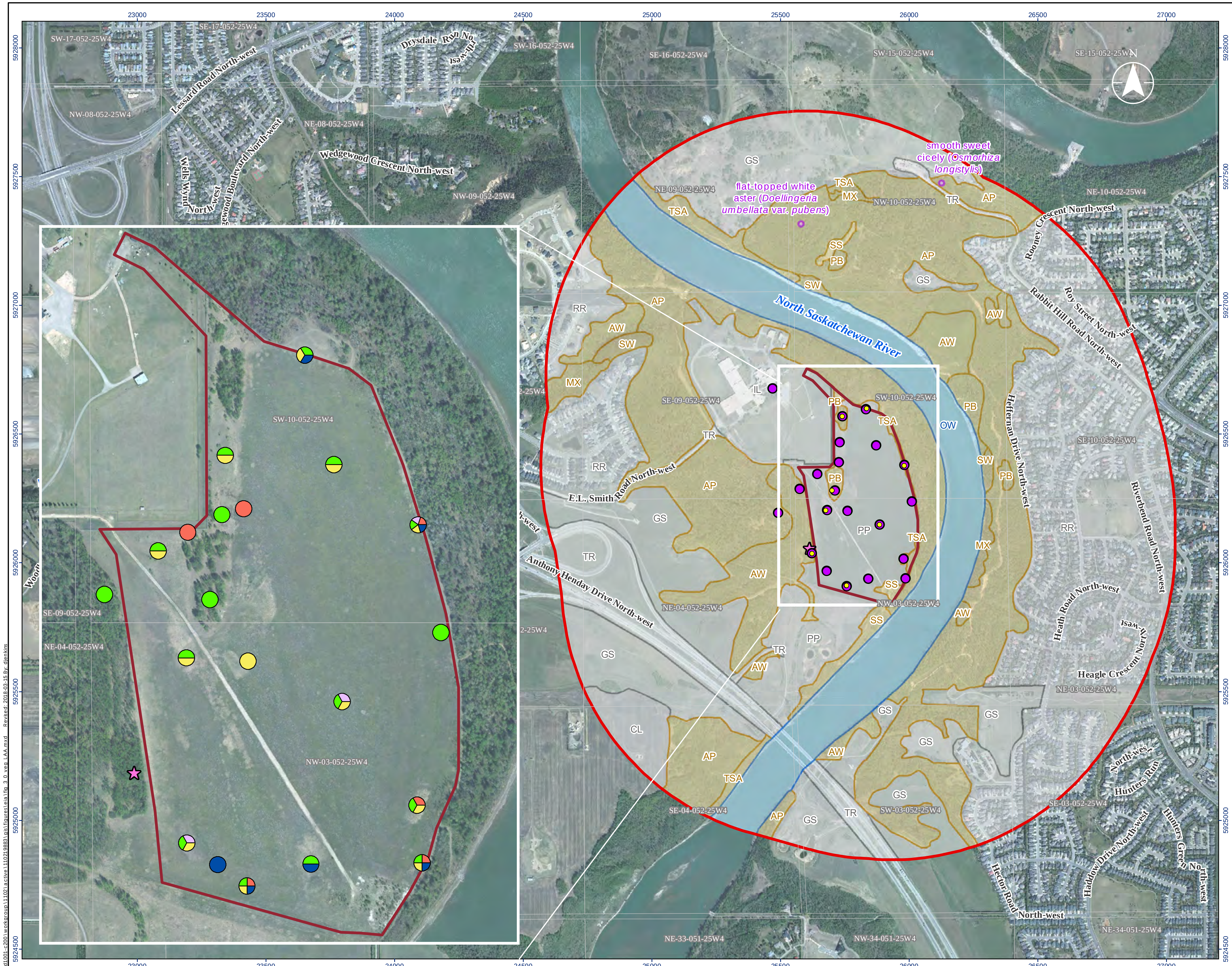
Project Location
SW¼ 10-52-25 W4M and
NW¼ 03-52-25 W4M
Edmonton, Alberta

110219883
Prepared by MK on 2019-02-04
Quality Review by DJ on 2019-02-21
Approved by SR on 2019-02-21

Client/Project
E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

Figure No.
2.0

Title
Project Layout



Stantec

1:15,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2015.
4. ACIMS: Alberta Conservation Information Management System. 2015. Alberta Environment and Parks, Edmonton, AB.

Project Location
SW¼ 10-52-25 W4M and
NW¼ 03-52-25 W4M
Edmonton, Alberta

110219883
Prepared by MK on 2017-10-20
Quality Review by MG on 2017-10-20
Approved by JR on 2017-10-20

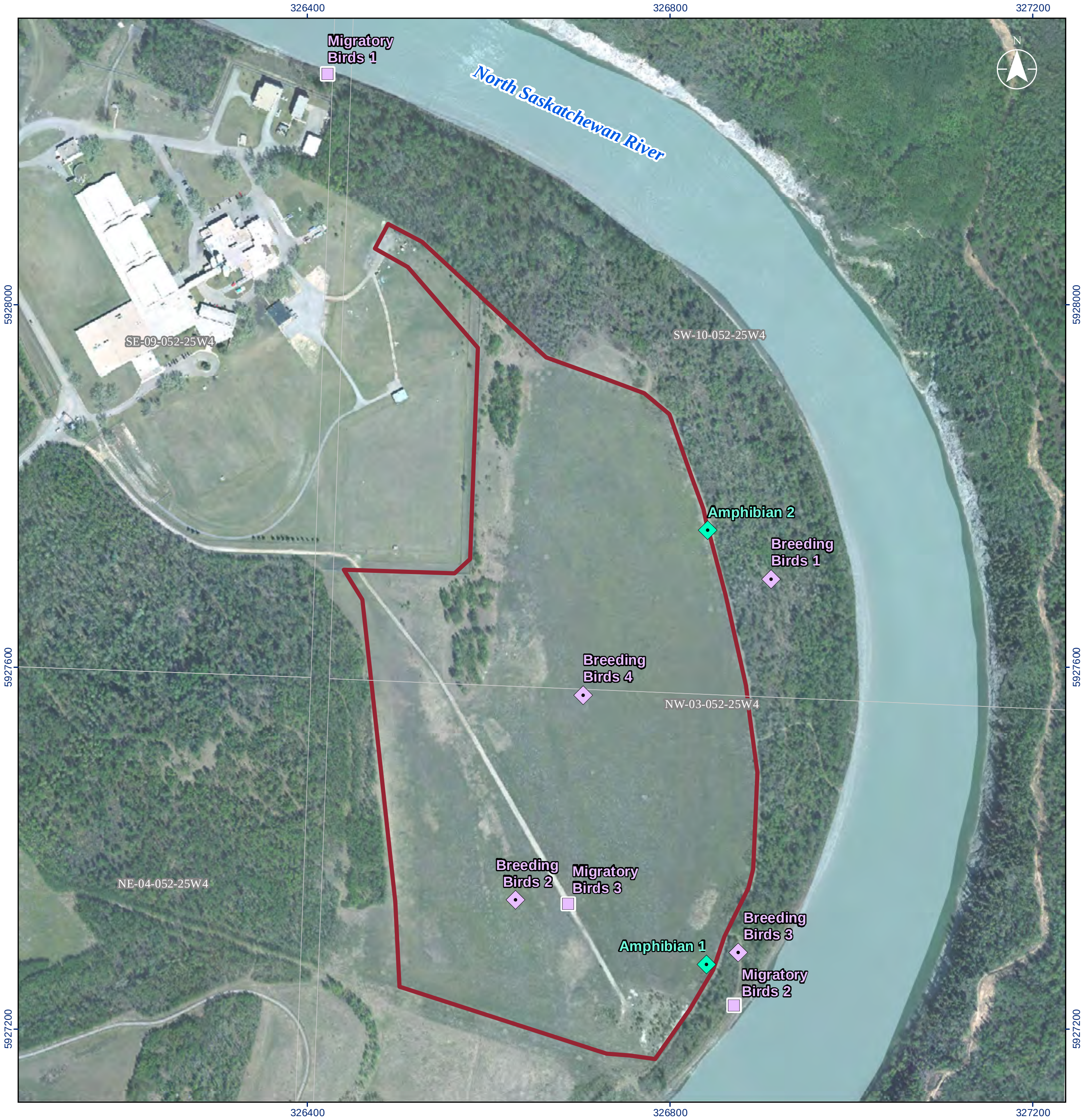
Client/Project
E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

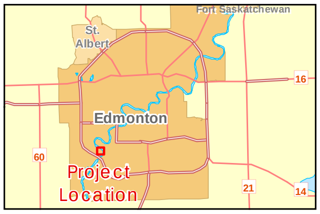
Figure No.
3.0

Title
Vegetation in the Local Assessment Area

\\Cd1001-c200\workgroup\1102\active\110219883\gis\figures\eia\fig_3_0_veg_LAA.mxd Revised: 2018-03-15 By: djenkins

\\Cd1001-c200\workgroup\1102\active\110219883\gis\figures\eia\fig_4_0_wildlife_survey_locs.mxd Revised: 2018-03-15 By: djenkins





▭ Project Development Area

Wildlife Survey

- ◆ Amphibian
- ◇ Breeding Bird
- ▢ Migratory Bird

▭ Waterbody

▭ Quarter Section

0 100 200 metres

1:6,500 (at original document size of 8.5x11)

Notes
1. Coordinate System: NAD 1983 UTM Zone 12N
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2015.
4. Site Features: Redrawn from EPCOR Site Location Plan (Received October 2017)

Stantec

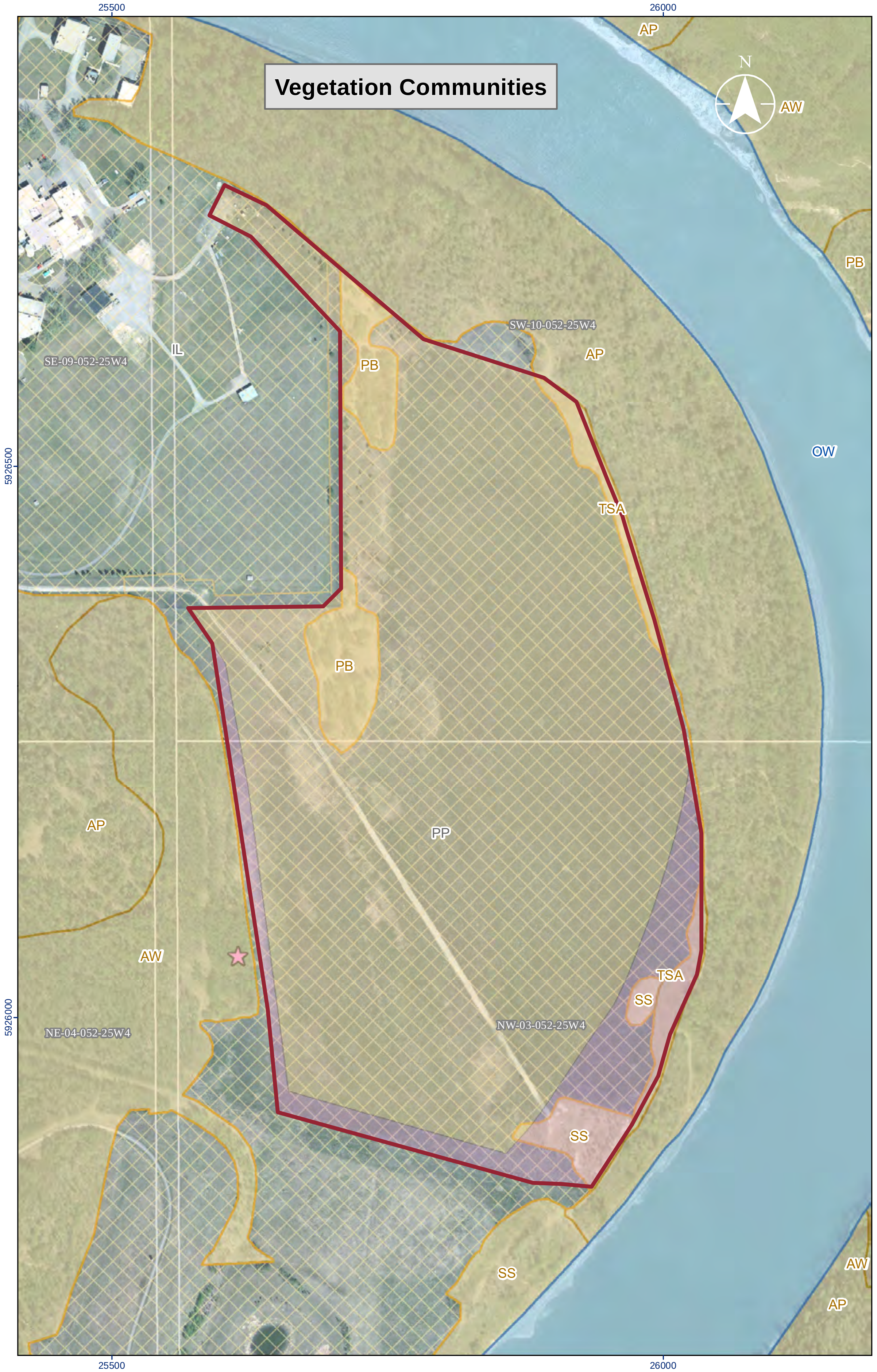
Project Location
SW¼ 10-52-25 W4M and
NW¼ 03-52-25 W4M
Edmonton, Alberta

110219883
Prepared by MK on 2017-10-20
Quality Review by MG on 2017-10-20
Approved by JR on 2017-10-20

Client/Project
E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

Figure No.
4.0

Title
Wildlife Survey Locations



Stantec

- ▭ Project Development Area
- ▭ Local Assessment Area
- ▭ Permanent Footprint
- ▭ Temporary Footprint
- ▭ Quarter Section

Water

- ▭ OW - Open Water

Upland

- ▭ AP - Aspen Poplar Woodland Alliance
- ▭ AW - Aspen Woodland Alliance
- ▭ MX - Mixed Deciduous and Evergreen Woodland Alliance
- ▭ PB - Balsam Poplar Woodland Alliance
- ▭ SS - Short Shrubland Alliance
- ▭ SW - White Spruce Woodland Alliance
- ▭ TSA - Tall Shrubland Alliance

Anthropogenic

- ▨ CL - Cultivated Land
- ▨ GS - Green Space
- ▨ IL - Industrial Development
- ▨ PP - Perennial Pasture
- ▨ RR - Residential
- ▨ TR - Transportation

Environmental Sensitivity

- ▭ Moderate Sensitivity
- ▭ High Sensitivity
- ▭ Very High Sensitivity

0 100 200 metres

1:5,000 (At original document size of 11x17)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2015.
4. ACIMS: Alberta Conservation Information Management System. 2015. Alberta Environment and Parks, Edmonton, AB.

Project Location

SW¼ 10-52-25 W4M and
NW¼ 03-52-25 W4M
Edmonton, Alberta

110219883
Prepared by MG on 2018-06-25
Quality Review by MK on 2018-06-25
Approved by SG on 2018-06-25

Client/Project

E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

Figure No.

5.0

Title

Vegetation and Environmental Sensitivities in the Local Assessment Area

\\Cd1001-c200\workgroup\1102\active\110219883\gis\figures\eia\EIA comment Response\fig_5_0_veg_LAA_envsensitivities.mxd Revised: 2018-07-12 By: djenkins

Client/Project

EPCOR

E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

Figure No.
6.0

Title
**Henderson Estates
Observation Point Rendering**

Client/Project

EPCOR

E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

Figure No.
7.0

Title
Trail Observation Point Rendering

Stantec

Client/Project

EPCOR

E.L. Smith Solar Farm
Municipal Environmental Impact Assessment

Figure No.
8.0

Title
Anthony Henday Drive
Observation Point Rendering

Plate 1: Demo solar panel currently on site

***Note: Equipment configuration and dimensions may not be as shown**

Plate 2: Demo racking currently on site

***Note: Equipment configuration and dimensions may not be as shown**

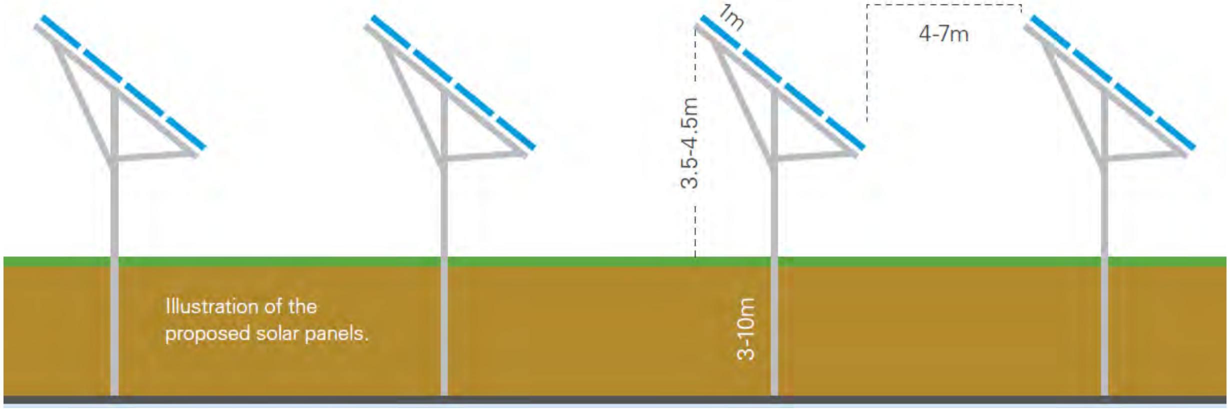
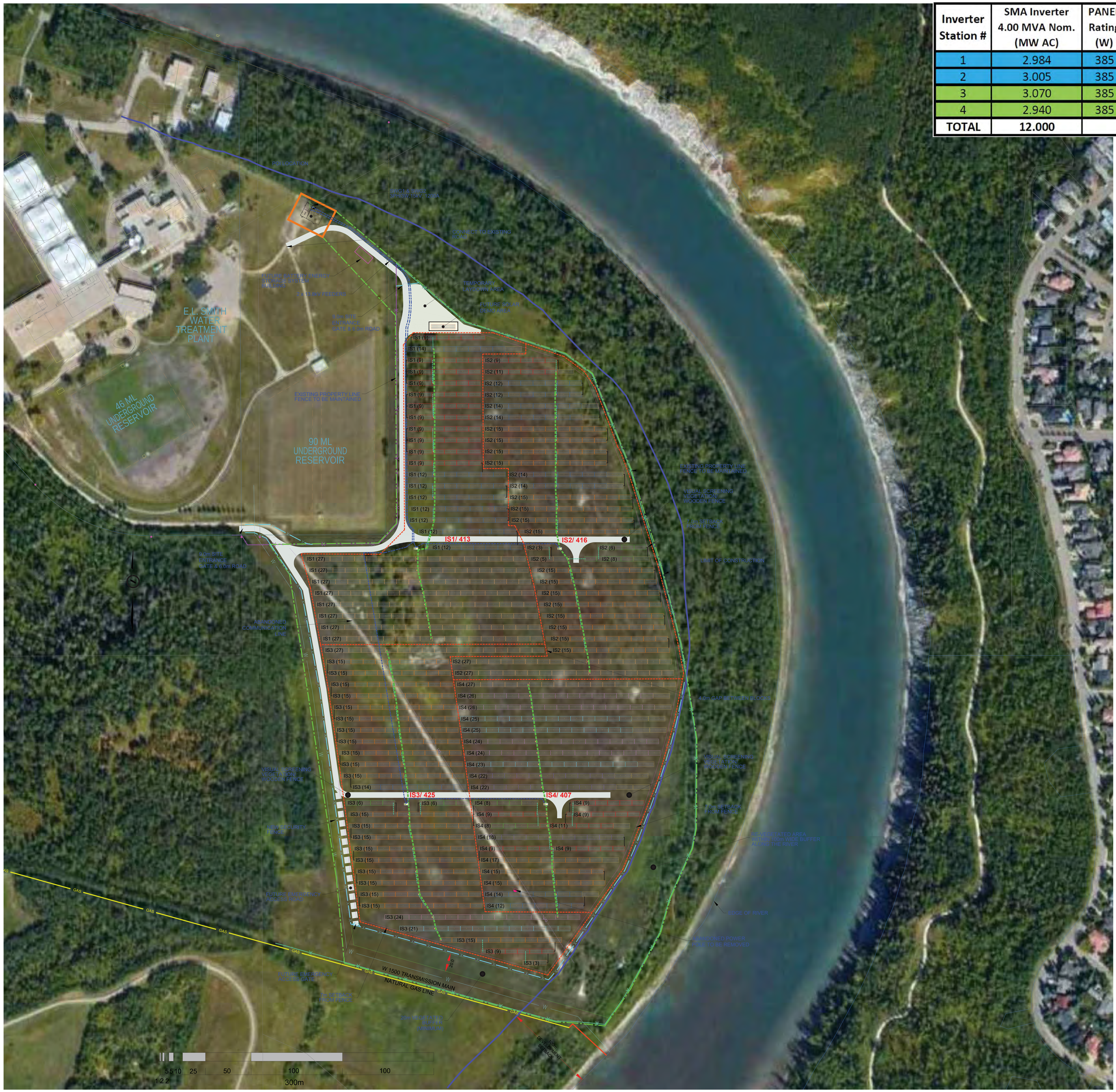


Plate 3: Example layout of a typical panel configuration (dimensions may not be as shown)



Inverter Station #	SMA Inverter 4.00 MVA Nom. (MW AC)	PANEL Rating (W)	# Of Modules	DC MW	Effective DC/AC Ratio	# Of Modules/ String	# Of String/ Block	AC System
1	2.984	385	10,738	4.1341	1.3856	26	413	A
2	3.005	385	10,816	4.1642	1.3856	26	416	
3	3.070	385	11,050	4.2543	1.3856	26	425	B
4	2.940	385	10,582	4.0741	1.3856	26	407	
TOTAL	**12.000**		**43,186**	**16.6266**	**1.3856**		**1661**	

PCL

CONSTRUCTION LEADERS

TORONTO DISTRICT
2201 Bristol Circle, Suite 500
Oakville, Ontario, L6H 0J8
Phone: 905-276-7600

LEGEND

2x(3 x 13) PANELS (PORTRAIT) PER TABLE SET
26 PV MODULES PER STRING (TYP.)

3 TABLE SETS = ±79.9m

2 TABLE SETS = ±53.2m

4.00 MVA INVERTER STATION
- 3.00 MW INVERTER
- 4.00 MVA TRANSFORMER

COMBINER BOX

SECURITY FENCE

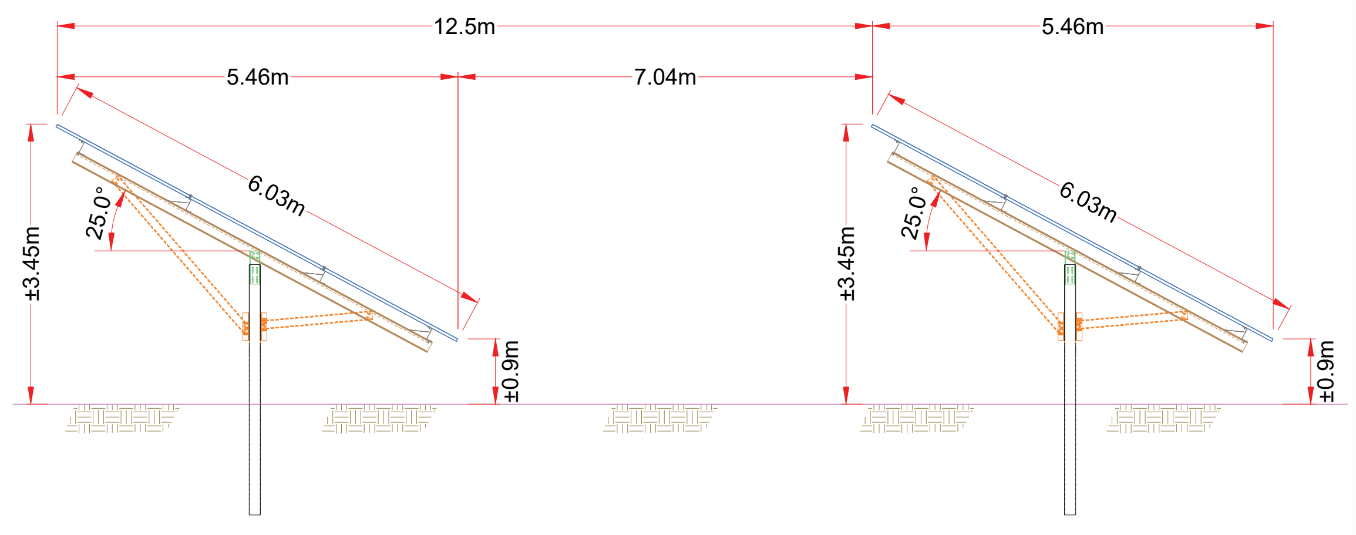
13.8 kV AC COLLECTOR FEEDER

DC TRENCH

DC PV HARNESS IN UG PVC CONDUIT

BLOCK OUTLINE

6.00m WIDE GRAVEL ROAD



PROPOSED TABLE SECTION

INFORMATION ONLY

Site layout and technical details are for information and subject to change during detailed design

THIS DRAWING IS FOR THE SOLE USE OF ANY PCL OPERATING COMPANY, OR ANY PCL JOINT VENTURE COMPANY. IT IS NOT TO BE USED, ALTERED OR REPRODUCED WITHOUT THE WRITTEN PERMISSION OF THE PCL FAMILY OF COMPANIES.

Rev. No.	Initials	Date	Description
0	MG	02/13/19	ISSUED FOR REVIEW

Plot Scale: AS SHOWN
Date: Oct. 09, 2018
Drawn By: A.M.
Checked By: W.S.
Sheet Title: E.L. Smith WTP Solar
Site Layout (12.0 MWAC)
3P Design / 4 x 3.0MW Inv.
385W Module / 1661 Strings
PCL Job No.:
Sheet No.: PCL-1

APPENDIX B

AEP Correspondence

Alberta Environment and Parks

Wildlife Management
Operations Division
4920 - 51 Street
Provincial Building
Red Deer, AB T4N 6K8, Canada
Telephone: 403-755-1496

April 30, 2018

Dave Slubik, M.Sc.
Environment Manager
EPCOR Water Services
2000 - 10423 101 Street NW
Edmonton, AB T5H 0E8
Office: 780-412-3767
Cell: 780-916-7722
dslubik@epcor.com

RE: Alberta Environment and Parks review of the E.L. Smith Solar Farm Project

This letter is to advise that Alberta Environment and Parks Wildlife Management (AEP – WM) Staff have reviewed the project information provided for the E.L. Smith Solar Farm Project and have determined that a review and referral letter provided by an AEP-WM Wildlife Biologist is not required for this project.

As stated in the *Wildlife Directive for Alberta Solar Energy Projects (2017)*, "Review by an AEP Wildlife Biologist is not required when solar energy projects are small-scale (i.e. less than 1MW) or within urban areas." Since this solar project is located within the city limits of Edmonton, a review by an AEP-WM Wildlife Biologist is not required, as defined by the Solar Directive. AEP-WM supports the siting and development of solar projects within urban limits because urban solar projects have limited impact to wildlife and wildlife habitat, have reduced requirements for transmission infrastructure, and reduce the pressure of development on locations with higher quality wildlife habitat value. Since the Solar Directive does not pertain to solar projects located within urban areas, AEP-WM does not require post-construction monitoring to be conducted for the E.L. Smith Solar Farm Project.

However, AEP-WM supports EPCOR in applying the standards and best management practices of the Solar Directive as much as possible in the construction and operation of the E.L. Smith Solar Farm Project. Furthermore, in the development and operation of the E.L. Smith Solar Farm Project, EPCOR is responsible for following all applicable provincial and federal wildlife legislation, including but not limited to the Alberta *Wildlife Act* and the federal *Migratory Birds Convention Act* and *Species at Risk Act*. This includes conducting surveys to ensure the house, den or nest of prescribed wildlife species are not disturbed by project related activity. AEP-WM also requires that construction occurs outside of the restricted breeding bird season (April 1 to July 15), and that pre-construction nest sweeps are conducted if development occurs inside this restricted timing period.

Alberta Environment and Parks

Wildlife Management
Operations Division
4920 - 51 Street
Provincial Building
Red Deer, AB T4N 6K8, Canada
Telephone: 403-755-1496

Sincerely,

Jason Un

Jason Unruh
Wildlife Biologist, Renewable Energy Projects

cc: Brandy Downey, AEP Renewable Energy Committee Chair
Delaney Frame, Wildlife Biologist, Red Deer-North Saskatchewan Region
Scott Stevens, Senior Wildlife Biologist, Red Deer-North Saskatchewan Region

APPENDIX C

Stage 1 Wildlife Directive Concordance Table

Parameter	Standards(100.x.x) / Best Management Practices (200.x.x)	Alignment with Standard/Best Management Practice
STAGE 1: Site Selection		
Land use (100.1.1)	Solar energy projects and temporary work spaces must be sited to avoid or minimize their occurrence in important wildlife habitats (ASRD 2011). Generally, solar energy project should not be sited in areas of native grasslands, native parkland, old growth forest stands, named water bodies, valley breaks (including coulees), valleys of large permanent watercourses and the eastern slopes region.	The site for the proposed Project is located within a previously disturbed area. The PDA has been strategically located at least 100 metres away from the NSR and the majority of the PDA is dominated by cultivated perennial pasture. The PDA is located within the valley of the North Saskatchewan River (NSR).
Prohibited Wildlife Zones (100.1.2)	Without limiting Standard 100.1.1, solar energy projects are not allowed in the following Wildlife Zones: • Greater Sage-Grouse Range (inclusive of the area described in the Emergency Order for the Protection of the Greater Sage-Grouse) (GOC 2014) • Trumpeter Swan Waterbodies and Watercourses (inclusive of 800m[1] setback from waterbody and watercourse) • Caribou Zones • Mountain Goat and Sheep Zones • Piping Plover Waterbodies (inclusive of200m setback from waterbody)	The Project is not located within the Wildlife Zones identified.
Wildlife Zone Avoidance (100.1.3)	Solar energy projects must be appropriately sited to avoid or minimize their occurrence in the following mapped Wildlife Zones: • Special Access Zones • Key Wildlife and Biodiversity Zones • Grizzly Bear Zones	Portions of the PDA occur within the Key Wildlife Biodiversity Zone (KWBZ) associated with the NSR and its tributaries. With the application of the 100 m buffer from the NSR, occurence within the KWBZ has been reduced to the temporary footprint. Construction activities will be scheduled outside of the Restricted Activity Period (RAP) for the KWBZ (January 15 - April 30) where this management zone overlaps the temporary footprint of the PDA. If any construction activity extends into the RAP a mitigation plan will be developed in consultation with a regional AEP biologist.
Critical Habitat (100.1.4)	Solar energy projects must be appropriately sited to avoid Critical Habitat[2] (i.e., fish, wildlife and plant species)	No Critical Habitat was identified within the LAA.
FWMIS, LAT, ACIMS, HIS, and RSF (100.1.5)	To determine the possible occurrence of species at risk or sensitive plants and animals in the proposed area of the solar energy project, applicants must examine the available data from AEP for the proposed solar energy project plus a 1km buffer zone around all disturbances associated with the project. Data sources include the Fish and Wildlife Management Information System (FWMIS), Wildlife Sensitivity Data Sets (i.e., key range layers and key wildlife layers), Landscape Analysis Tool (LAT), Alberta Conservation Information Management System (ACIMS; for occurrences of rare plant species), and available habitat identification tools where available (e.g., Habitat Suitability Index (HSI) tools, Resource Selection Function (RSF) modeling tools). Applicants must contact the appropriate AEP Wildlife Biologist to request a search of the FWMIS database; initial database searches can be conducted by searching "FWMIS" on http://www.alberta.ca.	FWMIS and ACIMS searches were conducted for the project which identified that the Project is located within a sharp-tailed grouse range and sensitive raptor range for bald eagles. Based on the field surveys completed, sharp-tailed grouse are unlikely to occur due to lack of suitable habitat and no evidence of bald eagles nest were identified in the LAA. A total of eight Species of Management Concern (SOMC) were identified within the LAA. Alder flycatcher, Baltimore oriole, and least flycatcher were observed wihtin the LAA, outside of the PDA. STEPH TO ADD MITIGATIONS
Grizzly Bear Watershed (100.1.6)	100.1.6 The solar energy project will not create new open access development in Grizzly Bear Watershed Units approaching or exceeding open road thresholds as per the Alberta Grizzly Bear Recovery Plan as amended (AEP In press).	This is not applicable as the Project is located in an Urban Area outside of known grizzly bear range.
Valleys and Coulees (100.1.7)	The solar energy project must not occur within 100 m from the top of a valley break (including coulees).	The Project is located below the valley break and top of bank of the NSR.
Named Lakes (100.1.8)	The solar energy project must not occur within 1000 m of a named lake, as per NRCAN (2016).	The Project is not located wihtin 1000 m of a named lake.
Wetlands (100.1.9)	The solar energy project must not occur within 100 m of any wetland class (bog, fen, marsh, shallow open water, swamp) identified in Table I in the Alberta Wetland Classification System except for wetland classes with Water Permanence listed as Temporary within the aforementioned Table (ESRD 2015).	No wetlands were identified within the PDA or within 100 m of the PDA.
Watercourses (100.1.10)	The solar energy project must not occur within: • 45 meters from the top of the break of intermittent watercourses or springs • 45 meters from the top of the break of small permanent watercourses • 100 meters from the top of the break of large permanent watercourses	The Project is located below the top of the break of the NSR.
CSP/PV Projects (100.1.11)	Solar energy projects using power tower CSP technology will be identified by the AEP Wildlife Biologist in the signed Wildlife Renewable Energy Referral Report as a high unmitigated risk for wildlife due to the high levels of wildlife mortality associated with this technology.	This Project is not using power tower CSP technology. Additionally, a referral report will not be completed for the Project since it is located within an Urban Area (see consultation with AEP Wildlife Biologist).
Important Bird Area (200.1.1)	The solar energy project should not occur within 1000 m of a wetland based Important Bird Area (IBA) as per IBA Canada (http://www.ibacanada.ca).	The Project is not located within 1000 m IBA.

---

[1] Note that within this document, a setback is measured from the edge of the feature to the nearest edge of the project footprint.

[2] Critical Habitat is defined by the Government of Canada, for more information on locations refer to the specific species federal recovery strategy.

APPENDIX D

Stormwater Management Plan

Municipal Stormwater Management Plan

E.L. Smith Solar Farm

1182-12071

Stantec

Prepared for:
EPCOR Water Services Inc. (EWSI)

Prepared by:
Stantec Consulting Ltd.
10160 112 Street
Edmonton AB T5K 2L6
Tel: (780) 917-7000

Rev 3

March 16, 2018

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This document titled Municipal Stormwater Management Plan was prepared by Stantec Consulting Ltd. for the account of EPCOR Water Services Inc. The material in it reflects Stantec's best judgment in light of the information available to it at the time of preparation. Any use which a third party makes of this report, or any reliance on or decisions made based on it, are the responsibilities of such third parties. Stantec Consulting Ltd. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

Prepared by Kairi
(signature)

Kairi Pawlick, P.Eng.

Reviewed by Jeff Drain
(signature)

Jeff Drain, P.L. (Eng.)

PERMIT TO PRACTICE
STANTEC CONSULTING LTD.
Signature Thomas Schaefer
Date 2018-03-19
PERMIT NUMBER: P 0258
The Association of Professional Engineers and Geoscientists of Alberta

KAIRI PAWLICK
2018-03-19

1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec) was retained by EPCOR Water Services Inc. (EWSI) to provide a municipal stormwater management plan in support of the E.L. Smith Solar Farm (the "Project").

1.1 SCOPE OF WORK

The Project is located within the City of Edmonton at the existing E.L. Smith Water Treatment Plant (WTP) located at 3900 E.L. Smith Road. The solar panels are to be installed within the quarter section NW 3-52-25-W4 in an area of undeveloped and vegetated land immediately southeast of the existing WTP, west of E.L. Smith Road, and abutting the North Saskatchewan River. The Project location and proposed layout is shown on **Figure 1** below. The intent of this report is to describe predevelopment site drainage patterns, evaluate the municipal stormwater management plan for post development conditions, and provide technical support for incorporation into detailed design.

Figure 1 – Project Location Plan & Proposed Layout

1.2 APPLICABLE LEGISLATION

There are two sources of provincial legislation that influence the site drainage and stormwater management design of new developments or disturbances to existing land. Both are administered by Alberta Environment and Parks (AEP), as follows:

1. The Environmental Protection and Enhancement Act (EPEA) is designed to "support and promote the protection, enhancement and wise use of the environment". Section 109 of the act states: "No person shall release or permit the release into the environment of a substance in an amount, concentration or level or at a rate of release that causes or may cause a significant adverse effect."

   The Wastewater and Storm Drainage Regulation and Wastewater and Storm Drainage (Ministerial) Regulation enables AEP to further regulate storm drainage and wastewater systems, their operators, and the design and construction of such works. These regulations were made under the EPEA.

   Through consultation with AEP, it has been determined that EPEA approval is not required for the Project.

2. The Water Act is administered by AEP "to support and promote the conservation and management of water" which includes any diversion of water, consumption of water, in-stream activity or other activity which affects watercourses and wetlands. Two codes of practice under the Water Act which affect drainage works include the Code of Practice for Watercourse Crossings and the Code of Practice for Outfall Structures on Water Bodies.

   The requirement for approval under the Water Act will be evaluated in consultation with AEP following approval of the land development application with the City of Edmonton.

The legislation identified above does not provide specific targets for the quality of stormwater that enters a receiving watercourse, however, the penalties for adverse impacts to the receiving watercourse or aquatic life exist.

Appropriate due diligence and utilizing best management practices from established municipal standards and guidelines must be exercised to minimize and avoid such impacts.

1.3 DESIGN CRITERIA

As part of the plan amendment and rezoning submission to the City of Edmonton (LDA17-0283) and comments received from Drainage Planning on the application, our understanding is that the existing overland stormwater drainage patterns are to be maintained as best as possible.

Therefore, the overall intent of the site drainage and municipal stormwater management plan is to maintain the natural runoff quality and quantity characteristics of the predevelopment system as best as possible, while also maintaining general requirements as outlined in the City of Edmonton Design and Construction Standards, and best practices for solar racking system design.

Water Quantity – flow rate requirements are not specifically identified in the standards. Due to proximity of the North Saskatchewan River, the size of the downstream water body and given the system will not be tying into a piped system, the flow rates are to be maintained as close as possible to predevelopment, with a focus on limiting changes to existing drainage paths and mitigating concentrated flows that may result in erosion.

Onsite Storage – as per City of Edmonton Design and Construction standards. The minimum storage volume required for the site is to retain the 1937 storm event.

Water Quality – water quality requirements are not specifically identified in the standards. Intent is to maintain storage volumes and drainage paths as close as possible to predevelopment and keep areas vegetated to slow down drainage and improve cleansing before overland flows move offsite.

Erosion and Sedimentation Control – as per City of Edmonton Erosion and Sedimentation Control Guidelines (January 2005). A detailed erosion and sediment control plan will be developed during detailed design, and an associated monitoring plan will be required for the site throughout the duration of, and following construction, to mitigate impacts to downstream areas.

Grading – the proposed grading program for the site has been developed using best management practices for solar racking system design. East to west slopes were limited to a maximum of 3% for most of the site, so that standard racking systems can be utilized to reduce foundation requirements. In some of the steeper areas at the north and east portions of the site, 600 mm steps in between sections will be accommodated. A maximum ponding elevation of 300 mm is also best practice to keep junction boxes, combiner boxes, and other electrical equipment from being submerged in a wet weather event, and to prevent the toe of the panel from being submerged.

1.4 BACKGROUND

1.4.1 Predevelopment Conditions

Northeast of the site is the existing E.L. Smith Water Treatment Plant with existing buildings, water reservoirs and graveled access roads. The predevelopment site conditions and topography are shown on **Figure 2** in **Appendix A** based on the site survey completed in December 2016. The drainage areas and runoff flow paths which will be affected by the proposed development have been identified based on the existing site topography.

The study area is approximately 25 ha of gently rolling terrain with elevations ranging from 628.8 m to 636.0 m. There are several hills and steep inclinations located north central, and at the northwest and southwest corners of the site. Excluding the concentrated hilly areas, the site is generally sloped from flat to 5%. Drainage is ultimately conveyed northeast toward the North Saskatchewan River. There is a ridgeline along the east portion of the site that runs north-south at approximately 100 m from the edge of trees along the river bank. The area east of this ridgeline currently directs overland drainage directly to the river.

There are several natural low points (or pooling areas) on site which store runoff during storm events. The land is currently undeveloped and vegetated with grass, with the exception of an existing gravel access road that runs from the existing plant to the southeast corner of the site.

The site soils are expected to have the infiltration characteristics of clay, based on site borehole records from the geotechnical report (*Geotechnical Investigation – EL Smith Solar Farm, Edmonton, AB, prepared by Stantec Consulting Ltd., October 2017*).

1.4.2 Post Development Conditions

The post development site conditions are shown on **Figure 3** in **Appendix A**. The proposed development consists primarily of solar panels with a perimeter gravel access road. The gravel access road will be a maximum of 6 m wide and is proposed to be at-grade where possible.

A preliminary grading and drainage plan has been developed and is also presented on **Figure 3** in **Appendix A**. As per Section 1.3, grading design criteria is to reduce slopes to a maximum of 3% and reduce ponding areas to a maximum of 300 mm depth, under the solar panel installations. This results in flattening out Drainage Area 3 (DA3) and combining and flattening out DA1 & DA2. The areas east of the ridgeline (DA4 & DA5) that naturally drain directly towards the river will generally follow existing ground with the incorporation of minor grading steps up to 600 mm in depth along the solar panel lengths as required to reduce slopes to less than 3%.

The solar panels will be mounted above ground and underlying ground will remain in vegetated grassed condition. The proposed change to overall site imperviousness is generally limited to the proposed access roads and e-Houses.

A temporary laydown area will be utilized during the construction phase of the Project. All areas disturbed during construction, including the laydown area, will be restored with topsoil and grass seed at the earliest possible opportunity with native seed mix appropriate for the region.

The site hydrologic processes such as infiltration, filtration through vegetation, and sheet flow runoff will continue in a manner generally similar to existing conditions.

2.0 ANALYSIS

Analysis was completed to determine the effect of the proposed development on offsite flow rates. The primary result is to determine changes to the site peak runoff flows, total runoff volume, and runoff quality as changes may have a negative impact on receiving watercourses if not mitigated.

2.1 SITE CHARACTERIZATION

Using the City of Edmonton Design and Construction standards, runoff coefficients 'C' were assigned to the pre and post development conditions (*Section 13.8, Table A5*).

The predevelopment condition assumes a vegetated surface with C of 0.10 for the majority of the site. There is an access road existing across the site and for this C of 0.95 was used. The average C for the predevelopment condition is therefore 0.11.

The post development condition uses C of 0.95 for the proposed gravel access road surrounding the site, and 0.10 for the solar panel areas, resulting in an average C of 0.14. The solar panels will be elevated off the ground and remain vegetated underneath and in-between the rows. Stormwater flowing off the solar panels will therefore fall to a vegetated pervious surface and runoff will continue in a manner similar to the predevelopment condition. The surface under the solar panels will therefore substantially maintain the existing infiltration and water treatment characteristics in the post development condition.

Since any required laydown areas are not permanent and will be reclaimed (reseeded) after construction of the solar farm, these were assumed to match predevelopment conditions in the post development review.

2.2 PEAK FLOWS

As per the City of Edmonton Design and Construction Standards, the site area is less than 65 ha in size and therefore the Rational Method has been used in calculating the pre and post development peak runoff flows for the 1 in 100 year storm event using a storm intensity rate of 215.7 mm/h (*as per the March 2015 City of Edmonton Design and Construction Standards published IDF curve for 100 yr frequency and 5 min time of concentration*).

$$Q_{100} = 1.25C \times I \times A$$

Where:

- Q_{100} = 1 in 100 year peak runoff flow, m^3/s
- C = runoff coefficient, dimensionless (x 1.25 for storm events greater than 50 years)
- I = rainfall intensity (215.7 mm/h)
- A = area in hectares

Based on this method and using the runoff coefficients summarized in Section 2.1 above, the predevelopment peak runoff flow is 2,032 L/s and the post development peak runoff flow is 2,666 L/s. A full summary of the peak flows is included in **Table 1** below.

Table 1 – Peak Flow Summary

Predevelopment Condition				Post Development Condition			
Drainage Area ID	Area (ha)	Runoff Coefficient ('C')	Peak Flow (L/s)*	Drainage Area ID	Area (ha)	Runoff Coefficient ('C')	Peak Flow (L/s)*
DA1	4.75	0.10	356	DA1+ DA2	7.07	0.12	625
DA2	2.18	0.10	163				
DA3	9.29	0.12	849	DA3	9.35	0.15	1,061
DA4	8.27	0.10	619	DA4	8.07	0.15	934
DA5	0.60	0.10	45	DA5	0.60	0.10	45
Total	**25.09**	**0.11**	**2,032**	**Total**	**25.09**	**0.14**	**2,666**

*assuming uncontrolled discharge for all drainage areas

Based on the above preliminary analysis, this indicates an approximate increase in peak runoff flow of 30%, due to the addition of the gravel access road around the perimeter of the solar farm. This increase has been reviewed as part of the environmental impact assessment for the Project and with the implementation of mitigation measures, including monitoring erosion and sedimentation control mechanisms at the tip-over locations and across the access road, potential residual effects on surface water bodies and hydrology are anticipated to not be significant.

2.3 STORMWATER STORAGE VOLUMES

The development of this site is not expected to significantly change the existing hydrologic conditions. Major overland drainage tip-over elevations and locations, as well as major overland drainage patterns and paths are being maintained for the site. Grading will occur primarily to flatten the site to remove concentrated deep pooling areas, and lessen the slopes to a maximum of 3% to accommodate solar panel installation.

The predevelopment and post development drainage areas, which were delineated based on the site topography and the preliminary grading plan, are shown on **Figure 2** and **Figure 3** in **Appendix A**.

Predevelopment stormwater storage volumes were calculated using Civil 3D and site survey provided by Stantec Geomatics Ltd., December 2016, for each drainage area as defined on **Figure 2**.

The post development storage volumes were also calculated using Civil 3D and the preliminary grading surface for the site. For the post development condition, the predevelopment tip-over elevations and drainage paths were held constant, and low-lying areas regraded to allow for a maximum of 300 mm depth of ponding, as depicted on **Figure 3**. For the post development condition, to slightly increase the stormwater storage across the site, drainage areas DA1 and DA2 are combined and regraded, however the ultimate tip over location and elevation will remain the same as the predevelopment condition.

Table 2 below summarizes the drainage areas and elevations for both the pre and post development conditions.

Table 2 - Drainage Summary

Predevelopment Condition				Post Development Condition			
Drainage Area ID	Area (ha)	Tip-Over Elev (m)	Low Point Elev (m)	Drainage Area ID	Area (ha)	Tip-Over Elev (m)	Low Point Elev (m)
DA1	4.75	630.10	629.47	DA1+ DA2	7.07	630.10	629.80
DA2	2.18	630.40	629.34				
DA3	9.29	630.50	629.13	DA3	9.35	630.50	630.20
DA4	8.27	*runoff direct to the River*		DA4	8.07	*runoff direct to the River*	
DA5	0.60	*runoff direct to the River*		DA5	0.60	*runoff direct to the River*	
Total	25.09	-	-	Total	25.09	-	-

As per the City of Edmonton Design and Construction Standards, for site areas less than 65 ha, major stormwater runoff volume requirements for the site can be estimated using the volume equivalent to 120 mm depth of water over the total catchment area. This value is based off the estimated volume of runoff from the recorded 1937 storm event. Based on this, the required total stormwater storage volume for the site for a major storm event is 30,108 m3.

The predevelopment condition totals approximately 44,260 m3 for the entire site. This indicates that the predevelopment condition provides more stormwater storage volume than is required as per City standards.

The post development condition totals approximately 30,288 m3. This indicates that the post development condition provides adequate stormwater storage for the 1937 storm event as per City Standards, and provides approximately 30% less stormwater storage volume than the predevelopment condition. **Table 3** below summarizes the storage volumes for each drainage area.

Table 3 – Stormwater Storage Volume Summary

Drainage Area ID	Area (ha)	Required Volume (m3)	Predevelopment Volume (m3)	Post Development Volume (m3)
DA1	4.75	5,700	4,848	8,646
DA2	2.18	2,616	2,927	
DA3	9.29	11,148	36,485	21,642
DA4	8.27	9,924	-	-
DA5	0.60	720	-	-
Total	**25.09**	**30,108**	**44,260**	**30,288**

Drainage areas 4 and 5 do not provide storage in the predevelopment condition and the proposed post development plan is to keep this area free-draining offsite. The stormwater storage requirements for these areas are therefore being met by increasing the storage volume for drainage areas 1, 2 and 3.

The increase in stormwater volume being discharged offsite has been reviewed as part of the environmental impact assessment for the Project and with the implementation of mitigation measures, including monitoring erosion and sedimentation control mechanisms in particular at the drainage area tip-over locations, potential residual effects on surface water bodies and hydrology are anticipated to be not significant.

3.0 EROSION & SEDIMENTATION CONTROL PLAN

Construction activities are required to develop the site including grading, infrastructure installation, and general construction traffic. The activities will result in the disturbance of at-surface soils, exposure of the underlying earth to potential erosion, and sediment transport to offsite locations.

In all instances where the potential for erosion is identified, a series of control measures should be implemented including, but not limited to:

- Erect silt fences, before grading begins, on the downstream sides of the area to be graded to protect downstream areas from potential sediment transport caused by entrainment in overland flows.
- Provide construction entrance features (e.g. mud mat) at site entrances to minimize the transport of sediment on construction vehicle tires.
- Direct runoff through swales and erosion control berms to sediment control measures, minimizing untreated runoff discharging from the site.
- Install temporary rock check dams, straw bale barriers and/or filter cloth barriers in swales to help attenuate flows, reduce flow velocities, and encourage sediment deposition.
- Stabilize all disturbed areas not subject to construction activities within 30 days, if not sooner.

A routine program should be implemented during construction as per City of Edmonton Erosion and Sedimentation Control Guidelines (January 2005) to review that erosion and sediment control measures are effectively executed.

Inspections of the erosion and sediment control measures should be performed after each significant rainfall event or weekly, whichever is more frequent, and any deficiencies identified should be rectified immediately.

4.0 MONITORING & MAINTENANCE PLAN

The filtration provided by vegetation provides treatment benefits, such as removal of sediment and other debris. The vegetated areas require periodic inspections and maintenance to ensure ongoing functionality. Vegetated conveyance systems represent a familiar and simple type of stormwater management practice, with operations and maintenance requirements to match.

Inspection, operation, and maintenance activities should be executed including:

- Routine observations as to the presence of retained trash/debris that could be conveyed downstream and/or affect the conveyance capacity of the system. Trash and debris should be removed when identified.
- A semi-annual walking inspection should be completed to identify areas of bare soil and/or the formation of eroded gullies for the first two years following construction (annually thereafter), and in particular during spring melt and after major storm events. The inspection should include a review of the condition at the tip-over locations of the drainage areas, as the potential for erosion is greater at these locations. Remediation efforts typically involve re-grading the area and/or re-vegetating with an appropriate seed mix, with fertilizer and water applied as necessary to promote germination and stabilization. More robust remediation measures such as an erosion control blanket may be required to further stabilize eroded soils.
- A visual assessment of any areas of isolated pooling or sediment build-up should be performed concurrently with the walking inspection. Minor areas of pooling can be rectified with re-grading/re-stabilization, if the magnitude of the associated pooling warrants such action. There are no functional concerns associated with pooling from a stormwater management perspective, therefore remediation is not strictly required. Excessive sedimentation is an issue requiring attention if it remains in a non-vegetated condition and is, therefore, prone to re-suspension and transport downstream. If the sedimentation creates an isolated pooling area as described above, or if it occurs to an extent that it impacts the conveyance capacity of a conveyance system, the sediment should be removed and the area re-stabilized.
- Vegetation management is not a strict requirement as excess growth serves to improve water quality treatment. However, if the density of vegetation reaches a level where conveyance capacity is impacted, a cutting operation should be undertaken. A minimum vegetation height of 0.15 m (6") should be maintained.

5.0 CONCLUSION

Stantec Consulting Ltd. was retained by EPCOR Water Services Inc. to provide a preliminary grading and municipal stormwater management plan in support of the E.L. Smith Solar Farm.

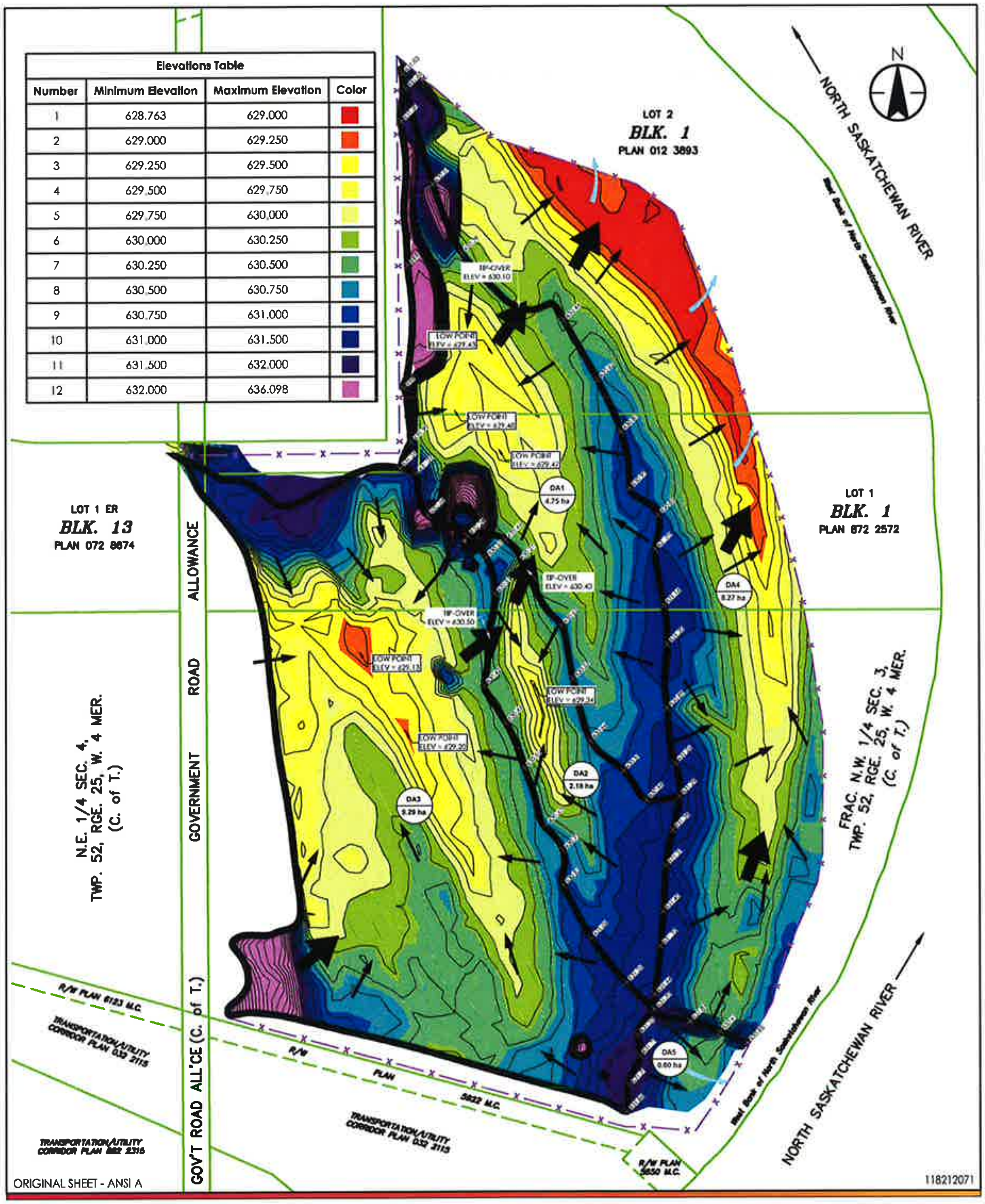
The total peak flows will be increased, and the total stormwater storage volumes reduced from the predevelopment condition, and upon implementing the site upgrades. The major drainage paths and tip-over locations and elevations will be maintained under post development conditions.

The results of the analysis indicate that the proposed development will result in slight changes to the existing condition, but meet City standards for runoff volume control. Through the implementation of Erosion and Sedimentation Control measures and regular monitoring of the

Project and site conditions, during and post construction, potential residual effects on surface water bodies and hydrology are anticipated to not be significant.

Detailed site grading plans, and stormwater storage and conveyance system design will be completed during a subsequent phase of the development process. Detailed design will be guided by the general intent of this municipal stormwater management plan.

APPENDIX A
STORMWATER FIGURES



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	628.763	629.000	🟥
2	629.000	629.250	🟧
3	629.250	629.500	🟨
4	629.500	629.750	🟨
5	629.750	630.000	🟨
6	630.000	630.250	🟩
7	630.250	630.500	🟩
8	630.500	630.750	🟦
9	630.750	631.000	🟦
10	631.000	631.500	🟦
11	631.500	632.000	🟪
12	632.000	636.098	🟪

Stantec

10160-112 Street
Edmonton, Alberta
www.stantec.com

Legend

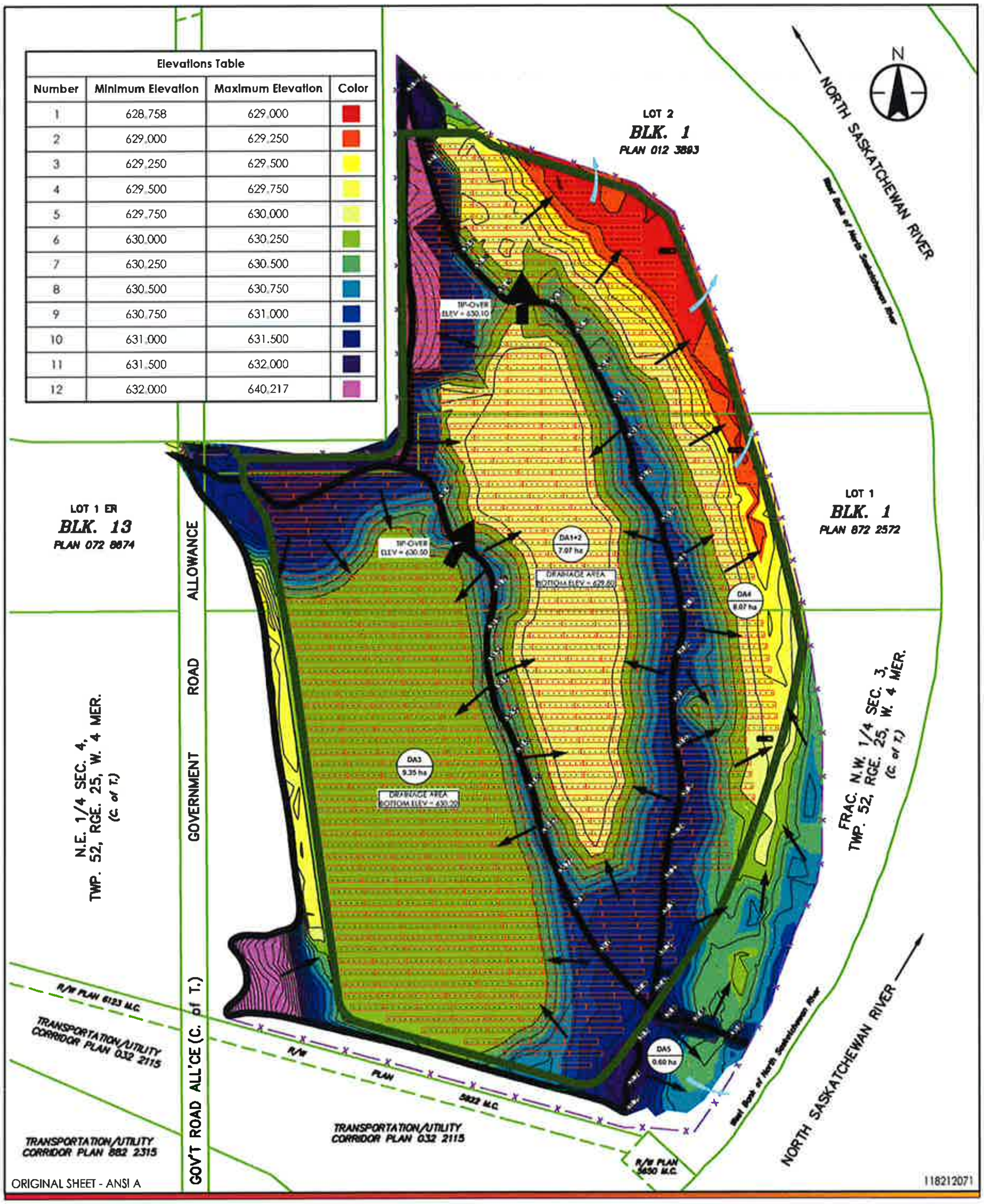
→ Minor Overland Flow Direction
➡ Major Overland Flow Direction
→ Offsite Discharge
Subcatchment Boundary
— Property Lines
—x— Existing Metal / Chainlink Fence
DA6 4.80 ha Drainage Area ID & Area

Client/Project
EPCOR WATER SERVICES INC.
E.L. SMITH SOLAR FARM

Figure No.
2

Title
Predevelopment Conditions & Site Drainage

Site Survey Provided by Stantec Geomatics Ltd. (December 2016)



Elevations Table

Number	Minimum Elevation	Maximum Elevation	Color
1	628.758	629.000	🟥
2	629.000	629.250	🟧
3	629.250	629.500	🟨
4	629.500	629.750	🟨
5	629.750	630.000	🟨
6	630.000	630.250	🟩
7	630.250	630.500	🟩
8	630.500	630.750	🟦
9	630.750	631.000	🟦
10	631.000	631.500	🟦
11	631.500	632.000	🟪
12	632.000	640.217	🟪

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Legend

→	Minor Overland Flow Direction
➡	Major Overland Flow Direction
➝	Offsite Discharge
⬭	Subcatchment Boundary
—	Property Lines
—x—	Existing Metal / Chainlink Fence
▭	Proposed Solar Panel Row
▬	Proposed e-House
▬	Proposed 6.0m Access Road
DA6 4.80 ha	Drainage Area ID & Area

Client/Project
EPCOR WATER SERVICES INC.
E.L. SMITH SOLAR FARM

Figure No.
3

Title
Post Development Conditions & Site Drainage

Site Survey Provided by Stantec
Geomatics Ltd. (December 2016)

APPENDIX E

Geotechnical Investigation

GEOTECHNICAL INVESTIGATION – E.L. SMITH SOLAR FARM, EDMONTON, AB

E.L. Smith Water Treatment Plant
Solar Farm

Prepared for:
EPCOR Water Services Inc.
Rossdale Water Treatment Plant
9469 Rossdale Rd
Edmonton AB T5K 0A5

Prepared by:
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200-325 25 St SE
Calgary AB T2A 7H8

Project Number 110219883

FINAL

October 2, 2017

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1.0 INTRODUCTION

Stantec Consulting Ltd. (Stantec), acting in accordance with the terms of reference provided in our proposal number 1233P903527 dated April 20, 2017, has carried out a geotechnical investigation for a proposed Solar Photovoltaic (SPV) panel site near the existing E.L. Smith Water Treatment Plant in Edmonton, Alberta. Authorization to proceed with the investigation was received from Mr. Nathaniel Papay of EPCOR Water Services Inc. (EPCOR) on March 6, 2017 under PO Number 700912.

The scope of work for the geotechnical investigation was carried out in accordance with the above referenced proposal and included the following:

- Geotechnical desktop study.
- Coordinate underground utility locates.
- Conduct a field drilling and test pitting program to characterize the subsurface conditions within the proposed solar array development.
- Install standpipes in selected boreholes for static groundwater level measurements.
- Complete a field electrical resistivity survey to support electrical grounding and transmission design.
- Conduct soils laboratory testing on selected soil samples including thermal resistivity.

A detailed geotechnical investigation was carried out to gather the necessary information about site conditions at specific locations to support the ongoing feasibility study and environmental assessment work being carried out by Stantec. While a detailed investigation was carried out, due to the current stage of the project with many unknowns that currently exist, this report provides geotechnical recommendations for the design and construction of foundations for the solar farm development to support the overall feasibility study based on the assumptions outlined within this report. Since the design details for the development were not confirmed at the time of this report, a geotechnical engineer should be consulted during the preliminary and detailed design phases of the project to ensure that the assumptions and recommendations provided within this report remain valid for the development.

1.1 AVAILABLE GEOTECHNICAL REPORTS

The following available geotechnical reports were reviewed as part of the desktop review of available information:

- Geotechnical Report, Stage 3 Expansion Package "B" Buildings and Package "C" Chemical Building Extension, E.L. Smith Water Treatment Plant, Edmonton, Alberta, Report by HBT AGRA Limited, dated September 10, 1993. File No.: EG-07555.
- Geotechnical Investigation, Low Lift Pumphouse, E.L. Smith Water Treatment Plant, Edmonton, Alberta, Report by AMEC Earth & Environmental, dated December 2, 2005. File No.: EG09255.
- Geotechnical Investigation, Filter Building Addition, E.L. Smith Water Treatment Plant, Edmonton, Alberta, Report by AMEC Earth & Environmental, dated December 9, 2005. File No.: EG09255.
- Geotechnical Investigation, Chemical Buildings Addition, E.L. Smith Water Treatment Plant, Edmonton, Alberta, Report by AMEC Earth & Environmental, dated December 21, 2005. File No.: EG09255.

1.2 SITE DESCRIPTION

The site of the proposed solar farm development is located on an existing river terrace located adjacent to the North Saskatchewan River that borders the entire east side of the site, shown on Figure 1 in **Appendix B**. The site covers an area of approximately 55 acres and is located southeast of the existing E.L Smith Water Treatment Plant. The site is located within the NW of Section 3 and SW of Section 10 of Township 52, Range 25, West of the Fourth Meridian (NW-3-52-25 W4 and SW-10-52-25 W4) in Edmonton, Alberta. At the time of the field investigation, the site consisted of a vegetated undeveloped area southeast of the existing water treatment plant. The topography was noted to be relatively flat to undulating.

1.3 REVIEW OF GEOLOGY MAPS AND GEOTECHNICAL REPORTS

Based on a review of published geological information[1], the proposed site is located within a region which may include alluvial river terrace deposits consisting of gravel, sand, and silt as well as erosional features consisting of thin colluvial cover on valley slopes, alluvial material along streams and mixed glacial and bedrock materials in slump areas.

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[1] Bayrock, L.A., 1972, *Surficial Geology, Edmonton (NTS 83H)*, Alberta Research Council, 1:250,000

The available geotechnical reports described in **Section 1.1** included geotechnical investigations carried out at the water treatment plant to the northwest of the site and did not include the proposed solar farm site. The subsurface conditions encountered at the water treatment plant were noted to be similar to the conditions encountered within the proposed solar farm site. The available geotechnical reports noted clay fills underlain by alluvial silt and clay underlain by alluvial sand and gravel. The fine-grained alluvium (clays and silts) typically extended to depths in the order of 5 m to 8 m, underlain by coarse grained alluvium consisting of sand transitioning to gravel with sand between depths of 8 m to 10 m underlain by bedrock. When bedrock was encountered within the boreholes it was typically found to be clay shale of the Edmonton Formation and noted the presence of coal beds, siltstone stringers, carbonaceous and bentonitic zones as well as the presence of sandstone. It was noted in these previous geotechnical investigations that depth to bedrock could vary significantly depending on the proximity to the river.

1.4 PROPOSED SOLAR FARM DEVELOPMENT

Based on the information provided, it is understood that a 5 MW to 10 MW ground-mount solar farm is proposed within the site and will consist of an array of solar panels with supporting infrastructure such as transformers and/or inverters. The geotechnical investigation is being completed as part of the overall feasibility and planning study being carried out by Stantec for the proposed development.

It is understood that various foundation options are currently being considered during the FEED stage for support of the solar panels including both shallow and deep foundations (piles) such as:

- Shallow foundations using pre-cast concrete ballasts.
- Deep foundations using augered installation methods such as grouted posts or piles;
- Deep foundations using driven steel H-piles; and,
- Deep foundations using torqued installation methods such as ground screws and/or helical (screw) piles.

No specific design loads, grades, or foundation configurations were available for consideration during this geotechnical investigation as a feasibility study is still ongoing. For the purpose of this geotechnical report, it was assumed that the final grades of the proposed development will be at the existing grades across the site. The recommendations provided within this report remain valid as long as the assumptions used within this report remain unchanged. Should these assumptions change a geotechnical engineer shall be consulted to review the design and confirm the geotechnical recommendations within this report remain valid.

2.0 METHOD OF INVESTIGATION

2.1 FIELD INVESTIGATION

Prior to the start of the field investigation, Stantec personnel made arrangements to verify the locations of underground utilities at and surrounding the proposed borehole and test pit locations. The field investigation was conducted between June 12 and June 22, 2017. Fifty-five (55) boreholes and eight (8) test pits were completed within the proposed development area. Boreholes were advanced using a truck-mounted drill rig equipped with solid-stem augers owned and operated by All Service Drilling Ltd. of Nisku, Alberta. Test pits were advanced using a Hitachi 240 tracked excavator owned and operated by Abacus Enterprises Inc. of Morinville, Alberta.

The borehole and test pit locations are shown in Figure 1, **Appendix B.** The borehole and test pit locations were selected by Stantec based on obtaining site coverage for the proposed development. All test locations were laid out in the field by Stantec personnel using hand held GPS with a known accuracy of ±3 m and the coordinates are summarized in **Table B-1** in **Appendix B.**

The subsurface stratigraphy encountered in the boreholes and test pits was recorded by Stantec personnel. All soil descriptions and identifications during drilling and test pitting were made in accordance with the visual manual method (ASTM D2488). Subsurface soil stratigraphy was classified using the Unified Soil Classification System (USCS), based on results of the laboratory testing. Representative samples of each stratum encountered were collected at various depth intervals during the performance of Standard Penetration Tests (SPTs). Undrained shear strength of cohesive soil was also assessed in the field using pocket penetrometer tests. Bulk samples were also obtained from auger cuttings during drilling and from test pits. Relatively undisturbed Shelby tube samples were also obtained at selected locations and depths. Samples collected were stored in moisture tight containers and returned to our Edmonton laboratory for classification and testing.

Of the fifty-five (55) boreholes advanced, fifteen (15) boreholes were completed with 25 mm diameter PVC standpipe piezometers to permit groundwater level monitoring. The groundwater levels are shown in **Table 3-4** in **Section 3.7** and on the Borehole Records in **Appendix C.**

The test pit program consisting of a total of eight (8) test pit excavations was carried out in conjunction with a preliminary archeology assessment. It is understood that a second phase of archeological field work is proposed, which will include relatively large tests pits advanced at selected locations throughout the site. Details regarding the findings of the preliminary archeological assessment and the next phase of proposed field work are reported under separate cover, however earthworks recommendations to remediate the archeology test pits are provided in **Section 4.6** of this report.

All eight (8) test pit excavations associated with the current investigation were backfilled with the same materials using minimal compactive effort using the excavator bucket. Therefore, these test pits will also require remediation during the construction process as described in more detail in **Section 4.6**.

2.2 LABORATORY TESTING

Laboratory testing was performed on selected samples, including:

- natural water content determinations
- Atterberg Limits (5 tests)
- grain size (hydrometer) analysis (5 tests)
- unconfined compressive strength testing (2 tests)
- water soluble sulphate content (3 tests)
- unit weight determination (2 tests)
- thermal resistivity testing, including dry out curve (3 tests).

The results of the laboratory testing are included in **Appendix D** and Borehole Records are provided in **Appendix C**, and discussed within the text of this report. Samples remaining after testing will be stored for a period of three (3) months after issuance of the final report. Samples will then be discarded after this period.

3.0 RESULTS OF THE INVESTIGATION

3.1 GENERAL

The soil and groundwater conditions encountered in the boreholes and test pits are described in detail on the Borehole and Test Pit Records with additional and supplementary information provided in this section. The Borehole and Test Pit Records, along with an explanation of the symbols and terms used in the descriptions, are provided in **Appendix C.**

The subsurface stratigraphy encountered at the borehole and test pit locations generally consisted of topsoil overlying clay fill over alluvial deposits consisting of interbedded clay, silt and sand layers over gravel and sand overlying bedrock. A summary of the subsurface conditions observed at the borehole and test pit locations are described in detail in the following sections. For the purpose of this report, we have separated the alluvial deposits into two distinct layers:

- upper alluvial deposits consisting of soft to firm clay and loose silt with loose sand layers
- lower alluvial deposits consisting of compact to very dense coarse grained sand and gravels.

The upper and lower alluvium are described in more detail in **Sections 3.4, 3.5, and 4.2.**

3.2 TOPSOIL

Topsoil was encountered at the surface in all borehole and test pits. The topsoil thickness ranged from 0.1 m to 0.6 m at the borehole and test pit locations. The topsoil thickness is expected to vary between borehole and test pit locations.

3.3 FILL

Fill typically consisting of lean clay to lean clay with sand, but also noted to contain clayey sand (BH17-18) was encountered in forty-eight (48) of the fifty-five (55) boreholes and two (2) of the eight (8) test pits. all but seven (7) (boreholes BH17-03, 17-11, 17-24, 17-32, 17-35, 17-44, and 17-52) of the fifty-five (55) boreholes advanced. Where encountered, the fill ranged in thickness from 0.5 m in BH17-30 to 2.5 m in BH17-12. The fill materials were commonly noted to contain organics and rootlets. Cobbles were also noted within the fill materials in TP17-04 and TP17-05. There are no construction records available for the existing fill, so the fill encountered is considered "uncontrolled fill" and the quality and thickness of fill is expected to vary across the site.

No additional laboratory testing was conducted on samples of the fill materials.

3.4 CLAY, SILT AND SAND (UPPER ALLUVIAL DEPOSITS)

Alluvial deposits of interbedded clay, silt and sand layers were encountered directly below the fill or below the topsoil in all the boreholes and test pits and extended to the compact to very dense sand and gravel with sand or bedrock. These upper alluvial deposits were typically fine grained dominated (clay and silt) and were soft to firm in consistency or loose in compactness condition. These clay and silt deposits were interbedded with loose sand layers. The soft to firm clay and loose silt, and sand layers extended to the compact to dense sand and gravel with sand deposits at depths in the range of 2.7 m to 8.8 m at the borehole locations.

The soil conditions encountered in the test pits were generally consistent with the soil conditions encountered in the boreholes. Cobbles ranging in size from 75 mm to 150 mm in diameter were encountered in TP17-07 at a depth of 2.3 m to 3.0 m within a sand with silt layer. It should be noted that the presence of cobbles has been confirmed on site in the test pits and cobbles may be present at locations between borehole and test pit locations.

Moisture content testing on the upper alluvial deposits indicated moisture contents ranging from 6% to 35%, with an average moisture of 16%. The results of Atterberg Limits test on five (5) samples of the upper alluvial deposits are summarized in **Table 3-1** below. Results of grain size (hydrometer) analyses on five (5) samples of the upper alluvial deposits are summarized in **Table 3-2**. Based on the laboratory test results and the USCS, the upper alluvium consisted of the following material types with varying sand content; lean clay (CL), low plastic silt (ML), silty clay (CL-ML) and silty sand (SM). In general, the laboratory test results are consistent with the field descriptions of a wide range of materials and compositions noted in the field.

Table 3-1 Results of Atterberg Limits – Upper Alluvial Deposits

Borehole & Sample Number	Depth (m)	Liquid Limit	Plastic Limit	Plasticity Index	Classification
BH17-03 – SS8	5.3 – 5.8	27	20	7	CL-ML
BH17-04A – SS6	3.7 – 4.2	27	23	4	ML
BH17-13 – ST8	5.2 – 5.8	30	15	15	CL
BH17-28 – ST4	2.3 – 2.7	39	19	20	CL
BH17-49 – SS4	2.4 – 2.9	31	18	13	CL

Table 3-2 Results of Grain Size Analysis – Upper Alluvial Deposits

Borehole & Sample Number	Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	Soil Classification
BH17-03 – SS8	5.3 – 5.8	0	31	56	13	Sandy silty CLAY (CL-ML)
BH17-04A – SS6	3.7 – 4.2	0	53	34	13	Silty SAND (SM)
BH17-13 – ST8	5.2 – 5.8	0	9	66	25	Lean CLAY (CL)
BH17-28 – ST4	2.3 – 2.7	0	24	54	22	Lean CLAY with Sand (CL)
BH17-49 – SS4	2.4 – 2.9	0	36	45	19	Sandy Lean CLAY (CL)

Two (2) unconfined compressive strength (UCS) tests and two (2) unit weight reports were conducted on Shelby tube samples of the upper alluvium. Results of the Shelby tube testing are summarized in **Table 3-3** below.

Table 3-3 Results of Shelby Tube Testing – Upper Alluvial Deposits

Borehole & Sample Number	Sample Depth (m)	Unconfined Compressive Strength (kPa)	Undrained Shear Strength (kPa)	Unit Weight (kN/m^3)	Type of Test
BH17-13 – ST8	5.2 – 5.8	80	40	17.3	UCS
BH17-28 – ST4	2.3 – 2.7	119	59	17.0	UCS

The majority of pocket penetrometer readings taken on samples of the cohesive soils typically ranged from 12 kPa to 50 kPa, with several lower and higher outlier values. In terms of relative consistency, based on Shelby tube tests, SPT N-values and pocket penetrometer tests, the upper alluvial deposits may generally be described as soft to firm with localized areas of stiff materials for cohesive materials (clay and plastic silt) and loose for non-cohesive materials (non-plastic silts and sands).

3.5 SAND AND GRAVEL (LOWER ALLUVIAL DEPOSITS)

Where encountered, alluvial deposits of sand, and gravel with sand were encountered directly below the upper alluvial deposits. The lower alluvium was encountered in fifty (50) of the fifty-five (55) boreholes, with the exception of boreholes BH17-12, 17-17, 17-33, 17-37, and 17-55. The lower alluvium extended to bedrock in nineteen (19) boreholes and extended beyond termination in twenty-nine (29) boreholes. These sand and gravel deposits are herein called the lower alluvial deposits and were coarse grained and compact to dense in relative compactness. The depth to the lower alluvial deposits varied across the site from 2.7 m to 8.8 m at the boreholes locations. Typically, shallow depths to the lower alluvial deposits means that the bedrock in turn is also relatively shallow in depth.

Moisture content determinations completed on samples of the coarse alluvium indicated moisture contents ranging from 2% to 17%, with an average moisture of 9%. No additional laboratory testing was carried out on samples of the coarse alluvium material. Results of SPTs conducted in the lower alluvial deposits indicated N-Values ranging from 10 to over 50, with an average value of 32, excluding values where refusal was encountered. In terms of relative compactness, the material is generally described as compact, with localized zones of dense to very dense.

3.6 SEDIMENTARY BEDROCK

Brown to grey sedimentary bedrock was encountered in twenty-two (22) boreholes at depths ranging between 2.8 m (BH17-27) and 11.0 m (BH17-01). The bedrock encountered was predominantly clay shale with interbedded sandstone and siltstone of the Edmonton Formation. Auger refusal was not encountered within the investigation depths of the boreholes where bedrock was encountered. SPTs completed within the bedrock generally had N-Values ranging from 15 to over 50, with an average value of 49 excluding values where refusal was encountered. SPTs were advanced mainly to obtain more representative samples of the bedrock and do not correlate directly to rock strength; however, the ability to penetrate the bedrock with augers and split spoons confirms the weak and weathered nature of the rock.

Generally, the bedrock was highly weathered and generally described as extremely weak to very weak rock. No bedrock coring was completed as part of the current work scope. Due to its weak and weathered nature, the bedrock encountered in the boreholes may be considered to have properties similar to a very stiff to hard soil matrix than sound bedrock, especially within the clay shale material, however it should be noted that stronger layers of sandstone may exist throughout the site.

3.7 GROUNDWATER

Groundwater levels were measured in the open boreholes at completion of drilling and the levels are provided on the borehole records and listed in **Table 3-4**. Sloughing (caving) conditions were also encountered in the open boreholes at completion of drilling. The sloughing conditions were noted on the borehole records.

At completion of drilling, standpipe piezometers were installed in fifteen (15) boreholes as listed below in Table 3-4. On June 28, 2017, approximately 11 days after drilling, measured groundwater levels varied from 3.1 m to 8.7 m below existing ground surface, with borehole BH17-06 being recorded as dry. The groundwater levels measured in the standpipes are shown in **Table 3-4** and provided on the Borehole Records in **Appendix C.**

Table 3-4 Summary of Measured Groundwater Levels

Borehole Number	Groundwater Level (mbgs) at Drilling Completion	Groundwater Level (mbgs) June 28, 2017
17-01	9.9	8.4
17-06	Dry	Dry
17-08	8.2	6.8
17-12	7.3	7.4
17-16	8.7	8.7
17-22	6.1	4.3
17-24	7.8	7.7
17-30	7.6	7.5
17-32	8.9	8.5
17-33	8.4	3.6
17-35	7.2	7.0
17-43	8.5	8.3
17-45	3.1	3.1
17-47	6.7	6.8
17-54	8.8	7.6

Note: mbgs = meter below ground surface

In general, groundwater levels are expected to vary from year to year and from season to season, and depend on many factors including surface and subsurface drainage, precipitation, and the hydrogeology of the area. Fluctuations in the groundwater levels should be anticipated. Due to the proximity of the site to the North Saskatchewan River and the coarse alluvial deposits encountered at the site, the groundwater levels across the site are expected to be hydraulically connected to the river levels and large groundwater level fluctuations may occur during river flood events.

3.8 CHEMICAL ANALYSIS TESTING

Water soluble sulphate testing (total sulphate ion content) was conducted on three (3) samples of the site materials. The testing was carried out by Maxxam Analytics International of Edmonton, Alberta. Results of the sulphate testing are presented below in **Table 3-5**.

Table 3-5 Results of Water Soluble Sulphate Testing

Borehole	Sample	Approximate Depth Range (m)	Water Soluble Sulphate in Soil (%)
17-07	SS4	2.4 – 2.9	<0.05[1]
17-22	SS4	2.4 – 2.9	<0.05[1]
17-49	SS8	5.3 – 5.8	<0.05[1]

Note:

1. The detectable limit for sulphates is 0.05%. All results were recorded below the detectable limit.

3.9 THERMAL RESISTIVITY TESTING

Thermal resistivity testing was conducted on three (3) samples of the near surface materials. The samples were shipped to Stantec's Dartmouth laboratory to conduct the testing. A memo outlining the procedures and test results are included in **Appendix E.**

3.10 ELECTRICAL RESISTIVITY TESTING

A field resistivity testing program was conducted across the site at five locations using the Wenner Four-Electrode Method. The testing was conducted to identify apparent resistivity values for the existing subsurface conditions at the specific locations. Apparent resistivity is a ratio between a known injected current and the measured voltage after traveling through variable soils. It is understood that apparent resistivity represents the general soil conditions present within that depth range at that spacing.

The scope of work included field electrical resistivity testing for five (5) long traverses at accessible areas within the site. The site location plan and the approximate traverse locations are shown in **Figure 3** in **Appendix B.** Our investigative procedures, site observations, and results of the field electrical resistivity measurements are presented in the following sections.

3.10.1 Electrical Resistivity – Investigative Procedure

The field work for this investigation was carried out on June 27 and 28, 2017. The traverses were located using a handheld GPS unit. The field electrical resistivity testing was completed in accordance with ASTM G57 – 06 (Standard Test Method for Field Measurement of Soil Resistivity Using the Wenner Four-Electrode Method) and IEEE STD 81™ (Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System). In this method, four electrodes are spaced at equal distances, current is sent through the soil via the outer two electrodes and the resulting voltage is measured across the inner electrodes. Spacing for the testing ranged from 0.25 m to 40 m. All electrodes were placed in the surface of the soil to a depth not exceeding 5% of the electrode spacing. Resistivity readings were taken using a SYSCAL Junior: 400V 4-Pin Resistance Meter.

A summary of site coordinates, test dates, range of temperatures over the testing period, configuration, and other general observations are summarized below in **Table 3-6**. The GPS coordinates provided in the table are at the center of the location tested.

Table 3-6 Test Locations for Resistivity Testing

Traverse	Approximate Center Point GPS 12U Coordinates		Test Date	Temperature (°C)		Notes
	Easting	Northing		Min.	Max.	
Traverse 1	0326538	5927528	June 27, 2017	18	20	Showers previous night
Traverse 2	0326589	5927344	June 27, 2017	15	18	Showers at end of work day
Traverse 3	0326763	5927378	June 28, 2017	18	20	N/A
Traverse 4	0326763	5927634	June 28, 2017	12	12	Light showers during probing and rainfall previous day
Traverse 5	0326684	5927827	June 28, 2017	15	18	Showers previous night

The surface topsoil varied in depth from 75 mm to 100 mm at the electrode locations. Surface organics and topsoil were temporarily pulled back at electrode locations to expose the native mineral soil subgrade and were replaced after the testing was completed. The maximum thickness of surface (topsoil) material removed was approximately 100 mm in depth. In general, the exposed subgrade was fine-grained in nature (silt and clay) and was noted to range between dry to moist moisture conditions.

3.10.2 Soil Resistivity Test Results

Measured apparent resistivity values in the subsurface soils at the traverse locations ranged from 14.6 ohm-m to 141.8 ohm-m. The values recorded are expected to represent the range of materials encountered at depth consisting of both fine-grained soils (silt and clay) and coarse grained soils (sand and gravel).

Soil resistivity values are variable and can depend on a range of properties of the soil, including moisture content, salt content and temperature.

Apparent resistivity results are expected to be representative of the subsurface profile specific to the traverse locations, at the probe spacing noted, for the temperature range and subsurface moisture conditions at the time of year tested. Temperature generally has minimal effect on soil resistivity above freezing levels; however, resistivity of the upper approximate 2 m to 3 m of soil may increase significantly seasonally due to freezing conditions. Similarly, periodic decrease in soil resistivity in the active zone (assumed to be approximately 2 m to 3 m) should be anticipated during increased moisture conditions such as immediately after spring thaw.

The measured field apparent resistivity versus electrode spacing at each test location are summarized in **Table 3-7.** Detailed field forms are provided in **Appendix F.**

Table 3-7 Measured Field Apparent Resistivity

Electrode Spacing (m)	Apparent Resistivity (ohm-m)										
	Traverse 1			Traverse 2		Traverse 3		Traverse 4		Traverse 5	
	E-W	N-S	NE-SW	E-W	N-S	E-W	N-S	E-W	N-S	E-W	N-S
0.25	64.2	79.1	86.6	47.0	58.8	70.5	61.7	91.0	98.0	83.9	57.3
0.5	39.9	40.3	50.4	47.2	46.1	59.0	69.5	77.8	65.0	53.1	58.1
1.0	39.5	40.5	40.7	38.5	45.1	59.0	70.4	78.1	76.2	52.3	61.0
2.0	49.6	48.5	46.9	52.0	53.8	68.2	71.8	96.4	92.9	72.3	63.1
3.0	59.4	60.6	60.7	73.6	70.2	82.9	76.2	99.0	103.4	84.6	79.5
5.0	83.8	70.4	106.6	93.8	91.4	82.7	78.8	110.0	108.9	102.2	99.1
10.0	111.5	96.9	111.7	123.9	122.5	70.8	71.2	133.9	131.2	141.8	120.3
15.0	98.4	90.7	98.4	130.8	116.7	57.1	66.1	123.1	120.8	134.6	118.4
20.0	73.8	82.3	68.5	114.0	97.8	44.0	51.7	97.2	101.0	104.0	101.6
25.0	45.0	64.5	43.7	98.1	75.8	33.4	38.6	77.4	80.7	75.3	78.0
30.0	29.7	45.9	26.4	94.4	57.8	27.2	29.0	56.0	65.1	60.1	61.0
40.0	14.6	22.4	14.7	88.3	31.4	18.8	18.1	32.0	41.1	38.1	36.3

4.0 DISCUSSION AND RECOMMENDATIONS

4.1 GEOTECHNICAL CONSIDERATIONS

It is understood that the development is still in the feasibility stages and preliminary design has not yet been completed. Based on similar projects, the development may include buried utilities, access roads, equipment pads and foundations for SPV panel arrays.

Based on the information obtained from the geotechnical investigation, the site soil and groundwater conditions are considered suitable for the proposed development, provided the recommendations outlined in this report are adhered to. Based on the soil conditions encountered in the boreholes and test pits, deep foundations (piles) are recommended for support of the proposed Solar Photovoltaic (SPV) panels. Competent soils at depth include the lower alluvial deposits consisting of compact to dense sand and gravel underlain by bedrock.

The upper alluvial deposits are relatively weak and compressible and as such, design of the development will need to consider the serviceability limit states of foundations and grade supported structures founded on or within this layer including deep foundations (piles).

Based on the results of the investigation, several issues of geotechnical concern are as follows:

- **Moderate to high frost susceptibility of the site soils:** Frost susceptibility is the tendency of the soil to grow ice lenses; resulting in soil expansion and heaving of foundations, leading to differential movements if the foundations are not designed to adequately resist these uplift forces. Due to local frost penetration depths and relatively light loading anticipated, resistance to uplift due to adfreeze may govern the foundation design.
- **Presence of seepage and sloughing soils (caving conditions)**: seepage and sloughing soils are considered potentially problematic for bored cast-in-place piles unless provisions such as full length casing are used for pile construction.
- **Presence of cobbles:** Cobbles were encountered in several test pits, which may be problematic to specific deep foundation types being considered such as torqued foundations (screw piles) and driven steel piles.
- **Sensitive, relatively weak and compressible nature of the upper alluvial deposits**: Soft to firm clays and silts and loose sand deposits were encountered in the upper profile across the site. The soils are sensitive to moisture and construction disturbance and as such subgrades should be protected. Due to the weak and compressible nature of the soft to firm clays and silts and loose sands, shallow foundations and grade supported structures that are sensitive to deformations are not recommended to be supported on these deposits. Also, due to the compressible nature of these deposits, any grade raises proposed across the site will result in relatively large elastic and consolidation settlements. For this reason, grade raises should only be considered with due consideration of the potential impacts to grade supported and underground infrastructure, including pile foundations. For pile foundations as an example, down drag load considerations and serviceability limit states (settlement) will need to be considered and accounted for in the pile design.

- **Varying depth to lower alluvial deposits:** Based on the borehole findings, the depth below ground surface to the lower alluvial deposits varied considerably across the site from 2.7 m to 8.8 m.
- **Varying depth to bedrock:** Based on the borehole findings, the depth below ground surface to bedrock varied considerably across the site from 2.8 m to deeper than 11 m. Although the bedrock was relatively weathered and weak in nature, shallow bedrock and strong layers within the bedrock could pose issues to achieving minimum embedment depths for piles, if proper equipment and construction methods are not utilized.
- **Test pit reinstatement:** Test pits were completed as part of the geotechnical and archelogy field investigations and it is understood that additional archelogy field work is proposed to further investigate the site. All test pits should be excavated safely following Occupational Health and Safety guidelines and should be reinstated with properly compacted engineered fill as outlined in **Sections 4.5** and **4.6,** to avoid adverse effects to the proposed development.

Feasibility of the various foundation options being considered for SPV panel support and related infrastructure, along with geotechnical recommendations, are provided in the following sections. A geotechnical engineer should be consulted to review the design as it progresses to verify that the geotechnical recommendations and assumptions provided in this report remain valid. Changes to our understanding of the proposed site grading and foundation loads and configuration could impact the design recommendations provided herein.

4.2 INTERPRETED SUBSURFACE CONDITONS

Due to the highly variable thicknesses, composition, and strengths of the alluvial deposits encountered in the boreholes and test pits, the site has been organized into three (3) zones. The zoning is shown graphically in **Figure 2, Appendix B. Table 4-1** summarizes the conditions in each of the three zones.

Table 4-1 Interpreted Soil and Bedrock Condition Zones

Zone	Thickness of Fill (m)	Thickness of Upper Alluvial Deposits (soft to firm clay and silt, and loose sands) (m)	Thickness [depth, mbgs(1)] of Lower Alluvial Deposits (compact to dense sands and gravels) (m)	Depth (mbgs(1)) to Bedrock (m)
1	0.8 – 1.0	1.7 – 4.9	0.0 – 3.2(2) [2.6 – 3.8 Depth]	2.8 – 5.9
2	0 – 2.0	4.4 – 7.2	1.0 – 4.1 [3.7 – 7.3 Depth]	7.2 – 8.8
3	0 – 2.5	5.3 – 8.4	0 – 3.1(3) [5.8 - >9 Depth]	>9(4)

Notes:

1. mbgs, metres below ground surface (existing)
2. Compact coarse grained materials (N>10) not encountered in boreholes BH17-17 and 17-33
3. Compact coarse grained materials (N>10) not encountered in boreholes BH17-12, 17-37, and 17-55
4. Bedrock encountered below ground surface at 10.2 m in borehole BH17-20 and 11.0 m in borehole BH17-1. Bedrock not encountered within investigation depths in remaining Zone 3 boreholes.

The zones have been interpreted based on the soil and bedrock conditions encountered in the boreholes and test pits. This information is provided to assist with the preliminary design and planning stages only and should not be relied on for detailed design, unless a geotechnical engineer has confirmed the assumptions and current understanding remain valid. It is recommended for borehole records to be reviewed at specific locations for design. Note that the stratigraphic interpretations provided in the above table and as shown graphically on **Figure 2, Appendix B** are approximate only and may vary between borehole and test pit locations.

4.3 FROST PENETRATION

The material on site has a moderate to high potential for frost heave in the presence of water and freezing temperatures. Although some upward movements will occur due to freezing, the more significant issue relates to the spring melt period. The thaw will release excess water which will cause a loss of subgrade strength and potential damage to supported structures if they have not been designed to account for weakened subgrade support.

The design frost penetration depth for foundations is estimated to be approximately 2.5 m at the site. It is noted that the seasonal frost penetration depth is expected to vary depending on surface cover, depth of the groundwater table, influence of surrounding infrastructure, and the return period considered. City of Edmonton specifications should be adhered to for deep utility installations such as water lines, as stricter frost cover requirements may apply.

For foundation elements installed shallower than the design frost penetration depth, consideration may be given to use of rigid, high strength, extruded polystyrene foam insulation as an alternative to soil cover. Appropriate insulation type should be chosen based on the design loading, deformation tolerance and exposure to chemicals. Considering viscoelastic behavior of insulation products, the compressive strength of the product should be at least three times the design bearing pressure (a factor of safety of 3 against long-term creep). Insulation requirements such as required thickness, extension length, and orientation will be dependent on the subgrade as well as foundation type, dimensions and burial depth. We can assist with insulation requirements during detailed design, if requested.

A minimum of 150 mm of void form or equivalent should be provided under all pile caps, grade beams, and skid-mounted equipment foundations to accommodate frost heave or heave resulting from seasonal moisture changes.

4.4 SITE GRADING AND PREPARATION

Following clearing and grubbing, all organic soil, loose or soft soil, uncontrolled fill, and any other deleterious materials must be removed from beneath the outline of proposed structures and traffic areas. Topsoil thickness was noted to vary throughout the site, ranging from 0.1 m to 0.6 m thick at the borehole and test pit locations and uncontrolled fill was noted to extend up to 2.5 m thick. Where excavation of unsuitable materials is carried out the existing subgrade should be graded to a slope shallower than five (5) horizontal to one (1) vertical (5H:1V) prior to placement of fill to reduce differential fill thickness and associated risk of unacceptable differential settlement. Within the development areas the exposed mineral soil should be scarified to a depth of 150 mm and moisture conditioned as appropriate for exposed subgrade type as outlined in **Section 4.5** and recompacted to 98% of Standard Proctor Maximum Dry Density (SPMDD).

Where construction is carried out during winter conditions, the subgrade should be protected from freezing. In addition, the subgrade should be protected from wetting or drying, both before and after the placement of granular base materials. Subgrade surfaces that are allowed to dry or become wet must be scarified, moisture conditioned, and recompacted.

The final subgrade surface on the site and within roadways should be carefully graded to prevent ponding and to direct water away from foundation areas. Further recommendations for backfill materials (types, re-use of site soils, moisture requirements, etc.) and compaction requirements are provided in **Section 4.5.**

Once the cut and fill operations to establish final subgrade elevations are complete, the entire subgrade should be proof rolled using a fully loaded tandem dump truck. Soft areas detected by the proof rolling should be sub-excavated and subgrade re-established using Engineered Fill. Inspection and testing services during subgrade preparation, proof rolling, soft area repairs and fill placement will be critical to ensure that recommendations are adhered to and subgrade performs as intended.

4.5 FILL MATERIALS AND COMPACTION REQUIREMENTS

Engineered Fill should consist of low to non-plastic, clean, mineral soil. The uncontrolled fill material and selected native alluvial deposits should be suitable for reuse as Engineered Fill with proper moisture conditioning. It should be noted that if significant organic materials are present within uncontrolled fills, the materials should not be used as Engineered Fills. Increased level of compactive effort and moisture conditioning should be anticipated when the silty-clay and silty sand/sandy silt native subgrade is reused as Engineered Fill. Drying or wetting of the site soils may also be required during periods of heavy rain, hot weather, or in the event excavated materials are allowed to dry excessively prior to reuse.

Engineered Fill should be placed in lifts to a maximum loose thickness of 300 mm. Thinner lifts may be required depending on the size and compactive effort of the equipment being used on site. Engineered Fill consisting of the native lean clay fill and lean clay alluvial deposits should be moisture conditioned to between optimum and 3% above optimum moisture content (ASTM D698) and compacted to a minimum of 98% of SPMDD. Engineered Fill consisting of the silty sand to sandy silt should be moisture conditioned to between ±2% of optimum moisture content and compacted to a minimum 98% of SPMDD.

Engineered Fill may also consist of imported clean, well graded, gravel. Engineered Fill consisting of granular soils should be moisture conditioned to within ±3% of optimum moisture content and compacted to a minimum of 98% of SPMDD. The use of granular Engineered Fill for repair of soft areas identified within the low permeable native clay subgrade may result in undesirable ponding and retention of water within the repaired areas. Soft area repairs using granular Engineered Fill should therefore be carried out with due consideration given to proper drainage of the repaired area.

Bedding materials for utilities should be specified and placed in accordance with the pipe design requirements and City of Edmonton or EPCOR standards. Utility trench backfill should consist of compacted Engineered Fill, similar to, or the same as, the excavated soils. Different abutting materials within the frost zone (upper 2.5 m) will require a frost taper to minimize differential frost heaving.

All imported fill materials should be tested and approved by a geotechnical engineer prior to delivery to the site.

4.6 TEST PITTING, EXCAVATIONS AND REINSTATEMENT

It is understood that additional excavations are proposed for an archeological investigation. Five (5) additional test pit excavations are planned with base areas ranging from 9 m^2 to 12 m^2 and depths extending from 2.3 m to 4.0 m below existing surface. So, including the eight (8) test pits (TP 17-01 to 17-08) already excavated as part of the current investigation, a total of thirteen (13) test pits should be reinstated as recommended below.

For the additional five (5) archeological test pits, the conditions are expected to consist of fill overlying soft to firm clay to loose silt with loose sand layers over the excavation depths. These conditions are generally classified as "soft, sandy, or loose soil" deposits as outlined in Part 32 of Alberta Occupational Health and Safety Regulations (OH&S). It is recommended that excavations are carried out using a maximum of 1H:1V slope extending to the base of the excavation following the recommendations provided in Part 32 of Alberta OH&S. All excavations should be monitored by geotechnical personnel on an on-going basis for signs of seepage, slumping and instability and should be flattened as required.

Control of surface water run-off will be required throughout the duration of the work. Prepared surfaces should be protected to minimize the amount of degradation during wet weather. We recommend sloping prepared surfaces at approximately 2% to direct water away from construction areas and sealing the surfaces of fill zones with a smooth-drum roller at the end of each work day to help keep water out.

Dewatering of excavations may be required if excavations extend below the groundwater table. Dewatering of excavations will be dependent upon weather conditions and the time of year of construction. Traditional trenching and sump techniques are expected to be sufficient for control of groundwater, if encountered. Unless drain rock is used for fill and excavation side slopes are sufficiently cut back or supported, it is recommended that the groundwater level be maintained a minimum of 0.5 m below excavation grade at all times.

It is expected that stockpiles of excavated materials will be kept a distance equal to the depth of the excavation away from the crest of slopes (i.e a 3 m deep excavation will require stockpiles to be kept 3 m from the crest of the slope).

Upon completion of the five (5) test pits, the excavations will need to be reinstated to grade. As there is a concern related to differential settlements between undisturbed materials adjacent to the excavations, it is recommended that materials are placed back into the excavation in a controlled manner under supervision of geotechnical personnel. If the excavations include shallow vertical side slopes or shored walls, they should be cut back and tapered to maximum 1H:1V or shallower slopes during reinstatement. Engineered fill should be placed in maximum 300 mm lifts and compacted to 98% of SPMDD. Silt and sand materials should be moisture conditioned to within ±2% of optimum moisture content while clay materials should be moisture conditioned to within optimum or +3% of optimum moisture.

All eight (8) tests pits already completed onsite for this current investigation should also be reinstated by completely removing the backfill and then following the recommendations described above.

The above recommendations have been provided assuming pile supported foundations are used for the proposed development. If grade supported structures are proposed overtop of the previously backfilled test pit areas, the design will need to take into consideration the state of the backfill and the size of the excavated area due to the potential to impact the performance of future grade supported structures.

4.7 PHOTOVOLTAIC ARRAY FOUNDATIONS

It is understood that foundation support options typically considered for solar panel structures include: shallow foundations using pre-cast ballast; and deep foundations using augered, driven, and torqued installation methods. It is understood that axial loading under Ultimate Limit States (ULS) conditions will be relatively low, and that Serviceability Limit States (SLS) from lateral loads and overturning moments (due to wind and snow), as well as uplift due to adfreeze are likely to govern design of foundations. Also, depending on the final site grades, SLS will also have to reviewed for all foundations types considering the high compressibility of the upper alluvial deposits and potential for downdrag if pile foundations are utilized.

A summary of recommended soil parameters for foundation design are presented in **Table 4-2**. It is noted that the following soil parameters are unfactored. From the Canadian Foundation Engineering Manual 4th Edition (CFEM) the recommended geotechnical resistance factors for deep foundations are included in **Table 4-3**.

Table 4-2 Average Soil Parameters (Unfactored)

Parameters	Upper Alluvial Deposits (Soft to Firm Clay and Loose Silt and Sand)	Lower Alluvial Deposits (Compact to Dense Sand and Gravel)	Bedrock
Total Unit Weight (kN/m³)	17.5	19	20
Effective Unit Weight (kN/m³)	7.7	9.2	10.2
Undrained Shear Strength (kPa)	20[1]	N/A	150
Effective Cohesion c' (kPa)	0 to 5[2]	0	0
Effective Angle of Internal Friction, ϕ' (°)	27	33	N/A

Notes:

[1] Undrained shear strength has been provided for the clay alluvium material. The borehole records should be reviewed to confirm the soil conditions present at the foundation location to confirm the appropriate parameters are applied.

[2] Based on the variability of clay content within the encountered materials, a range of effective cohesion can be expected.

Table 4-3 Geotechnical Resistance Factors

Description	Resistance Factor, Φ
Deep foundation	
Resistance to axial load	
Semi-empirical analysis using laboratory and in-situ test data	0.4
Uplift resistance by semi-empirical analysis	0.3
Horizontal load resistance	0.5

For design purposes, the following design recommendations and limitations of each foundation alternative should be considered when selecting the appropriate foundation type. Further detailed design and construction recommendations can be provided during the detailed design stage once the loading conditions are known and the preferred foundation type is selected and the design has been reviewed by a geotechnical engineer to confirm the assumptions within this report remain valid.

4.7.1 Torqued Foundations (Helical Piles or Ground Screws)

Torqued foundation types include ground screws and helical piles. Both ground screws and helical piles consist of a steel shaft (typically cylindrical) with steel plates or fins and are advanced into the ground by a torque drive head. Ground screws typically consist of a continuous spiral ridge (fins) extending from the tip of the shaft up to a point below the top of the shaft. Helical piles typically consist of one or more individual helical plates welded onto the steel shaft. Similar to augered and driven foundations, torqued foundations are designed to resist ULS and SLS loads on the basis of the shaft and toe resistances. Although both torqued foundation types may be feasible, ground screws are similar to straight shaft augered and driven steel piles, as they resist uplift primarily from shaft resistance. Therefore, ground screws are likely to encounter similar concerns with requiring longer pile lengths to adequately resist adfreeze.

The advantage of using helical piles is that the steel helix typically protrudes sufficiently out from the diameter of the pile shaft to develop bearing resistance, both in compression and in tension (uplift). The helices therefore reduce the required pile lengths while providing the required capacity.

Helical piles are expected to be the most suitable foundation type for support of the solar panel structures at this site. High capacity piles with shaft sizes up to 0.4 m and helix diameters approximately double the shaft diameters are available in Western Canada. Ultimate compressive pile capacities in excess of 1000 kN have been achieved using helical piles. Actual pile size and helix details vary from contractor to contractor.

4.7.1.1 Helical Pile Design Considerations

Design recommendations for helical piles should come from an experienced helical pile contractor based on review of the soil data presented in this report. For design, the recommendations in **Table 4-4** can be used.

Table 4-4 Helical Pile Design Bearing Capacity Factors

Parameters	Upper Alluvial Deposits (Soft to Firm Clay, Loose Silt and Sand) (m)	Lower Alluvial Deposits (Compact to Dense Sand and Gravels) (m)	Bedrock
N_c	5.1[1] 24[2]	39	5.1
N_q	1[1] 13[2]	26	1
N_γ	0[1] 5.3[2]	14	0

Notes:

1. Undrained bearing capacity factors have been provided for the clay alluvium materials. The borehole records should be reviewed to confirm the soil conditions present at the specific location to confirm the appropriate parameters are applied.
2. Drained bearing capacity factors have been provided for the silt and sand loose alluvium materials. The borehole records should be reviewed to confirm the soil conditions present at the specific locations to confirm the appropriate parameters are applied.

While helical piles are considered to be the most feasible foundation option for the site, the following items should be addressed by the helical pile contractor/designer:

- Based on the results of our investigation, the site is underlain by a soft to firm clay, loose silt and sand alluvium transitioning to compact to dense alluvium and underlain by bedrock.
- Cobbles were encountered in three (3) test pits advanced for this investigation. Cobbles and boulders are not uncommon in alluvial deposits. If encountered, these large particles can lead to early refusal or helix damage; an allowance should be made for pre-drilling through or removal of these obstructions to achieve the target penetration depths for piles.
- The depth to and thickness of the lower alluvial deposits varies considerably across the site. Designers can reference the zoning summaries provided in **Figure 2** for planning purposes, however, the borehole records in **Appendix C** should be reviewed for design and construction planning to ensure the most appropriate parameters and equipment are used at each pile location.
- Potential for early refusal on bedrock presents the greatest risk to successful helical pile installations in shallow bedrock areas or areas with dense to very dense gravel deposits. It is recommended that a pile verification program is carried out to ensure minimum embedment depths can be achieved across the site at various locations within the three zones (Zones 1, 2 and 3).
- Geotechnical axial compressive and tensile resistance factors of 0.4 and 0.3, respectively, should be used in design unless load testing of proposed helical pile is completed in advance of production piling.
- Shaft resistance should be neglected within the frost zone (upper 2.5 m).

- Any gaps around the shaft after installation should be filled with sand or cementitious grout.
- Should installations be scheduled to occur when the subgrade is frozen, an allowance should be made for pre-drilling through frost and backfilling annulus with sand or cementitious grout.
- The penetration rate of a helical pile as it is rotated into the ground should be equal to the pitch of the helix plate. The spacing between the helix plates should be in even multiples of the pitch, such that the paths travelled by upper helices are coincidental with the path of the lower-most helix.
- Monitoring of the pile installation by qualified personnel is recommended to confirm that the helical piles are installed in accordance with acceptable installation procedures. To provide an indication of the vertical load resistance, the monitoring should include measurement and recording of the torques applied during installation of each pile.
- The use of torque measurement as the sole basis for design is not recommended since there can be considerable differences between the actual load resistances and those derived from empirical relationships between torque and pile resistances. Design should also consider design methodologies provided in the Canadian Foundation Engineering Manual (CFEM) 4th Edition, Section 18.2.1.4.
- The design depth of the helical piles should take into account that the piles are supporting unheated elements and should account for the uplift forces from adfreeze on the piles.
- Design of piles should also take into consideration any downdrag forces and settlement influences (serviceability limit states) on piles for the case of grade increases resulting in consolidation of the upper alluvial deposits.

4.7.1.2 Helical Pile Installation Verification Program

Based on our current understanding and results of the investigation, helical piles are expected to be the most feasible foundation type for the proposed development. Inspections from qualified geotechnical personnel during foundation construction is recommended to confirm that foundations are constructed in accordance with design assumptions and requirements. In order to confirm that helical piles can be successfully installed to target installation depths, a helical pile installation verification program is recommended. As a secondary benefit, the program could also include pile load testing to identify soil response to loading and assist with design optimization. Given the large number of piles associated with solar grid developments coupled with the highly variable subsurface conditions across the site, well documented proven pile installations will greatly reduce design and construction uncertainties; thereby reducing construction risks and associated costs.

Details for a proposed test piling program such as equipment and testing procedures can be provided if required for design and planning during later stages of the project.

4.7.2 Augered Foundations

4.7.2.1 Concrete Cast-In-Place

Augered deep foundations such as grouted posts, micropiles, and bored cast-in-place concrete piles are drilled into the ground using auger boring techniques. Upon reaching required design depth the auger is retracted from the hole and the hole is then concreted or grouted in place. As sloughing and seepage conditions were observed in the boreholes, full length casing is expected to be required and should be on hand during foundation installation. The augered foundations may be designed to resist ULS and SLS loading based on the shaft and toe resistances provided in **Table 4-5**. The base of the augered foundations should be founded sufficiently below frost depth to resist uplift due to adfreeze. It should be noted that factored ULS values are based on the assumption that the piles are a minimum of three (3) pile diameters apart. If the piles are spaced closer, group effects should be considered in the detailed design.

Design of augered foundations should consider uplift forces due to an assumed adfreeze stress of 65 kPa developing between the concreted or grouted foundation and the adjacent frozen soil. The adfreeze stress can be assumed to act over the embedded circumference of the foundation shaft for the extent of the frost penetration depth (approximately 2.5 m in the local area). When determining the required embedded shaft length under frost conditions, the weight of the foundation, the unfactored dead loads on the foundation, and the resistance from the portion of the shaft embedded in the soil below the frost zone should be considered in the calculation.

Table 4-5 Augered Foundation Design Criteria at ULS (Factored)

Material and Depth[1]	**Factored Shaft Resistance (kPa)**	**Factored Toe Resistance (kPa)**
Frost Zone (Upper 2.5 m)	0	N/A
Uncontrolled Fill	0	N/A
Engineered Fill and Upper Alluvial Deposits (Soft to Firm Clay, Loose Silt and Sand)	8	56[3]
Lower Alluvial Deposits (Compact to Dense Sand and Gravel)	25	N/A[4]
Bedrock[2]	25	420

Notes:

[1] Lateral and vertical extent of the alluvial deposits varies across the Site. Refer to the borehole logs and site zoning map for the material depths at pile locations as referenced in **Section 3.1**.

[2] Bedrock condition and depth is expected to be variable and must be confirmed during construction by the geotechnical engineer.

[3] Toe resistance provided for upper alluvium for locations where lower alluvium and bedrock not encountered. Refer to the borehole records for these locations.

[4] Due to sloughing and potential disturbance to the bearing surface, it is not recommended that augered piles are terminated in the compact to very dense lower alluvium as it will be difficult to ensure the base of the pile has been cleaned sufficiently to provide a competent bearing surface.

Designers should review the pile resistances along with the site zoning outlined in **Section 4.2** to ensure that the correct thickness of layer is applied at each piling location. To achieve the shaft and toe resistance values shown in **Table 4-5**, the sides and base of the pile boring must be free of water and loose or remolded material prior to placing concrete. Inspection by qualified geotechnical personnel during piling is required to ensure that the recommended values are obtained. The inspection must also include assurance that the as-built pile installations are in accordance with pile designs as approved by the geotechnical and structural engineers.

Sloughing and seepage were noted during drilling; therefore, it is recommended that the piling contractor have full length casing on site. The piles should be concreted immediately following inspection, to reduce potential for sloughing or accumulation of seepage. Based on sloughing within the alluvial deposits, casing into competent bedrock, casing extending to full pile depth, dewatering and/or use of tremie methods may be required.

Serviceability Limit State (SLS) for pile foundations have not been checked, as loads have not been provided at the time of report issue. To determine the reactions for the Serviceability Limits States (SLS) the pile loadings, configurations and the settlement criteria are required. Once this data is available, the SLS reactions can be calculated, if requested.

Although generally suitable for support of the solar panel structures, the primary concern with straight shaft augered foundations is the low strength of the upper alluvial deposits. The low strength corresponds to a lower shaft and toe resistance, and will likely require increased pile lengths to obtain adequate resistance to uplift forces due to adfreeze. As the depth to the lower alluvial deposits and bedrock varies throughout the site the use of straight shaft augered piles will likely require different designs for different areas of the site. The variable pile lengths may correspond to an increased cost of detailed foundation design and pile installation.

4.7.2.2 Continuous Flight Auger Piles

Continuous Flight Auger (CFA) concrete piles may be considered a feasible foundation type at this site to support moderate to heavy foundation loads.

Continuous flight auger concrete piles may be designed to resist static axial compressive loads on the basis of the unfactored shaft resistance parameters at Ultimate Limits States (ULS). Proper cleaning of the base cannot be confirmed during installation using the CFA piling method and bearing condition can be a function of construction technique and existing soil conditions. Consequently, increased settlement may occur due to disturbance at the base of the pile. Therefore, unfactored toe resistance should not be considered in the pile design unless adequate load testing is completed or the contractor has proven experience in the area with the proposed installation method.

For preliminary foundation design the design method for shaft resistance of drilled cast-in-place piles may be used. Resistances may be adopted for detailed design provided a geotechnical engineer has been given an opportunity to review the design and the assumptions included within this report remain valid. A local piling contractor experienced in the design and use of this pile type should be consulted to determine their feasibility within the site. CFA concrete piles are proprietary foundation systems and specialized contractors would design the piles and propose design loads to be approved by the projects' structural and geotechnical engineers. It should be noted that the ULS values are based on the assumption that the piles are a minimum of 3 pile diameters apart. If the piles are spaced closer, group effects may reduce the resistance.

4.7.3 Driven Foundations

Driven steel piles may consist of driving a steel H-beam or pipe sections into the ground using impact hammers. As the pile is installed by being driven into the ground surface, the existing soil is displaced and stiffens as a result. For design of steel piles against frost heave, design should consider an assumed 100 kPa adfreeze stress acting over the embedded surface area of the foundation shaft for the extent of the frost penetration depth (approximately 2.5 m in the local area).

Driven steel piles may be designed to resist static axial compressive loads on the basis of the factored shaft resistance and factored toe resistance parameters at ULS. The factored pile design parameters are provided in **Table 4-6.** It should be noted that factored ULS values are based on the assumption that the piles are a minimum of three (3) pile diameters apart. If the piles are spaced closer, group effects should be considered in the detailed design.

Selection of pile size should consider design loads, soils resistance, material availability, and local experience. It is recommended that the contractor confirm successful nearby local driven pile experience for similar pile lengths, sizes and loads proposed.

Table 4-6 Driven Steel Pile Design Criteria at ULS (Factored)

Material and Depth[1]	Factored Shaft Resistance (kPa)	Factored Toe Resistance (kPa)
Frost Zone (Upper 2.5 m)	0	N/A
Uncontrolled Fill	0	N/A
Engineered Fill and Upper Alluvial Deposits (Soft to Firm Clay, Loose Silt and Sand)	8	56[3]
Lower Alluvial Deposits (Compact to Dense Sand and Gravel)	35[4]	600[4]
Bedrock	25[4]	420[4]

Notes:

1. Lateral and vertical extent of the materials varies across the Site. Refer to the borehole logs and site zoning map for the material depths at pile locations.
2. Bedrock condition and depth is expected to be variable and must be confirmed during construction by geotechnical engineer's field representative.
3. Toe resistance provided for upper alluvial deposits. Refer to the borehole records for these locations.
4. Compact alluvium and bedrock were not encountered within investigation depths in several boreholes and shaft and toe resistances provided above should only be used when conditions have been confirmed with the borehole logs and the target depth in this stratum can be confirmed.

Driven steel piles are considered to be suitable for use at this site. Similar concerns with increased pile lengths due to the variability of the lower alluvial deposits and bedrock depths as discussed above in **Section 4.7.2** will also apply to the driven steel piles.

The required depth for driven piles will depend on the design loads; however, piles should terminate on the lower alluvial deposits or bedrock. The pile design should be suitable to resist uplift due to expansion or adfreeze (see **Section 4.3**).

Recommended parameters provided in **Table 4-6** are for calculations of pile capacity versus embedment length. Designers should review the pile resistances along with the site zoning outlined in **Section 4.2** to ensure that the correct depth and thickness of each layer is applied at each piling location. Actual pile capacities and pile lengths should be confirmed in the field through pile driving monitoring by qualified geotechnical personnel.

To determine the reactions for the Serviceability Limit State (SLS) the pile loadings, configurations and the settlement criteria are required. Once this data is available, the SLS reactions can be calculated, if requested.

4.7.3.1 Additional Driven Steel Pile Considerations

It is noted that cobbles were identified within test pits and that harder sandstone stringers may be encountered within the clay shale bedrock. These potential pile-driving obstructions can result in refusal of piles before reaching target embedment and/or pile damage. Consideration should be given to use driving shoes/points to prevent damage to the pile toe. If used, driving shoes should be fitted flush to the outside of the pipe piles so that shaft resistance is not compromised. If piles are terminated prior to reaching minimum design depth, these piles should be cut off below ground level and replacement piles installed.

All piles for a given structure should be driven into the same stratum and to similar depth, to reduce the potential for differential movements between piles.

The elevation of the tops of driven piles should be recorded immediately after driving. This will allow checks for heave due to driving of adjacent piles. If uplift of 6 mm or greater occurs during driving of adjacent piles the displaced pile should be re-driven to at least its original embedment depth and final set. Piles should be checked during installation to ensure the vertical piles are within 2% of plumb.

Voids created near the ground surface during driving or from predrilling should be backfilled with free-flowing silica sand or grout to maintain required contact between the pile and surrounding soil to provide resistance to vertical and lateral loads. If pile installation is to occur during winter conditions, pre-drilling pilot holes through the frost may be required to avoid pile damage. Pre-drilling of driven piles may also be required for removal of an obstruction, or for ease of pile placement. Pre-drilling of driven piles will reduce shaft resistance, lateral resistance and in some cases end bearing. Pre-drilling through the frost depth (see **Section 4.3**) may be completed without adversely affecting pile capacities calculated using parameters identified above, provided voids are filled. Where possible, it is advised that pre-drilled holes be filled with sand prior to placing and driving piles to ensure good contact between pile and soil. If required, pre-drilled pilot holes should not exceed 100% of the pile diameter. The geotechnical engineer should be contacted for review and approval of any intended pre-drilling in excess of the pile diameter or in excess of frost depth.

4.7.4 Pre-Cast Concrete Ballast Block

Shallow foundations used for solar panel structures typically consist of pre-cast concrete ballast blocks installed at-grade. The ballast blocks would be designed to resist lateral loads and bending moments; and are also expected to satisfy axial loading. Pre-cast concrete ballast blocks may be suitable for use; however, the primary concern with this foundation type is the potential for differential movements due to frost heave. Also, if any raise in grade is proposed, significant time dependent consolidation settlements are also expected to occur which would likely exceed the SLS settlement limits.

Based on the results of the investigation and our experience with similar conditions, approximately 50 mm to 150 mm of seasonal differential movement may be expected to occur due to frost heave of the in-situ soils. Use of insulation may be considered to protect against these potential differential movements; however due to the large number of solar panels within close proximity, insulation will likely span over the entire site footprint and is not expected to be practical or economical.

Due to concerns with differential movements from frost heave for shallow foundations coupled with the weak and compressible nature of the upper alluvial deposits, pre-cast concrete ballast blocks (shallow foundations) are not considered the preferred foundation type for the existing site conditions.

4.8 CORROSIVITY OF BURIED STEEL IN CONTACT WITH SITE SOILS

Results of soil property analyses carried out on the site soils is provided in **Sections 3.8** and **3.10** for structural integrity considerations by designers for buried elements.

Published rates of corrosion for buried steel elements in contact with soil are primarily related to the soils' electrical resistivity, but other factors including pH, chemical composition, sulphate-reducing bacteria, and availability of free oxygen have also been connected with the rate of corrosion in soil. Many correlations exist to relate these factors to corrosion severity, corrosion loss, and protection requirements for various buried steel elements; however, the appropriate correlation to apply will depend on the type of steel design element, client or regulatory requirements, and/or considerations by the designer for the loading and design life of the structure.

In the absence of client or regulatory requirements we revert to the Canadian Foundation Engineering Manual 4th Edition (CFEM). As identified in Section 19.4.2 of CFEM, experience indicates that corrosion is seldom a problem for steel piles driven into natural soil. This has been corroborated by detailed design studies documented in the National Bureau of Standards Monograph 127 (NBS127). Findings reported in NBS127 indicated that soil properties such as type, drainage, resistivity, pH, or chemical composition are of no practical value in determining corrosiveness of steel pilings driven into natural soils. However, in fill at or above the groundwater table moderate corrosion may occur. For consideration of corrosion rates on steel piling in fill soils at or above the groundwater table, CFEM indicates it is typically common to increase the thickness of steel H-Pile sections by 1.5 mm to provide allowance for corrosion. In the 7th Edition of Foundation Design and Construction Practice by M.J. Tomlinson (2001), it is reported that for fresh water conditions corrosion rates in disturbed (fill) soils can be in the range of 0.01 to 0.08 mm/year due to oxygen present. These rates are considered representative for the conditions that exists at the site, designers may need to consider higher rates of corrosion for near surface or above surface steel exposure depending on the prevalent corrosive environment that may be applicable post-development.

4.9 INVERTERS AND TRANSFORMER SKIDS

No design details, such as proposed size and loads, have been provided for the inverters and transformer skids. Based on our experience with similar projects, these structures are typically founded on slabs-on-grade at or close to existing grade. While slabs-on-grade may be feasible for this site, potential issues related to frost heave, uncontrolled fill, soft and loose soils and settlements due to increase in grades all need to be considered. Alternatively, if grade supported slabs are deemed not feasible, the inverters and transformer skids can be founded on pile foundations.

The following recommendations assume that grade supported slabs are feasible. Changes in site grades may impact the geotechnical recommendations and a geotechnical engineer should be consulted to review the detailed design to confirm slabs remain feasible.

Any organic soil, loose or soft soil, uncontrolled fill and deleterious materials must be removed from beneath the footprint of the proposed slabs-on-grades. The area of stripping and removals should extend a minimum of 1.2 m beyond the perimeter of the slabs-on-grade. Following stripping, the exposed subgrade surface should be prepared by scarifying to a depth of 200 mm and moisture conditioning within the range of -1% to +2% of optimum (optimum to be measured in accordance with ASTM D698), and compacted to a minimum of 98% of Standard Proctor Maximum Dry Density (SPMDD).

Following preparation, the exposed subgrade should be proof-rolled under the supervision of geotechnical personnel. Soft areas encountered during proof-rolling should be sub-excavated to competent material and replaced with approved Engineered Fill similar to the existing upper alluvium subgrade.

If the inverter and transformer skids cannot accommodate the seasonal movement outlined in **Section 4.3**, frost resistant designs will need to be considered. As an alternative to burying the foundations below frost, consideration may be given to placing the slabs-on-grade on an elevated gravel pad, using a minimum 300 mm thick layer of 25 mm minus Crushed Granular Base. A layer of extruded polystyrene rigid insulation buried below the subgrade for the slabs could be used to provide an equivalent soil cover for frost protection as outlined in **Section 4.3**. Stantec can provide further recommendations for the type, thickness, and area of rigid insulation during detailed design stages, if required.

To protect against potential moisture changes in the soil (resulting in swelling or shrinking), positive grading away from the footprint of the slabs-on-grade must be maintained both during and after construction. The Crushed Granular Base layer should be sloped down and away from the perimeter of the slabs-on-grade at a minimum 2% gradient wherever possible. Ponded water within the footprints of the slabs-on-grade should be promptly removed to prevent surface water infiltration and changes in soil moisture.

Elastic response of the subgrade is commonly evaluated using a modulus of subgrade reaction. Typical values of the modulus of vertical subgrade reaction for a 1 ft^2 plate (300 mm by 300 mm), k_{v1}, are about 5 MPa/m for subgrades consisting of the native soft/loose clay and silt subgrade. The modulus of subgrade reaction is not an intrinsic property. The values of modulus of subgrade reaction provided above are estimates based on the current geotechnical data and are meant to cover average conditions for the site. Actual modulus values change with rigidity and contact area of the slab. If requested, Stantec can determine representative modulus values during detailed design based on predicted settlement for specific foundation rigidity, loading conditions and contact area.

4.10 SEISMIC CONSIDERATIONS

The 2010 NBCC seismic design procedures are based on ground motion parameters (e.g., peak ground acceleration (PGA) and spectral acceleration, Sa values) having a 2% probability of exceedance in 50 years; i.e., the 2,475 year return period earthquake event.

Based on the results of the Stantec field investigation, it is appropriate to classify the existing ground conditions at the subject site as a Class E Site, in accordance with the 2010 NBCC (Table 4.1.8.4.A).

4.11 GRAVEL SURFACED ACCESS ROAD

The subgrade for the gravel surfaced access road should be prepared as described in **Section 4.4.** Actual traffic frequency, axle loading, and maintenance plans are not known at this time; however, based on expected infrequent traffic consisting of service vehicles, the recommended structure for the gravel surfaced access road is provided in **Table 4-7** below. As the subgrade conditions across the site are expected to consist of relatively soft to firm clays and loose silts and sands, ongoing maintenance to the roadways may be required during construction. Maintenance may include soft spot repair and placing and compacting of additional gravel to repair rutting.

If the access roads will be subject to frequent heavy loading throughout its service life, a more robust structure may be required and can be provided once traffic loading details and final grading is determined.

Table 4-7 Gravel Road Design – Infrequent Traffic (Low Volume)

Material	Thickness (mm)
25 mm Gravel Surfacing AT Designation 4, Class 25	100
80 mm Gravel Base AT Designation 6 Class 80	300
Total	**400**

The final subgrade surface within the roadway should be carefully graded in order to prevent ponding and to direct water toward the shoulders of the roadway. Recommended minimum grades of 2% should be used where possible.

Periodic maintenance of the gravel road will be required. During and immediately following prolonged precipitation events and during spring thaw, it should be anticipated that the proposed structure may require increased maintenance.

4.12 CONCRETE

Three (3) tests were conducted on selected soil samples to determine the water soluble sulphate (total sulphate ion) content of site soils. The sulphate concentrations were all reported below the detectable limit of 0.05%. Based on these values, the degree of exposure is below moderate (below Class S-3). Therefore, Type GU or GUb cement may be used for concrete in contact with existing site soils.

Air entrainment to the requirements CSA A23.1-09 should be specified for all concrete in contact with freezing temperatures. Slabs that will receive a surface hardener should not be air entrained. Stricter specifications may be required for structural requirements, other exposure conditions, or other considerations.

5.0 CLOSURE

This report has been prepared for the sole benefit of EPCOR Water Services Inc. (EPCOR) and its agents, and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and EPCOR Canada.

Any use, which a third party makes of this report, is the responsibility of such third party. Use of this report is subject to the Statement of General Conditions provided in **Appendix A.** It is the responsibility of EPCOR Canada, who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec should any of these not be satisfied. The Statement of General Conditions addresses the following:

- use of the report
- basis of the report
- standard of care
- interpretation of site conditions
- varying or unexpected site conditions
- planning, design or construction

We trust the above information meets with your present requirements. Should you have any questions or require further information, please contact us. This report has been prepared by Jason Warners, P.Eng., and Patrick Doyle, P.Eng., and reviewed by Bernie Mills, M.Sc.E, P.Eng.

Yours truly,

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APEGA PERMIT No.: P0258

APPENDIX A:
STATEMENT OF GENERAL CONDITIONS

E.L. SMITH WATER TREATMENT PLANT – SOLAR FARM GEOTECHNICAL INVESTIGATION

FINAL
October 2, 2017

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec's present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behaviour. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec will not be responsible to any party for damages incurred as a result of failing to notify Stantec that differing site or sub-surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec, sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec cannot be responsible for site work carried out without being present.

APPENDIX B:
FIGURES

\\Cd1001-c200\workgroup\1102\active\110219883\gis\figures\bh_tp_locs\fig_1_borehole_testpit_locations.mxd Revised: 2017-09-21 By: mkuhl

▭ Project Area
⊕ Borehole Location
⊞ Test Pit Location
▭ Quarter Section

0 100 200 metres
1:5,000 (at original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2015.
4. Locations surveyed using a handheld GPS with a known accuracy of ±5 m.
   Locations shown on the figures are approximate.

Stantec

Project Location
SE¼ 09-52-25 W4M, SW¼ 10-52-25 W4M
NW¼ 03-52-25 W4M
Edmonton, Alberta

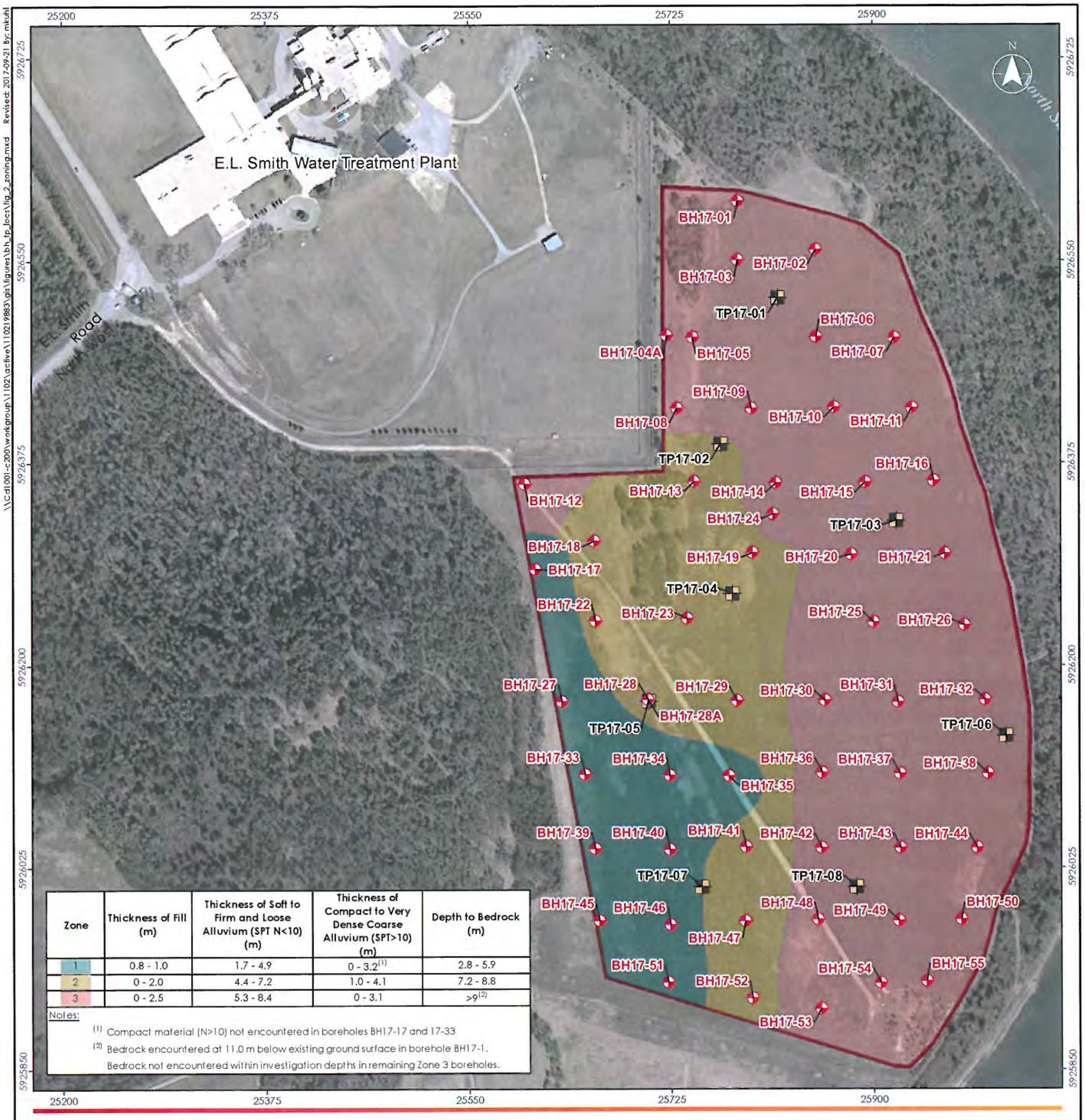
110219883
Prepared by MK on 2017-07-25
Quality Review by LF on 2017-08-14
Approved by DRAFT on 2017-08-xx

Client/Project
EPCOR
Geotechnical Program for the EPCOR E.L. Smith Water Treatment Plant Solar Project

Figure No.
1

Title
Borehole and Test Pit Locations

\\Cd1001-c200\workgroup\1102\active\110219883\gis\figures\bh_tp_locs\fig_2_zoning.mxd Revised: 2017-09-21 By: mkuhl



Zone	Thickness of Fill (m)	Thickness of Soft to Firm and Loose Alluvium (SPT N<10) (m)	Thickness of Compact to Very Dense Coarse Alluvium (SPT>10) (m)	Depth to Bedrock (m)
1	0.8 - 1.0	1.7 - 4.9	0 - 3.2[1]	2.8 - 5.9
2	0 - 2.0	4.4 - 7.2	1.0 - 4.1	7.2 - 8.8
3	0 - 2.5	5.3 - 8.4	0 - 3.1	>9[2]

Notes:

[1] Compact material (N>10) not encountered in boreholes BH17-17 and 17-33

[2] Bedrock encountered at 11.0 m below existing ground surface in borehole BH17-1. Bedrock not encountered within investigation depths in remaining Zone 3 boreholes.

Project Area

Borehole Location

Test Pit Location

Zoning For Use in Foundation Design

Zone 1

Zone 2

Zone 3

0 100 200 metres

1:5,000 (at original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2015.
4. Zones have been interpreted based on the conditions encountered in the boreholes. Thicknesses of materials and depth to bedrock may vary between borehole and test pit locations and are approximate.
5. This plan is for information only and is not intended to be used for design. The borehole and test pit logs should be reviewed along with this figure to determine the conditions at the borehole and test pit locations.
6. All intervals notes in metres below grounds surface (m BGS)
7. Locations surveyed using a handheld GPS with a known accuracy of ±5 m. Locations shown on the figures are approximate.

Disclaimer: Stantec assumes no responsibility for data supplied in electronic format. The recipient accepts full responsibility for verifying the accuracy and completeness of the data. The recipient releases Stantec, its officers, employees, consultants and agents, from any and all claims arising in any way from the content or provision of the data.

Stantec

Project Location
SE¼ 09-52-25 W4M, SW¼ 10-52-25 W4M
NW¼ 03-52-25 W4M
Edmonton, Alberta

110219883
Prepared by MK on 2017-08-04
Quality Review by LF on 2017-08-14
Approved by DRAFT on 2017-08-xx

Client/Project
EPCOR
Geotechnical Program for the EPCOR E.L. Smith Water Treatment Plant Solar Project

Figure No.
2

Title
Zoning For Use in Foundation Design

\\Cd1001-c200\workgroup\1102\active\110219883\gis\figures\bh_tp_locs\fig_3_resistivity_testing_locs.mxd Revised: 2017-09-21 By: mkuhl

▭ Project Area

⊕ Resistivity Testing Location

0 100 200 metres

1:5,000 (at original document size of 8.5x11)

Notes

1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, 2015.
4. Locations surveyed using a handheld GPS with a known accuracy of ±5 m.
   Locations shown on the figures are approximate.

Stantec

Project Location SE¼ 09-52-25 W4M, SW¼ 10-52-25 W4M NW¼ 03-52-25 W4M Edmonton, Alberta	110219883 Prepared by MK on 2017-08-09 Quality Review by LF on 2017-08-14 Approved by DRAFT on 2017-08-xx

Client/Project
EPCOR
Geotechnical Program for the EPCOR E.L. Smith Water Treatment Plant Solar Project

Figure No.
3

Title
Resistivity Testing Locations

APPENDIX C: BOREHOLE RECORDS

Stantec

BOREHOLE RECORD

BH17-01

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

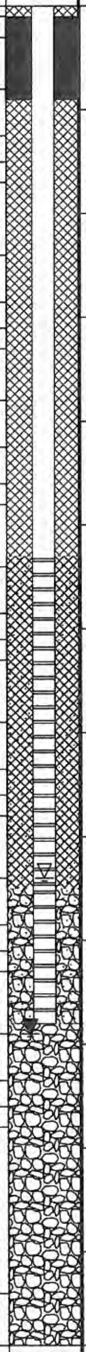
BH SIZE **SS: 150 mm**

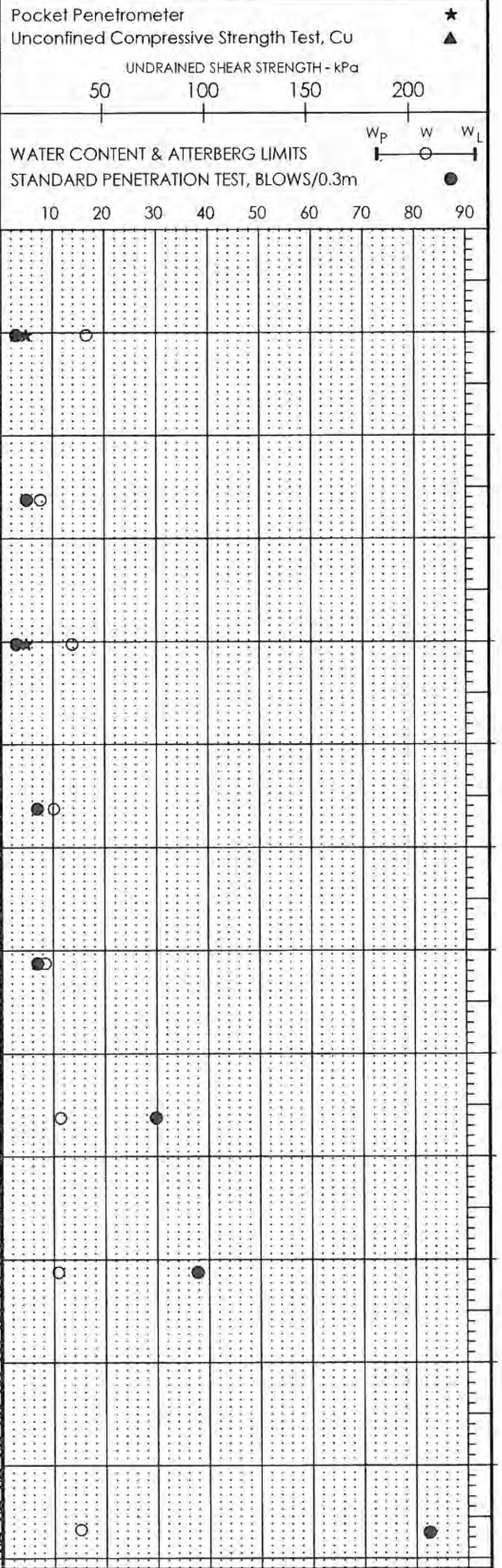
DATES (mm/dd/yy): BORING **6/13/17** WATER LEVEL **9.9 m on 6/28/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0		TOPSOIL
		FILL: Light brown lean clay (CL) - occasional coal specks, moist
1		Loose light brown poorly graded SAND (SP) with silt - moist
2		Soft light brown lean CLAY (CL) with sand - moist
3		Loose light brown poorly graded SAND (SP) - moist
4		Soft light brown lean CLAY (CL) with sand - moist - sand seam at 3.9 m - sandy below 4.2 m
5		Loose light brown silty SAND (SM) - moist - 0.1 m thick sand layer at 6.1 m - trace coal below 7.0 m
8		Compact light brown poorly graded SAND (SP) - trace gravel, wet
9		Compact to dense light to dark brown poorly graded GRAVEL (GP) with sand - wet
11		Inferred poor quality grey to brown SEDIMENTARY BEDROCK - sandstone
13		

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	400	5
BS	5		
SS	6	450	3
BS	7		
SS	8	450	7
BS	9		
SS	10	450	7
BS	11		
SS	12	300	30
BS	13		
SS	14	370	38
BS	15		
SS	16	0	83





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Stantec BOREHOLE RECORD **BH17-01**

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/13/17** WATER LEVEL **9.9 m on 6/28/2017**

PROJECT No. **110219883**

BH SIZE **SS: 150 mm**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT		SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
13		End of borehole (12.9 m) - borehole sloughed to 8.5 m and water level at 9.9 m upon completion - 25 mm standpipe piezometer hand slotted from 5.3 m to 9.8 m - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0							
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									

Pocket Penetrometer ★
Unconfined Compressive Strength Test, Cu ▲
UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

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Stantec

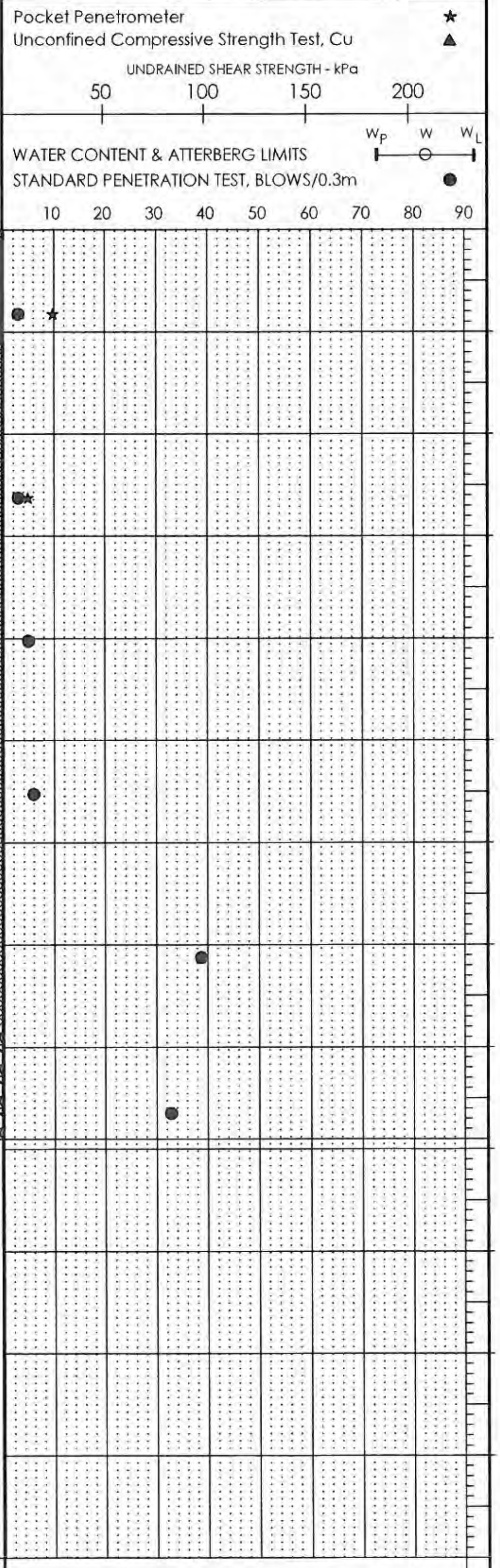
BOREHOLE RECORD

BH17-02

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/20/17**
WATER LEVEL **7.7 m on 6/20/2017**
DATUM **N/A**

DEPTH(m)	SOIL DESCRIPTION
0	TOPSOIL
	FILL: Brown lean clay (CL) - trace rootlets, moist
1	Soft light brown lean CLAY (CL) - trace coal, oxidation, rootlets, and moist - 0.2 m thick silty sand layer at 2.6 m - 0.2 m thick sand layer at 3.3 m
4	Loose light brown poorly graded SAND (SP) - moist
7	Dense brown poorly graded GRAVEL (GP) with sand - wet
9	End of borehole (8.9 m) - borehole sloughed to 7.8 m and water level at 7.7 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	400	3
BS	5		
SS	6	450	5
BS	7		
SS	8	450	6
BS	9		
SS	10	400	39
BS	11		
SS	12	300	33



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Stantec

BOREHOLE RECORD

BH17-03

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/21/17**

WATER LEVEL **8.7 m on 6/21/2017**

DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

Soft light brown lean CLAY (CL)
- trace rootlets, mottled grey, moist

Soft light brown silty CLAY (CL-ML) with sand
- trace gravel, moist

Soft to firm light brown lean CLAY (CL) to SILTY-CLAY (CL-ML)
- moist
- 0.1 m thick sand layer at 5.3 m
- trace coal below 5.5 m
- trace gravel below 6.5 m
- 0.5 m thick layer of interbedded silty sand and clay at 6.6 m

Compact light brown poorly graded SAND (SP)
- trace gravel, coal, and moist
- 0.2 m thick clay layer at 7.4 m
- wet below 8.6 m

Compact brown poorly graded GRAVEL (GP) with sand
-wet

End of borehole (8.9 m)
- borehole sloughed to 8.5 m and water level at 8.7 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

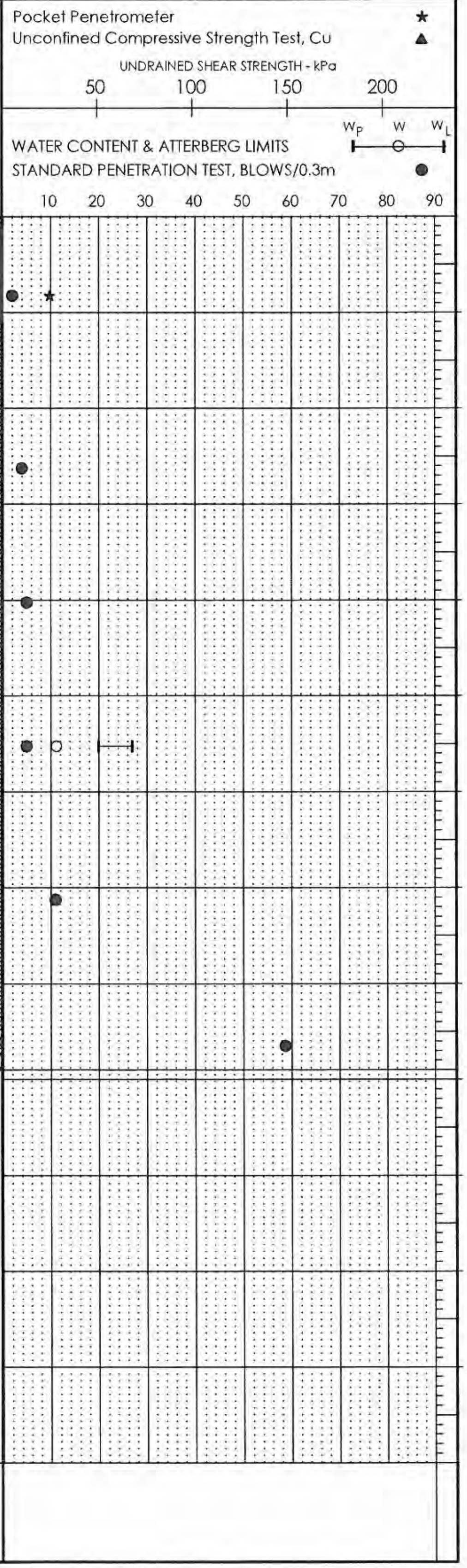
SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	2
BS	3		
SS	4	450	4
BS	5		
SS	6	450	5
BS	7		
SS	8	450	5
BS	9		
SS	10	450	11
BS	11		
SS	12	400	59

DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

ELEVATION(m)

STRATA PLOT

MONITOR WELL/ PIEZOMETER



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Stantec

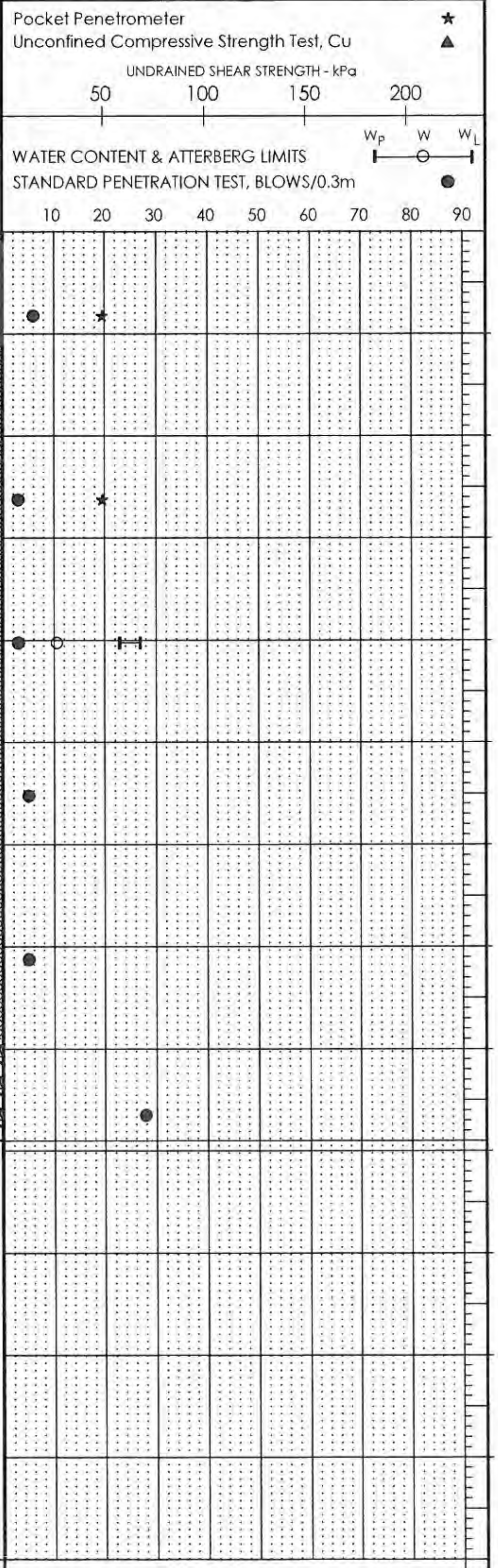
BOREHOLE RECORD

BH17-04A

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/19/17**
WATER LEVEL **7.9 m on 6/19/2017**
DATUM **N/A**

DEPTH(m)	SOIL DESCRIPTION
0 – 0.2	TOPSOIL
0.2 – 1.0	FILL: Brown lean clay (CL) - trace sand, organics and rootlets, damp
1.0 – 2.7	Soft light brown lean CLAY (CL) - trace sand, organics and rootlets, mottled white, moist
2.7 – 7.3	Loose light brown sandy SILT (ML) to silty SAND (SM) - trace clay, moist - silt with sand below 4.6 m - oxidized below 6.4 m - increase in clay content below 7.1 m
7.3 – 8.9	Compact brown poorly graded GRAVEL (GP) with silt and sand - trace clay wet
8.9	End of borehole (8.9 m) - borehole sloughed to 7.9 m and water level at 7.8 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	400	6
BS	3		
SS	4	450	3
BS	5		
SS	6	450	3
BS	7		
SS	8	450	5
BS	9		
SS	10	450	5
BS	11		
SS	12	350	28



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Stantec

BOREHOLE RECORD

BH17-05

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/13/17**

WATER LEVEL **8.2 m on 6/13/2017**

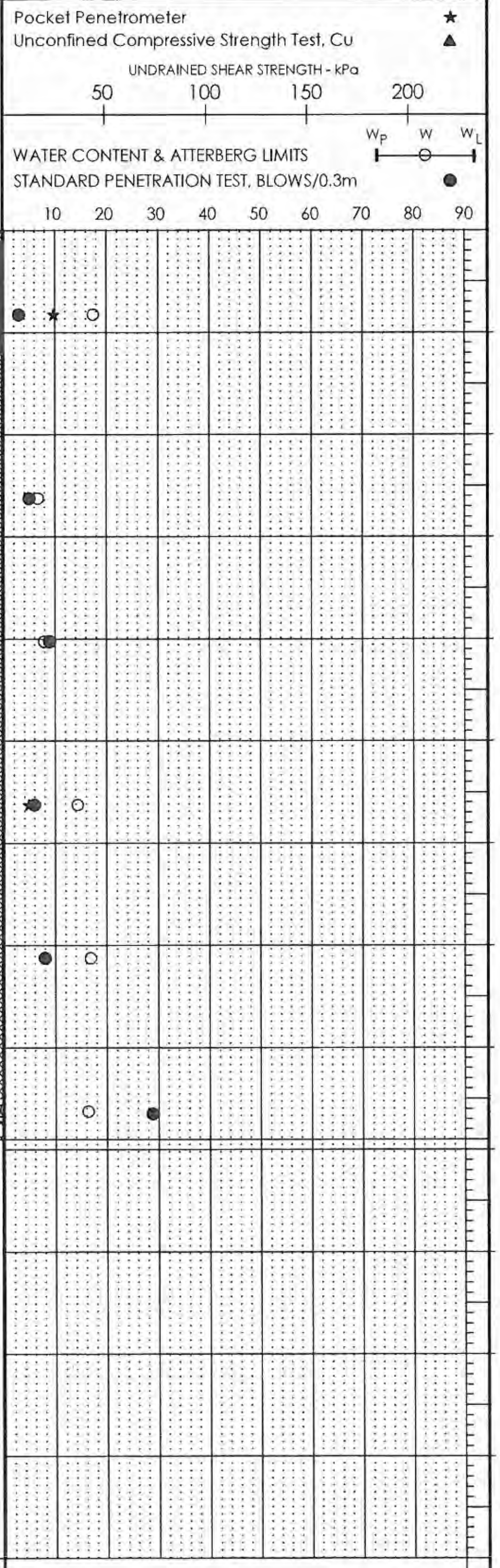
PROJECT No. **110219883**

BH SIZE **SS: 150 mm**

DATUM **N/A**

SOIL DESCRIPTION	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
TOPSOIL				
FILL: Light brown lean clay (CL) - trace oxidation, moist	BS SS	1 2	 450	 3
Soft to firm brown lean CLAY (CL) with sand - trace coal, moist	BS	3		
Loose light brown poorly graded SAND (SP-SM) with silt - moist	SS BS	4 5	300	5
Soft to firm light brown lean CLAY (CL) - moist				
Loose light brown poorly graded SAND (SP) - moist - trace coal below 4.6 m	SS BS	6 7	450	9
Firm light brown sandy CLAY (CL) - moist - occasional sand partings at 5.6 m	SS BS	8 9	450	6
Loose light brown silty GRAVEL (GP-GM) - moist - 0.3 m thick clay layer at 7.4 m	SS BS	10 11	450	8
Loose light brown poorly graded SAND (SP) - trace coal, moist	SS	12	300	29
Compact brown well graded GRAVEL (GW) with sand - trace oxidation, wet				

End of borehole (8.9 m)
- borehole open and water level at 8.2 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.2 m



DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

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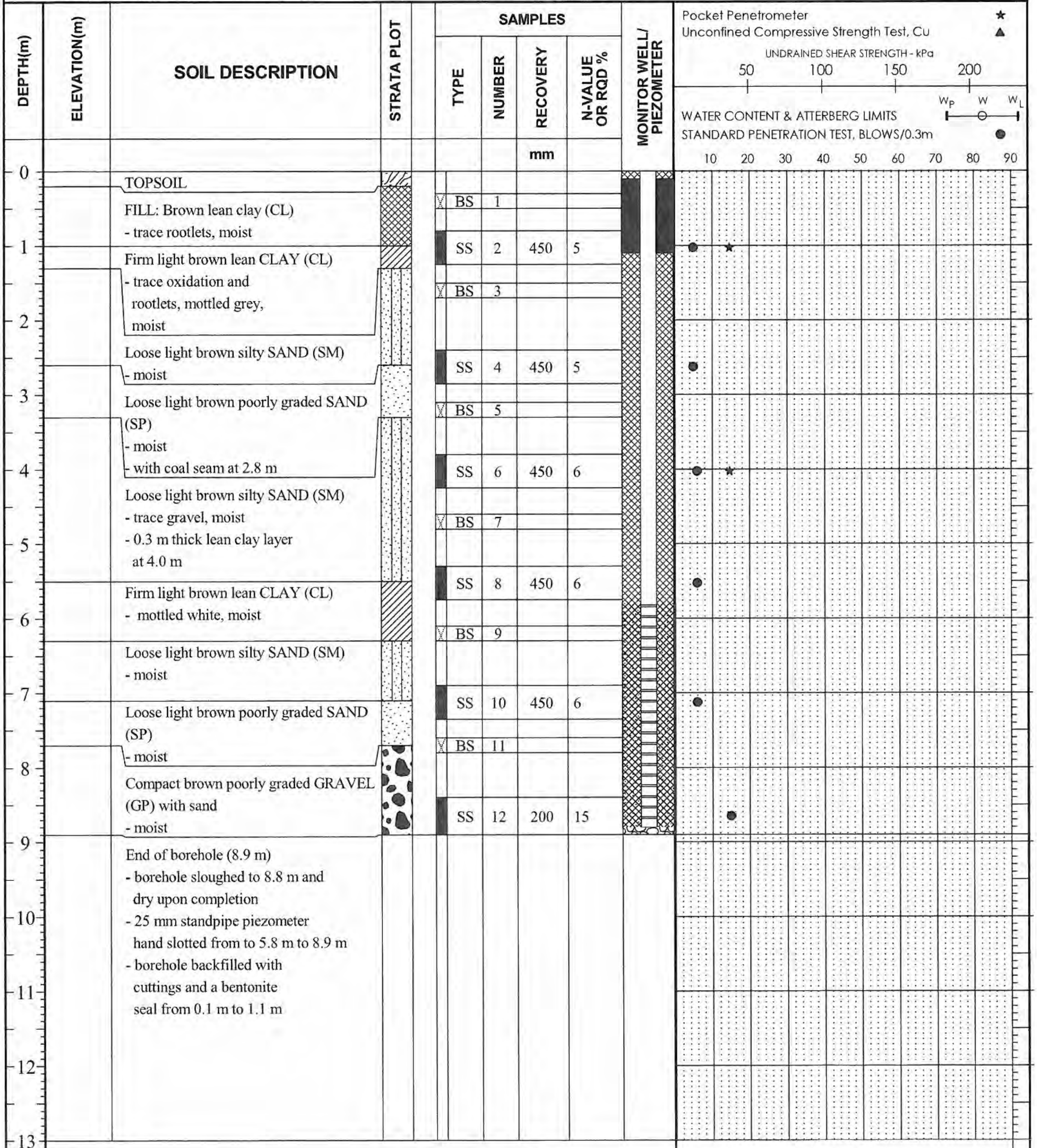
Stantec BOREHOLE RECORD

BH17-06

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/20/17**
WATER LEVEL **Dry on 6/28/2017**
DATUM **N/A**



SOIL DESCRIPTION

TOPSOIL

FILL: Brown lean clay (CL)
- trace rootlets, moist

Firm light brown lean CLAY (CL)
- trace oxidation and rootlets, mottled grey, moist

Loose light brown silty SAND (SM)
- moist

Loose light brown poorly graded SAND (SP)
- moist
- with coal seam at 2.8 m

Loose light brown silty SAND (SM)
- trace gravel, moist
- 0.3 m thick lean clay layer at 4.0 m

Firm light brown lean CLAY (CL)
- mottled white, moist

Loose light brown silty SAND (SM)
- moist

Loose light brown poorly graded SAND (SP)
- moist

Compact brown poorly graded GRAVEL (GP) with sand
- moist

End of borehole (8.9 m)
- borehole sloughed to 8.8 m and dry upon completion
- 25 mm standpipe piezometer hand slotted from to 5.8 m to 8.9 m
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	450	5
BS	3		
SS	4	450	5
BS	5		
SS	6	450	6
BS	7		
SS	8	450	6
BS	9		
SS	10	450	6
BS	11		
SS	12	200	15

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BOREHOLE RECORD

BH17-07

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

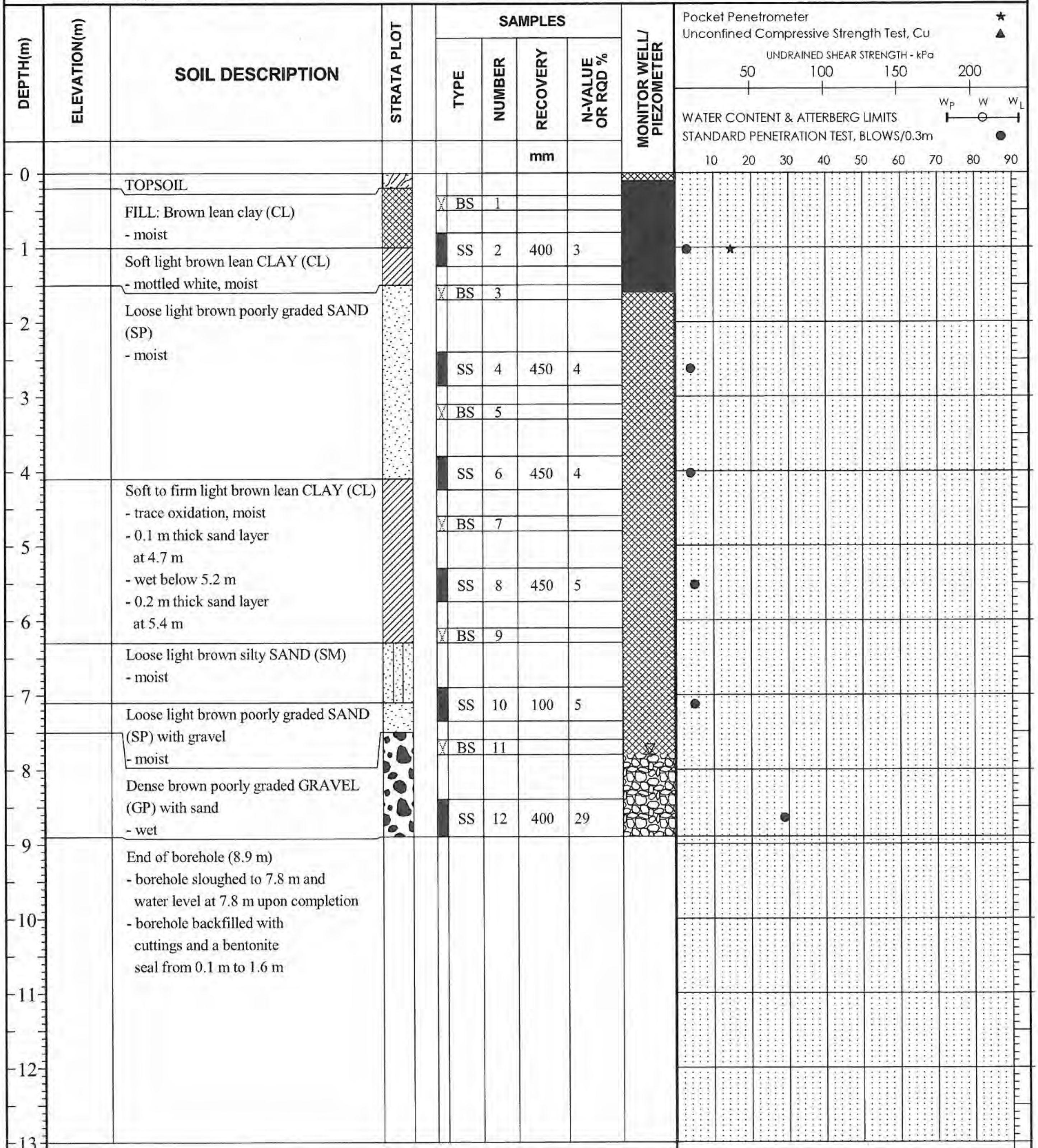
DATES (mm/dd/yy): BORING **6/20/17**

WATER LEVEL **7.8 m on 6/20/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0		TOPSOIL
		FILL: Brown lean clay (CL) - moist
1		Soft light brown lean CLAY (CL) - mottled white, moist
2		Loose light brown poorly graded SAND (SP) - moist
4		Soft to firm light brown lean CLAY (CL) - trace oxidation, moist - 0.1 m thick sand layer at 4.7 m - wet below 5.2 m - 0.2 m thick sand layer at 5.4 m
6		Loose light brown silty SAND (SM) - moist
7		Loose light brown poorly graded SAND (SP) with gravel - moist
8		Dense brown poorly graded GRAVEL (GP) with sand - wet
9		End of borehole (8.9 m) - borehole sloughed to 7.8 m and water level at 7.8 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	450	4
BS	5		
SS	6	450	4
BS	7		
SS	8	450	5
BS	9		
SS	10	100	5
BS	11		
SS	12	400	29



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Stantec

BOREHOLE RECORD

BH17-08

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/13/17**
WATER LEVEL **8.2 m on 6/28/2017**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Brown lean clay (CL)
- trace organics

Firm light brown sandy lean CLAY (CL)
- moist

Loose light brown silty SAND (SM)
- moist

Soft brown sandy lean CLAY (CL) to clayey SAND (SC)
- moist
- interbedded clay and sand below 5.4 m

Soft brown sandy lean CLAY (CL)
- moist
- wet below 5.9 m

Very loose brown silty SAND (SM)
- wet
- trace gravel, oxidation and coal below 7.0 m

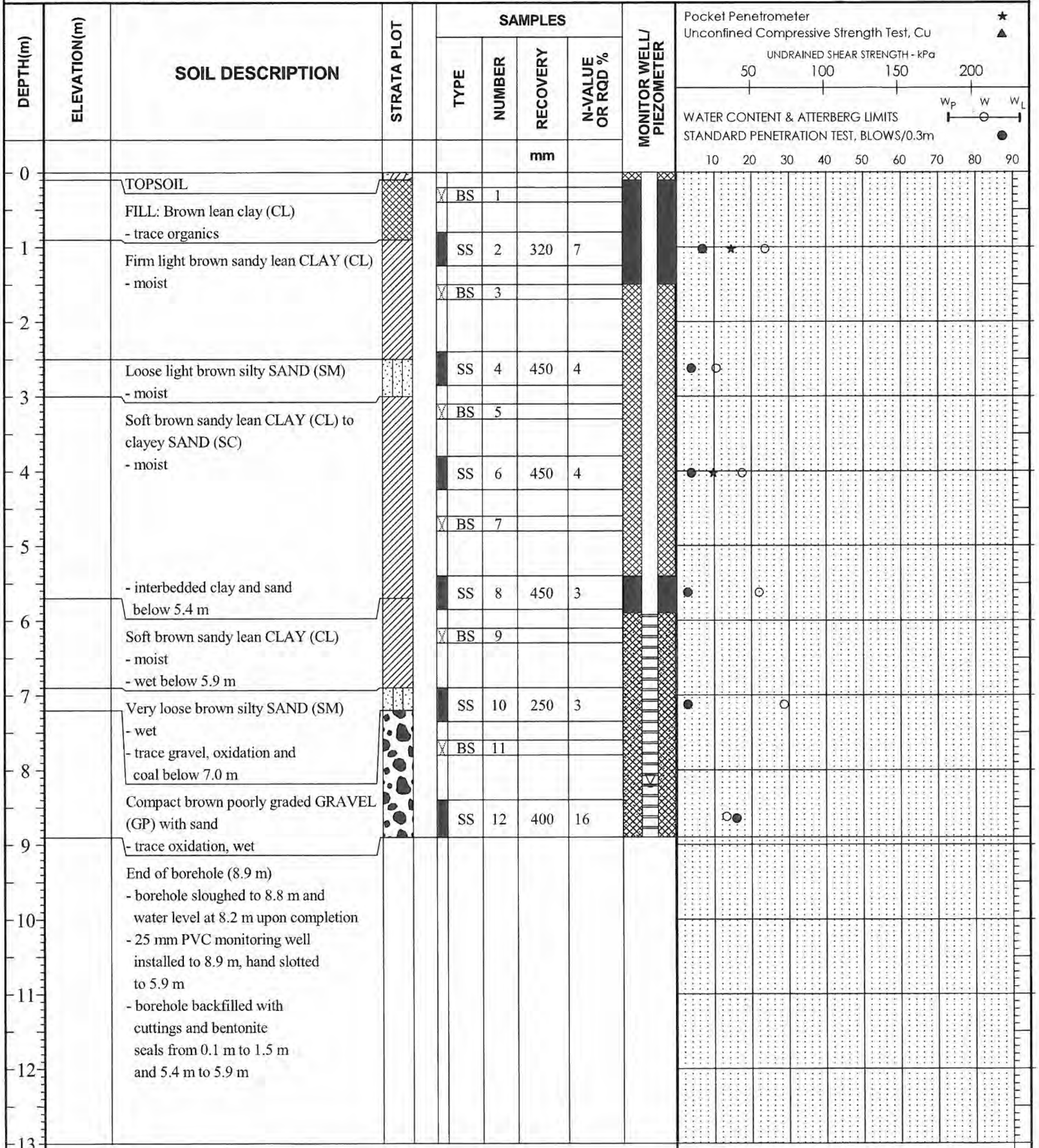
Compact brown poorly graded GRAVEL (GP) with sand
- trace oxidation, wet

End of borehole (8.9 m)
- borehole sloughed to 8.8 m and water level at 8.2 m upon completion
- 25 mm PVC monitoring well installed to 8.9 m, hand slotted to 5.9 m
- borehole backfilled with cuttings and bentonite seals from 0.1 m to 1.5 m and 5.4 m to 5.9 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	320	7
BS	3		
SS	4	450	4
BS	5		
SS	6	450	4
BS	7		
SS	8	450	3
BS	9		
SS	10	250	3
BS	11		
SS	12	400	16

Pocket Penetrometer ★
Unconfined Compressive Strength Test, Cu ▲
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
STANDARD PENETRATION TEST, BLOWS/0.3m ●



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Stantec

BOREHOLE RECORD

BH17-09

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/19/17** WATER LEVEL **7.6 m on 6/19/2017**

PROJECT No. **110219883**

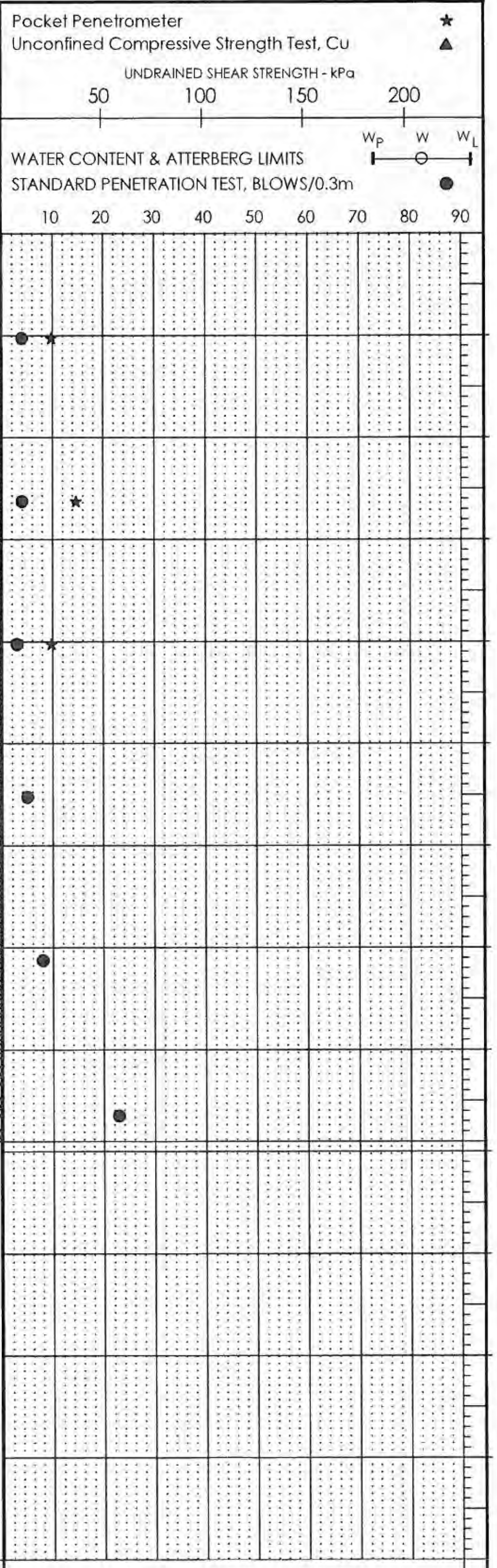
BH SIZE **SS: 150 mm**

DATUM **N/A**

DEPTH (m)	ELEVATION (m)	SOIL DESCRIPTION
0		TOPSOIL
0.2		FILL: Brown soft lean clay (CL) - moist
1		Soft light brown lean CLAY (CL) - moist
3.2		Loose light brown silty SAND (SM) - moist - 0.1 m thick clay layer at 3.9 m
4.1		Loose light brown poorly graded SAND (SP) - moist - 0.2 m thick clay layer at 5.8 m
6.2		Loose light brown silty SAND (SM) - moist - 0.2 m thick clay layer at 7.1 m
7.3		Compact brown poorly graded GRAVEL (GP) with sand - wet
8.9		End of borehole (8.9 m) - borehole sloughed to 8.1 m and water level at 7.8 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	4
BS	3		
SS	4	400	4
BS	5		
SS	6	450	3
BS	7		
SS	8	450	5
BS	9		
SS	10	450	8
BS	11		
SS	12	150	23

MONITOR WELL/ PIEZOMETER ∇



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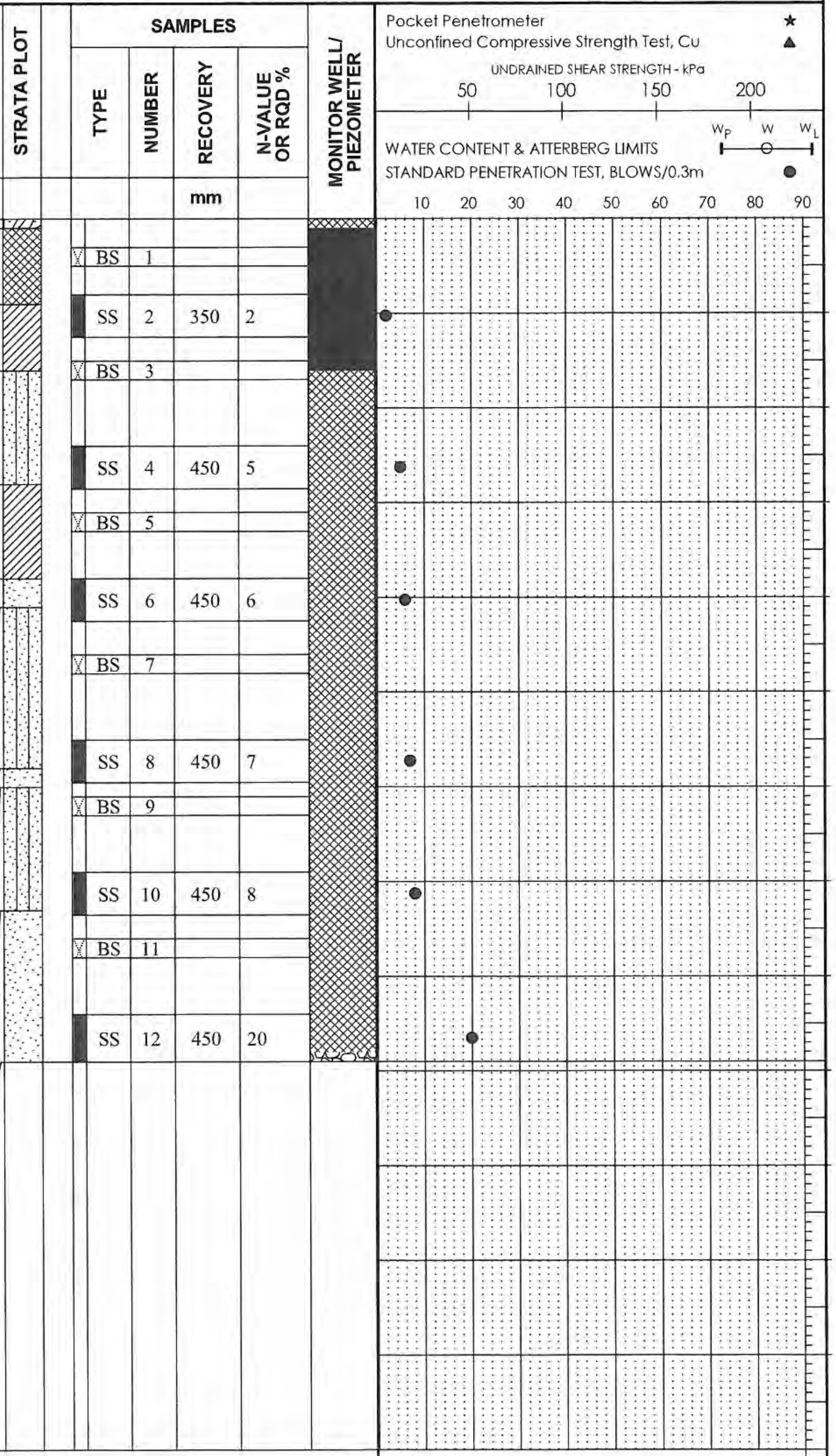
Stantec

BOREHOLE RECORD

BH17-10

CLIENT **EPCOR Water Services Inc.**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES (mm/dd/yy): BORING **6/19/17**
WATER LEVEL **Dry on 6/19/2017**
PROJECT No. **110219883**
BH SIZE **SS: 150 mm**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
0		TOPSOIL				
		FILL: Light brown lean clay (CL) - moist	BS	1		
1		Soft light brown lean CLAY (CL) - trace sand, moist	SS	2	350	2
			BS	3		
2		Loose light brown silty SAND (SM) - trace gravel, moist	SS	4	450	5
3		Soft light brown lean silty CLAY (CL) - moist	BS	5		
4		Loose light brown poorly graded SAND (SP) - moist	SS	6	450	6
			BS	7		
5		Loose light brown silty SAND (SM) - moist - lean clay seam at 5.7 m	SS	8	450	7
6		Loose light brown poorly graded SAND (SP) - moist	BS	9		
7		Loose light brown silty SAND (SM) - moist - lean clay seam at 7.2 m	SS	10	450	8
			BS	11		
8		Loose to compact light brown poorly graded SAND (SP) - moist - 0.2 m layer of lean clay at 7.6 m	SS	12	450	20
9		End of borehole (8.9 m) - borehole open and dry upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m				
10						
11						
12						
13						



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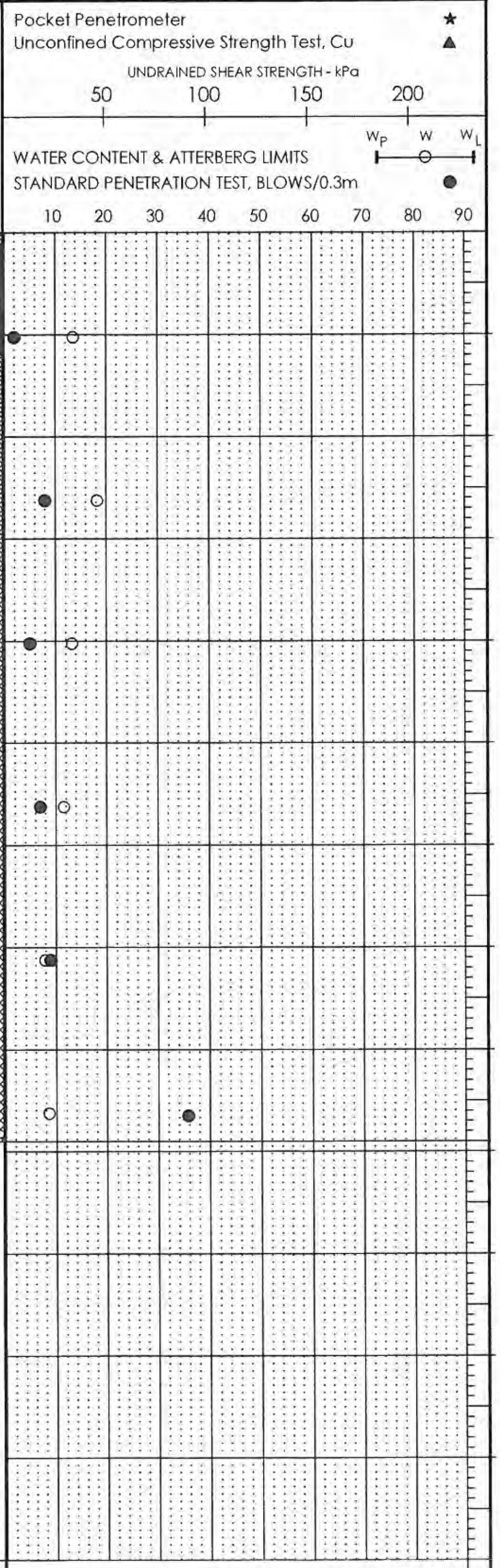
Stantec

BOREHOLE RECORD

BH17-11

CLIENT **EPCOR Water Services Inc.**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES (mm/dd/yy): BORING **6/13/17** WATER LEVEL **8.2 m on 6/13/2017**
PROJECT No. **110219883**
BH SIZE **SS: 150 mm**
DATUM **N/A**

SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
TOPSOIL				
Brown lean CLAY (CL) - trace sand, moist	BS	1		
Very loose to loose light brown poorly graded SAND (SP) with silt - moist - clayey between 1.8 m to 2.4 m	SS	2	450	2
	BS	3		
	SS	4	410	8
Firm light brown lean CLAY (CL) with sand - moist - trace coal between 3.5 m to 3.8 m	BS	5		
	SS	6	410	5
	BS	7		
Loose light brown silty SAND (SM) - moist	SS	8	450	7
Loose light brown poorly graded SAND (SP-SM) - moist - trace gravel below 6.9 m	BS	9		
	SS	10	450	9
Compact to dense light brown well graded GRAVEL (GW) with sand - trace coal, moist to wet - wet below 8.4 m	BS	11		
	SS	12	250	36
End of borehole (8.9 m) - borehole sloughed to 8.6 m and water level at 8.2 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.2 m				



DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

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Stantec

BOREHOLE RECORD

BH17-12

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

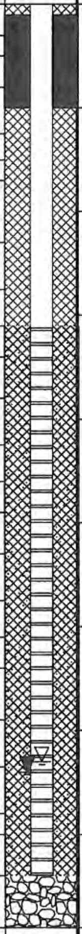
DATES (mm/dd/yy): BORING **6/12/17**

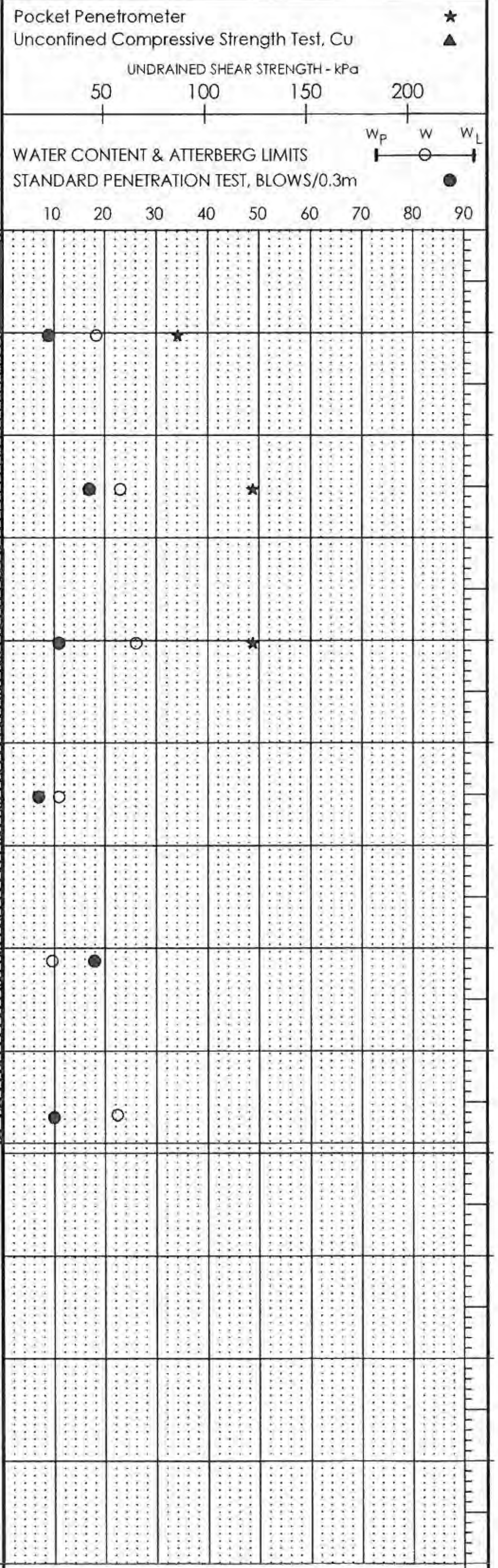
WATER LEVEL **7.4 m on 6/28/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
0		FILL: firm to stiff brown lean clay (CL) with sand - trace gravel, moist	BS	1		
1			SS	2	400	9
			BS	3		
2						
		Stiff brown lean CLAY (CL) - mottled grey, moist - trace organics between 2.5 m to 2.8 m	SS	4	410	17
3			BS	5		
4			SS	6	400	11
		Loose light brown sandy SILT (ML) - trace clay, moist	BS	7		
5						
		Loose to compact light brown poorly graded SAND (SP) - moist	SS	8	350	7
6			BS	9		
7		- compact, wet below 7.0 m - trace gravel below 7.3 m	SS	10	350	18
8			BS	11		
			SS	12	400	10
9		End of borehole (8.9 m) - borehole sloughed to 7.6 m and water level at 7.3 m upon completion - 25 mm standpipe installed to 8.4 m, hand slotted to 3.1 m - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m				
10						
11						
12						
13						

MONITOR WELL/ PIEZOMETER





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Stantec

BOREHOLE RECORD

BH17-13

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/20/17**

WATER LEVEL **7.8 m on 6/20/2017**

DATUM **N/A**

DEPTH(m) | ELEVATION(m) | SOIL DESCRIPTION | STRATA PLOT | SAMPLES | MONITOR WELL/ PIEZOMETER

TOPSOIL

FILL: brown lean clay (CL)
- trace rootlets, moist

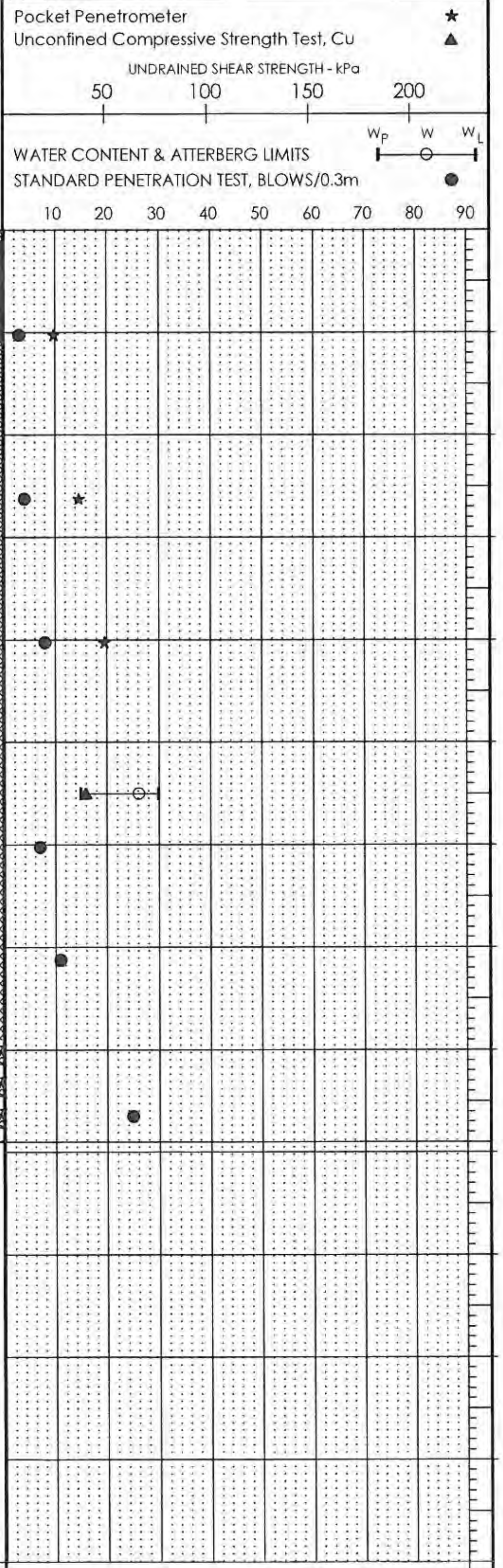
Soft light brown lean CLAY (CL)
- trace sand, mottled grey, moist
- firm below 3.6 m
- 0.2 m silty sand layer at 4.1 m
- moist to wet and oxidized below 4.4 m
- wet below 7.0 m

Compact brown poorly graded GRAVEL (GP) with sand
- trace clay, oxidized, and wet

Inferred poor quality grey SEDIMENTARY BEDROCK
- sandstone
- oxidized

End of borehole (8.9 m)
- borehole sloughed to 7.9 m and water level at 8.7 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	450	4
BS	5		
SS	6	450	8
BS	7		
ST	8	600	
SS	9	450	7
SS	10	450	11
BS	11		
SS	12	300	25



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Stantec

BOREHOLE RECORD

BH17-14

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/20/17**

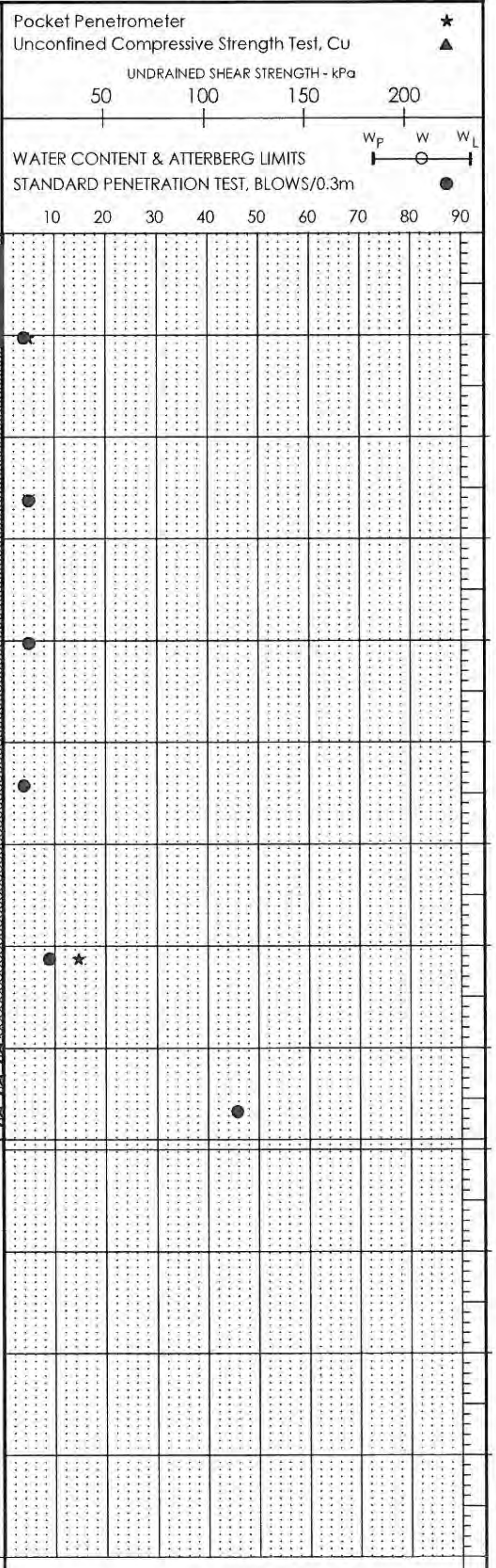
WATER LEVEL **Dry on 6/20/2017**

PROJECT No. **110219883**

BH SIZE **SS: 150 mm**

DATUM **N/A**

SOIL DESCRIPTION	TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
TOPSOIL				
FILL: Light brown lean clay (CL) - moist	BS	1		
Soft light brown lean CLAY (CL) - mottled grey, moist - 0.3 m layer of silty sand at 2.7 m	SS	2	450	4
	BS	3		
	SS	4	450	5
	BS	5		
	SS	6	450	5
Loose light brown silty SAND (SM) - trace clay, moist	BS	7		
	SS	8	450	4
Loose light brown poorly graded SAND (SP) - moist	BS	9		
Firm light brown lean CLAY (CL) - moist - mottled grey and wet below 7.1 m	SS	10	450	9
Compact brown poorly graded GRAVEL (GP) with sand - trace clay, wet	BS	11		
	SS	12	60	46
End of borehole (8.9 m) - borehole sloughed to 7.9 m and dry upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m				



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Stantec

BOREHOLE RECORD

BH17-15

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

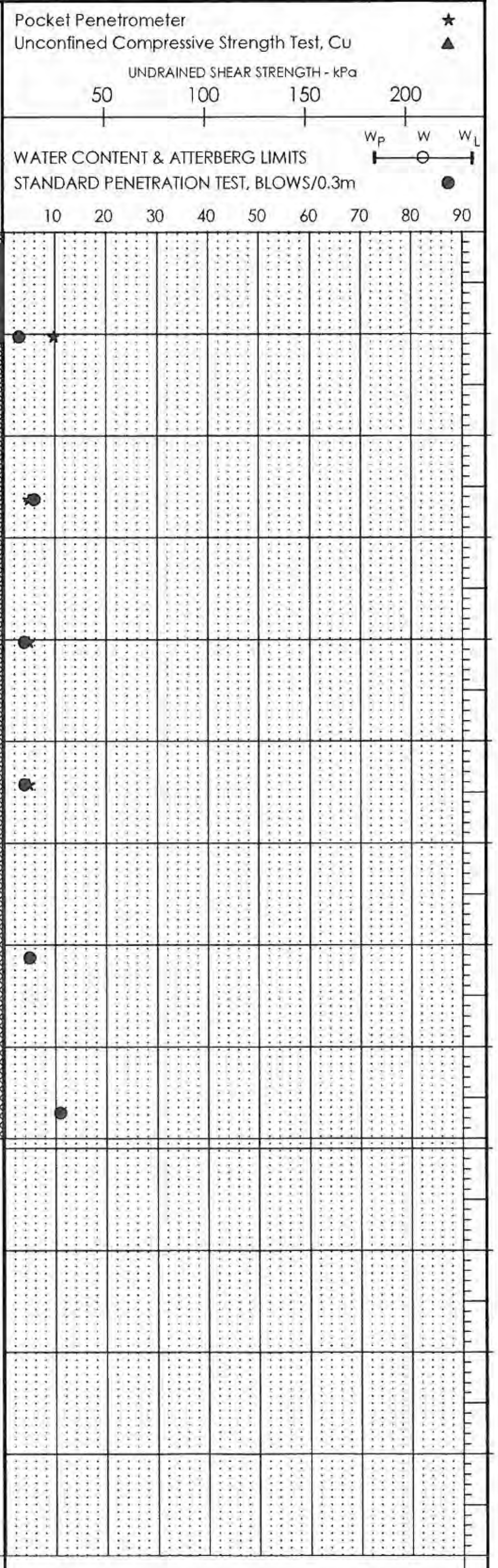
BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/20/17**

WATER LEVEL **Dry on 6/20/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
0		TOPSOIL						
		FILL: Light brown lean clay (CL) - trace rootlets, moist		BS	1			
1		Loose light brown silty SAND (SM) - moist		SS	2	400	3	
				BS	3			
2		Soft light brown lean CLAY (CL) - trace sand, moist						
				SS	4	450	6	
3		- 0.3 m thick silty sand layer at 2.7 m		BS	5			
4		- 0.3 m thick silty sand layer at 4.1 m		SS	6	400	4	
				BS	7			
5				SS	8	400	4	
6				BS	9			
7		- 0.2 m silty sand layer at 6.8 m - mottled grey and oxidized below 7.3 m		SS	10	450	5	
				BS	11			
8		- trace gravel below 8.1 m						
		Compact brown poorly graded SAND (SP) with gravel - moist		SS	12	400	11	
9								
		End of borehole (8.9 m) - borehole open and dry upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m						
10								
11								
12								
13								



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BOREHOLE RECORD

BH17-16

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/20/17**
WATER LEVEL **8.7 m on 6/28/2017**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Brown to light brown lean clay (CL)
- trace rootlets, moist

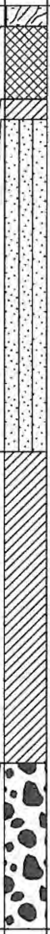
Soft light brown lean CLAY (CL)
- moist

Loose light brown silty SAND (SM)
- moist

Firm light brown lean CLAY (CL)
- moist
- 0.2 m thick layer of silty sand at 5.6 m
- wet below 6.9 m
- mottled grey and oxidized below 7.0 m

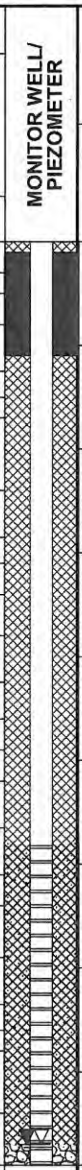
Compact to dense brown poorly graded GRAVEL (GP) with sand
- wet

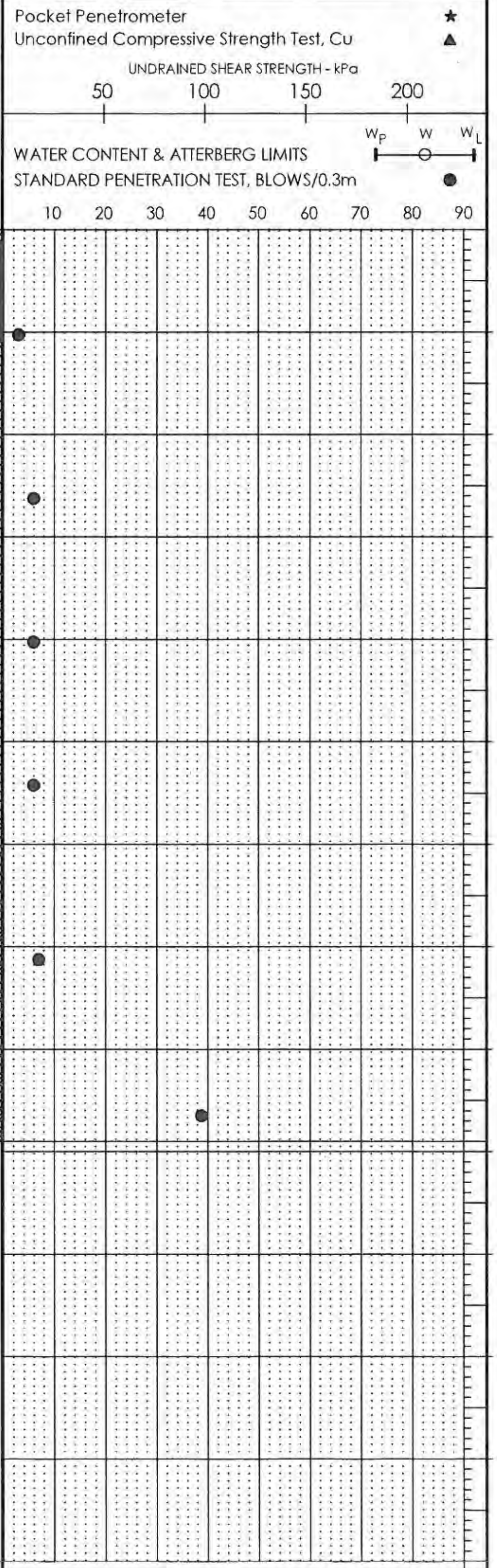
End of borehole (8.9 m)
- borehole sloughed to 8.7 m and water level at 8.7 m upon completion
- 25 mm standpipe piezometer hand slotted from 5.8 m to 8.9 m
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m



SAMPLES

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	400	6
BS	5		
SS	6	450	6
BS	7		
SS	8	400	6
BS	9		
SS	10	450	7
BS	11		
SS	12	350	39





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BOREHOLE RECORD

BH17-17

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/19/17**
WATER LEVEL **8.4 m on 6/19/2017**
DATUM **N/A**

DEPTH(m) 0 – 13; ELEVATION(m)

SOIL DESCRIPTION

TOPSOIL

FILL: Dark brown lean clay (CL) with sand
- trace gravel, rootlets, moist

Brown to black poorly graded SAND (SP) with gravel
- trace organics, rootlets, oxidation, wet

Firm light brown lean CLAY (CL)
- trace oxidation, moist
- brown to dark brown below 1.3 m
- wet below 2.7 m
- 0.2 m thick layer of sand with silt at 2.8 m
- mottled grey and wet below 3.0 m

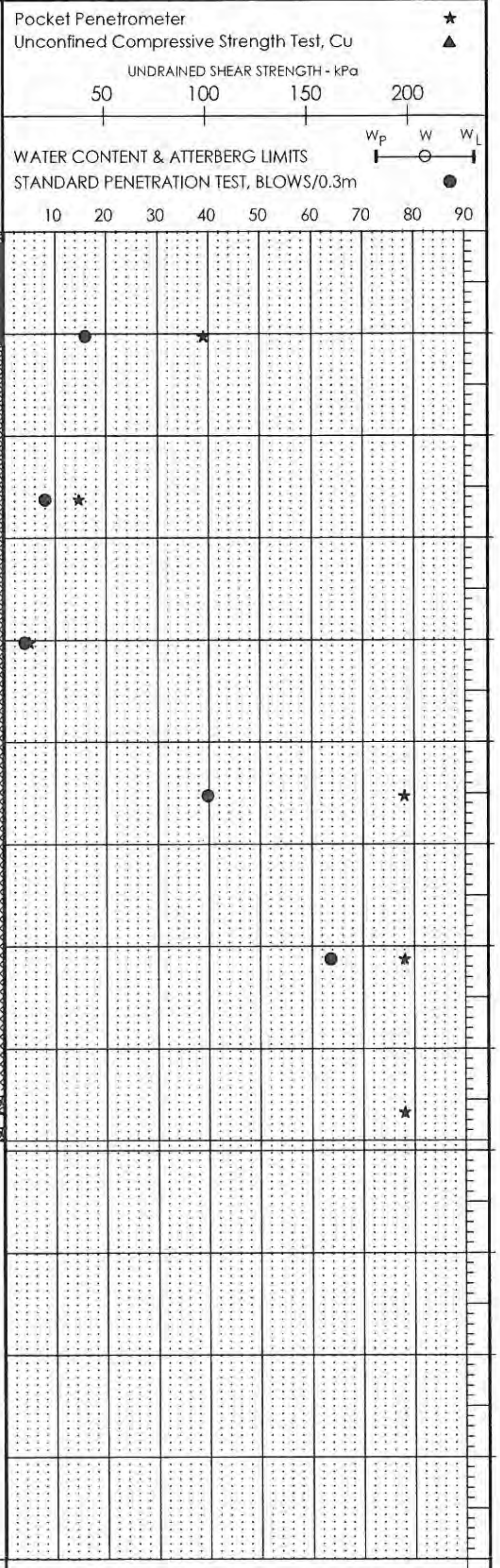
Inferred poor quality light grey SEDIMENTARY BEDROCK
- clay shale

Inferred poor quality light grey SEDIMENTARY BEDROCK
- interbedded clay shale and sandstone

End of borehole (8.9 m)
- borehole sloughed to 8.4 m and water level at 8.8 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

STRATA PLOT; MONITOR WELL/ PIEZOMETER

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	16
BS	3		
SS	4	360	8
BS	5		
SS	6	350	4
BS	7		
SS	8	400	40
BS	9		
SS	10	400	64
BS	11		
SS	12	450	50+



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BOREHOLE RECORD

BH17-18

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/19/17**

WATER LEVEL **7.0 m on 6/19/2017**

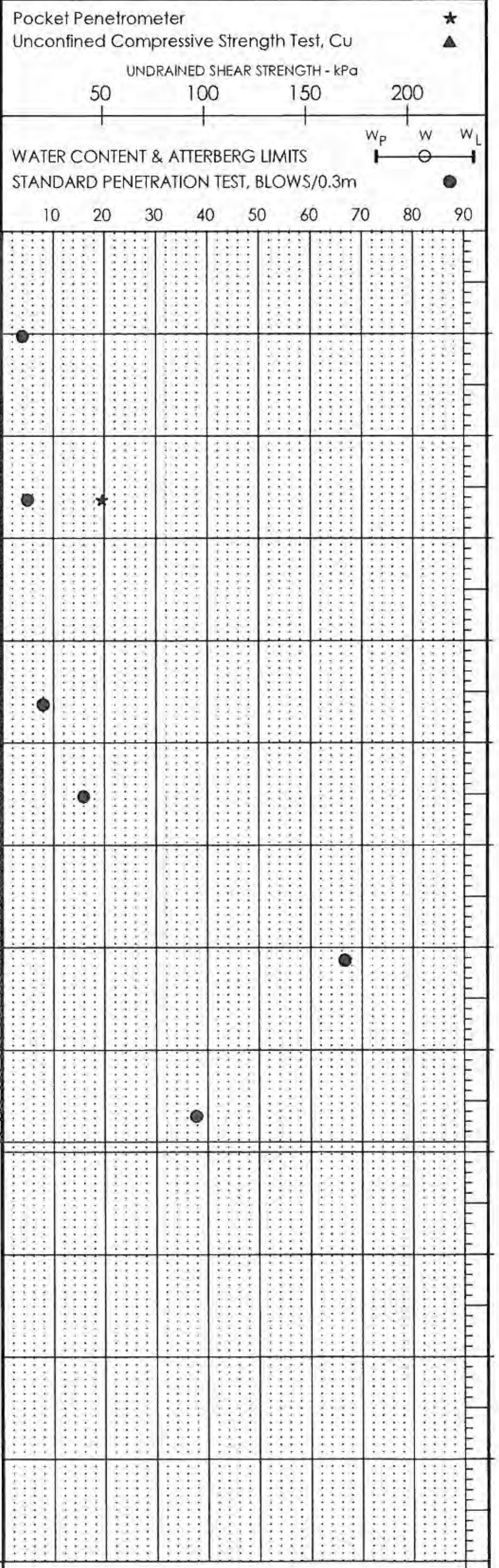
DATUM **N/A**

DEPTH(m)	SOIL DESCRIPTION
0	TOPSOIL
	FILL: Brown lean clay (CL) - trace rootlets, oxidation, moist
1	FILL: Brown clayey sand (SC) - trace gravel, moist
2	Soft brown lean CLAY (CL) - trace sand, moist
	Soft light brown lean CLAY (CL) - trace silt, rootlets, mottled grey, moist - firm below 3.0 m
4	Loose to compact light brown poorly graded SAND (SP) - moist
5	Compact to very dense brown poorly graded SAND (SP) with gravel - trace oxidation, moist - trace clay and wet below 7.1 m
8	Inferred poor quality grey SEDIMENTARY BEDROCK - sandstone

End of borehole (8.9 m)
- borehole sloughed to 7.2 m and water level at 7.0 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	300	4
BS	3		
SS	4	350	5
BS	5		
ST	6	50	
SS	7	400	8
SS	8	300	16
BS	9		
SS	10	300	67
BS	11		
SS	12	400	38

MONITOR WELL/ PIEZOMETER



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BOREHOLE RECORD

BH17-19

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/20/17**
WATER LEVEL **7.7 m on 6/20/2017**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Brown lean clay (CL)
- trace rootlets, moist

Soft brown lean CLAY (CL)
- trace oxidation, mottled white, moist
- mottled grey below 3.4 m
- 0.5 m thick layer of sand at 3.5 m

Soft to firm light brown lean silty CLAY (CL-ML)
- moist
- wet below 7.3 m

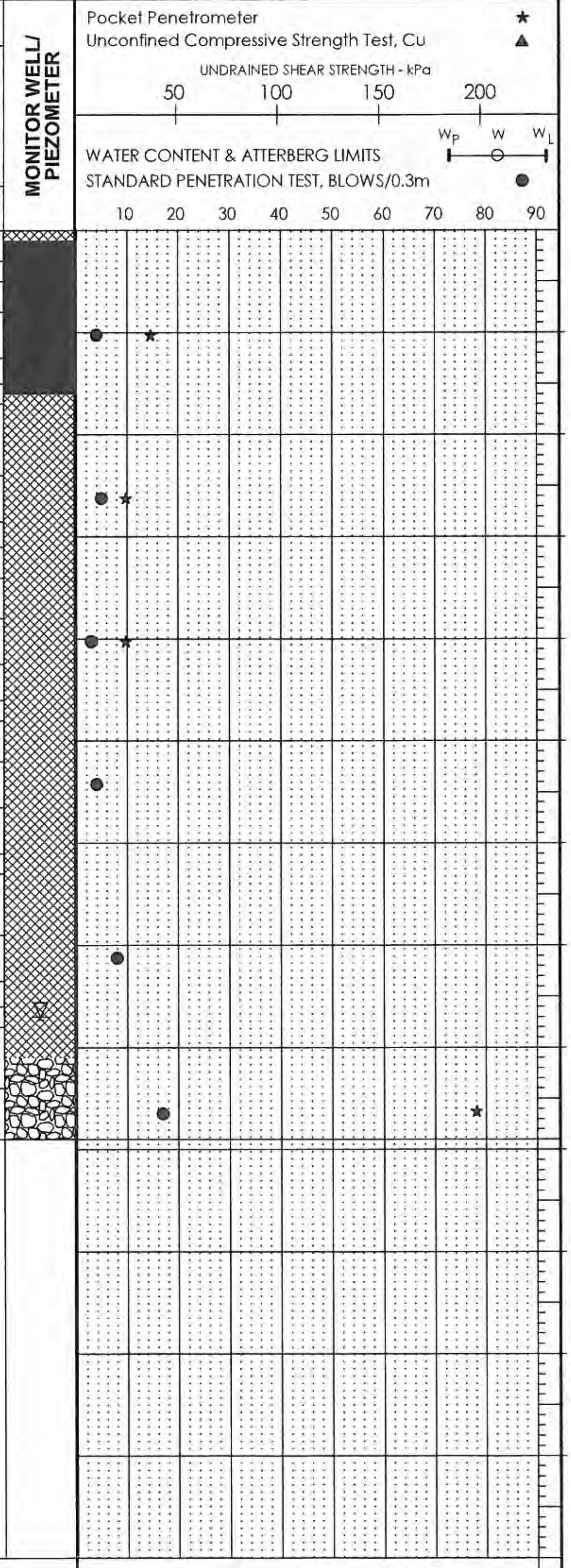
Compact brown poorly graded GRAVEL (GP) with sand
- wet

Inferred poor quality grey SEDIMENTARY BEDROCK
- clay shale
- trace oxidation

End of borehole (8.9 m)
- borehole sloughed to 8.1 m and water level at 7.2 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	300	4
BS	3		
SS	4	350	5
BS	5		
SS	6	400	3
BS	7		
SS	8	450	4
BS	9		
SS	10	450	8
BS	11		
SS	12	300	17



DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

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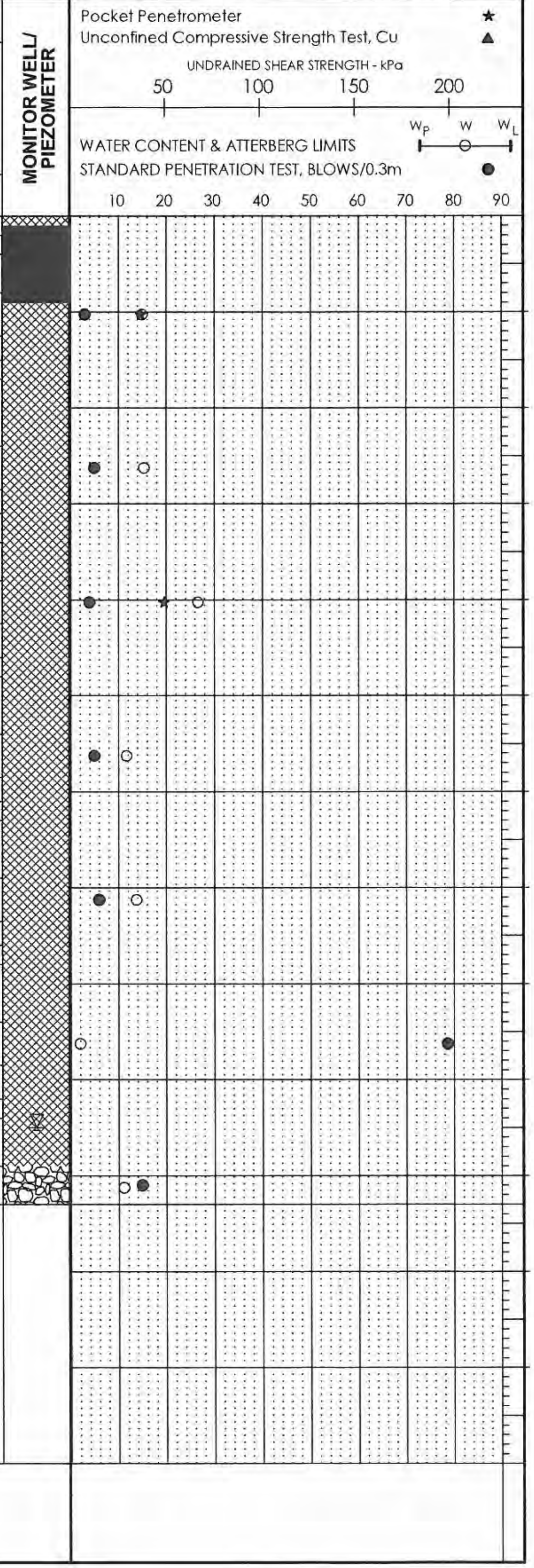
BOREHOLE RECORD

BH17-20

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/13/17**
WATER LEVEL **9.5 m on 6/13/2017**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0		TOPSOIL
		FILL: Brown lean clay (CL) with sand - trace organics, rootlets, and moist
1		Brown silty lean CLAY (CL) - trace sand, organics, rootlets, moist
2		Loose light brown SILT (ML) with sand - trace clay, moist
3		- increased silt content below 3.1 m
4		Soft to firm light brown silty lean CLAY (CL) with sand - moist - trace coal at 4.5 m
5		Loose light brown silty SAND (SM) to sandy SILT (ML) - moist - trace oxidation at 5.8 m
7		- 0.5 m thick layer of poorly graded sand at 5.8 m - trace clay below 7.9 m
8		Compact poorly graded Gravel (GP-GM) with silt and sand - moist
10		- wet sand seam at 10.1 m
		Inferred poor quality brown to grey SEDIMENTARY BEDROCK - sandstone
11		End of borehole (10.3 m) - borehole sloughed to 9.9 m and water level at 9.5 m upon completion - borehole backfilled with cuttings and a bentonite
13		

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	400	5
BS	5		
SS	6	400	4
BS	7		
SS	8	450	5
BS	9		
SS	10	400	6
BS	11		
SS	12	400	79
BS	13		
SS	14	400	15



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BOREHOLE RECORD

BH17-20

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/13/17**
WATER LEVEL **9.5 m on 6/13/2017**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT		SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
13		seal from 0.1 m to 0.9 m							
14									
15									
16									
17									
18									
19									
20									
21									
22									
23									
24									
25									
26									

Pocket Penetrometer ★
Unconfined Compressive Strength Test, Cu ▲
UNDRAINED SHEAR STRENGTH - kPa
50 100 150 200
WATER CONTENT & ATTERBERG LIMITS W_P W W_L
STANDARD PENETRATION TEST, BLOWS/0.3m ●
10 20 30 40 50 60 70 80 90

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Page 1 of 1

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BOREHOLE RECORD

BH17-21

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/20/17**

WATER LEVEL **8.5 m on 6/20/2017**

DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Brown lean clay (CL)
- trace rootlets, moist

Soft light brown lean CLAY (CL)
- trace oxidation, mottled grey, moist
- sand seam at 1.3 m
- 0.5 m thick sand layer at 1.9 m

Loose light brown silty SAND (SM)
- moist
- trace clay below 4.2 m

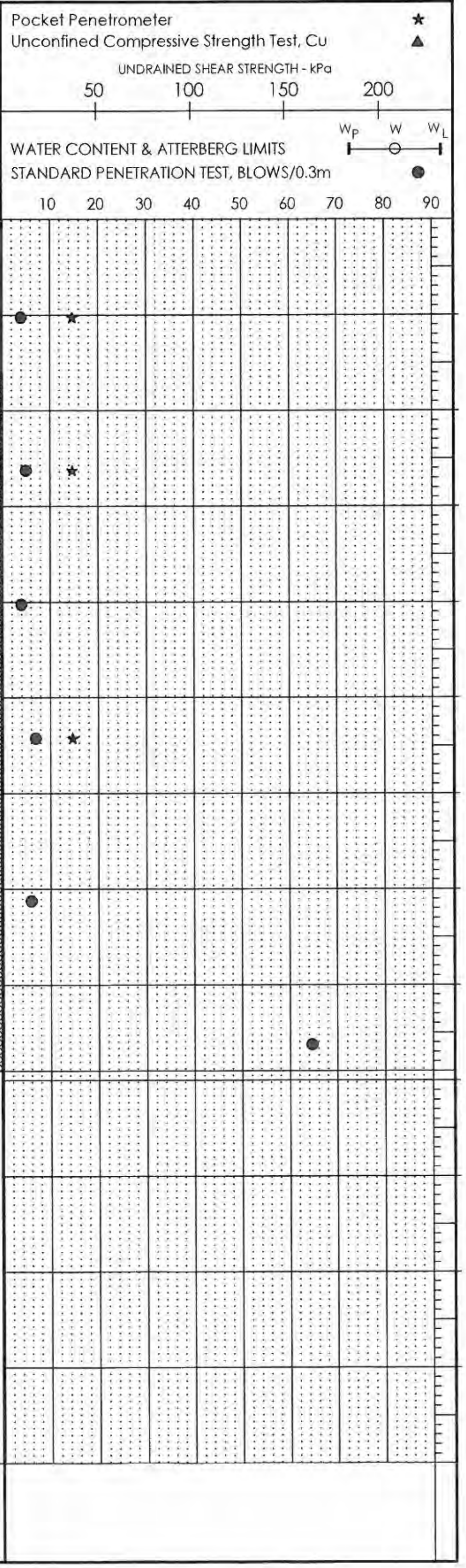
Firm light brown lean CLAY (CL)
- trace oxidation mottled grey, moist
- moist to wet below 6.4 m

Compact poorly graded GRAVEL (GP) with sand
- trace clay, oxidation, wet

End of borehole (8.9 m)
- borehole open and water level at 8.5 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	4
BS	3		
SS	4	450	5
BS	5		
SS	6	450	4
BS	7		
SS	8	450	7
BS	9		
SS	10	400	6
BS	11		
SS	12	400	65



DEPTH(m): 0 1 2 3 4 5 6 7 8 9 10 11 12 13

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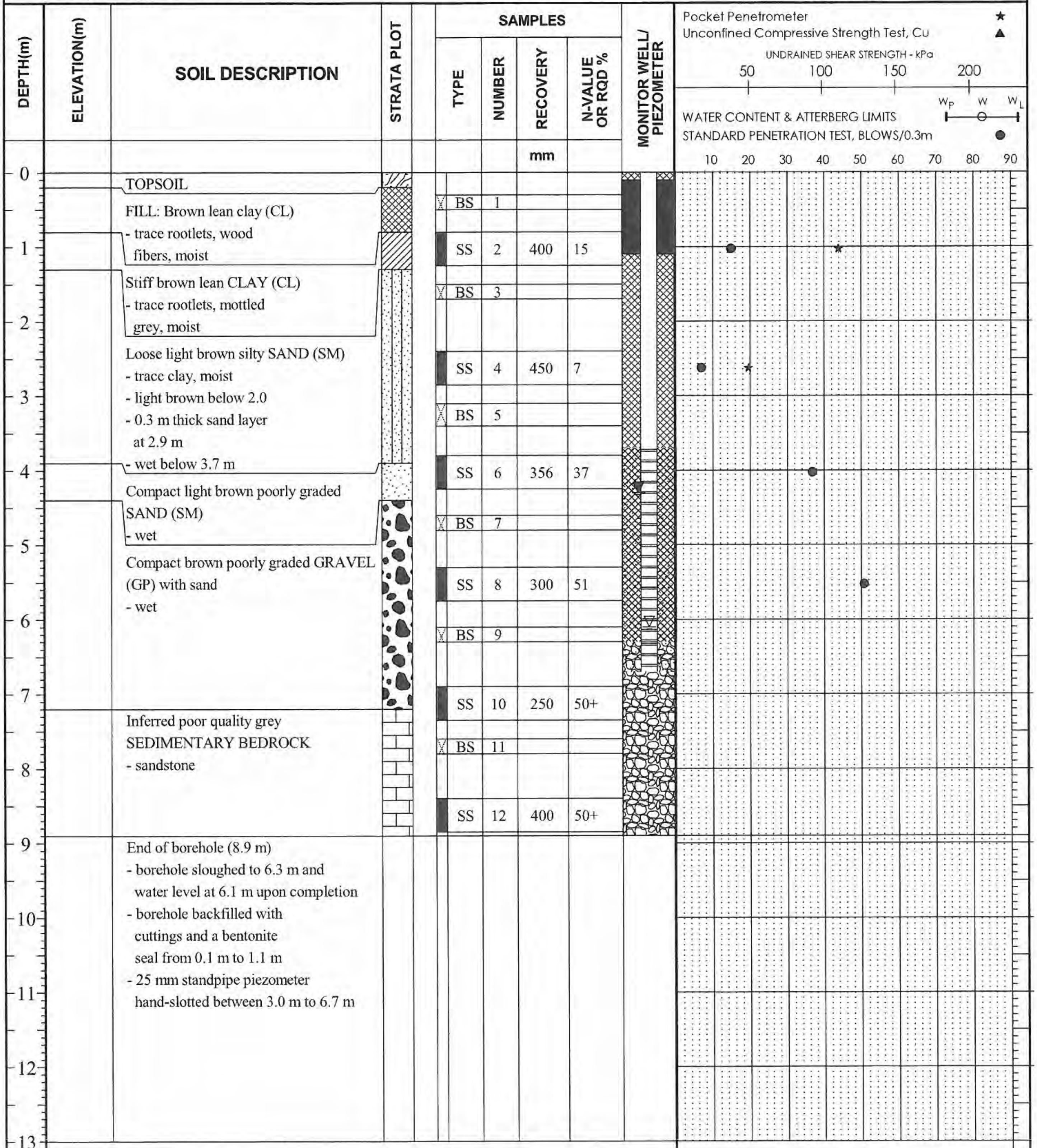
BOREHOLE RECORD

BH17-22

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/19/17**
WATER LEVEL **4.3 m on 6/28/2017**
DATUM **N/A**



TOPSOIL

FILL: Brown lean clay (CL)
- trace rootlets, wood fibers, moist

Stiff brown lean CLAY (CL)
- trace rootlets, mottled grey, moist

Loose light brown silty SAND (SM)
- trace clay, moist
- light brown below 2.0
- 0.3 m thick sand layer at 2.9 m
- wet below 3.7 m

Compact light brown poorly graded SAND (SM)
- wet

Compact brown poorly graded GRAVEL (GP) with sand
- wet

Inferred poor quality grey SEDIMENTARY BEDROCK
- sandstone

End of borehole (8.9 m)
- borehole sloughed to 6.3 m and water level at 6.1 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m
- 25 mm standpipe piezometer hand-slotted between 3.0 m to 6.7 m

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	400	15
BS	3		
SS	4	450	7
BS	5		
SS	6	356	37
BS	7		
SS	8	300	51
BS	9		
SS	10	250	50+
BS	11		
SS	12	400	50+

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BOREHOLE RECORD

BH17-23

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

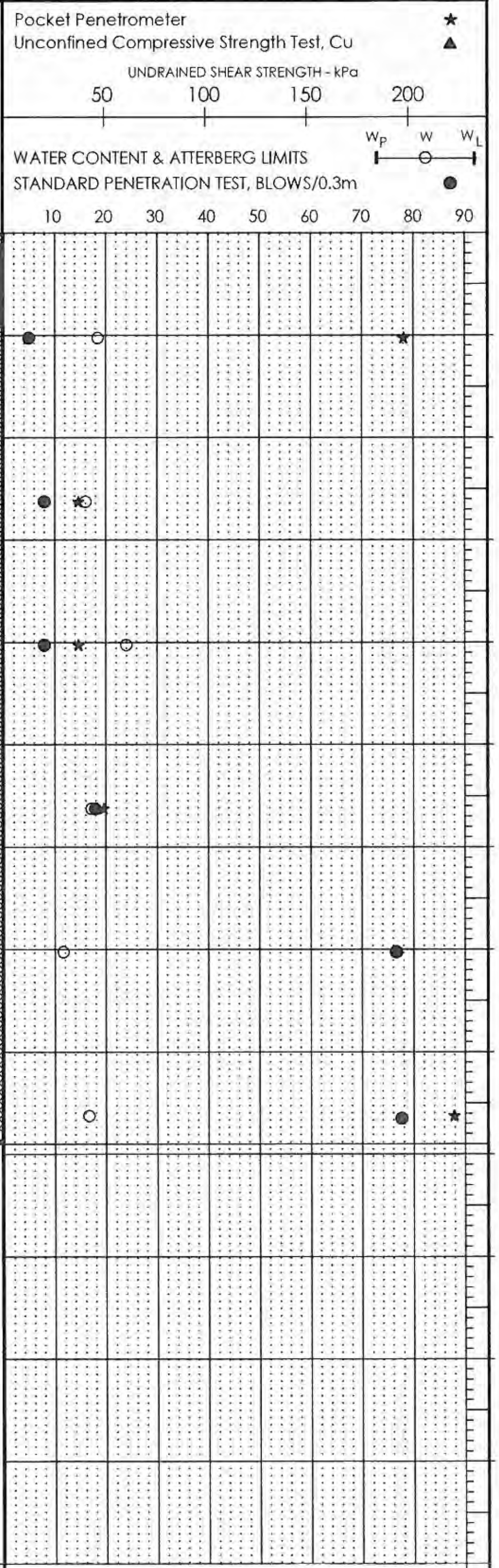
BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/13/17**

WATER LEVEL **8.8 m on 6/13/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
0		TOPSOIL						
		FILL: Brown lean clay (CL) - trace organics, dry to moist		BS	1			
1				SS	2	300	5	
		Firm to stiff light brown lean CLAY (CL) - moist		BS	3			
2				SS	4	450	8	
3				BS	5			
4		- sand seams at 3.9 m and 4.1 m		SS	6	450	8	
		- with sand below 4.6 m		BS	7			
5		Compact light brown poorly graded SAND (SP) - trace gravel, dry to moist		SS	8	400	18	
6				BS	9			
7		- very dense below 6.8 m		SS	10	375	77	
		Inferred poor quality grey SEDIMENTARY BEDROCK - clay shale		BS	11			
8				SS	12	200	78	
9		End of borehole (8.9 m) - borehole open and water level at 8.8 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.9 m						
10								
11								
12								
13								



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BOREHOLE RECORD

BH17-24

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/14/17**
WATER LEVEL **7.7 on 6/28/2017**
DATUM **N/A**

DEPTH(m) | ELEVATION(m) | SOIL DESCRIPTION | STRATA PLOT

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- some rootlets, trace oxidation, moist

Firm light brown lean CLAY (CL)
- trace oxidation, grey specks, moist

Loose light brown silty SAND (SM)
- fine grained, moist

Firm light brown lean CLAY (CL)
- trace sand, moist

Loose light brown silty SAND (SM)
- fine grained, moist

Firm light brown lean CLAY (CL) with sand
- moist
- trace oxidation below 5.0 m

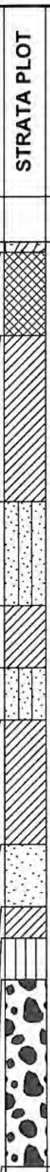
Loose light brown poorly graded SAND (SP)
- fine grained, moist

Soft to firm light brown lean CLAY (CL)
- wet

Loose light brown SILT with sand (ML)
- wet

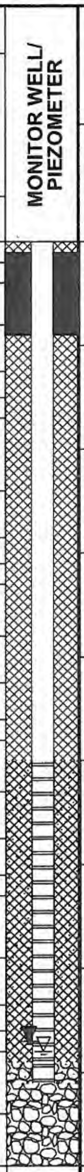
Compact to dense brown well-graded GRAVEL (GW) with sand
- wet

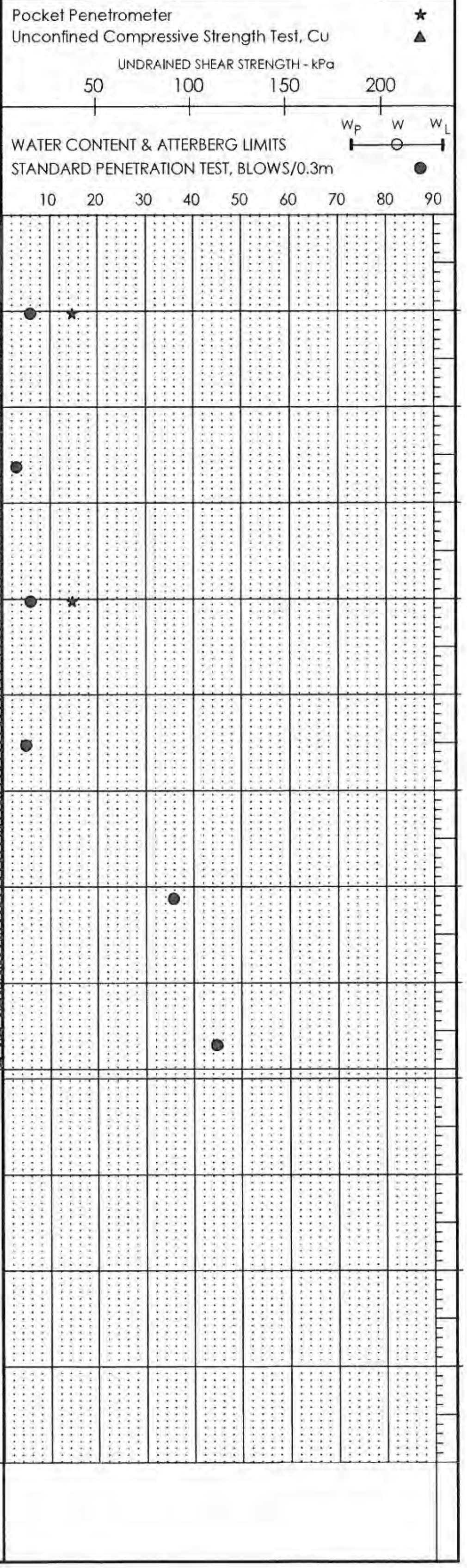
End of borehole (8.9 m)
- borehole sloughed to 7.9 m and water level at 7.8 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.9 m
- 25 mm standpipe piezometer hand-slotted from 5.0 m to 8.1 m



SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	300	6
BS	3		
SS	4	300	3
BS	5		
SS	6	400	6
BS	7		
SS	8	400	5
BS	9		
SS	10	300	36
BS	11		
SS	12	250	45





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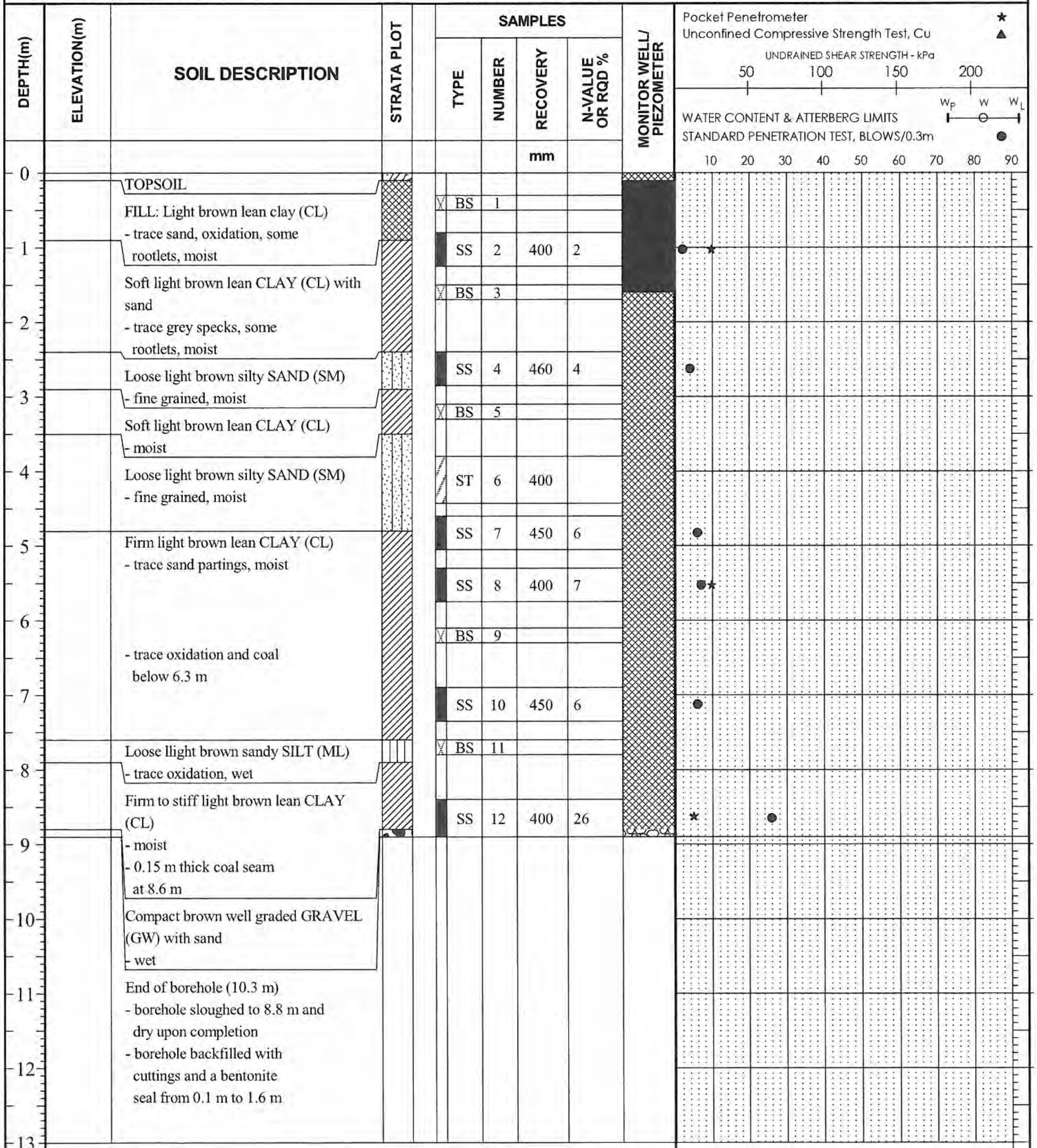
BOREHOLE RECORD

BH17-25

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/14/17**
WATER LEVEL **Dry on 6/14/2017**
DATUM **N/A**



SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- trace sand, oxidation, some rootlets, moist

Soft light brown lean CLAY (CL) with sand
- trace grey specks, some rootlets, moist

Loose light brown silty SAND (SM)
- fine grained, moist

Soft light brown lean CLAY (CL)
- moist

Loose light brown silty SAND (SM)
- fine grained, moist

Firm light brown lean CLAY (CL)
- trace sand partings, moist
- trace oxidation and coal below 6.3 m

Loose llight brown sandy SILT (ML)
- trace oxidation, wet

Firm to stiff light brown lean CLAY (CL)
- moist
- 0.15 m thick coal seam at 8.6 m

Compact brown well graded GRAVEL (GW) with sand
- wet

End of borehole (10.3 m)
- borehole sloughed to 8.8 m and dry upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	2
BS	3		
SS	4	460	4
BS	5		
ST	6	400	
SS	7	450	6
SS	8	400	7
BS	9		
SS	10	450	6
BS	11		
SS	12	400	26

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BOREHOLE RECORD

BH17-26

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/14/17**
WATER LEVEL **8.7 m on 6/14/2017**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- some rootlets, moist

Firm light brown lean CLAY (CL)
- trace grey specks, moist

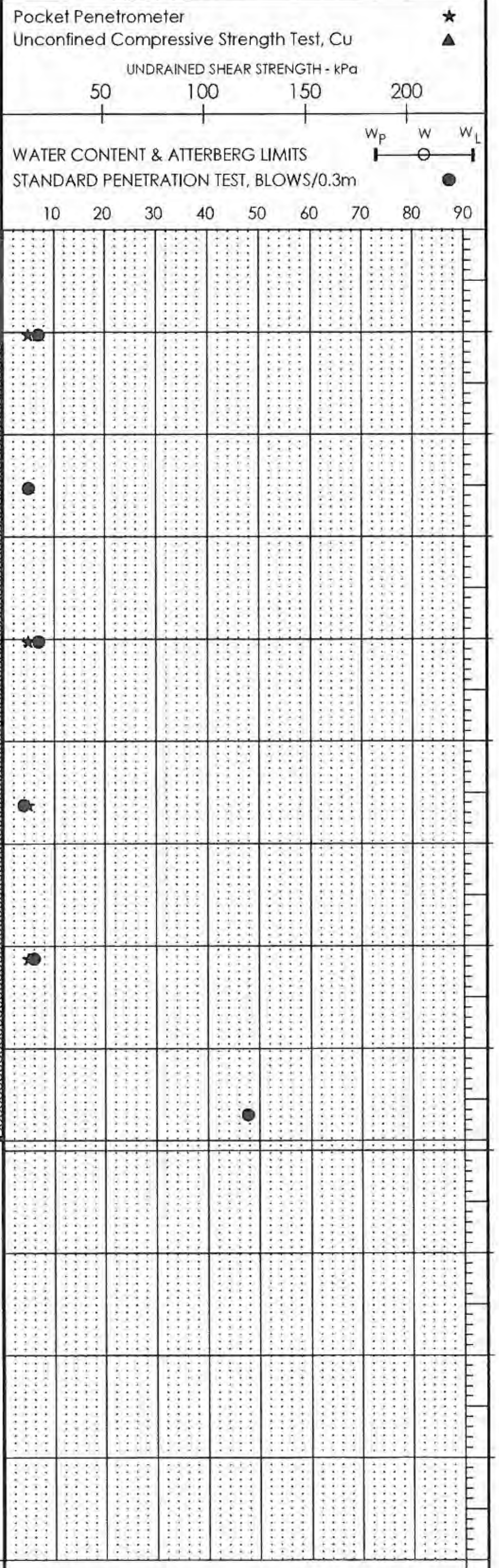
Loose light brown silty SAND (SM)
- fine grained, moist

Soft to firm light brown lean CLAY (CL)
- moist
- 0.2 m thick sand layer at 4.0 m
- 0.2 m thick sand layer at 5.2 m
- wet below 6.7 m
- trace oxidation and grey mottling between 7.0 m to 7.4 m

Compact to dense brown well-graded GRAVEL (GW) with sand
- wet
- 30 mm thick coal seam at 7.5 m

End of borehole (8.9 m)
- borehole sloughed to 8.8 m and water level at 8.7 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	350	7
BS	3		
SS	4	350	5
BS	5		
SS	6	400	7
BS	7		
SS	8	400	4
BS	9		
SS	10	400	6
BS	11		
SS	12	400	48



DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

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BOREHOLE RECORD

BH17-27

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/19/17**

WATER LEVEL **7.0 m on 6/19/2017**

DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Brown lean CLAY (CL)
- trace gravel, rootlets, oxidation, and moist

Stiff brown lean CLAY (CL)
- trace sand, rootlets, oxidation, and moist

Compact light brown silty SAND (SM)
- moist

Compact light brown poorly graded SAND (SP) with gravel
- trace oxidation, moist

Inferred poor quality grey SEDIMENTARY BEDROCK
- clay shale

Inferred poor quality grey SEDIMENTARY BEDROCK
- sandstone

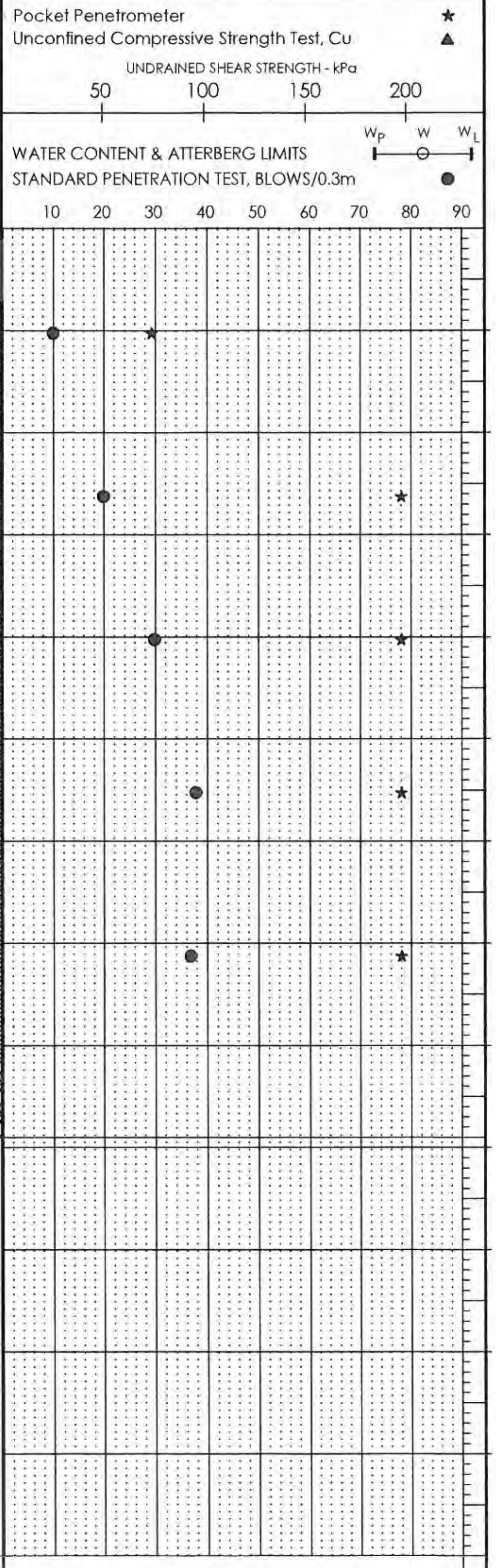
Inferred poor quality grey SEDIMENTARY BEDROCK
- clay shale

Inferred poor quality grey SEDIMENTARY BEDROCK
- sandstone

End of borehole (8.9 m)
- borehole sloughed to 8.2 m and water level at 7.0 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.7 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	10
BS	3		
SS	4	350	20
BS	5		
SS	6	350	30
BS	7		
SS	8	450	38
BS	9		
SS	10	450	37
BS	11		
SS	12	360	50+



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BOREHOLE RECORD

BH17-28

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/14/17**
WATER LEVEL **Dry on 6/14/2017**
DATUM **N/A**

DEPTH(m) | ELEVATION(m) | SOIL DESCRIPTION | STRATA PLOT

TOPSOIL

FILL: Light brown lean CLAY (CL)
- some roots, moist

Firm light brown lean CLAY (CL) with sand
- trace grey specks, some small rootlets, moist
- wet below 3.0 m
- 10 mm thick sand seam at 3.2 m

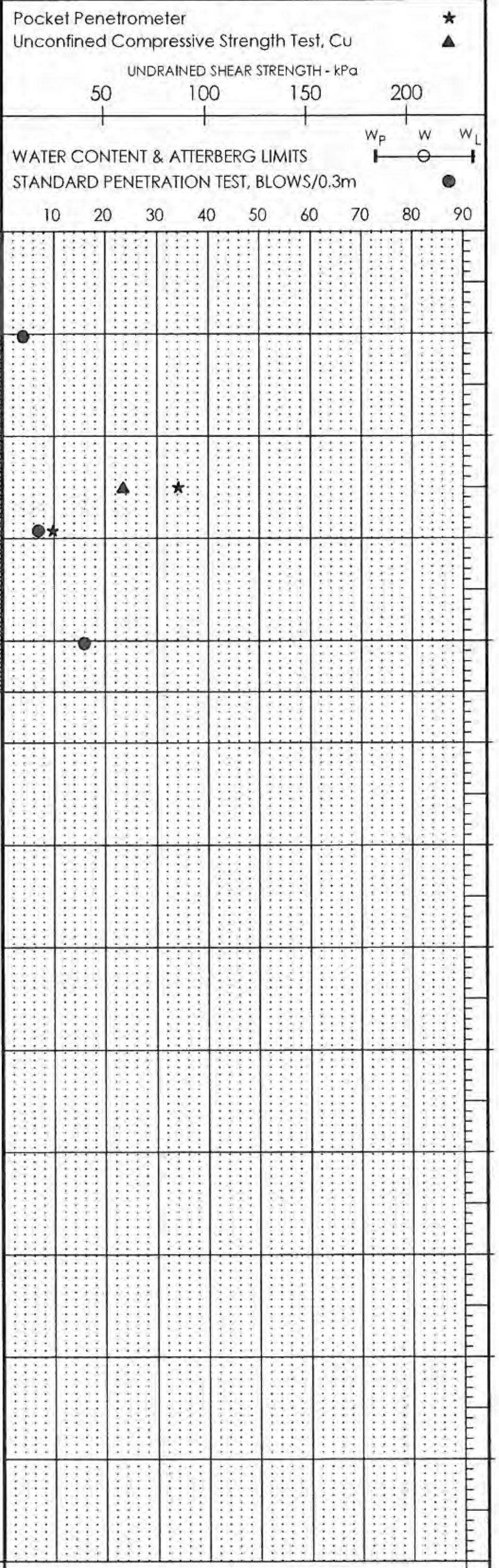
Compact brown well graded GRAVEL (GW) with sand
- wet

End of borehole (4.5 m)
- Auger refusal encountered at 4.5 m; borehole continued 1 m north of borehole at BH 17-28A
- borehole open and dry
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.0 m

SAMPLES

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	300	4
BS	3		
ST	4	350	
SS	5	400	7
SS	6	250	16

MONITOR WELL/ PIEZOMETER



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Stantec BOREHOLE RECORD BH17-28A

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

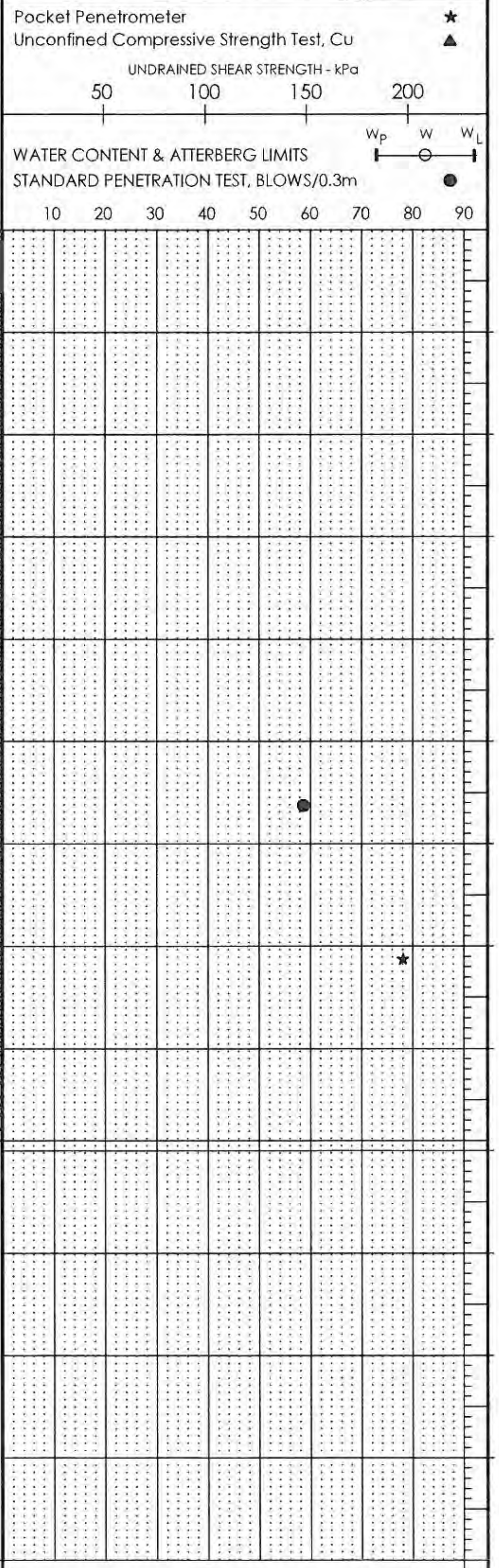
DATES (mm/dd/yy): BORING **6/14/17**

WATER LEVEL **4.3 m on 6/14/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0 – 4.6		See BH17-28 borehole record - Auger refusal encountered at 4.5 m in borehole BH17-28
4.6 – 5.3		Compact to dense brown poorly graded GRAVEL (GP) with sand - saturated
5.3 – 7.0		Inferred poor quality blue to grey SEDIMENTARY BEDROCK - sandstone - light orange to grey between 5.3 m to 5.4 m
7.0 – 8.9		Inferred poor quality blue to grey SEDIMENTARY BEDROCK - clay shale
8.9		End of borehole (8.9 m) - See borehole BH 17-28 for upper 4.5 m - borehole sloughed to 8.1 m and water level at 4.3 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.6 m

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	7		
SS	8	400	59
BS	9		
SS	10	400	50+
BS	11		
SS	12	300	50+



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BOREHOLE RECORD

BH17-29

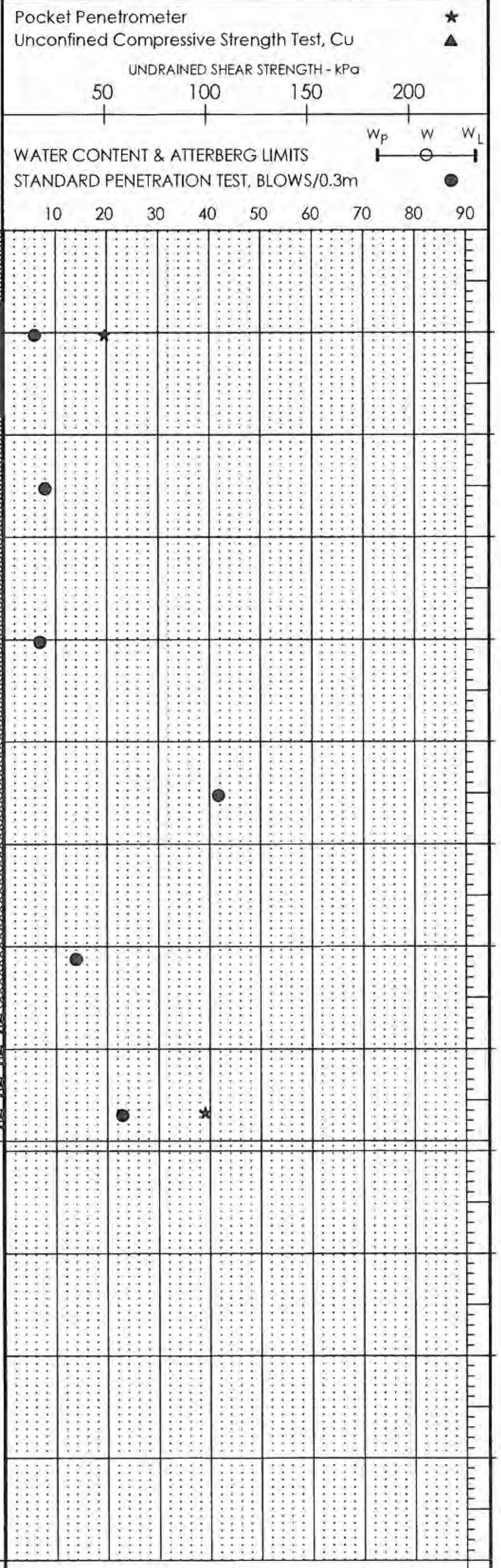
CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/14/17**
WATER LEVEL **7.5 m on 6/14/2017**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0		TOPSOIL
		FILL: Light brown lean clay (CL) - some roots, moist
1		Firm light brown lean CLAY (CL) - trace sand, mottled grey, moist
5		- trace oxidation below 5.3 m
		Dense brown well graded GRAVEL (GW) with sand - moist - trace coal between 6.5 m to 6.7 m
7		Compact brown poorly graded SAND (SP) with gravel - moist
		Inferred poor quality greyish brown SEDIMENTARY BEDROCK - clay shale - oxidized between 7.6 to 7.9 m
9		End of borehole (8.9 m) - borehole sloughed to 7.6 m and water level at 7.5 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.8 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	300	6
BS	3		
SS	4	450	8
BS	5		
SS	6	450	7
BS	7		
SS	8	350	42
BS	9		
SS	10	450	14
BS	11		
SS	12	400	23

MONITOR WELL/ PIEZOMETER



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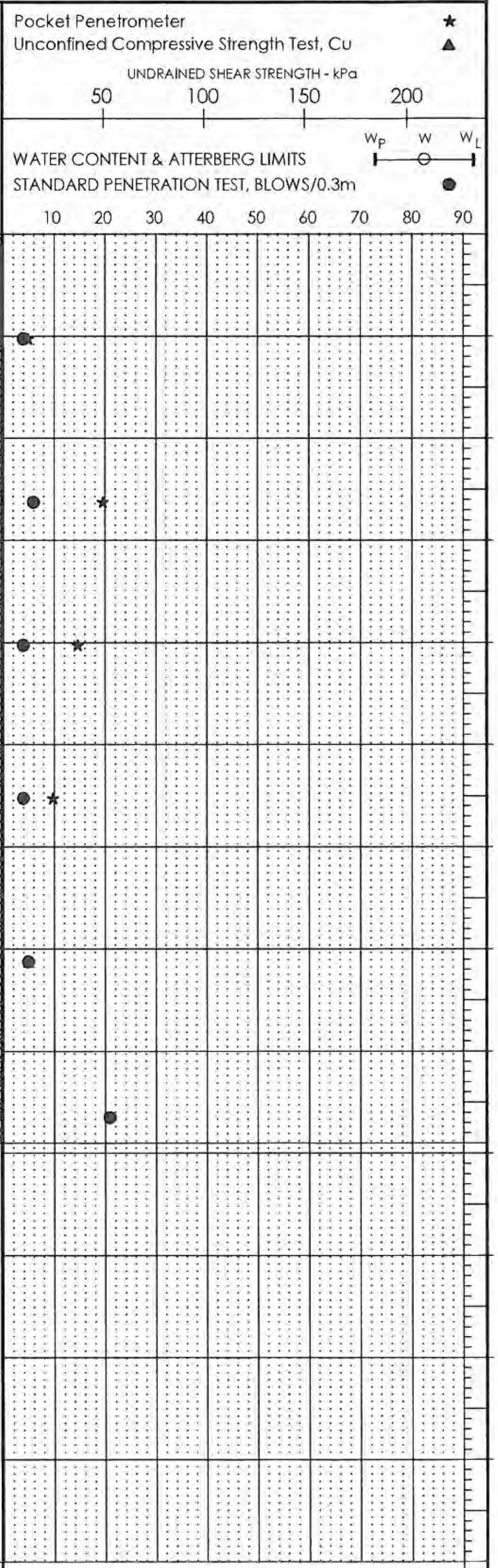
BOREHOLE RECORD

BH17-30

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/21/17**
WATER LEVEL **7.6 m on 6/28/2017**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
0		TOPSOIL				
		FILL: Brown lean clay (CL) - trace rootlets, moist	BS	1		
1		Soft light brown lean CLAY (CL) - moist - firm below 1.3 m	SS	2	350	4
			BS	3		
			SS	4	400	6
3		- 0.1 m thick sand layer at 2.7 m - soft to firm below 3.0 m	BS	5		
4			SS	6	400	4
		- 0.4 m thick sand layer at 4.4 m	BS	7		
		- occasional grey mottling below 5.5 m	SS	8	450	4
6		- moist to wet below 5.7 m - trace oxidation below 5.8 m	BS	9		
7		- wet below 6.8 m	SS	10	450	5
		- trace gravel below 7.5 m	BS	11		
8		Compact poorly graded GRAVEL (GP) with sand - wet	SS	12	400	21
9		End of borehole (8.9 m) - borehole sloughed to 8.1 m and water level at 7.6 m upon completion - 25 mm standpipe piezometer hand-slotted from 5.3 m to 8.7 m - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m				



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BOREHOLE RECORD

BH17-31

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/14/17**

WATER LEVEL **Dry on 6/14/2017**

DATUM **N/A**

DEPTH(m) 0–13 | ELEVATION(m)

SOIL DESCRIPTION

TOPSOIL

FILL: Brown lean clay (CL) with sand
- trace organics, moist

Soft to firm light brown lean CLAY (CL) with sand
- moist

Loose light brown silty SAND (SM)
- dry to moist

Firm light brown lean CLAY (CL) with sand
- dry to moist

Loose light brown silty SAND (SM)
- trace clay, dry to moist

Firm to soft light brown sandy CLAY (CL) to SILT with sand (ML)
- dry to moist

Very loose light brown silty SAND (SM)
- trace clay, dry to moist
- trace coal between 4.5 m to 5.2 m
- loose below 5.3 m

Firm light brown lean CLAY (CL) with sand
- moist
- increase in sand content below 6.9 m

Light brown poorly graded SAND (SP) with Gravel
- trace coal, moist

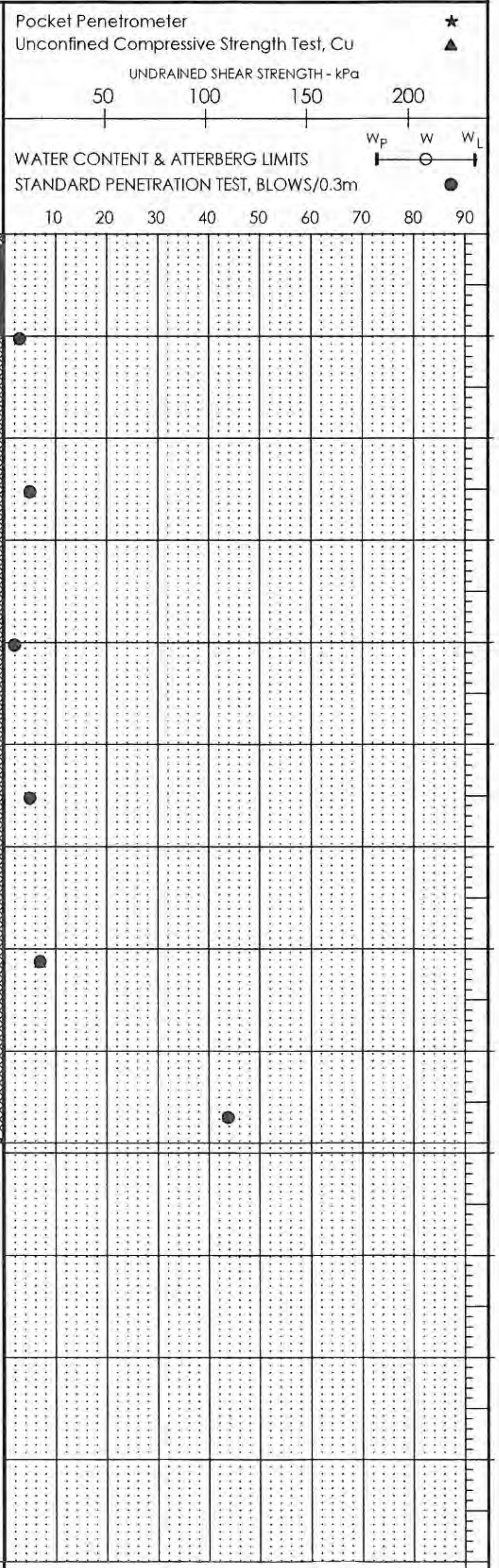
Firm light brown lean CLAY (CL) with sand
- moist

Dense brown well graded GRAVEL (GW) with sand
- moist

End of borehole (8.9 m)
- borehole sloughed to 8.8 m and dry upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.0 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	450	3
BS	3		
SS	4	450	5
BS	5		
SS	6	450	2
BS	7		
SS	8	450	5
BS	9		
SS	10	450	7
BS	11		
SS	12	450	44

STRATA PLOT | MONITOR WELL/ PIEZOMETER



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BOREHOLE RECORD

BH17-32

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

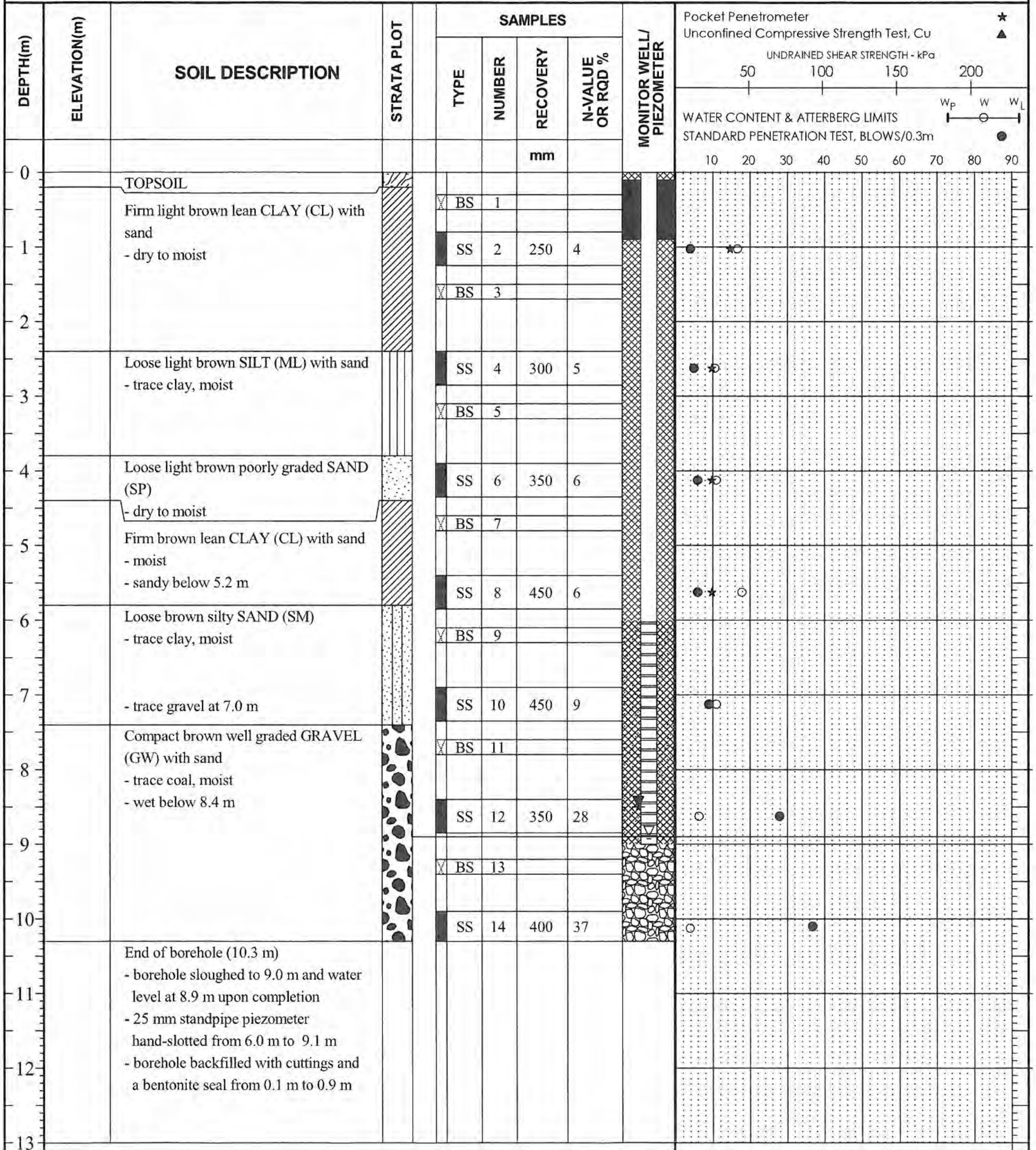
DATES (mm/dd/yy): BORING **6/13/17**

WATER LEVEL **8.5 m on 6/28/2017**

DATUM **N/A**

SOIL DESCRIPTION	TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
TOPSOIL				
Firm light brown lean CLAY (CL) with sand - dry to moist	BS	1		
	SS	2	250	4
	BS	3		
Loose light brown SILT (ML) with sand - trace clay, moist	SS	4	300	5
	BS	5		
Loose light brown poorly graded SAND (SP) - dry to moist	SS	6	350	6
Firm brown lean CLAY (CL) with sand - moist - sandy below 5.2 m	BS	7		
	SS	8	450	6
Loose brown silty SAND (SM) - trace clay, moist	BS	9		
- trace gravel at 7.0 m	SS	10	450	9
Compact brown well graded GRAVEL (GW) with sand - trace coal, moist - wet below 8.4 m	BS	11		
	SS	12	350	28
	BS	13		
	SS	14	400	37

End of borehole (10.3 m)
- borehole sloughed to 9.0 m and water level at 8.9 m upon completion
- 25 mm standpipe piezometer hand-slotted from 6.0 m to 9.1 m
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.9 m



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BOREHOLE RECORD

BH17-33

CLIENT **EPCOR Water Services Inc.**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES (mm/dd/yy): BORING **6/12/17** WATER LEVEL **3.6 m on 6/28/2017**
PROJECT No. **110219883**
BH SIZE **SS: 150 mm**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Dark brown lean clay (CL)
- trace rootlets, gravel, moist

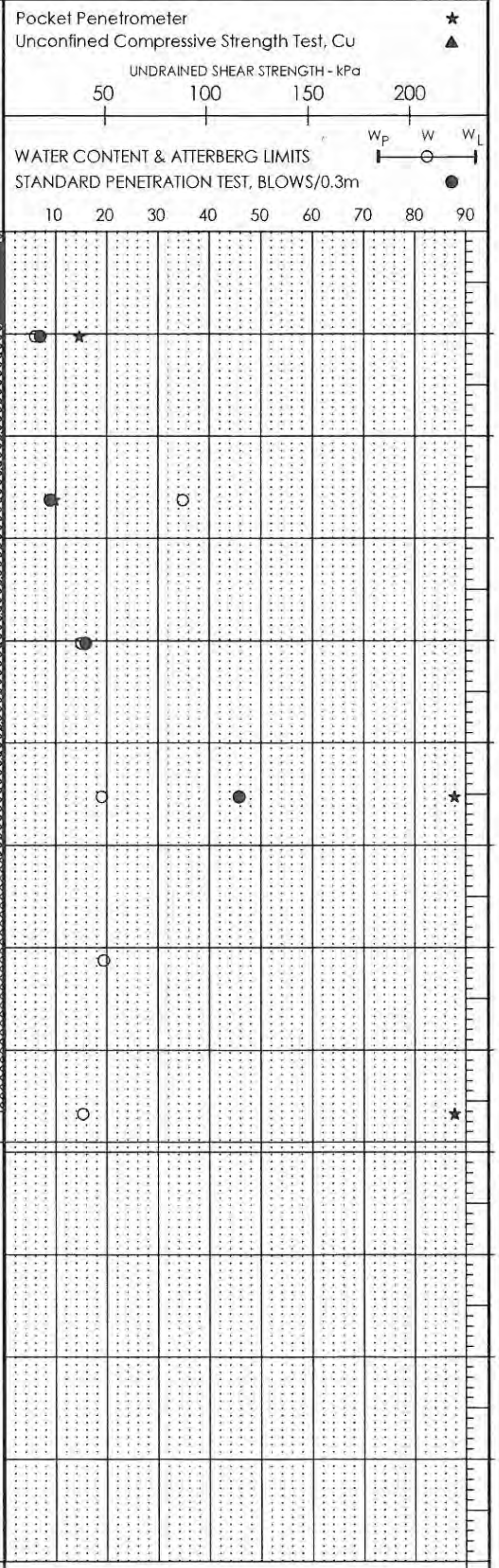
Firm brown lean CLAY (CL) with sand
- moist
- 0.1 m thick sand layer at 2.1 m
- sandy below 2.5 m

Compact light brown poorly graded SAND (SP)
- wet
- trace coal below 3.2 m

Inferred poor quality grey SEDIMENTARY BEDROCK
- clay shale

End of borehole (8.6 m)
- borehole open and water level at 8.4 m upon completion
- 25 mm standpipe piezometer hand-slotted from 3.1 m to 6.1 m
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.9 m

SAMPLES			
TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	300	7
BS	3		
SS	4	400	9
BS	5		
SS	6	220	16
BS	7		
SS	8	450	46
BS	9		
SS	10	160	
BS	11		
SS	12	120	



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BOREHOLE RECORD

BH17-34

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/19/17**
WATER LEVEL **Dry on 6/19/2017**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Brown lean CLAY (CL)
- trace rootlets, moist

Soft to firm light brown lean CLAY (CL)
- trace rootlets, moist
- firm below 1.7
- moist to wet below 2.7 m
- trace oxidation between 2.7 m to 3.2 m

Loose light brown silty SAND (SM)
- moist

Very dense brown poorly graded GRAVEL (GW) with sand
- evidence of cobbles, trace oxidation, wet

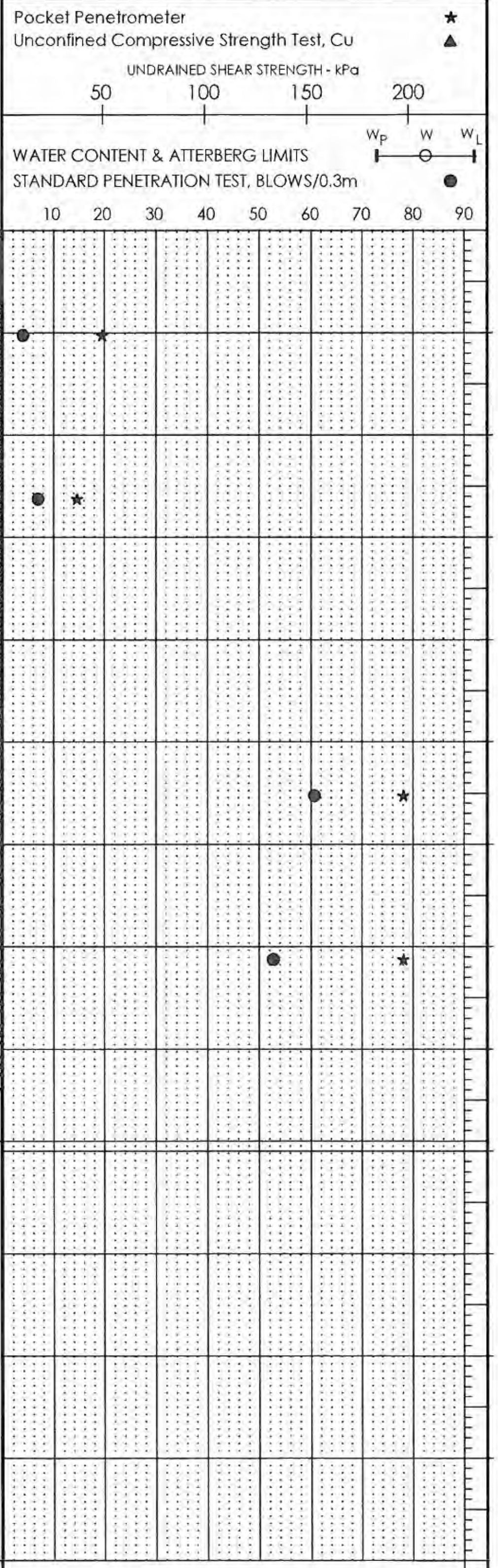
Inferred poor quality dark grey to brown SEDIMENTARY BEDROCK
- clay shale

Inferred poor quality grey SEDIMENTARY BEDROCK
- clayey sandstone
- striations between 5.8 m to 6.6 m

Inferred grey poor quality SEDIMENTARY BEDROCK
- siltstone

End of borehole at 8.4 m due to auger refusal
- borehole sloughed to 4.6 m and dry upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.7 m

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	300	4
BS	3		
SS	4	370	7
BS	5		
SS	6	150	50+
BS	7		
SS	8	450	61
BS	9		
SS	10	450	53
BS	11		
BS	12		



DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

ELEVATION(m) STRATA PLOT MONITOR WELL/ PIEZOMETER

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BOREHOLE RECORD

BH17-35

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

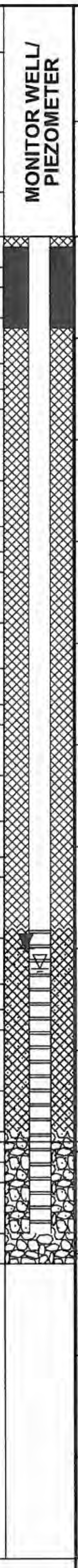
BH SIZE **SS: 150 mm**

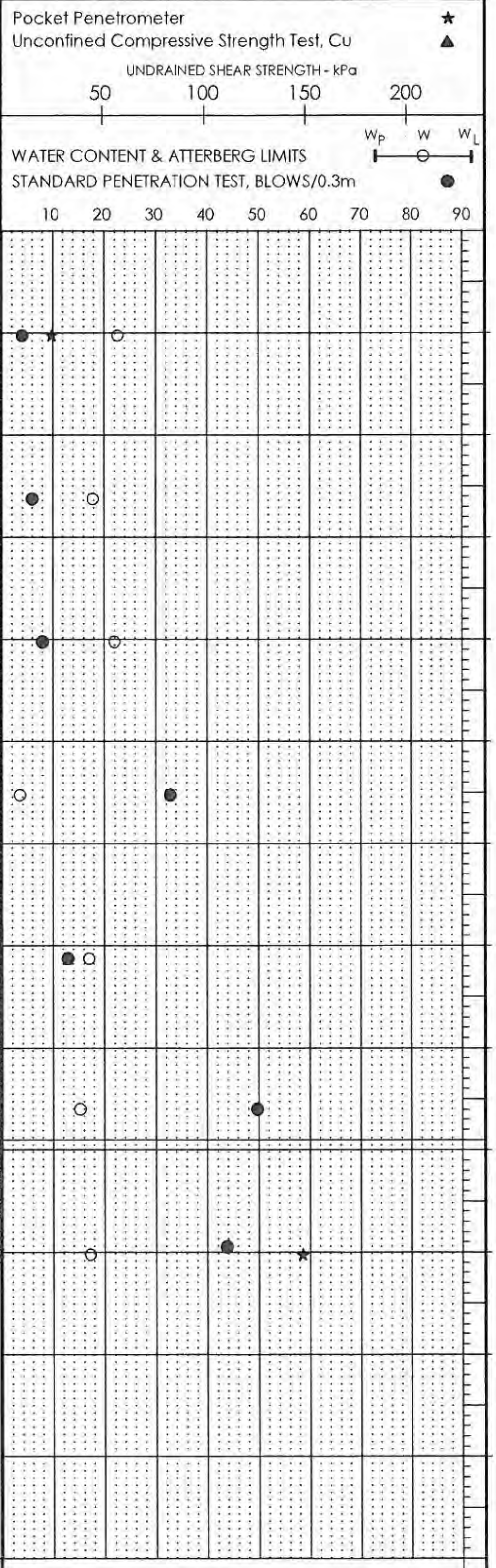
DATES (mm/dd/yy): BORING **6/12/17**

WATER LEVEL **7.0 m on 6/28/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm	SAMPLES N-VALUE OR RQD %
0		TOPSOIL				
		Firm brown lean CLAY (CL)	BS	1		
1		- trace organics, gravel, grey mottling, moist	SS	2	300	4
		Firm light brown lean CLAY (CL)	BS	3		
2		- grey mottling, moist				
		Firm light brown sandy SILT (ML) - moist	SS	4	350	6
3			BS	5		
4			SS	6	450	8
		- trace clay and wet below 4.2 m				
			BS	7		
5		Dense light brown poorly graded SAND (SP) with gravel - dry to moist	SS	8	450	33
6			BS	9		
7		- becoming compact at 7.0 m	SS	10	400	13
		- trace coal below 7.4 m				
8		Inferred poor quality grey SEDIMENTARY BEDROCK	BS	11		
		- sandstone - trace oxidation at 7.8 m	SS	12	440	50
9			BS	13		
10		Inferred poor quality grey SEDIMENTARY BEDROCK - clay shale	SS	14	300	44
11		End of borehole (10.1 m) - borehole sloughed to 8.8 m and water level at 7.2 m upon completion - 25 mm standipe piezometer hand-slotted from 6.8 m to 9.8 m - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.9 m				
12						
13						





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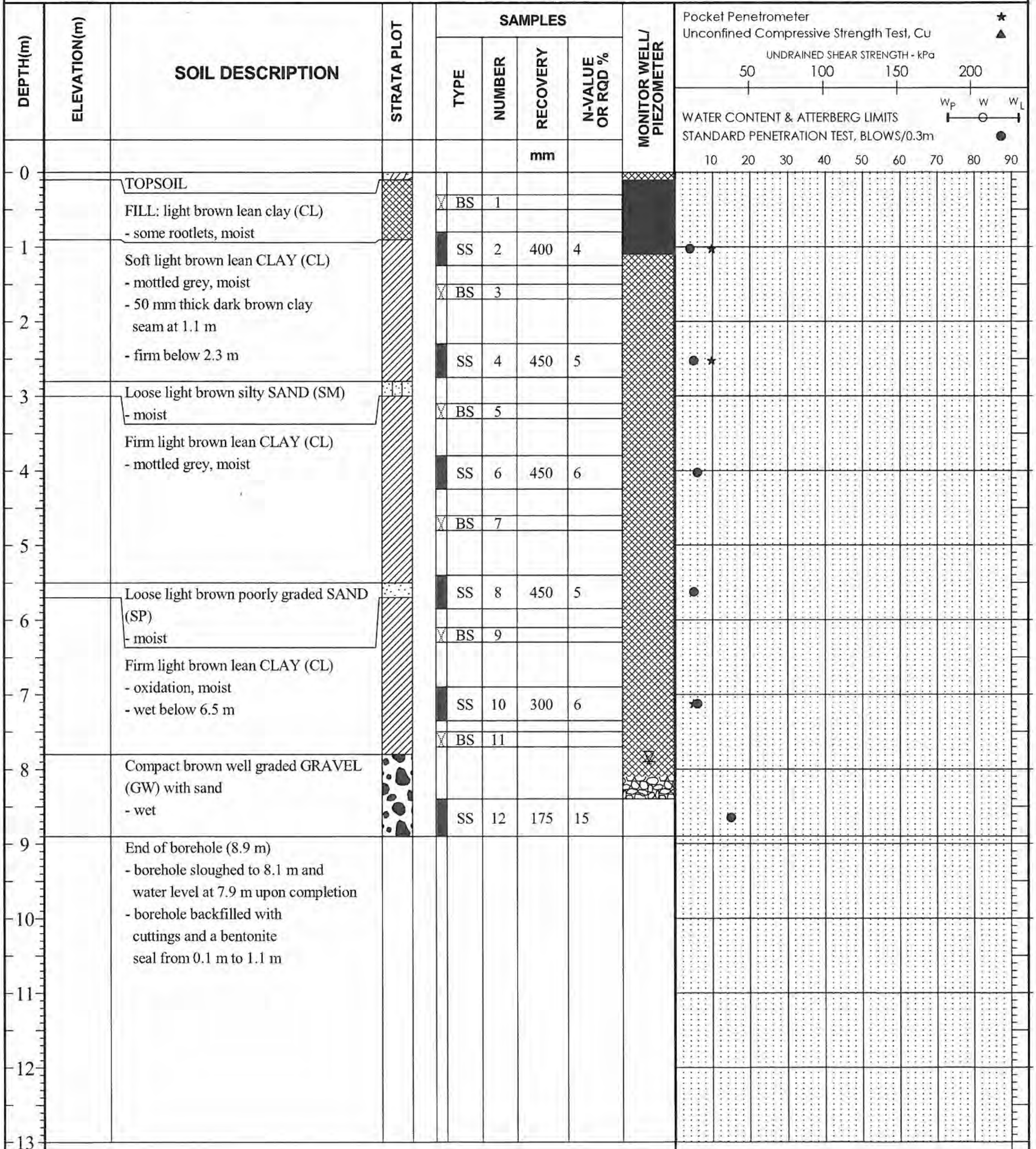
BOREHOLE RECORD

BH17-36

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/14/17**
WATER LEVEL **7.9 m on 6/14/2017**
DATUM **N/A**



SOIL DESCRIPTION

TOPSOIL

FILL: light brown lean clay (CL)
- some rootlets, moist

Soft light brown lean CLAY (CL)
- mottled grey, moist
- 50 mm thick dark brown clay seam at 1.1 m
- firm below 2.3 m

Loose light brown silty SAND (SM)
- moist

Firm light brown lean CLAY (CL)
- mottled grey, moist

Loose light brown poorly graded SAND (SP)
- moist

Firm light brown lean CLAY (CL)
- oxidation, moist
- wet below 6.5 m

Compact brown well graded GRAVEL (GW) with sand
- wet

End of borehole (8.9 m)
- borehole sloughed to 8.1 m and water level at 7.9 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	4
BS	3		
SS	4	450	5
BS	5		
SS	6	450	6
BS	7		
SS	8	450	5
BS	9		
SS	10	300	6
BS	11		
SS	12	175	15

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BOREHOLE RECORD

BH17-37

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/14/17**
WATER LEVEL **Dry on 6/14/2017**
DATUM **N/A**

DEPTH(m): 0 – 13

ELEVATION(m)

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- trace rootlets, moist

Very soft to soft light brown lean CLAY (CL)
- trace sand, mottled grey, moist

Loose light brown silty SAND (SM)
- moist

Firm light brown, lean CLAY (CL)
- trace sand, mottled grey, moist

Loose light brown silty SAND (SM)
- moist

Firm light brown lean CLAY (CL)
- trace sand, mottled grey, moist

Loose light brown silty SAND (SM)
- moist

Firm Light brown lean CLAY (CL)
- moist

Loose light brown silty SAND (SM)
- moist

Firm Light brown lean CLAY (CL)
- moist

Loose light brown silty SAND (SM)
- moist

Stiff to firm light brown lean CLAY (CL)
- moist
- wet below 7.3 m

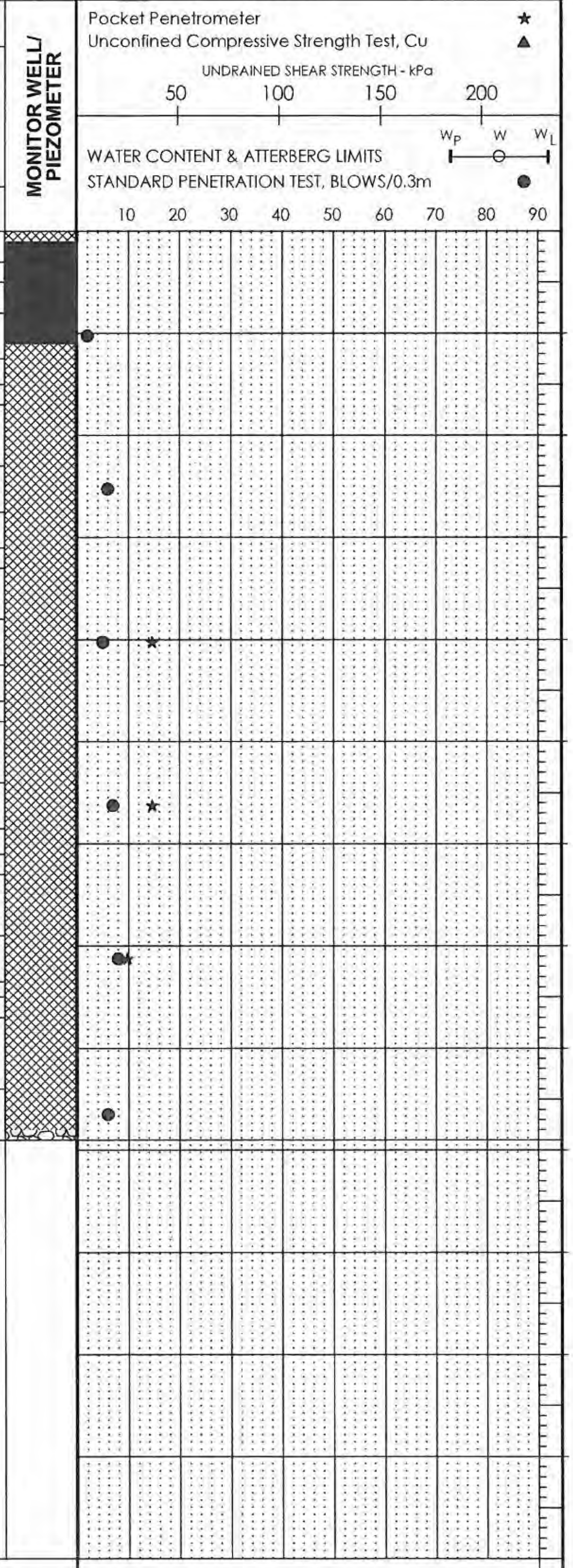
Loose light brown poorly graded SAND (SP)
- wet

Firm light brown lean CLAY (CL)
- moist

End of borehole (8.9 m)
- borehole sloughed to 8.8 m and dry upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

STRATA PLOT

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	2
BS	3		
SS	4	400	6
BS	5		
SS	6	400	5
BS	7		
SS	8	300	7
BS	9		
SS	10	450	8
BS	11		
SS	12	400	6



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Stantec

BOREHOLE RECORD

BH17-38

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/14/17** WATER LEVEL **7.8 m on 6/14/2017** DATUM **N/A**

DEPTH(m) | ELEVATION(m) | SOIL DESCRIPTION | STRATA PLOT | MONITOR WELL/ PIEZOMETER

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown clay (CL)
- some rootlets, moist

Soft light brown lean CLAY (CL)
- some rootlets, grey specs, moist

Loose light brown poorly graded SAND (SP-SM) with silt
- moist

Firm light brown lean CLAY (CL)
- moist

Loose light brown poorly graded SAND (SP-SM) with silt
- moist

Soft to firm light brown lean CLAY (CL)
- moist
- 80 mm thick sand layer at 5.1 m

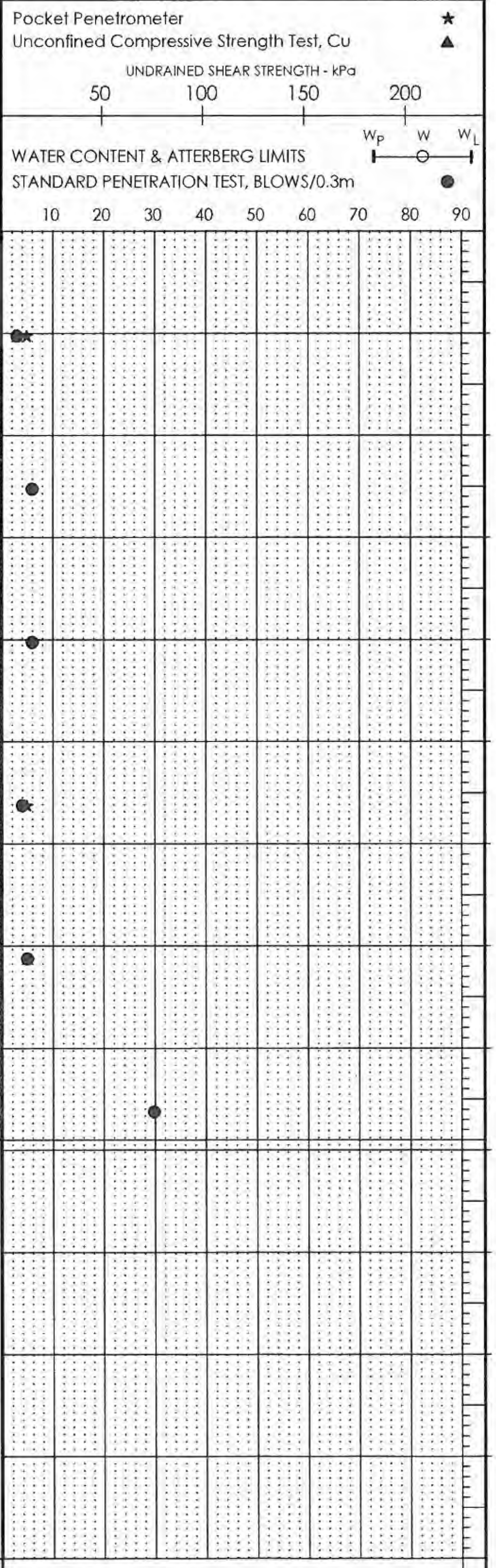
Loose light brown poorly graded SAND (SP-SM) with silt
- moist
- wet below 7.5 m

Compact brown well graded GRAVEL (GW) with sand
- trace oxidation, some coal, wet

End of borehole (8.9 m)
- borehole slough to 7.9 m and water level at 7.8 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	350	3
BS	3		
SS	4	400	6
BS	5		
SS	6	400	6
BS	7		
SS	8	400	4
BS	9		
SS	10	400	5
BS	11		
SS	12	250	30



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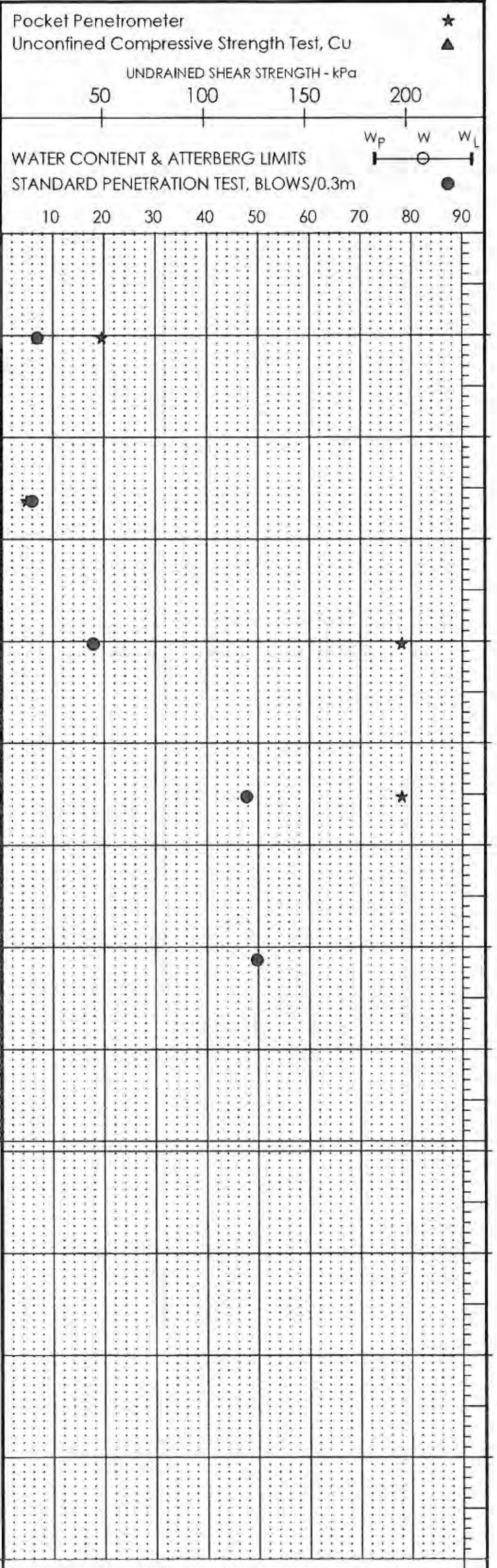
Stantec **BOREHOLE RECORD** **BH17-39**

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/16/17**
WATER LEVEL **3.1 on 6/16/2017**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	SAMPLES TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
0		TOPSOIL				
		FILL: Brown to dark brown lean clay (CL)	BS	1		
1		Firm light brown lean CLAY (CL) - moist - brown below 1.1 m - trace oxidation and mottled grey below 1.6 m - wet below 2.0 m - coal seam at 2.6 m	SS	2	450	7
			BS	3		
			SS	4	350	6
2.7		Compact poorly graded GRAVEL (GW) with sand - wet	BS	5		
			SS	6	350	18
4		Inferred poor quality grey SEDIMENTARY BEDROCK - clay shale - trace oxidation	BS	7		
			SS	8	400	48
5.6		Inferred poor quality grey SEDIMENTARY BEDROCK - sandstone - brown striations below 7.0 m	BS	9		
			SS	10	400	50
			BS	11		
			SS	12	200	50+
9		End of borehole (8.9 m) - borehole sloughed to 4.6 m and water level at 3.1 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m				



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Stantec

BOREHOLE RECORD

BH17-40

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

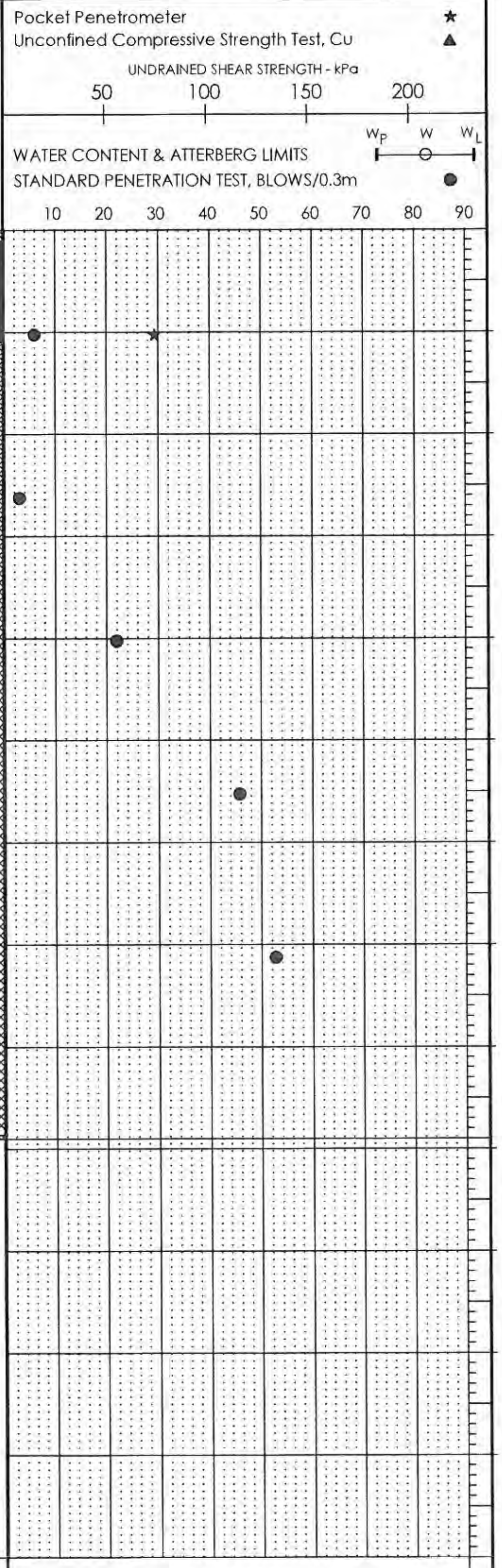
BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/16/17**

WATER LEVEL **Dry on 6/16/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %	MONITOR WELL/ PIEZOMETER
0		TOPSOIL						
		FILL: Light brown lean clay (CL) - trace rootlets, moist		BS	1			
1		Firm to stiff light brown lean CLAY (CL) - trace white specs, moist		SS	2	350	6	
				BS	3			
2		Loose light brown sandy SILT (ML) - fine grained, moist		SS	4	400	3	
3		Loose light brown poorly graded SAND (SP) - fine to medium grained, moist - medium grained below 2.5 m		BS	5			
4		Firm light brown lean CLAY (CL) - moist		SS	6	400	22	
		Compact poorly graded GRAVEL (GP) with sand - moist - 0.2 m thick brown to black sand layer at 4.5 m		BS	7			
5				SS	8	10	46	
6		Inferred poor quality brown SEDIMENTARY BEDROCK - clay shale - highly weathered - trace oxidation - fresh below 7.0 m		BS	9			
7				SS	10	400	53	
				BS	11			
8				SS	12	400	50+	
9		End of borehole (8.9 m) - borehole sloughed to 8.8 m and dry upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m						
10								
11								
12								
13								



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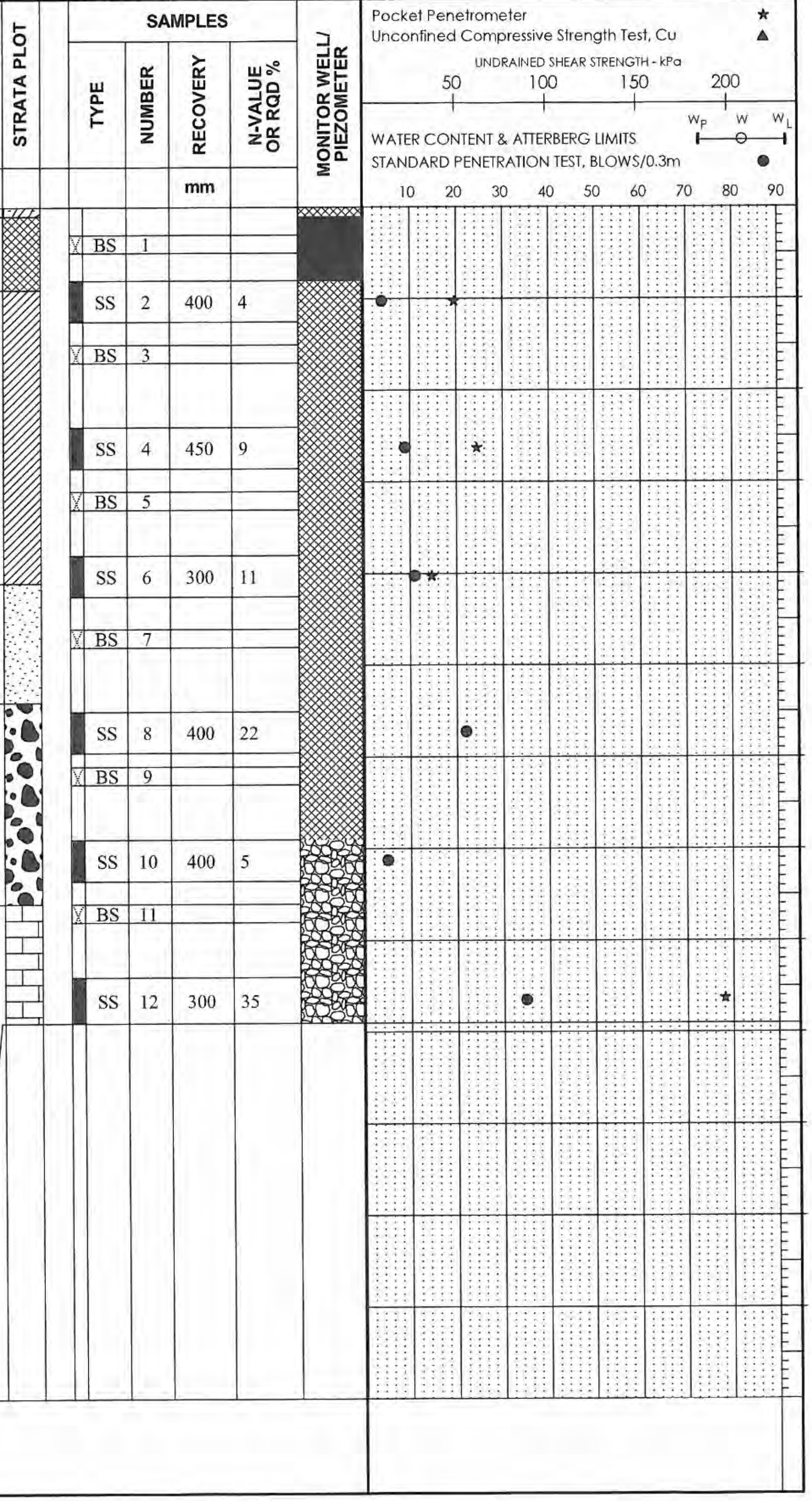
BOREHOLE RECORD

BH17-41

CLIENT **EPCOR Water Services Inc.**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES (mm/dd/yy): BORING **6/16/17**
WATER LEVEL **Dry on 6/16/2017**
PROJECT No. **110219883**
BH SIZE **SS: 150 mm**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0		TOPSOIL
		FILL: Light brown lean clay (CL) - some rootlets, moist
1		Soft light brown lean CLAY (CL) - occasional rootlets, moist - firm below 1.6 m
4		Compact light brown poorly graded SAND (SP) - medium grained, occasional gravel, moist
5		Compact poorly graded GRAVEL (GP) with sand - moist - grey and black sand from 5.9 m to 6.3 m - loose, wet below 6.7 m
7		Inferred poor quality grey SEDIMENTARY BEDROCK - clay shale, occasional brown striations - trace oxidation between 7.6 m to 9.0 m
9		End of borehole (8.9 m) - borehole sloughed to 6.9 m and dry upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.8 m

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	4
BS	3		
SS	4	450	9
BS	5		
SS	6	300	11
BS	7		
SS	8	400	22
BS	9		
SS	10	400	5
BS	11		
SS	12	300	35



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BOREHOLE RECORD

BH17-42

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/15/17** WATER LEVEL **7.4 m on 6/15/2017**

PROJECT No. **110219883**

BH SIZE **SS: 150 mm**

DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- some rootlets, moist

Soft to firm light brown lean CLAY (CL)
- trace grey specks, some rootlets, moist
- firm below 2.0 m
- trace oxidation at 2.5 m

Firm light brown sandy SILT (ML)
- moist

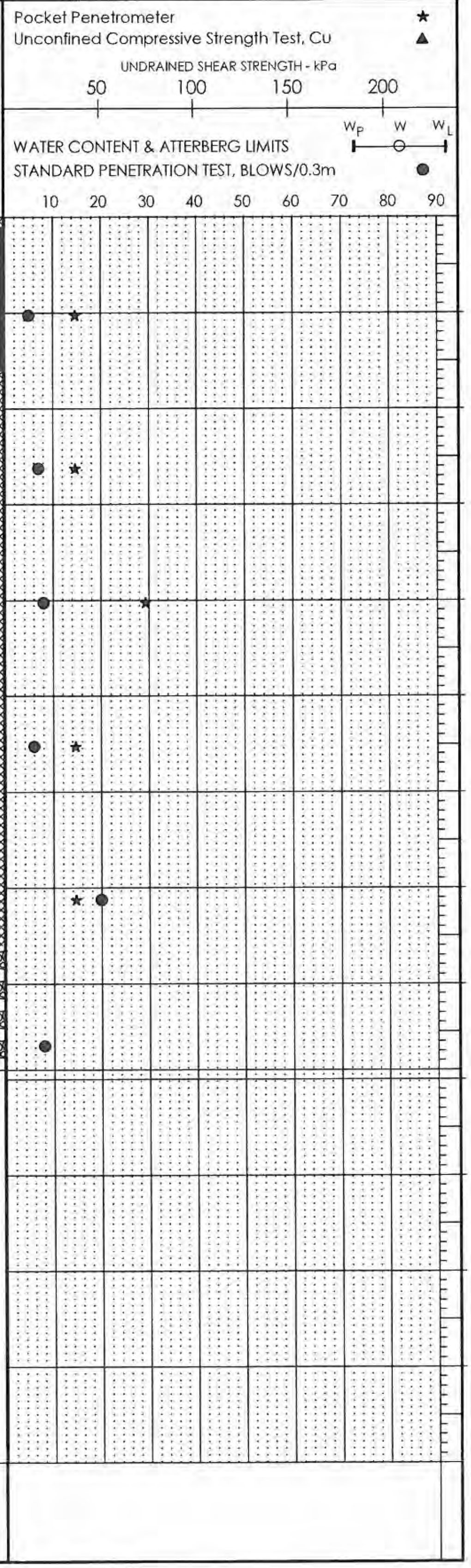
Firm light brown lean CLAY (CL)
- moist
- wet below 6.1 m

Loose brown poorly graded SAND (SP)
- medium grained, wet
- trace coal below 8.4 m

End of borehole (8.9 m)
- borehole sloughed to 7.6 m and water level at 7.4 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	300	5
BS	3		
SS	4	400	7
BS	5		
SS	6	400	8
BS	7		
SS	8	450	6
BS	9		
SS	10	400	20
BS	11		
SS	12	400	8



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BOREHOLE RECORD

BH17-43

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/15/17**

WATER LEVEL **8.3 m on 6/28/2017**

DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown clay (CL)
- trace rootlets, moist

Soft, light brown, lean CLAY (CL)
- some rootlets, mottled grey, moist

Loose light brown sandy SILT (ML)
- moist

Soft, light brown, lean CLAY (CL)
- some rootlets, trace grey specks, moist

Loose light brown sandy SILT (ML)
- moist

Loose brown poorly graded SAND (SP)
- fine grained, moist

Firm light brown lean CLAY (CL)
- moist
- sandy between 4.5 m to 5.3 m

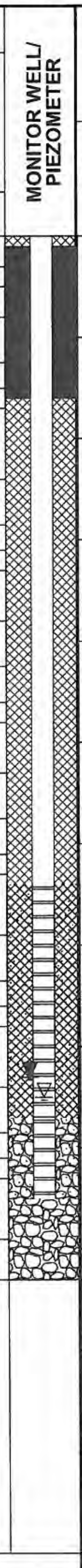
Loose, light brown, poorly graded SAND (SP-SM) with silt
- fine grained, moist

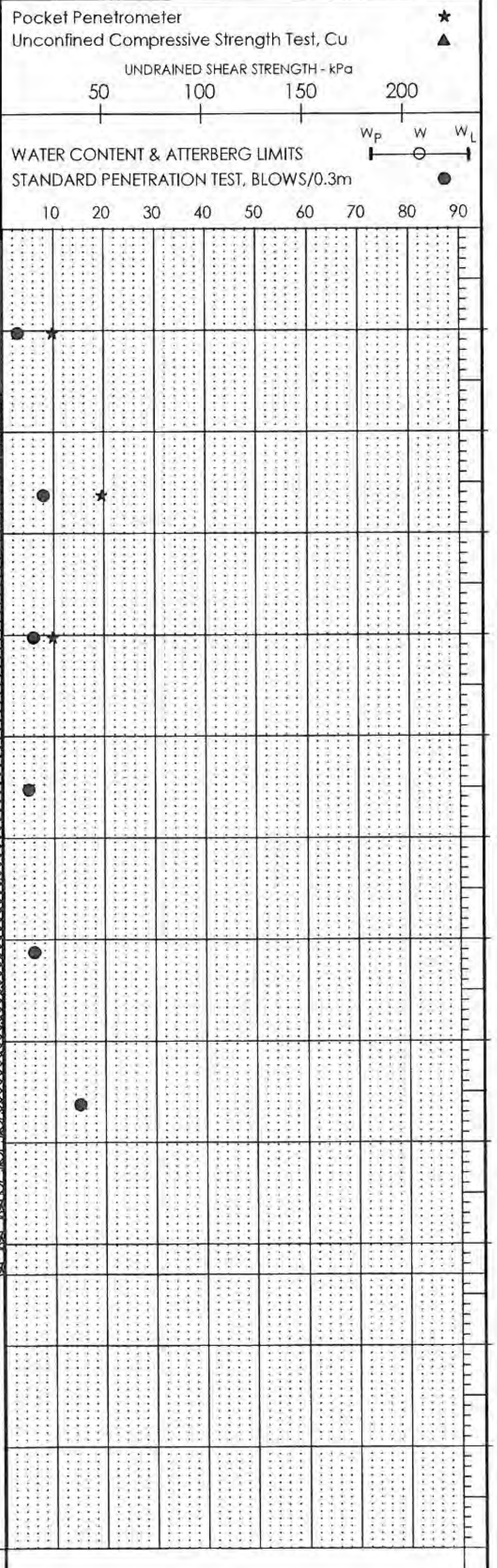
Soft to firm light brown lean CLAY (CL)
- wet

Compact to very dense brown well graded GRAVEL (GW) with sand
- wet

End of borehole (10.3 m)
- borehole sloughed to 8.7 m and water level at 8.5 m upon completion
- 25 mm standpipe piezometer hand-slotted from 6.4 m to 9.5 m
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	450	3
BS	3		
SS	4	450	8
BS	5		
SS	6	450	6
BS	7		
SS	8	450	5
BS	9		
SS	10	450	6
BS	11		
SS	12	450	15
BS	13		
SS	14	400	50+





DEPTH(m): 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13

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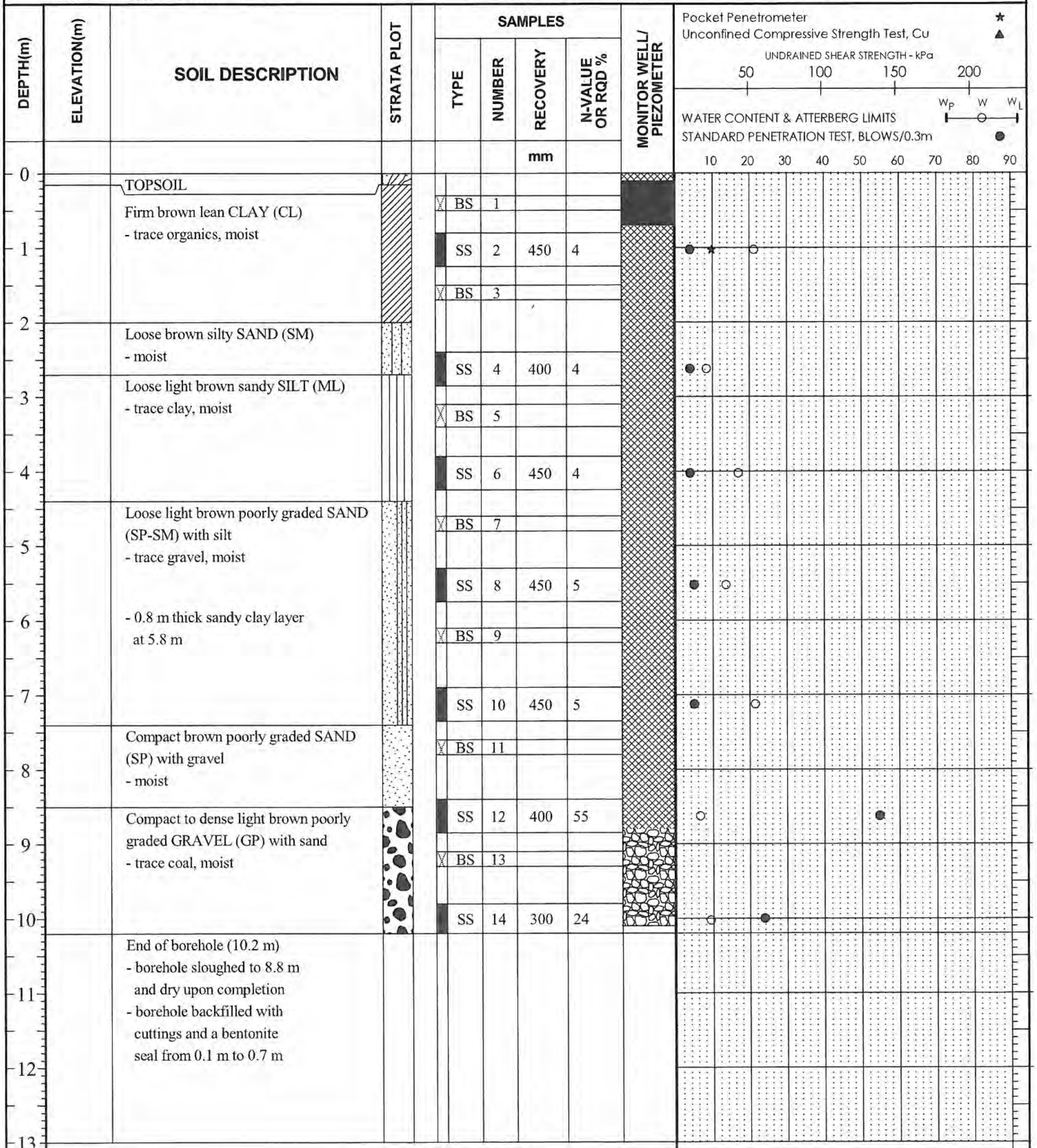
BOREHOLE RECORD

BH17-44

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/12/17**
WATER LEVEL **Dry on 6/12/2017**
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0		TOPSOIL
		Firm brown lean CLAY (CL) - trace organics, moist
2		Loose brown silty SAND (SM) - moist
		Loose light brown sandy SILT (ML) - trace clay, moist
		Loose light brown poorly graded SAND (SP-SM) with silt - trace gravel, moist - 0.8 m thick sandy clay layer at 5.8 m
		Compact brown poorly graded SAND (SP) with gravel - moist
		Compact to dense light brown poorly graded GRAVEL (GP) with sand - trace coal, moist
		End of borehole (10.2 m) - borehole sloughed to 8.8 m and dry upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 0.7 m

SAMPLES			
TYPE	NUMBER	RECOVERY	N-VALUE OR RQD %
		mm	
BS	1		
SS	2	450	4
BS	3		
SS	4	400	4
BS	5		
SS	6	450	4
BS	7		
SS	8	450	5
BS	9		
SS	10	450	5
BS	11		
SS	12	400	55
BS	13		
SS	14	300	24



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Stantec

BOREHOLE RECORD

BH17-45

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
BH SIZE **SS: 150 mm**
DATES (mm/dd/yy): BORING **6/16/17**
WATER LEVEL **3.1 m on 6/28/2017**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- trace gravel, oxidation, some rootlets, moist

Stiff light brown lean CLAY (CL)
- trace coal, oxidation, some rootlets, moist
- oxidation below 1.2 m
- mottled grey below 2.3 m
- wet below 2.6 m

Loose to compact brown poorly graded SAND (SP) with gravel
- medium grained, wet
- increased gravel content below 3.5 m

Compact to dense brown well graded GRAVEL (GW) with sand
- trace coal, wet
- blueish grey sand below 5.4 m

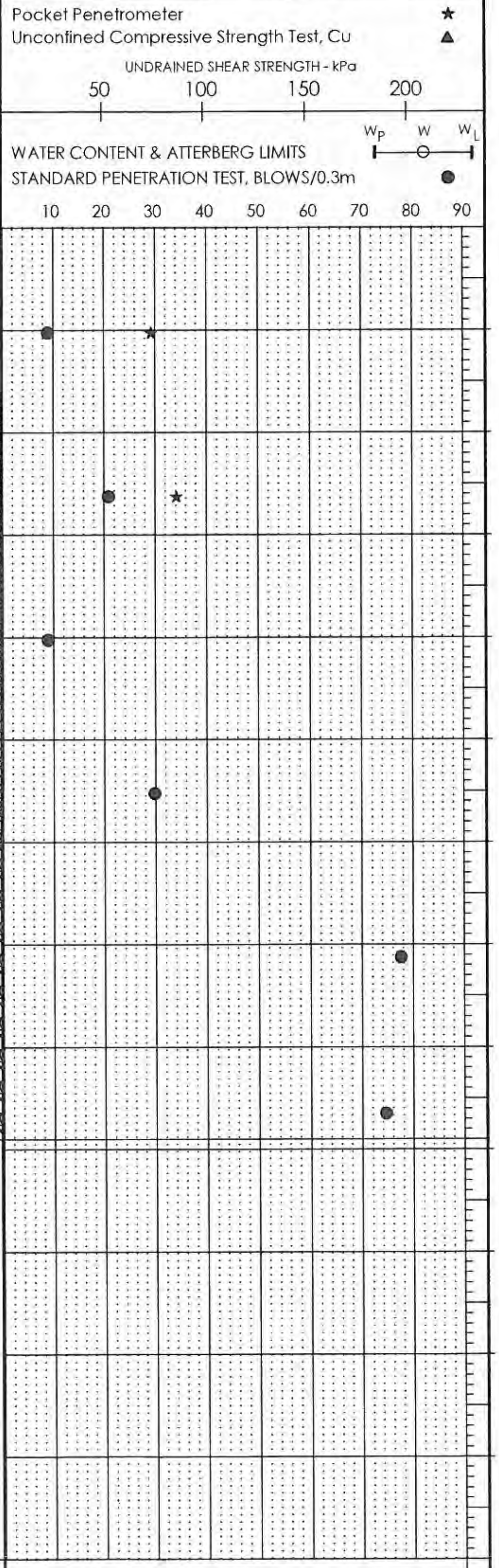
Inferred poor quality blue to grey SEDIMENTARY BEDROCK
- bentonitic
- sandstone
- trace oxidation

Inferred poor quality brown SEDIMENTARY BEDROCK
- claystone
- 30 mm coal seam at 8.7 m

End of borehole (8.9 m)
- borehole sloughed to 5.5 m and water level at 3.1 m upon completion
- 25 mm standpipe piezometer hand-slotted from 3.0 m to 6.1 m
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES

TYPE	NUMBER	RECOVERY (mm)	N-VALUE OR RQD %
BS	1		
SS	2	400	9
BS	3		
SS	4	300	21
BS	5		
SS	6	100	9
BS	7		
SS	8	250	30
BS	9		
SS	10	300	78
BS	11		
SS	12	450	75



DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

ELEVATION(m)

STRATA PLOT

MONITOR WELL/ PIEZOMETER

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BOREHOLE RECORD

BH17-46

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

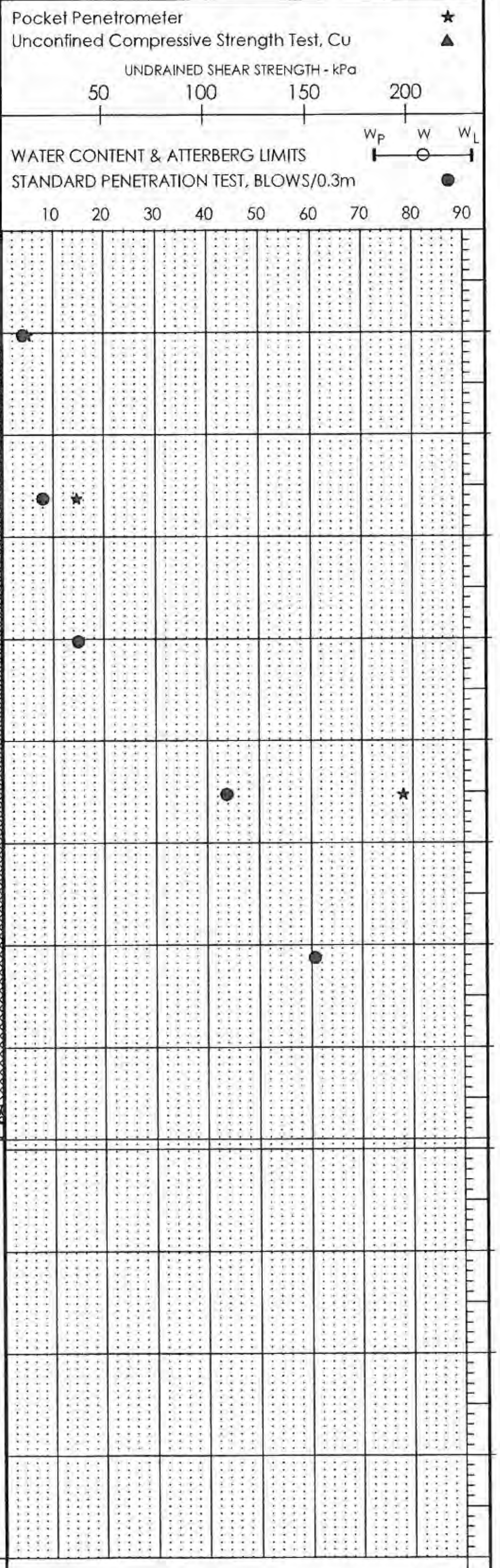
BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/16/17**

WATER LEVEL **Dry on 6/16/2017**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
0		TOPSOIL				
		FILL: Light brown lean clay (CL) - some rootlets, moist	BS	1		
1		Soft light brown lean CLAY (CL) - trace sand, grey specks, some rootlets, moist - 100 mm dark brown clay layer at 1.0 m	SS	2	450	4
			BS	3		
2						
		Loose, light brown, sandy SILT (ML) - moist	SS	4	450	8
3		Compact brown well graded GRAVEL (GW) with sand - medium grained sand, moist - 80 mm coal seam at 3.9 m - cobbles up to 90 mm diameter below 4.3 m	BS	5		
4			SS	6	400	15
			BS	7		
5		Inferred poor quality grey SEDIMENTARY BEDROCK - clay shale - light grey striations - trace oxidation between 4.7 m to 5.1 m	SS	8	450	44
6			BS	9		
7		Inferred poor quality blue to grey SEDIMENTARY BEDROCK - bentonitic - sandstone	SS	10	450	61
			BS	11		
8		Inferred poor quality light grey SEDIMENTARY BEDROCK - clay shale - 100 mm coal layer at 7.0 m	SS	12	250	50+
9		Inferred poor quality light grey SEDIMENTARY BEDROCK - sandstone				
10		End of borehole (8.9 m) - borehole sloughed to 8.8 m and dry upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m				
11						
12						
13						



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Stantec

BOREHOLE RECORD

BH17-47

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/16/17** WATER LEVEL **6.8 m on 6/28/2017**

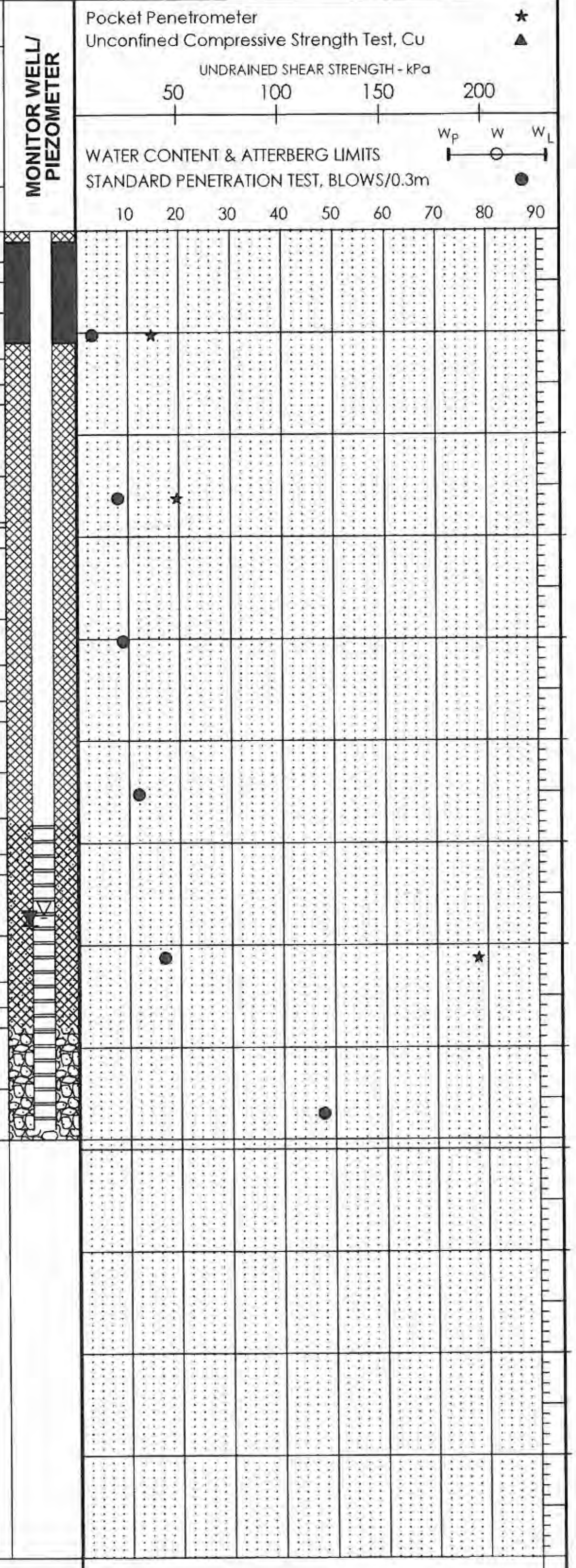
PROJECT No. **110219883**

BH SIZE **SS: 150 mm**

DATUM **N/A**

DEPTH(m)	SOIL DESCRIPTION
0	TOPSOIL
	FILL: Light brown lean clay (CL) - some rootlets, moist
1	Soft light brown lean CLAY (CL) - trace sand, mottled grey, some rootlets, moist - firm below 2.0 m - moist below 2.6 m
3	Loose light brown silty SAND (SM) - fine grained, moist
4	Firm light brown lean CLAY (CL) - trace sand, mottled grey, some rootlets, moist
5	Compact brown poorly graded SAND (SP) with gravel - medium to fine grained sand, trace coal, wet - wet below 5.0 m - increased gravel content below 5.5 m
7	Inferred poor quality light brown SEDIMENTARY BEDROCK - clay shale - trace coal
8	Inferred poor quality blue to grey SEDIMENTARY BEDROCK - bentonitic - sandstone
9	End of borehole (8.9 m) - borehole sloughed to 7.8 m and water level at 6.7 m upon completion - 25 mm standpipe piezometer hand-slotted from 5.8 m to 8.8 m - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	450	3
BS	3		
SS	4	450	8
BS	5		
SS	6	400	9
BS	7		
SS	8	300	12
BS	9		
SS	10	350	17
BS	11		
SS	12	450	48



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BOREHOLE RECORD

BH17-48

CLIENT **EPCOR Water Services Inc.**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES (mm/dd/yy): BORING **6/16/17** WATER LEVEL **8.4 m on 6/16/2017**
PROJECT No. **110219883**
BH SIZE **SS: 150 mm**
DATUM **N/A**

DEPTH(m) 0–13; ELEVATION(m)

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- some rootlets, moist

Soft light brown lean CLAY (CL)
- trace oxidation, mottled grey, some rootlets, moist

Loose light brown sandy SILT (ML)
- fine grained, moist

Soft light brown lean CLAY (CL)
- trace oxidation, mottled grey, some rootlets, moist

Loose light brown sandy SILT (ML)
- trace clay, moist

Firm light brown lean CLAY (CL)
- moist
- trace oxidation below 5.0 m
- wet below 5.2 m

Loose light brown silty SAND (SM)
- fine grained, moist

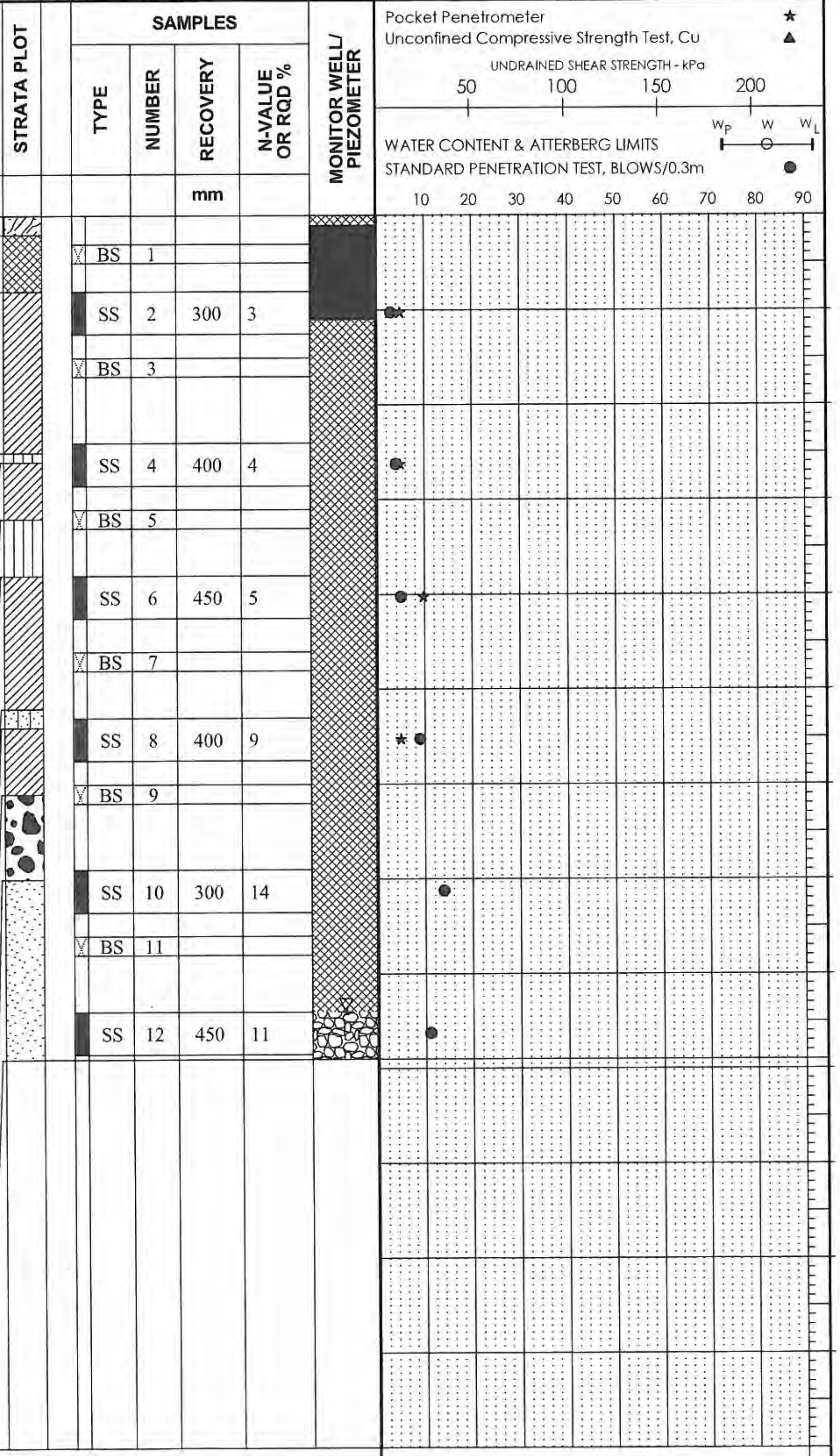
Firm light brown lean CLAY (CL)
- trace oxidation, wet

Compact brown well graded GRAVEL (GW) with sand
- wet
- increased sand content below 6.7 m

Compact brown poorly graded SAND (SP)
- trace gravel, wet
- 20 mm coal seam at 7.1 m

End of borehole (8.9 m)
- borehole sloughed to 8.4 m and water level at 8.3 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	300	3
BS	3		
SS	4	400	4
BS	5		
SS	6	450	5
BS	7		
SS	8	400	9
BS	9		
SS	10	300	14
BS	11		
SS	12	450	11



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BOREHOLE RECORD

BH17-49

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/15/17**

WATER LEVEL **8.4 m on 6/15/2017**

DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- some rootlets, moist

Soft light brown lean CLAY (CL)
- trace grey specks, some rootlets, moist

Loose light brown poorly graded SAND (SP-SM) with silt
- fine grained, moist

Soft light brown sandy lean CLAY (CL)
- moist
- 100 mm sand layer at 3.3 m

Loose light brown poorly graded SAND (SP)
- fine grained, moist

Firm light brown lean CLAY (CL)
- moist
- trace oxidation below 4.7 m

Loose light brown poorly graded SAND (SP-SM) with silt
- fine grained, moist

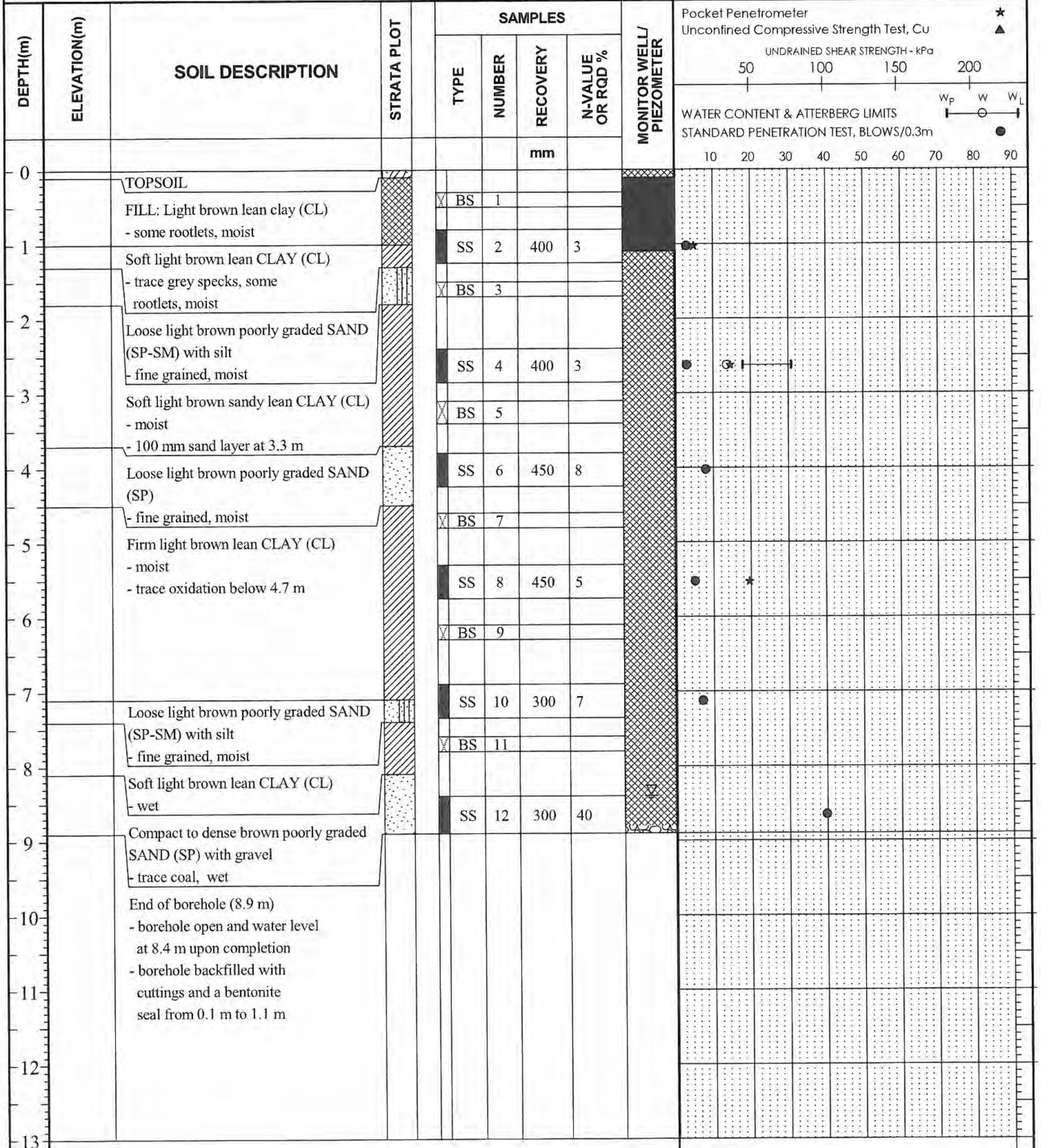
Soft light brown lean CLAY (CL)
- wet

Compact to dense brown poorly graded SAND (SP) with gravel
- trace coal, wet

End of borehole (8.9 m)
- borehole open and water level at 8.4 m upon completion
- borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.1 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	400	3
BS	5		
SS	6	450	8
BS	7		
SS	8	450	5
BS	9		
SS	10	300	7
BS	11		
SS	12	300	40



App'd________ Aug 21 2017 9:28:58

Stantec

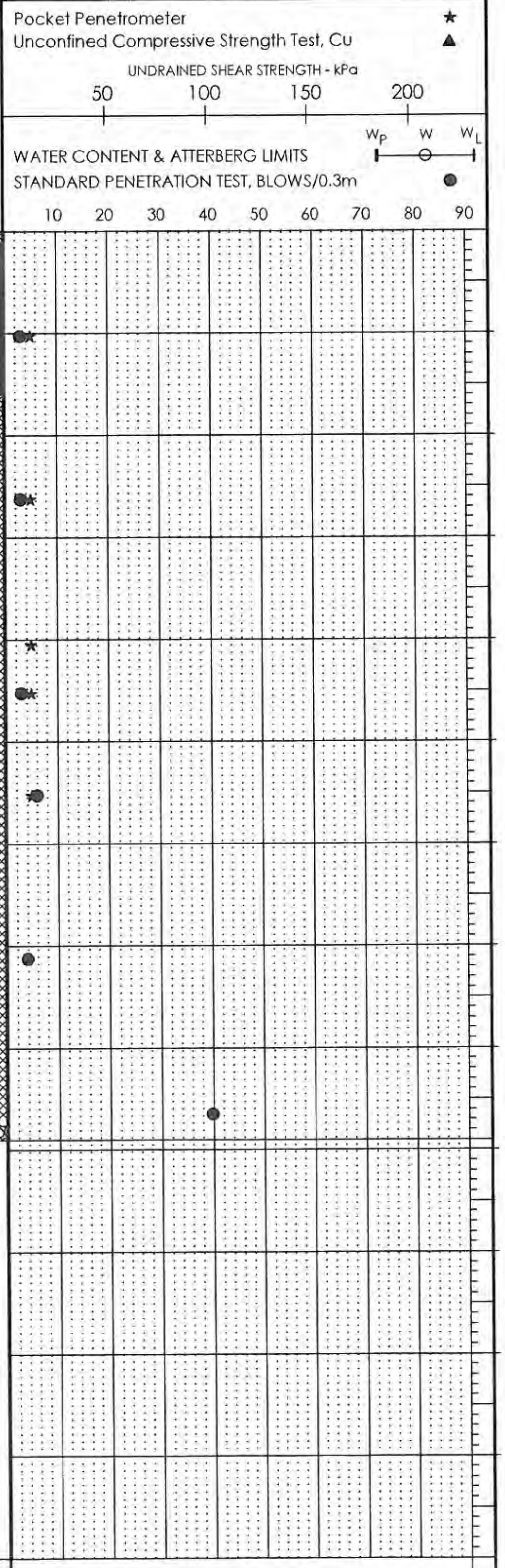
BOREHOLE RECORD

BH17-50

CLIENT **EPCOR Water Services Inc.**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES (mm/dd/yy): BORING **6/15/17** WATER LEVEL **8.6 m on 6/15/2017**
PROJECT No. **110219883**
BH SIZE **SS: 150 mm**
DATUM **N/A**

SOIL DESCRIPTION
TOPSOIL
FILL: Light brown lean clay (CL) - some rootlets, moist
Soft light brown lean CLAY (CL) - trace sand, mottled grey, some rootlets, moist - wet below 1.3 m - oxidation below 2.6 m
Loose light brown poorly graded SAND (SP-SM) with silt - fine grained, wet
Soft light brown lean CLAY (CL) - moist to wet - wet below 6.5 m
Compact to dense brown well graded GRAVEL (GW) with sand - wet to saturated
End of borehole (8.9 m) - borehole sloughed to 8.7 m and water level at 8.6 m upon completion - borehole backfilled with cuttings and a bentonite seal from 0.1 m to 1.6 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	3
BS	3		
SS	4	400	3
BS	5		
ST	6	500	
SS	7	450	3
SS	8	250	6
BS	9		
SS	10	400	4
BS	11		
SS	12	300	40



App'd________ Aug 21 2017 9:28:59

Stantec

BOREHOLE RECORD

BH17-51

CLIENT **EPCOR Water Services Inc.**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES (mm/dd/yy): BORING **6/15/17**
WATER LEVEL **8.6 m on 6/15/2017**
PROJECT No. **110219883**
BH SIZE **SS: 150 mm**
DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean CLAY (CL)
- trace oxidation, rootlets, gravel, moist

Firm light brown lean CLAY (CL)
- trace rootlets, mottled grey, moist

Loose light brown sandy SILT (ML)
- fine grained

Firm light brown lean CLAY (CL)
- trace rootlets, mottled grey, moist

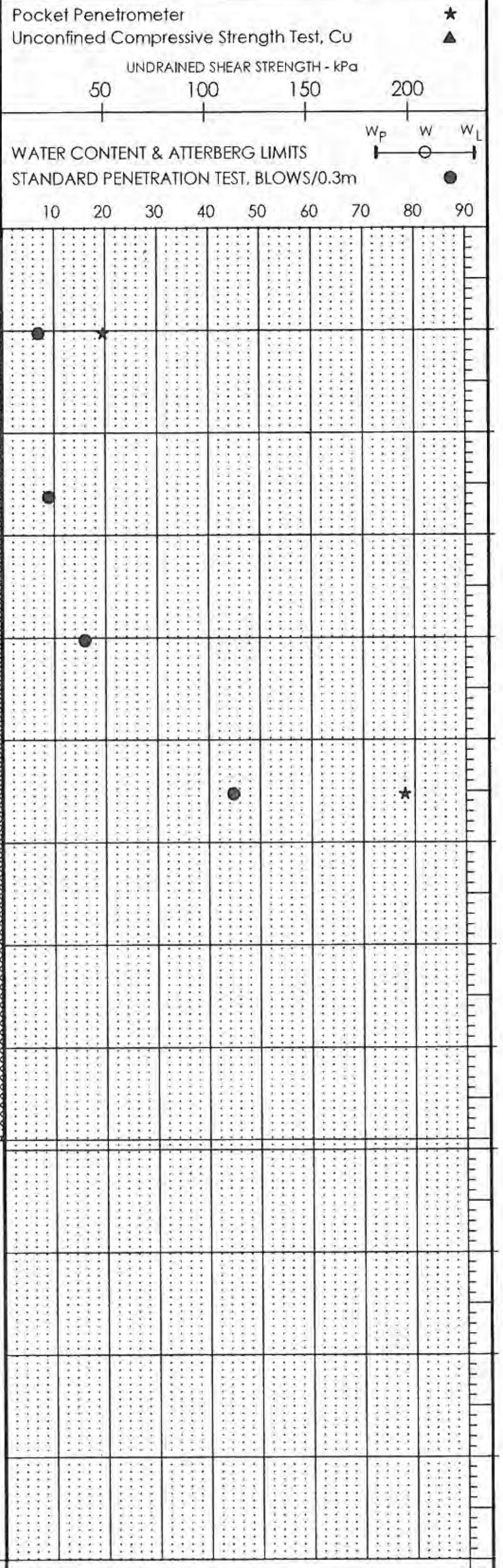
Compact brown poorly graded GRAVEL (GP) with sand
- medium grained sand, gravel up to 8 cm, trace oxidation, wet
- trace coal at 3.5 m
- 100 mm thick layer of coal at 4.7 m

Inferred poor quality light orange weathered SEDIMENTARY BEDROCK
- clay shale
- grey below 5.3 m

End of borehole (8.9 m)
- borehole sloughed to 8.5 m and water level at 8.8 m upon completion
- borehole backfilled with cuttings and bentonite seal from 0.1 m to 0.8 m

SAMPLES

TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	7
BS	3		
SS	4	400	9
BS	5		
SS	6	450	16
BS	7		
SS	8	400	45
BS	9		
SS	10	275	50+
BS	11		
SS	12	150	50+



DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

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BOREHOLE RECORD

BH17-52

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/15/17** WATER LEVEL **7.3 m on 6/15/2017**

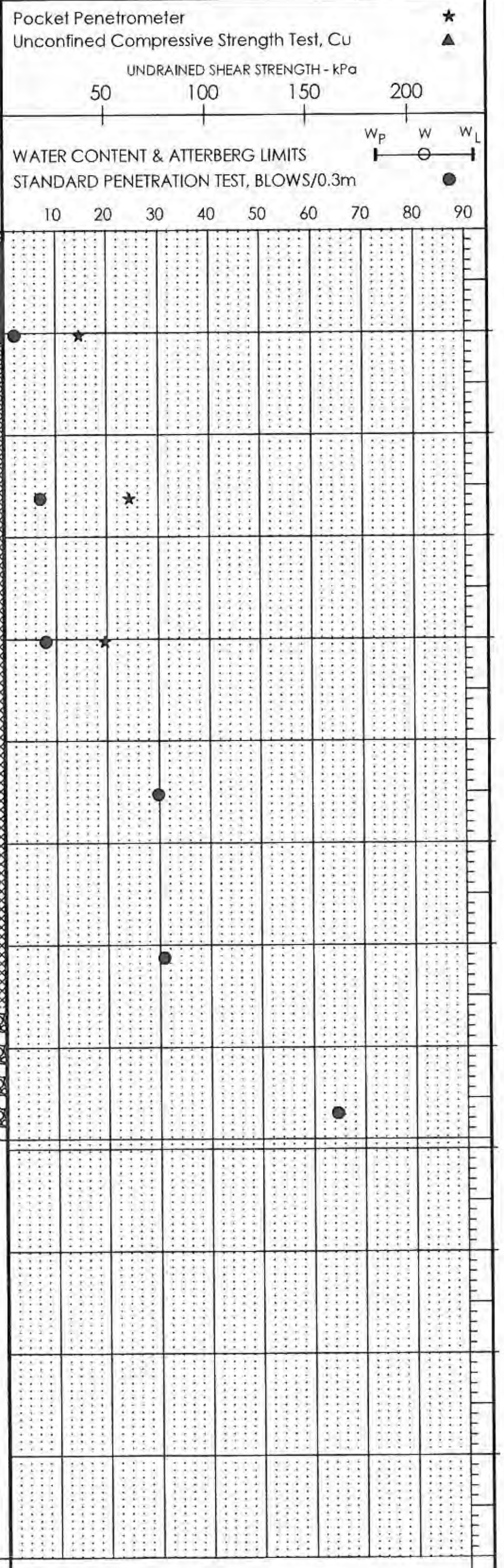
PROJECT No. **110219883**

BH SIZE **SS: 150 mm**

DATUM **N/A**

DEPTH(m)	SOIL DESCRIPTION
0	TOPSOIL
	FILL: Light brown to brown lean clay (CL) - moist
1	Soft to firm light brown lean CLAY (CL) - mottled white, moist - 0.2 m thick silt layer at 1.3 m - trace oxidation below 3.8 m - wet below 4.5 m
	Compact brown poorly graded SAND (SP) with gravel - wet
	Compact to dense GRAVEL (GP) with sand - wet
	Inferred light poor quality grey SEDIMENTARY BEDROCK - clay shale - orange to light brown, highly weathered between 8.3 m to 8.4 m
	End of borehole (8.9 m) - borehole sloughed to 8.5 m and water level at 7.3 m upon completion - borehole backfilled with cuttings and bentonite seal from 0.1 m to 1.1 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	450	2
BS	3		
SS	4	450	7
BS	5		
SS	6	450	8
BS	7		
SS	8	400	30
BS	9		
SS	10	400	31
BS	11		
SS	12	400	65



App'd________ Aug 21 2017 9:29:2

Stantec

BOREHOLE RECORD

BH17-53

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/12/17** WATER LEVEL **8.2 m on 6/12/2017**

PROJECT No. **110219883**

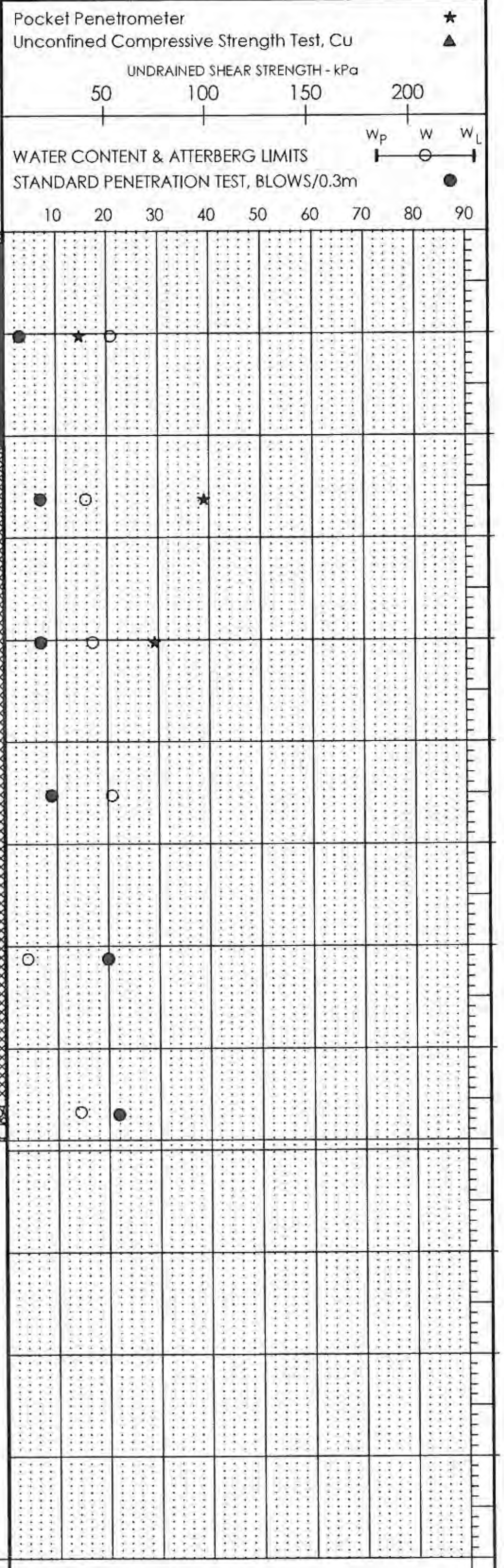
BH SIZE **SS: 150 mm**

DATUM **N/A**

SOIL DESCRIPTION	TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
TOPSOIL				
FILL: Brown lean CLAY (CL) - trace organics, moist	BS	1		
Firm to stiff brown lean CLAY (CL) - trace sand, moist - sandy between 1.1 m to 1.3 m - 75 mm thick sand seam at 1.7 m	SS	2	400	3
	BS	3		
	SS	4	450	7
	BS	5		
Loose light brown sandy SILT (ML) - trace clay, moist	SS	6	450	7
	BS	7		
	SS	8	400	9
Compact light brown well graded GRAVEL (GW) with sand - moist	BS	9		
Compact brown poorly graded SAND (SP) - trace coal, moist - trace gravel from 6.9 m to 7.2 m	SS	10	260	20
	BS	11		
- wet below 8.4 m	SS	12	400	22
End of borehole (8.9 m) - borehole sloughed to 8.5 m and water level at 8.2 m upon completion - borehole backfilled with cuttings and bentonite seal from 0.1 m to 0.8 m				

DEPTH(m) 0 1 2 3 4 5 6 7 8 9 10 11 12 13

ELEVATION(m) STRATA PLOT MONITOR WELL/ PIEZOMETER



App'd________ Aug 21 2017 9:29:3

Stantec

BOREHOLE RECORD

BH17-54

CLIENT **EPCOR Water Services Inc.**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES (mm/dd/yy): BORING **6/15/17**

WATER LEVEL **7.6 m on 6/28/2017**

PROJECT No. **110219883**

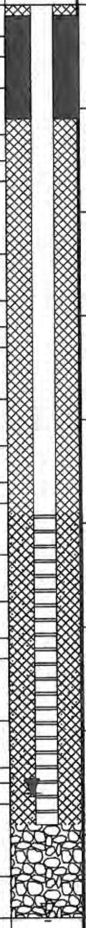
BH SIZE **SS: 150 mm**

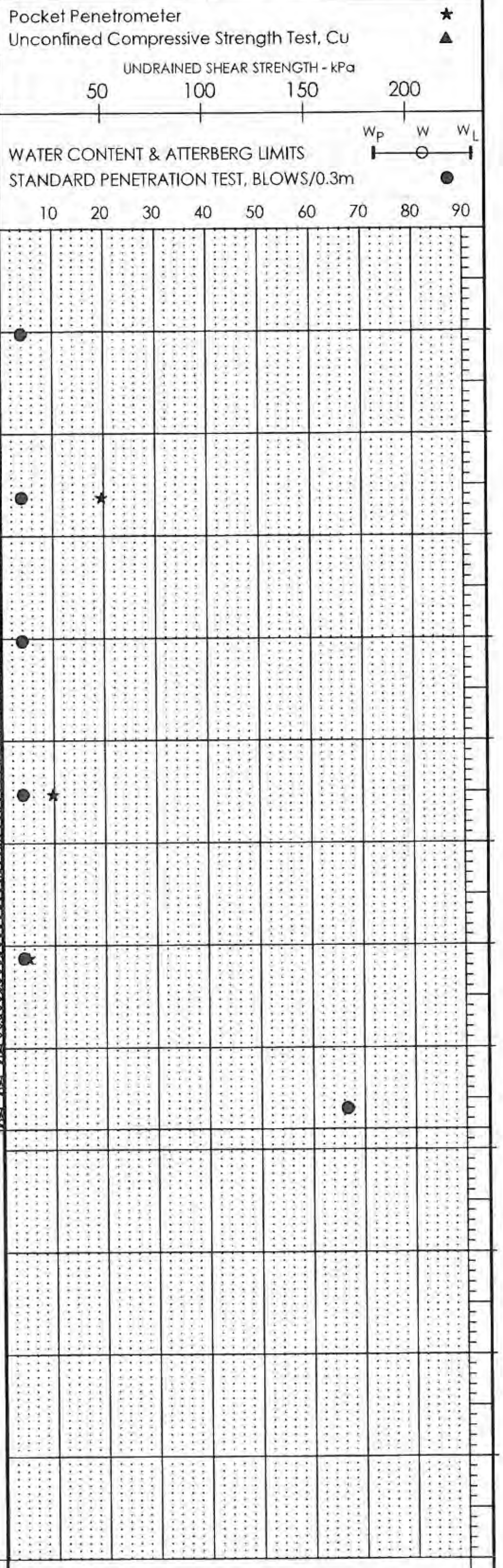
DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION
0		TOPSOIL
		FILL: Brown lean clay (CL) - trace rootlets, moist
1		Soft light brown lean CLAY (CL) - mottled white, moist - trace oxidation at 2.4 m - inferred 0.2 m thick sand layer at 2.5 m
3		Loose light brown sandy SILT (ML) - fine grained, moist
4		Soft light brown lean CLAY (CL) - moist - 0.4 m thick sand layer at 4.4 m - occasional white mottling below 5.4 m - wet below 6.5 m
8		Inferred very dense poorly graded GRAVEL (GP) - wet
9		End of borehole (8.8 m) - borehole sloughed to 7.9 m and water level at 8.8 m upon completion - 25 mm standpipe piezometer hand-slotted from 4.9 m to 7.9 m - borehole backfilled with cuttings and bentonite seal from 0.1 m to 1.1 m

SAMPLES TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	400	4
BS	3		
SS	4	400	4
BS	5		
SS	6	50	4
BS	7		
SS	8	450	4
BS	9		
SS	10	450	4
BS	11		
SS	12	0	67

MONITOR WELL/ PIEZOMETER





App'd________ Aug 21 2017 9:29:4

Stantec

BOREHOLE RECORD

BH17-55

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

BH SIZE **SS: 150 mm**

DATES (mm/dd/yy): BORING **6/15/17**

WATER LEVEL **Dry on 6/15/2017**

DATUM **N/A**

SOIL DESCRIPTION

TOPSOIL

FILL: Light brown lean clay (CL)
- some rootlets, dry

Soft light brown lean CLAY (CL)
- trace white specs, some rootlets, moist

Loose light brown sandy SILT (ML)
- moist

Firm light brown lean CLAY (CL)
- moist

Loose light brown poorly graded SAND (SP)
- dry to moist
- silty below 3.1 m

Firm light brown lean CLAY (CL)
- moist

Loose light brown silty SAND (SM)
- fine grained, damp

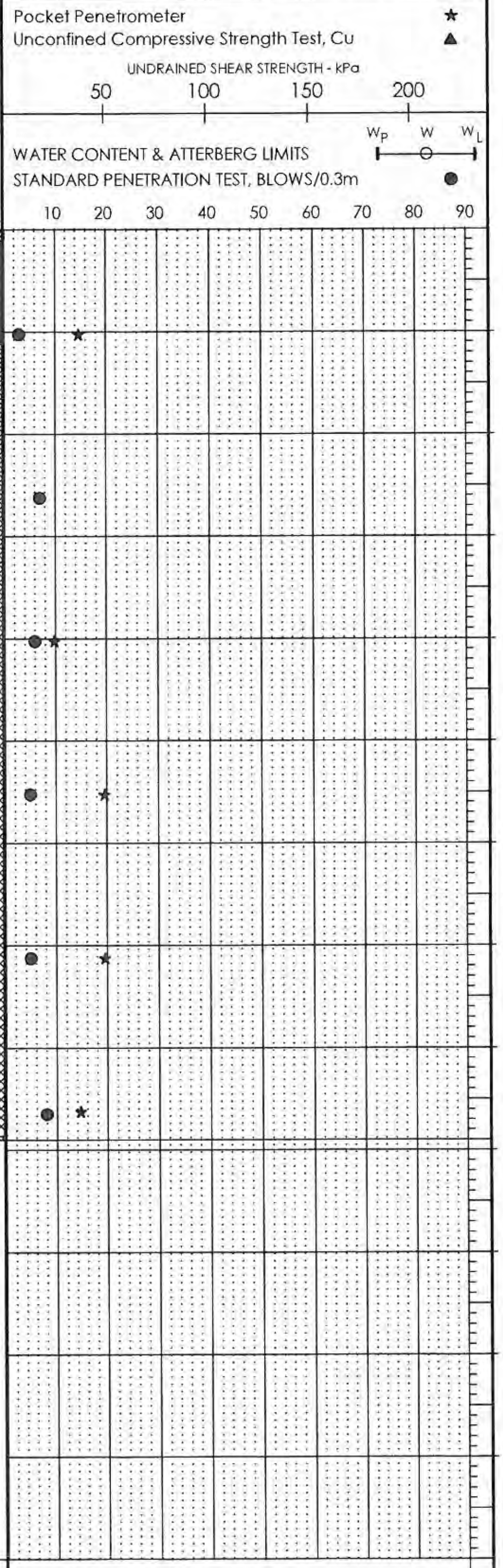
Firm light brown lean CLAY (CL)
- moist

Loose light brown silty SAND (SM)
- fine grained, damp

Firm light brown lean CLAY (CL)
- moist
- 0.2 m thick sand layer at 8.0 m
- wet below 8.5 m
- trace oxidation, sandy below 8.6 m

End of borehole (8.9 m)
- borehole sloughed to 8.8 m and dry upon completion
- borehole backfilled with cuttings and bentonite seal from 0.1 m to 1.1 m

SAMPLES			
TYPE	NUMBER	RECOVERY mm	N-VALUE OR RQD %
BS	1		
SS	2	350	3
BS	3		
SS	4	400	7
BS	5		
SS	6	450	6
BS	7		
SS	8	450	5
BS	9		
SS	10	450	5
BS	11		
SS	12	450	8



App'd________ Aug 21 2017 9:29:5

Stantec

TEST PIT RECORD

TP17-01

CLIENT **EPCOR Water Services Inc.** PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES: EXCAVATED **6/22/17** WATER LEVEL **Dry (6/22/2017)** DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS
0		TOPSOIL					
		Brown lean CLAY (CL) - trace to frequent rootlets, moist					
		Light brown silty SAND (SM) to clayey SAND (SC) - damp			BS	1	
1					BS	2	
		Brown sandy lean CLAY (CL) - trace coal, dry to moist					
2		Light brown silty SAND (SM) - dry to moist			BS	3	
3							
4							
		End of test pit at 4.5 m - Test pit open and dry upon completion - No cobbles/boulders encountered within test pit - Backfilled with excavated material					
5							
6							

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

10 20 30 40 50 60 70 80 90

App'd________ Aug 17 2017 14:22:14

Stantec

TEST PIT RECORD

TP17-02

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES: EXCAVATED **6/22/17**

WATER LEVEL **Dry (6/22/2017)**

DATUM **N/A**

UNDRAINED SHEAR STRENGTH - kPa: 50 100 150 200

WATER CONTENT & ATTERBERG LIMITS: W_P W W_L

10 20 30 40 50 60 70 80 90

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS
0		TOPSOIL					
		Brown lean CLAY (CL) with sand - trace organics, dry to moist - sandy between 0.5 m and 1.0 m	▨		BS	1	
1		- end of organics at 1.2 m	▨				
			▨		BS	2	
2			▨				
3		Brown silty SAND (SM) - dry to moist			BS	3	
4		Brown sandy lean CLAY (CL) - moist	▨				
		End of test pit at 4.5 m - test pit open and dry upon completion - No cobbles/boulders encountered within test pit - backfilled with excavated material					
5							
6							

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Stantec

TEST PIT RECORD

TP17-03

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES: EXCAVATED **6/22/17**

WATER LEVEL **Dry (6/22/2017)**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS
0		TOPSOIL					
1		Brown lean CLAY (CL) - trace organics, dry to moist - end of organics at 1.3 m	▨		BS	1	
		Brown silty SAND (SM) - dry to moist			BS	2	
2		Brown sandy lean CLAY (CL) - fossils encountered (archaeological)	▨				
		Brown silty SAND (SM) - dry to moist					
		Brown sandy lean clay (CL) to clayey SAND (SC)	▨		BS	3	
3 4		Brown silty, clayey SAND (SC-SM)	▨				
5 6		End of test pit of 4.2 m - Test pit open and dry upon completion - No boulders/cobbles encountered within test pit - Test pit backfilled with excavated material					

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

10 20 30 40 50 60 70 80 90

App'd________Aug 17 2017 14:22:15

Stantec

TEST PIT RECORD

TP17-04

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES: EXCAVATED **6/22/17**

WATER LEVEL **Dry (6/22/2017)**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS
0		TOPSOIL					
		FILL: brown lean clay (CL) - trace gravel, occassional cobbles (up to 200 mm thick), dry to moist					
1		Brown lean CLAY (CL) - trace gravel, dry to moist - with sand below 1.5 m			BS	1	
2							
3		Brown sandy SILT (ML) - dry to moist			BS	2	
4							
5		End of test pit at 5.0 m - Test pit open and dry upon completion - Cobbles encountered to 0.8 m - Test pit backfilled with excavated material					
6							

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS

W_P W W_L

10 20 30 40 50 60 70 80 90

App'd________ Aug 17 2017 14:22:15

Stantec

TEST PIT RECORD

TP17-05

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES: EXCAVATED **6/21/17**

WATER LEVEL **Dry (6/21/2017)**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa (50, 100, 150, 200) WATER CONTENT & ATTERBERG LIMITS (W_P W W_L) 10 20 30 40 50 60 70 80 90
0		TOPSOIL						
		FILL: brown lean clay (CL) - trace cobbles (less than 100 mm diameter), trace rootlets, moist						
		Brown lean CLAY (CL) with sand - trace rootlets, dry to moist - end of trace rootlets at 0.8 m						
1					BS	1		
2		- light brown, with sand below 2.0 m			BS	2		
		- coal inclusions below 2.5 m						
3		Light brown silty SAND (SM) - moist to wet						
4		- trace to with gravel below 4.0 m						
		End of test pit at 4.5 m - Test pit open and dry upon completion - Cobbles encountered to 0.4 m - Test pit backfilled with excavated material						
5								
6								

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Stantec

TEST PIT RECORD

TP17-06

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES: EXCAVATED **6/21/17**

WATER LEVEL **Dry (6/21/2017)**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS
0		TOPSOIL	▨				
		Brown lean CLAY (CL) - trace rootlets, dry to moist	▨		BS	1	
1		- end of trace rootlets at 1.0 m	▨		BS	2	
		Brown silty SAND (SM) - dry to moist	░				
2							
3		Brown sandy CLAY (CL) - fossils encountered between 3.0 m and 3.9 m (archaeological)	▨		BS	3	
		Brown silty SAND (SM) - dry to moist	░				
4							
		End of test pit at 4.2 m - Test pit open and dry upon completion - No cobbles/boulders encountered - Test pit backfilled with excavated material					
5							
6							

UNDRAINED SHEAR STRENGTH - kPa

50 100 150 200

WATER CONTENT & ATTERBERG LIMITS W_P W W_L

10 20 30 40 50 60 70 80 90

App'd________ Aug 17 2017 14:22:16

Stantec

TEST PIT RECORD

TP17-07

CLIENT **EPCOR Water Services Inc.**
PROJECT No. **110219883**
LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**
DATES: EXCAVATED **6/21/17**
WATER LEVEL **Dry (6/21/2017)**
DATUM **N/A**

UNDRAINED SHEAR STRENGTH - kPa: 50, 100, 150, 200
WATER CONTENT & ATTERBERG LIMITS: W_P W W_L — 10, 20, 30, 40, 50, 60, 70, 80, 90

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS
0		TOPSOIL					
		Brown lean CLAY (CL) - trace rootlets, moist - end of trace rootlets at 0.7 m - dry to moist below 1.5 m					
2		Brown poorly graded SAND (SP-SM) with silt - fine to medium grained, dry to moist - trace cobbles from 2.3 m to 3.0 m (75 mm to 150 mm diameter) - 100 mm thick coal seam at 2.4 m			BS	1	
		End of test pit at 4.5 m - Test pit open and dry upon completion - Cobbles encountered between 2.3 m to 3.0 m - Test pit backfilled with excavated materials					

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Stantec

TEST PIT RECORD

TP17-08

CLIENT **EPCOR Water Services Inc.**

PROJECT No. **110219883**

LOCATION **E.L. Smith Water Treatment Plant, Edmonton, Alberta**

DATES: EXCAVATED **6/21/17**

WATER LEVEL **Dry (6/21/2017)**

DATUM **N/A**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	WATER LEVEL	SAMPLE TYPE	SAMPLE NUMBER	OTHER TESTS	UNDRAINED SHEAR STRENGTH - kPa (50 100 150 200) WATER CONTENT & ATTERBERG LIMITS W_P W W_L (10 20 30 40 50 60 70 80 90)
0		TOPSOIL						
		Brown lean CLAY (CL) - trace rootlets, dry to moist	▨					
		- archaeoligical artifacts encountered between 0.5 m and 1.0 m - end of trace rootlets at 0.8 m	▨					
1			▨		BS	1		
2			▨					
		- archaeoligical artifacts encountered between 2.3 m and 2.5 m	▨					
			▨		BS	2		
3		- with sand below 3.0 m	▨					
4			▨					
		End of test pit at 4.5 m - Test pit open and dry opon completion - No cobbles/boulders encountered within test pit - Test pit backfilled with excavated material						
5								
6								

App'd________ Aug 17 2017 14:22:17

APPENDIX D:
LABORATORY TEST RESULTS

Your Project #: 110219883.300
Your C.O.C. #: A174506

Attention:Jason Warners

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2017/08/02
Report #: R2422134
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B759641
Received: 2017/07/19, 14:55

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Soluble Sulphate via CSA method (1)	3	N/A	2017/07/26		

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported: unless indicated otherwise, associated sample data are not blank corrected.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) This test was performed by Sub Edmonton to ALS Edmonton

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Wendy Sears, Project manager
Email: WSears@maxxam.ca
Phone# (403)735-2277
==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		RN9138	RN9139	RN9140	
Sampling Date		2017/06/20	2017/06/19	2017/06/15	
COC Number		A174506	A174506	A174506	
	UNITS	**BH17-07 SS4**	**BH17-22 SS4**	**BH17-49 SS8**	**QC Batch**
Parameter					
Subcontract Parameter	N/A	ATTACHED	ATTACHED	ATTACHED	8714234

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	24.3°C

Results relate only to the items tested.

Maxxam Job #: B759641
Report Date: 2017/08/02

STANTEC CONSULTING LTD
Client Project #: 110219883.300
Sampler Initials: LO

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

917

Chain of Custody

A174506

Page: 1 of 1

Company: Invoice To: STANTEC — C/O Report Address ☑
Contact: JASON WARNERS
Address: 200-325 25th STREET SE
Prov: ALBERTA PC:
Contact #s: Ph: (403)613-4419 Cell: (403) 207-7595

Report To: Same as Invoice ☐
Prov: PC:
Ph: Cell:

Report Distribution (E-Mail):
JASON.WARNERS@STANTEC.COM
GEOMATERIALSDISPATCH@STANTEC.COM
LAWRENCE.OULUODE@STANTEC.COM

REGULATORY GUIDELINES:
☐ AT1
☐ CCME
☐ Regulated Drinking Water
☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #: 110219883.300
Project # / Name: EL SMITH SOLAR
Site Location:
Quote #:
Sampled By: L.O CU

SERVICE REQUESTED:
☐ RUSH (Contact lab to reserve)
Date Required:
☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	SOIL: Sieve (75 micron)	SOIL: Regulated Metals (CCME / AT1)	SOIL: Salinity 4	SOIL: Assessment ICP Metals	SOIL: Basic Class II Landfill	WATER SOLUBLE SULPHATES CSA			WATER: ☐BTEX F1 ☐VOCs	WATER: ☐BTEX F1-F2 ☐BTEX F1-F4	WATER: ☐ Routine Water ☐ Turb ☐ F	WATER: ☐ TOC ☐ DOC	WATER: Regulated Metals (CCME / AT1) Total	WATER: Regulated Metals (CCME / AT1) Dissolved	WATER: Mercury ☐ Total ☐ Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH17-07 SS4			17/06/20							✓	✓											
2	BH17-22 SS4			17/06/19							✓												
3	BH17-49 SS8			17/06/15							✓												
4																							
5																							
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print): Rabah Echtay Date (YY/MM/DD): 2017/07/19 Time (24:00): 14:55
Relinquished By (Signature/Print): Date (YY/MM/DD): Time (24:00):
Special Instructions:
# of Jars Used & Not Submitted

LAB USE ONLY
Received By: Delaneymckerricher Date: 20170719 Time: 1455
Maxxam Job #: B759641
Lab Comments:

Custody Seal	Temperature	Ice
	25,24,24	

AB FCD-00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

MAXXAM ANALYTICS INC
ATTN: Wendy Sears
9331 48 Street
EDMONTON AB T6B 2R4

Date Received: 21-JUL-17
Report Date: 31-JUL-17 16:13 (MT)
Version: FINAL

Client Phone: 403-735-2277

Certificate of Analysis

Lab Work Order #: L1962268
Project P.O. #: NOT SUBMITTED
Job Reference: B759641
C of C Numbers:
Legal Site Desc:

Minnie Estigoy, Chem. Eng. Tech. DIPL
Account Manager

[This report shall not be reproduced except in full without the written authority of the Laboratory.]

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1962268-1 RN9138-BH17-07-SS4 Sampled By: CLIENT on 20-JUN-17 Matrix: SOIL							
Miscellaneous Parameters							
Total Sulphate Ion Content	<0.050		0.050	%	26-JUL-17	26-JUL-17	R3783561
L1962268-2 RN9139-BH17-22-SS4 Sampled By: CLIENT on 19-JUN-17 Matrix: SOIL							
Miscellaneous Parameters							
Total Sulphate Ion Content	<0.050		0.050	%	26-JUL-17	26-JUL-17	R3783561
L1962268-3 RN9140-BH17-49-SS8 Sampled By: CLIENT on 15-JUN-17 Matrix: SOIL							
Miscellaneous Parameters							
Total Sulphate Ion Content	<0.050		0.050	%	26-JUL-17	26-JUL-17	R3783561

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
SO4-T-CSA-A23-ED	Soil	Total Sulphate Ion Content	CSA INTERNATIONAL A23.2

Total sulphate content is determined by mixing soil with water then hydrochloric acid, and digesting just below boiling point, for 15 minutes. Analysis by ion chromatography follows.
NOTE: the CSA-A23 method states that for a total sulphate ion content greater than 0.2%, soluble sulphate ion content shall be determined on the basis of a water extraction. This water extraction requires the total sulphate ion content result to calculate the correct ratio for the water extraction.

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
ED	ALS ENVIRONMENTAL - EDMONTON, ALBERTA, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

L1962268

Maxxam
A Bureau Veritas Group Company

Sent To: ALS Edmonton
9936 67 Ave. NW
Edmonton, AB, T6E 0P5
Tel: (780) 413-5227

CHAIN OF CUSTODY RECORD FOR SUBCONTRACTED WORK

Page 01 of 01

COC # B759641-EALS-01-01

L1962268-COFC

REPORT INFORMATION

Company: Maxxam

Address: 9331 - 48th Street, Edmonton, Alberta, T6B 2R4

Contact Name: Wendy Sears

Email: WSears@maxxam.ca, edmenvirocs@maxxamanalytics.com

Phone: (403) 735-2277

Maxxam Project #: B759641

ANALYSIS REQUESTED

#	SAMPLE ID	MATRIX	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	SAMPLER INITIALS	# CONT.	Soluble Sulphate via CSA method	ADDITIONAL SAMPLE INFORMATION
1	RN9138-BH17-07 SS4	SOIL	2017/06/20	N/A	LO	1	X	(P: 01)
2	RN9139-BH17-22 SS4	SOIL	2017/06/19	N/A	LO	1	X	(P: 01)
3	RN9140-BH17-49 SS8	SOIL	2017/06/15	N/A	LO	1	X	(P: 01)
4								
5								
6								
7								
8								
9								
10								

REGULATORY CRITERIA

N/A

SPECIAL INSTRUCTIONS

Please inform Maxxam immediately if you are not accredited for the requested test(s).
Please return a copy of this form with the report.

TURNAROUND TIME

☐ Rush Required

2017/08/02

Date Required

Please inform us if rush charges will be incurred.

COOLER ID:

	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:

	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

COOLER ID:

	YES	NO	Temp: (°C)	1	2	3
Custody Seal Present						
Custody Seal Intact						
Cooling Media Present						

RELINQUISHED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (SIGN & PRINT)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
1. Chris Kelly	2017/07/19	14:55	1.		
2.			2.		

Rm @ 8:47
7/21/17

✓

Stantec

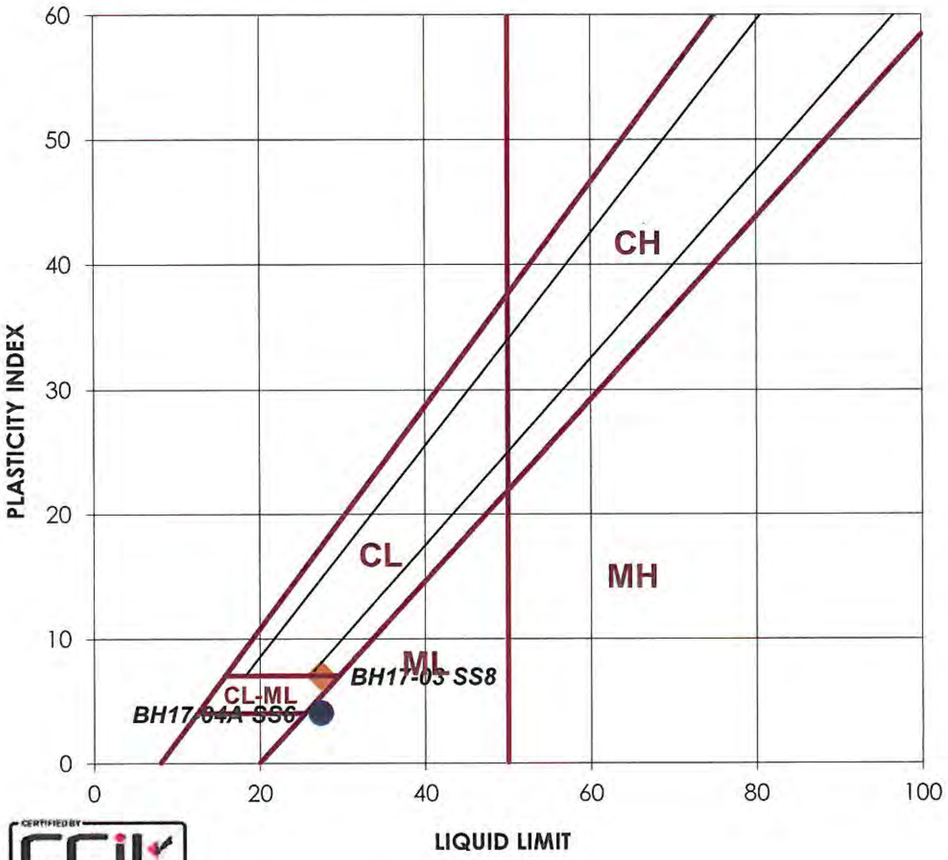
Atterberg Limits
ASTM D4318
Method B- One Point

Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300
Date Received: June 21, 2017
Date Tested: July 21, 2017
Tested By: JA

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5
Tel: (780) 917-7463

Sample:			Sample:	
BH17-04A SS6			BH17-03 SS8	
LIQUID			LIQUID	
1	2	Trial No.	1	2
20	20	Number of Blows	21	21
21A	4B	Container Number	18B	7B
34.87	40.46	Wt. Sample (wet+tare)(g)	47.66	42.83
30.64	34.97	Wt. Sample (dry+tare)(g)	40.57	36.88
15.56	15.53	Wt. Tare (g)	15.23	15.55
15.1	19.4	Wt. Dry Soil (g)	25.3	21.3
4.2	5.5	Wt. Water (g)	7.1	6.0
28.1%	28.2%	Water Content (%)	28.0%	27.9%
27.3%	27.5%	Corrected Water Content (%	27.4%	27.3%
PLASTIC			PLASTIC	
1	2	Trial No.	1	2
AF	BS	Container Number	BC	AT
20.1	21.52	Wt. Sample (wet+tare)(g)	21.45	21.21
19	20.11	Wt. Sample (dry+tare)(g)	20.21	20.03
14.08	13.91	Wt. Tare (g)	14.19	14.15
4.9	6.2	Wt. Dry Soil (g)	6.0	5.9
1.1	1.4	Wt. Water (g)	1.2	1.2
22.4%	22.7%	Water Content (%)	20.6%	20.1%
AVERAGE VALUES			AVERAGE VALUES	
1	2		1	2
LL	27		LL	27
PL	23		PL	20
PI	4		PI	7
Natural MC (%)	10.6%		Natural MC (%)	11.2%
CLASSIFICATION			CLASSIFICATION	
ML ●			CL-ML ◆	



CERTIFIED BY CCIL

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Reviewed By: ____________________

Stantec

Atterberg Limits

ASTM D4318
Method B- One Point

Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300
Date Received: June 21, 2017
Date Tested: July 24, 2017
Tested By: JA

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6

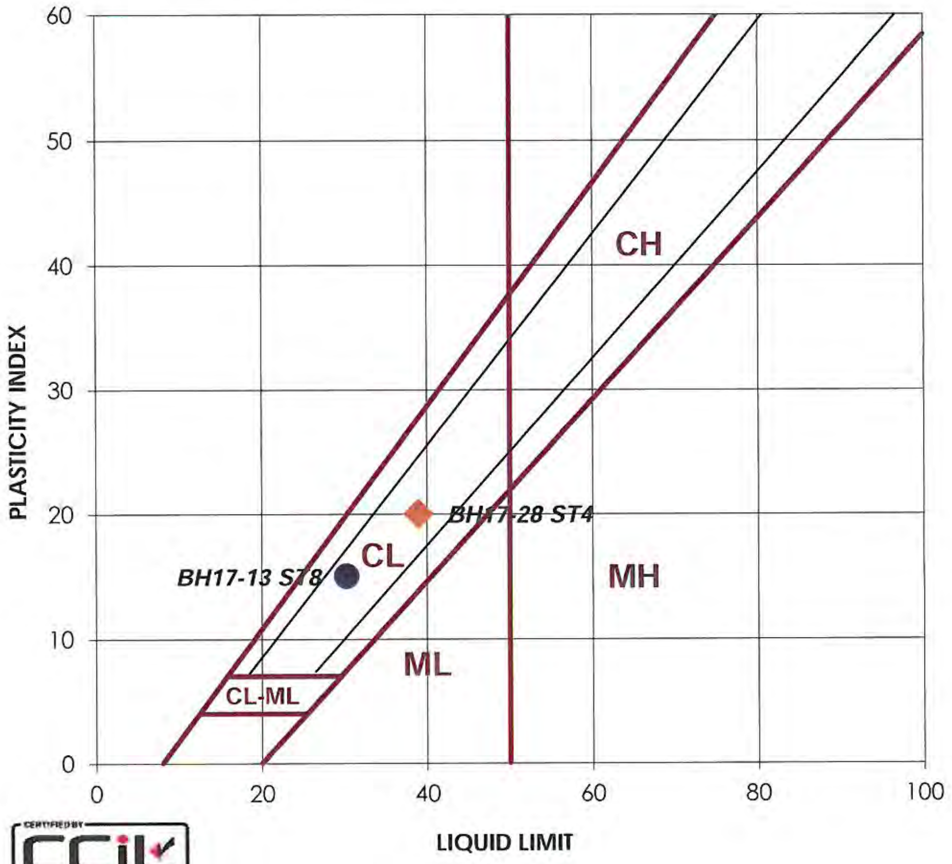
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5

Tel: (780) 917-7463

Sample: BH17-13 ST8 — Sample: BH17-28 ST4

BH17-13 ST8			BH17-28 ST4	
LIQUID			LIQUID	
1	2	Trial No.	1	2
22	22	Number of Blows	21	23
3B	19B	Container Number	22B	37B
36.31	36.52	Wt. Sample (wet+tare)(g)	37.88	38.68
31.37	31.53	Wt. Sample (dry+tare)(g)	31.55	32.07
15.39	15.22	Wt. Tare (g)	15.57	15.34
16.0	16.3	Wt. Dry Soil (g)	16.0	16.7
4.9	5.0	Wt. Water (g)	6.3	6.6
30.9%	30.6%	Water Content (%)	39.6%	39.5%
30.4%	30.1%	Corrected Water Content (%	38.8%	39.1%
PLASTIC			PLASTIC	
1	2	Trial No.	1	2
BG	CF	Container Number	AR	BU
20.96	20.39	Wt. Sample (wet+tare)(g)	20.43	20.41
20.11	19.49	Wt. Sample (dry+tare)(g)	19.45	19.4
14.67	13.24	Wt. Tare (g)	14.1	14
5.4	6.3	Wt. Dry Soil (g)	5.4	5.4
0.9	0.9	Wt. Water (g)	1.0	1.0
15.6%	14.4%	Water Content (%)	18.3%	18.7%
AVERAGE VALUES			AVERAGE VALUES	
1	2		1	2
LL	30		LL	39
PL	15		PL	19
PI	15		PI	20
Natural MC (%)	26.2%		Natural MC (%)	24.1%
CLASSIFICATION			CLASSIFICATION	
CL ●			CL ◆	



Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. STANTEC is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of STANTEC.

Reviewed By: ____________________

Stantec

Atterberg Limits

ASTM D4318
Method B- One Point

Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300
Date Received: June 21, 2017
Date Tested: July 21, 2017
Tested By: JA

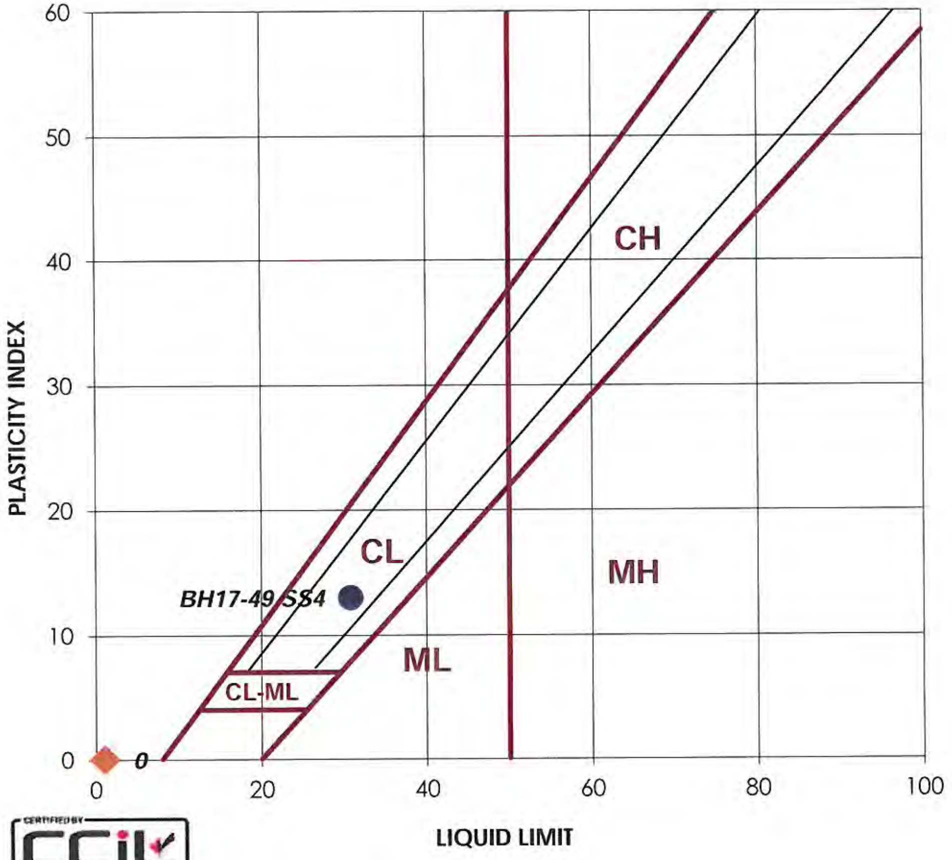
OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6

Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5

Tel: (780) 917-7463

Sample:			Sample:	
BH17-49 SS4				
LIQUID			LIQUID	
1	2	Trial No.	1	2
22	21	Number of Blows		
39B	15B	Container Number		
38.06	38.92	Wt. Sample (wet+tare)(g)		
32.64	33.35	Wt. Sample (dry+tare)(g)		
15.39	15.58	Wt. Tare (g)		
17.3	17.8	Wt. Dry Soil (g)		
5.4	5.6	Wt. Water (g)		
31.4%	31.3%	Water Content (%)		
30.9%	30.7%	Corrected Water Content (%		
PLASTIC			PLASTIC	
1	2	Trial No.	1	2
BK	AT	Container Number		
20.64	20.62	Wt. Sample (wet+tare)(g)		
19.66	19.56	Wt. Sample (dry+tare)(g)		
14.27	13.85	Wt. Tare (g)		
5.4	5.7	Wt. Dry Soil (g)		
1.0	1.1	Wt. Water (g)		
18.2%	18.6%	Water Content (%)		
AVERAGE VALUES			AVERAGE VALUES	
1	2		1	2
LL	31		LL	
PL	18		PL	
PI	13		PI	
Natural MC (%)	13.7%		Natural MC (%)	
CLASSIFICATION			CLASSIFICATION	
CL ●			NON-PLASTIC ◆	



CERTIFIED BY CCIL

Reviewed By: ____________________

Stantec

Grain Size Analysis

Hydrometer Report
ASTM D422
CANFEM

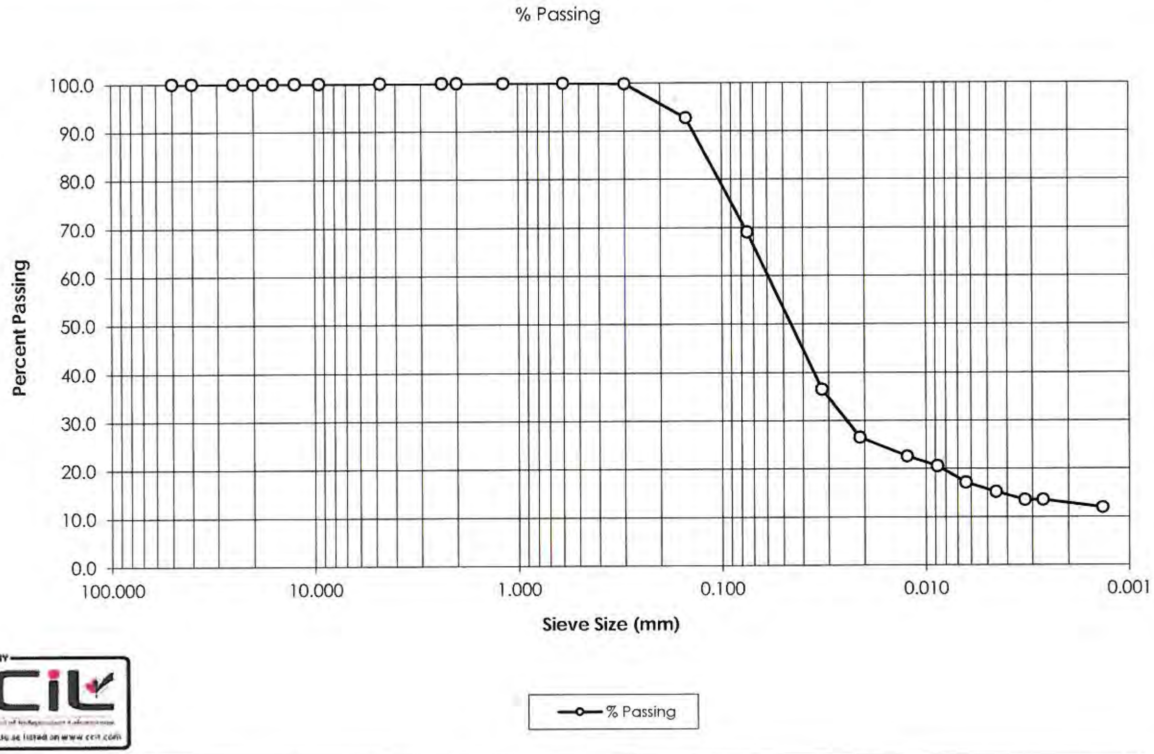
Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5
Tel: (780) 917-7463

SAMPLE No.: SS8
SOURCE: BH17-03
TESTED BY: JA

DATE RECEIVED: June 21, 2017
DATE TESTED: July 26, 2017
SAMPLE DESCRIPTION: Silty clay with sand



Sieve (mm)	Sample % Passing	Sieve (mm)	Sample % Passing
50.0	100.0	0.0064	17.2
40.0	100.0	0.0045	15.2
25.0	100.0	0.0033	13.6
20.0	100.0	0.0027	13.6
16.0	100.0	0.0014	12.0
12.5	100.0		
9.5	100.0		
4.75	100.0		
2.36	100.0		
2.00	100.0		
1.18	100.0		
0.600	100.0		
0.300	99.8		
0.150	92.7		
0.075	69.1		
0.0324	36.6		
0.0212	26.6		
0.0124	22.6		
0.0088	20.6		

Gravel:	0.0%	D_{10}:	-
Sand:	30.9%	D_{30}:	0.0254
Silt:	56.2%	D_{60}:	0.0656
Clay:	12.9%	C_u:	-
		C_c:	-

Comments:

Reviewed by:

Grain Size Analysis

Hydrometer Report
ASTM D422
CANFEM

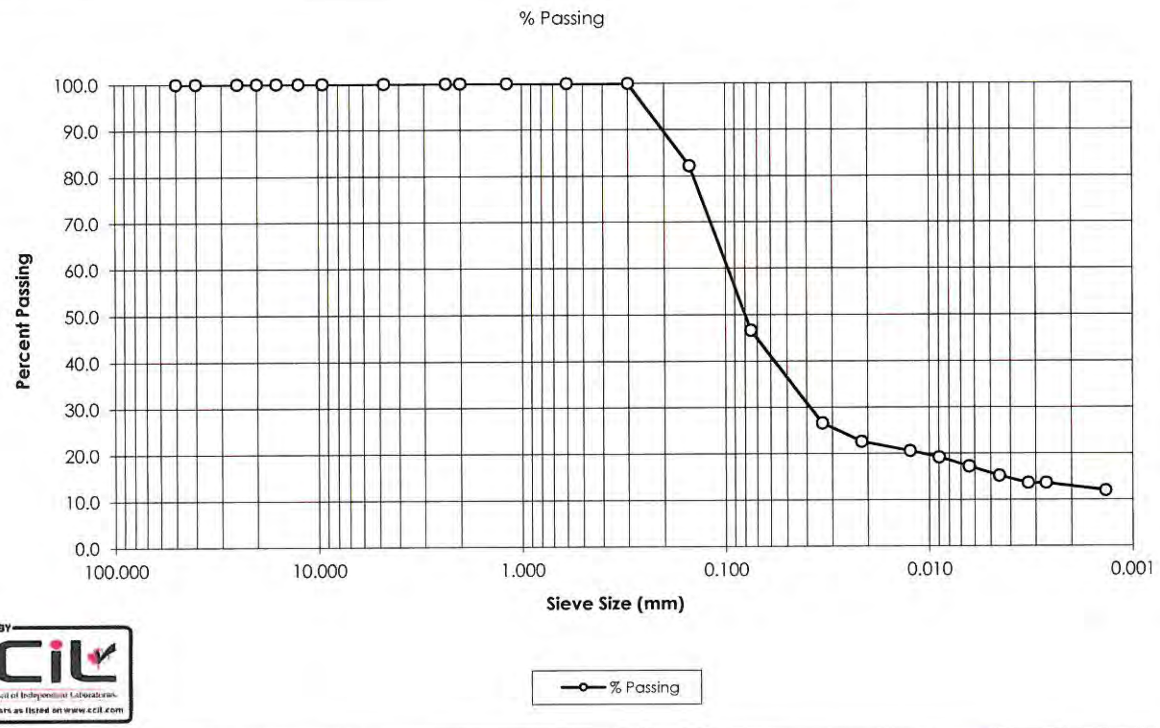
Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5
Tel: (780) 917-7463

SAMPLE No.: SS6
SOURCE: BH17-04A
TESTED BY: JA

DATE RECEIVED: June 21, 2017
DATE TESTED: July 26, 2017
SAMPLE DESCRIPTION: Silty sand



Sieve (mm)	Sample % Passing	Sieve (mm)	Sample % Passing
50.0	**100.0**	**0.0064**	**17.2**
40.0	**100.0**	**0.0045**	**15.2**
25.0	**100.0**	**0.0033**	**13.6**
20.0	**100.0**	**0.0027**	**13.6**
16.0	**100.0**	**0.0014**	**12.0**
12.5	**100.0**		
9.5	**100.0**		
4.75	**100.0**		
2.36	**100.0**		
2.00	**100.0**		
1.18	**100.0**		
0.600	**100.0**		
0.300	**100.0**		
0.150	**82.1**		
0.075	**46.6**		
0.0334	**26.6**		
0.0215	**22.6**		
0.0124	**20.6**		
0.0090	**19.2**		

Gravel:	0.0%	D_{10}:	-
Sand:	53.4%	D_{30}:	0.0425
Silt:	33.7%	D_{60}:	0.1085
Clay:	12.9%	C_u:	-
		C_c:	-

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Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

Comments:

Reviewed by:

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Stantec

Grain Size Analysis

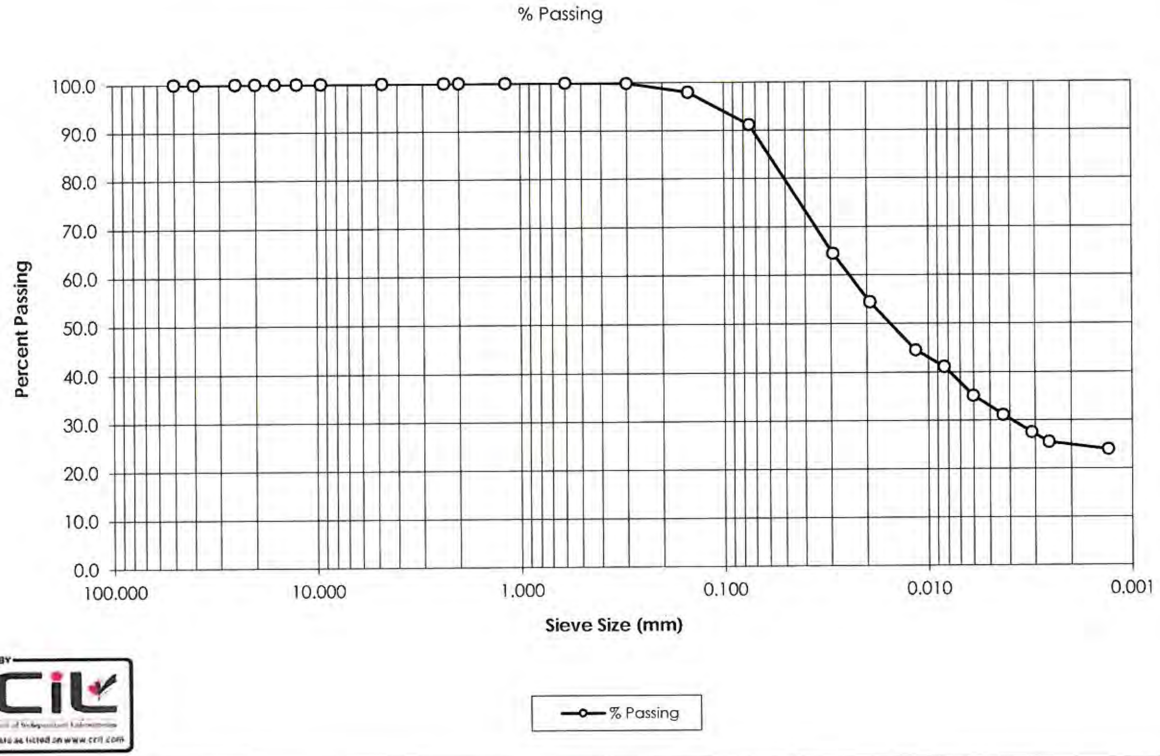
Hydrometer Report
ASTM D422
CANFEM

Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300

OFFICE	**LABORATORY**
10160 - 112 ST	10575 106 ST
Edmonton, Alberta	Edmonton, Alberta
Canada T5K 2L6	Canada T5H 2X5
Tel: (780) 917-7000	Tel: (780) 917-7463

SAMPLE No.: ST8
SOURCE: BH17-13
TESTED BY: JA

DATE RECEIVED: June 21, 2017
DATE TESTED: July 26, 2017
SAMPLE DESCRIPTION: Lean clay



Sieve (mm)	Sample % Passing	Sieve (mm)	Sample % Passing
50.0	100.0	0.0060	35.1
40.0	100.0	0.0043	31.1
25.0	100.0	0.0031	27.5
20.0	100.0	0.0026	25.5
16.0	100.0	0.0013	24.0
12.5	100.0		
9.5	100.0		
4.75	100.0		
2.36	100.0		
2.00	100.0		
1.18	100.0		
0.600	100.0		
0.300	99.9		
0.150	97.9		
0.075	91.2		
0.0293	64.5		
0.0193	54.5		
0.0116	44.5		
0.0084	41.1		

Gravel:	0.0%	D_{10}:	-
Sand:	8.8%	D_{30}:	0.0040
Silt:	66.2%	D_{60}:	0.0250
Clay:	25.0%	C_u:	-
		C_c:	-

Comments:

Reviewed by:

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Stantec

Grain Size Analysis

Hydrometer Report
ASTM D422
CANFEM

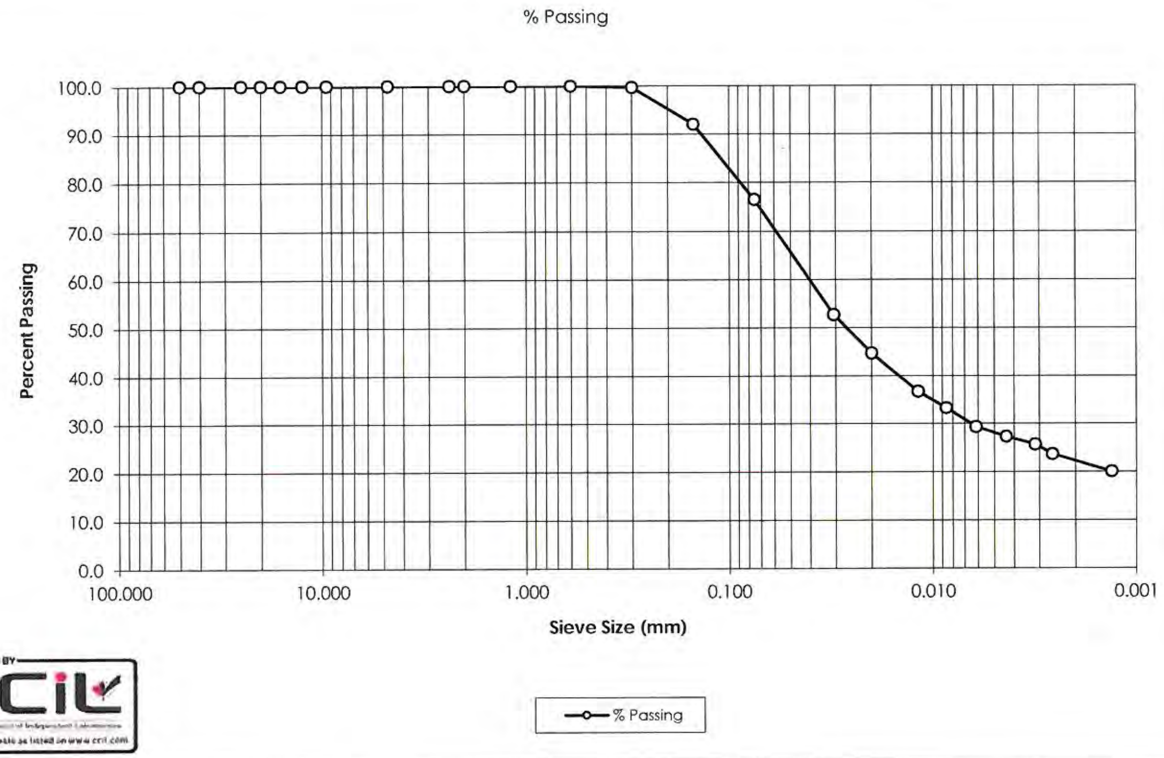
Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5
Tel: (780) 917-7463

SAMPLE No.: ST4
SOURCE: BH17-28
TESTED BY: JA

DATE RECEIVED: June 21, 2017
DATE TESTED: July 26, 2017
SAMPLE DESCRIPTION: Lean clay with sand



Sieve (mm)	Sample % Passing	Sieve (mm)	Sample % Passing
50.0	**100.0**	**0.0062**	**29.3**
40.0	**100.0**	**0.0044**	**27.3**
25.0	**100.0**	**0.0031**	**25.7**
20.0	**100.0**	**0.0026**	**23.7**
16.0	**100.0**	**0.0013**	**20.0**
12.5	**100.0**		
9.5	**100.0**		
4.75	**100.0**		
2.36	**100.0**		
2.00	**100.0**		
1.18	**100.0**		
0.600	**100.0**		
0.300	**99.7**		
0.150	**92.0**		
0.075	**76.5**		
0.0307	**52.7**		
0.0200	**44.7**		
0.0118	**36.7**		
0.0086	**33.3**		

Gravel:	0.0%	D_{10}:	-
Sand:	23.5%	D_{30}:	0.0066
Silt:	54.2%	D_{60}:	0.0461
Clay:	22.3%	C_u:	-
		C_c:	-

CERTIFIED BY CCIL

Comments:

Reviewed by:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

Stantec

Grain Size Analysis

Hydrometer Report
ASTM D422
CANFEM

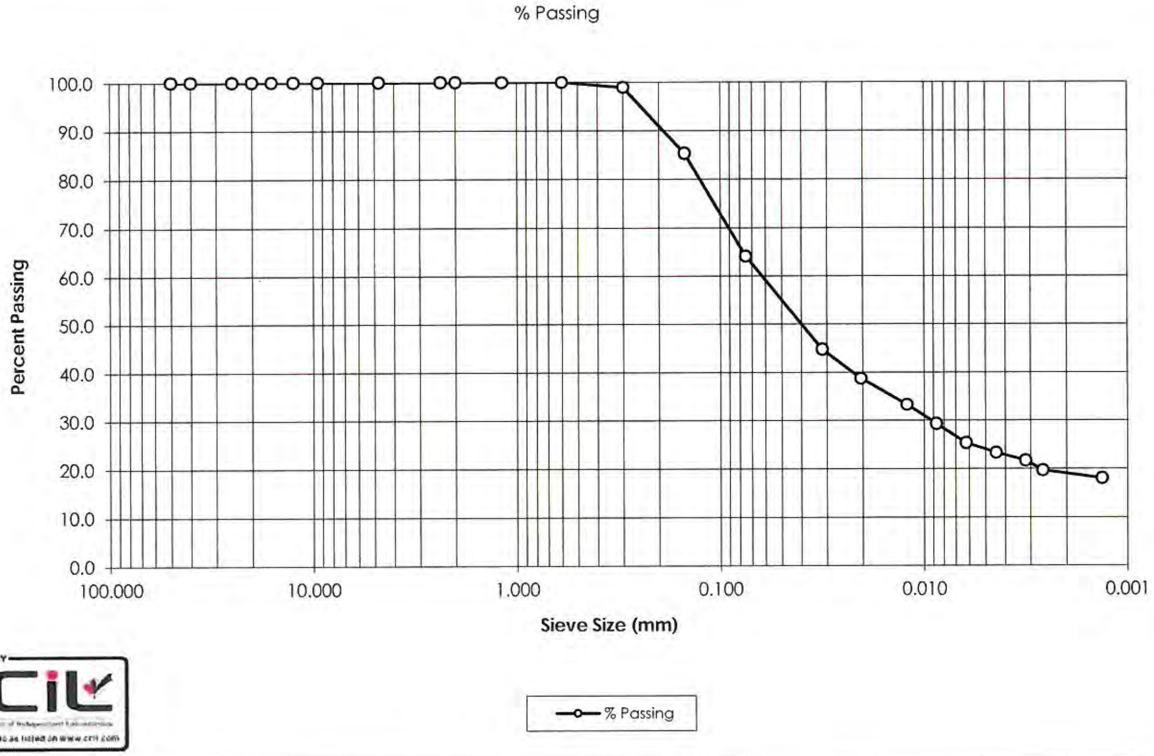
Client: EPCOR Water Services Inc.
Project Name: ELS Solar Power System Enviro
Project No: 110219883.1200.300

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5
Tel: (780) 917-7463

SAMPLE No.: SS4
SOURCE: BH17-49
TESTED BY: JA

DATE RECEIVED: June 21, 2017
DATE TESTED: July 26, 2017
SAMPLE DESCRIPTION: Sandy lean clay



Sieve (mm)	Sample % Passing	Sieve (mm)	Sample % Passing
50.0	**100.0**	**0.0062**	**25.3**
40.0	**100.0**	**0.0044**	**23.3**
25.0	**100.0**	**0.0032**	**21.7**
20.0	**100.0**	**0.0026**	**19.7**
16.0	**100.0**	**0.0013**	**18.1**
12.5	**100.0**		
9.5	**100.0**		
4.75	**100.0**		
2.36	**100.0**		
2.00	**100.0**		
1.18	**100.0**		
0.600	**100.0**		
0.300	**98.9**		
0.150	**85.3**		
0.075	**64.1**		
0.0316	**44.8**		
0.0204	**38.7**		
0.0122	**33.3**		
0.0087	**29.3**		

Gravel:	0.0%	D_{10}:	-
Sand:	35.9%	D_{30}:	0.0093
Silt:	45.1%	D_{60}:	0.0670
Clay:	19.0%	C_u:	-
		C_c:	-

CERTIFIED BY CCIL

Comments:

Reviewed by:

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. Stantec is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of Stantec.

Stantec Consulting Ltd.

Unconfined Compression Test Report (ASTM D2166)

Date7/26/2017

Checked By

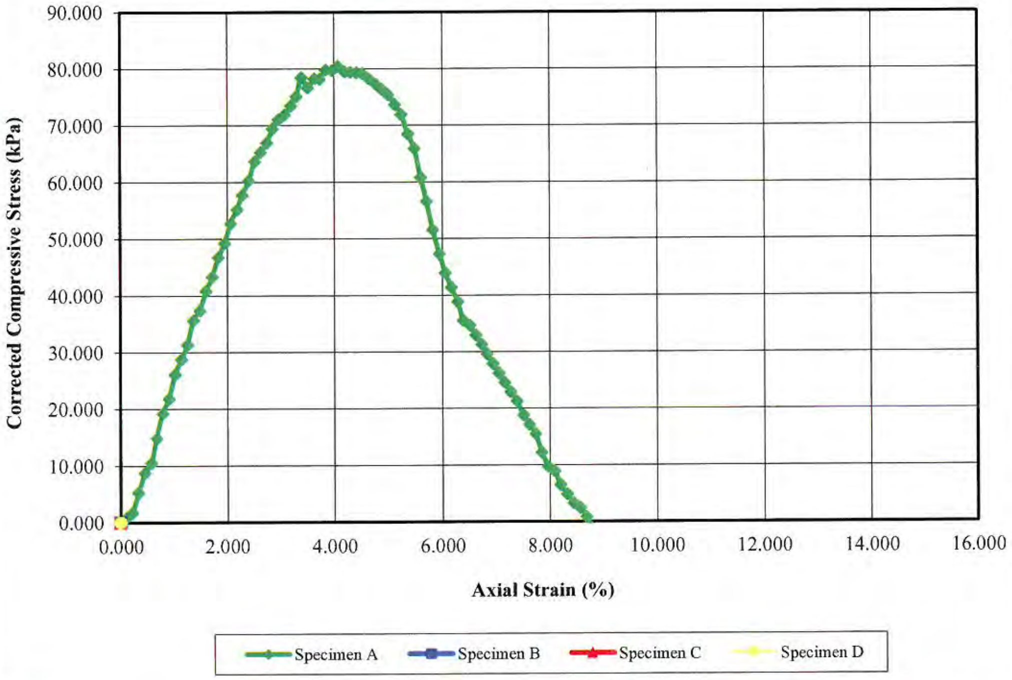
Date 7/25/2017

Computed By JA

Date 7/20/2017

Tested By JA

Compressive Stress Axial Strain Curve



	Specimen			
Before Test	**A**	**B**	**C**	**D**
Water Content (%)	26.23			
Dry Density (g/cm3)	1.533			
Saturation (%)	95.36			
Void Ratio	0.73			
Diameter (mm)	72.667			
Height (mm)	147.367			
Test Data	**A**	**B**	**C**	**D**
Unconfined Strength (kPa)	80.382			
Undrained Shear Strength (kgf/cm^2)	0.410			
Undrained Shear Strength (kPa)	40.191			
Rate of Strain (mm/min)	2.000000			
Strain at Failure (%)	4.07			
Description				

Project Information		**Specimen Description**	
Project Num	1102019883.1200.300	Specimen A	TILL - Clay and silt, tr sand, oxidize stain
Project	ELS Solar Power System Enviro		
Sampling Date		Specimen B	
Sample #	BH17-13 ST8	Specimen C	
Client	EPCOR Water Services Inc.	**Test Variables**	
		Specific Gravity	2.65
		Liquid Limit:	
		Plastic Limit:	

Remarks

Stantec Consulting Ltd.

Unconfined Compression Test Report (ASTM D2166)

Tested By JA

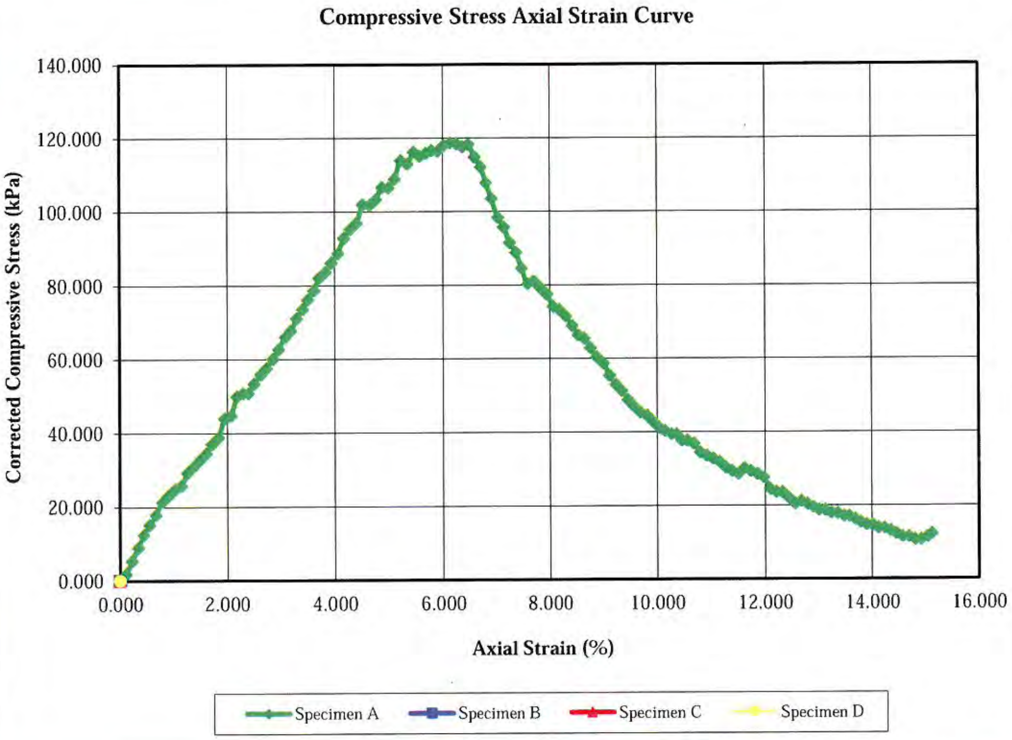
Date 7/20/2017

Computed By JA

Date 7/25/2017

Checked By

Date 7/26/2017



Before Test	Specimen A	B	C	D
Water Content (%)	24.10			
Dry Density (g/cm3)	1.595			
Saturation (%)	96.59			
Void Ratio	0.66			
Diameter (mm)	72.067			
Height (mm)	147.167			
Test Data	**A**	**B**	**C**	**D**
Unconfined Strength (kPa)	118.676			
Undrained Shear Strength (kgf/cm^2)	0.605			
Undrained Shear Strength (kPa)	59.338			
Rate of Strain (mm/min)	2.000000			
Strain at Failure (%)	6.14			
Description				

Project Information		Specimen Description	
Project Num	1102019883.1200.300	Specimen A	TILL - Clay and silt, tr sand, oxidize stain
Project	ELS Solar Power System Enviro		
Sampling Date		Specimen B	
Sample #	BH17-28 ST4	Specimen C	
Client	EPCOR Water Services Inc.	**Test Variables**	
		Specific Gravity	2.65
		Liquid Limit:	
		Plastic Limit:	

Remarks

APPENDIX E:
THERMAL RESISTIVITY ANALYSIS

Stantec Consulting Ltd.
102-40 Highfield Park Drive, Dartmouth NS B3A 0A3

August 11, 2017
File: 110219883.1200.300

Attention: Mr. Nathaniel Papay
EPCOR Water Services Inc.
Rossdale Water Treatment Plant
9469 Rossdale Road
Edmonton AB T5K 0A5

Dear Mr. Papay,

Reference: EL Smith Solar Farm – Soil Thermal Resistivity Testing

Stantec Consulting Ltd. (Stantec) was retained by EPCOR Water Services Inc. to complete thermal resistivity laboratory testing on three bulk soil samples, received on July 25, 2017. Results of the testing are summarized in this report.

PROCEDURE

A series of laboratory thermal resistivity tests was performed on three reconstituted bulk soil samples, in accordance with IEEE Std 442-03, to determine the thermal dryout curve for the material. Samples were reconstituted to 98% standard proctor (ASTM D-698). Resistivity readings were taken using a Decagon KD2 Pro Thermal Properties Analyzer, with a TR-1 sensor. The TR-1 sensor is best suited for soil or granular materials, and conforms to the specifications for the Lab Probe called out by the IEEE 442-03 standard.

IEEE Std 442-03 does not depict a procedure specifically for measuring the thermal dryout curve. For the purposes of this report, a thermal dryout curve was measured using the thermal resistivity properties of reconstituted samples from the bulk soil samples provided.

Samples from TP17-01, BS2 were compacted to an approximate dry density of 1751 kg/m^3, at moisture contents ranging from approximately 18% to approximately 0%. Samples from TP17-03, BS1 were compacted to an approximate dry density of 1595 kg/m^3, at moisture contents ranging from approximately 22% to approximately 0%. Samples from TP17-05, BS1 were compacted to an approximate dry density of 1567 kg/m^3, at moisture contents ranging from approximately 34% to approximately 0%. For each dryout curve, a practical range of moisture contents was tested based on the soil classification, and the as received moisture content, of the bulk samples.

Moisture content tests were performed on each sample, to confirm the representative moistures of the samples.

RESULTS

A standard proctor test, grain size analysis, and an Atterberg Limits test was performed on each of the three bulk samples. Based on laboratory testing, sample TP17-01, BS2 was classified as silty

SAND (SM), sample TP17-01, BS1 was classified as Lean CLAY (CL) with sand, and sample TP17-05, BS1 was classified as Lean CLAY (CL). A summary of the thermal resistivity sample information is shown below in Table 1.

Table 1 Summary of Sample Information

Sample ID	Sample Type	Soil Description	Sample Depth (m)	As Received Moisture Content (%)
TP17-01, BS2	Bulk	Silty SAND (SM)	1.0 – 1.5	12.7
TP17-03, BS1	Bulk	Lean CLAY (CL) with sand	1.0 – 1.5	19.1
TP17-05, BS1	Bulk	Lean CLAY (CL)	1.0 – 1.5	18.1

Thermal resistivity measurements were plotted against moisture contents, to depict the thermal dryout curve for the material. See attached plots for detailed thermal dryout curve results.

CLOSURE

This report has been prepared by Heidi McKnight-Whitford, P.Eng., and reviewed by Mark Bochmann, P.Eng. We trust that the information contained in this report is adequate for your present purposes. If you have any questions about the contents of the report, or if we can be of any other assistance, please do not hesitate to contact us at your convenience.

Yours truly,

STANTEC CONSULTING LTD.

Heidi McKnight-Whitford, P.Eng.
Geotechnical Engineer
Phone: (902) 468-7777
Heidi.McKnight-Whitford@stantec.com

Mark Bochmann, P.Eng.
Associate, Geotechnical Engineering
Phone: (902) 468-0431
Mark.Bochmann@stantec.com

Attachments: Thermal Resistivity Analysis
Materials Testing Report

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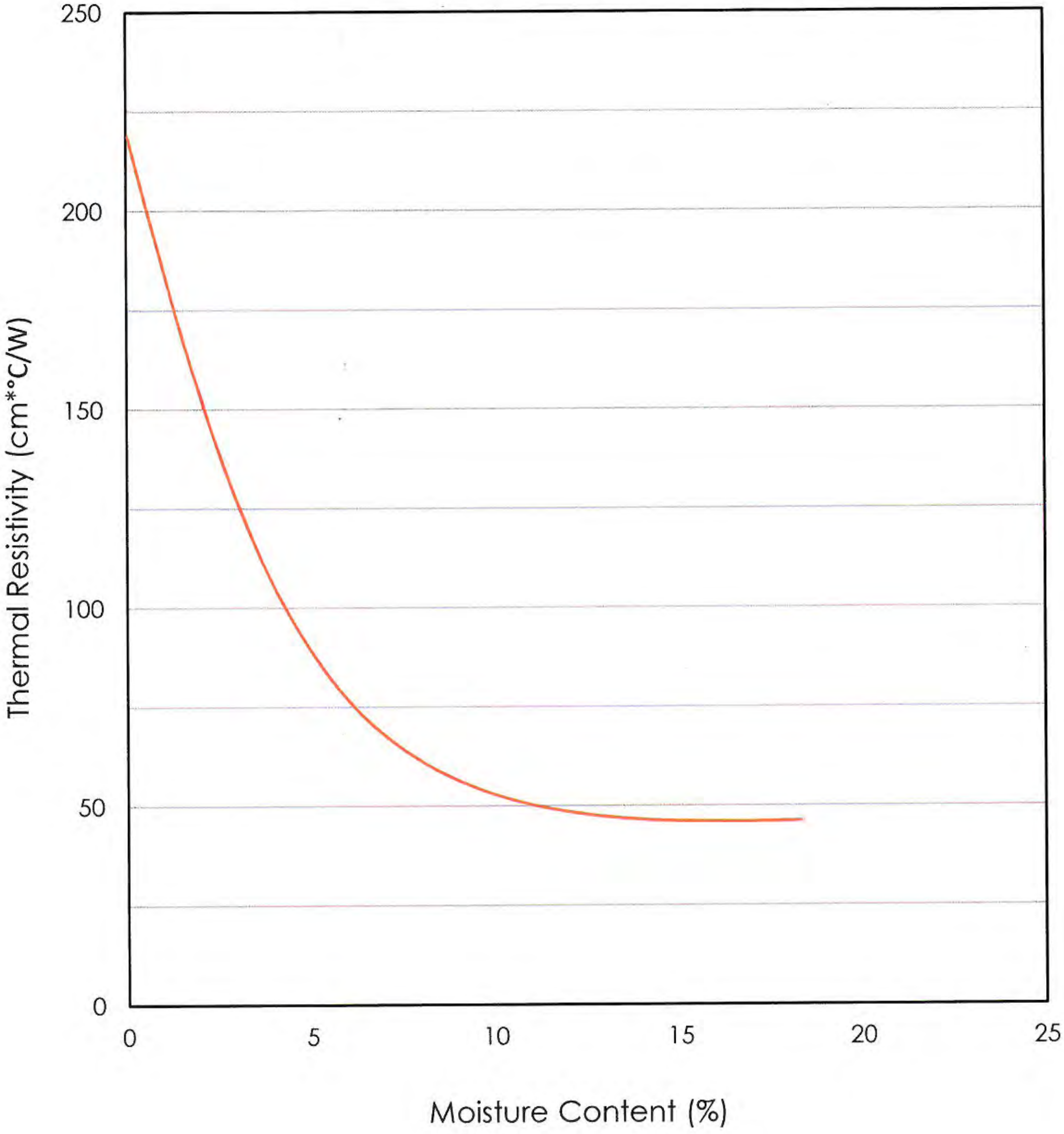
THERMAL RESISTIVITY ANALYSIS



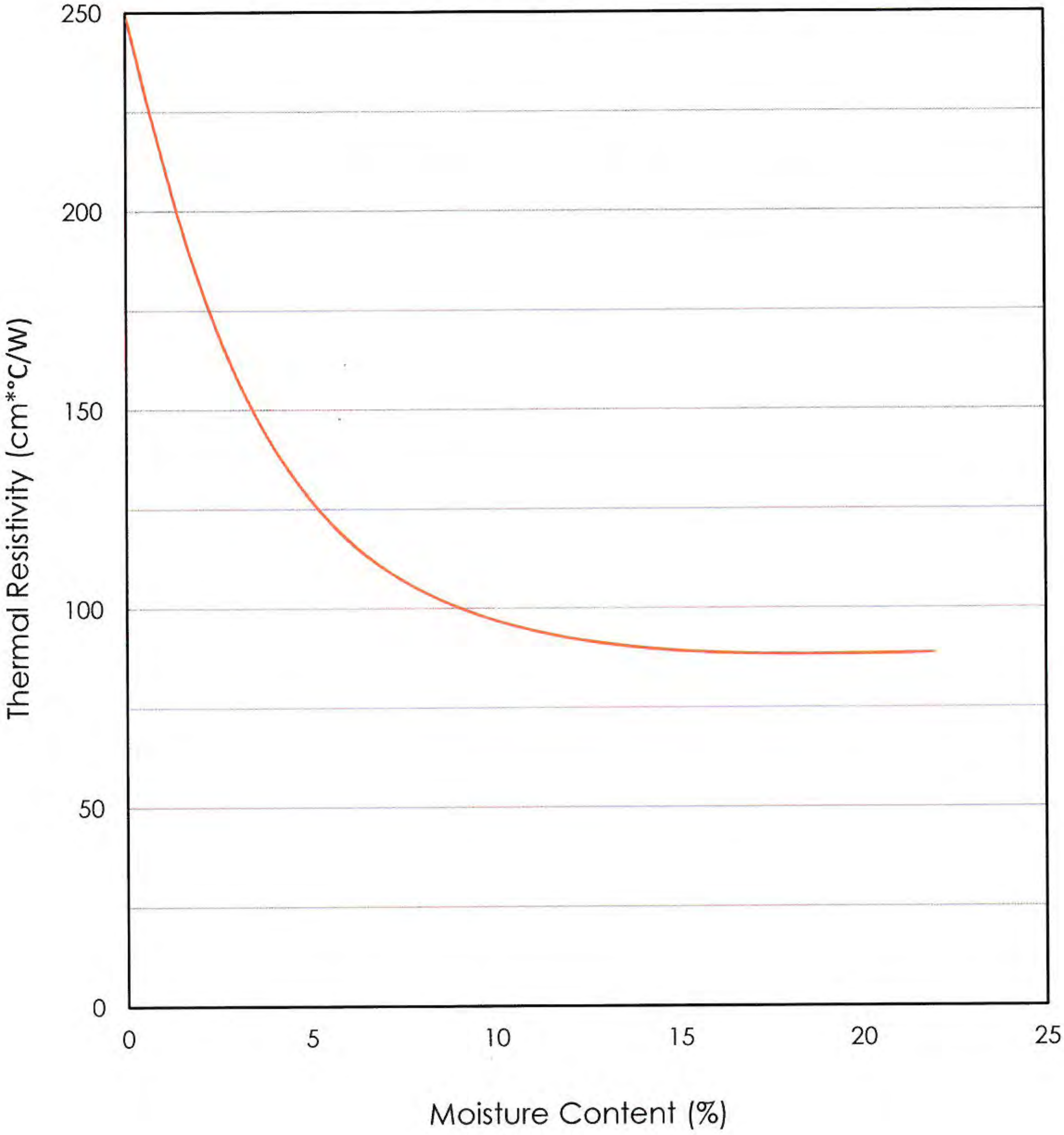
Sample ID: TP17-01, BS2
Project Number: 110219883.1200.300
Stantec Consulting LTD.

Tested By: TW Date: August 1, 2017

Checked By: HMW Date: August 9, 2017

Tested By: TW Date: August 1, 2017 Checked By: HMW Date: August 9, 2017

THERMAL RESISTIVITY ANALYSIS

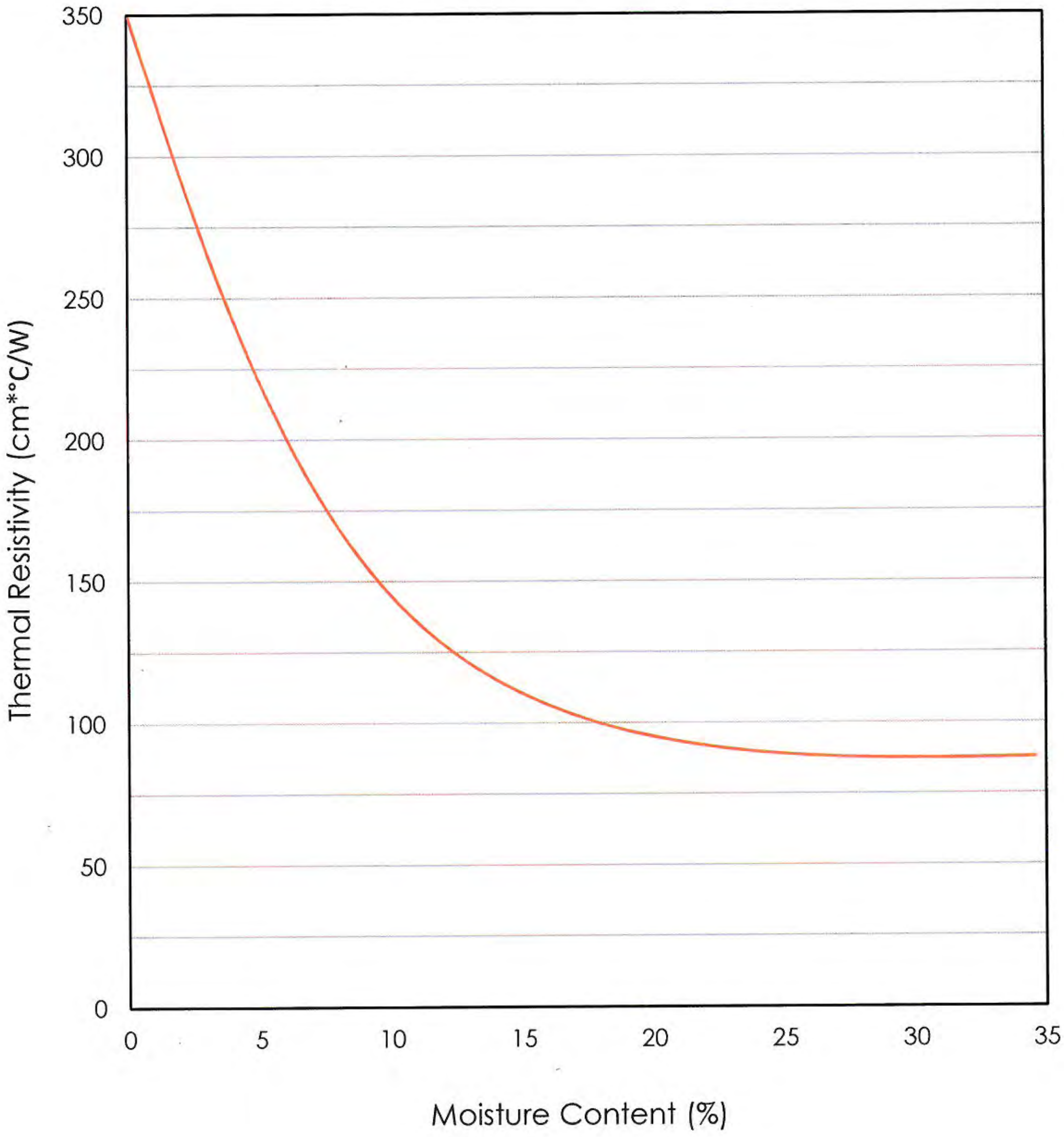


Sample ID: TP17-03, BS1
Project Number: 110219883.1200.300
Stantec Consulting LTD.

Stantec

Tested By: TW Date: August 1, 2017 Checked By: HMW Date: August 9, 2017

THERMAL RESISTIVITY ANALYSIS



Sample ID: TP17-05, BS1
Project Number: 110219883.1200.300
Stantec Consulting LTD.

STANTEC MATERIALS TESTING REPORT

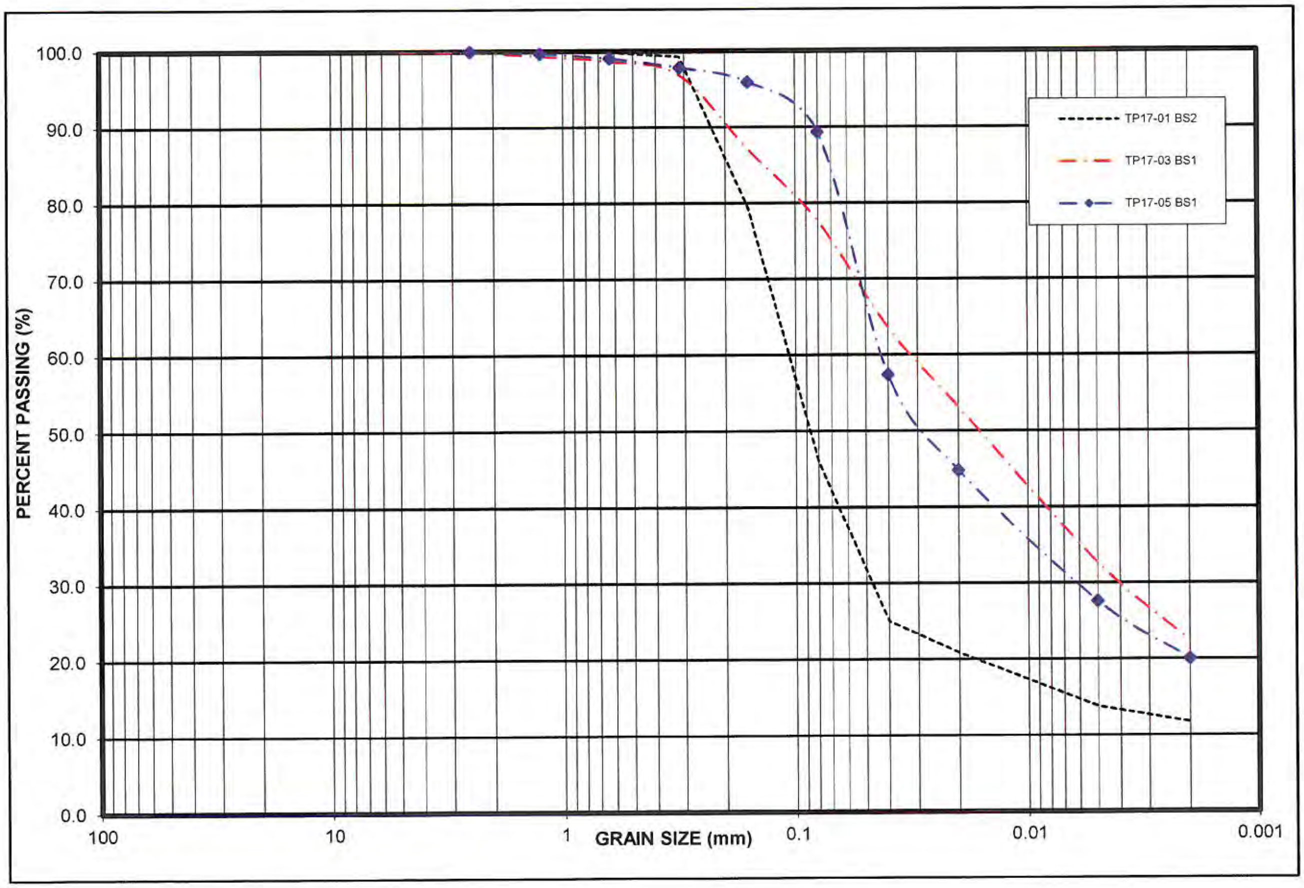
Project #: 110219883.1200.300

Client: EPCOR Water Services
Project: EL Smith Solar Farm
Source: Test Pit Samples

Material Type: Site Material
Date Received: 25-Jul-17
Date Tested: 1-Aug-17

GRADING				
SAMPLE #	TP17-01 BS2	TP17-03 BS1	TP17-05 BS1	SPEC
SIEVE (mm)	% PASSING	% PASSING	% PASSING	
28				-
20				-
14				-
10				-
5		100.0		-
2.5	100.0	99.9	100.0	-
1.25	99.9	99.3	99.7	-
0.630	99.9	98.6	99.0	-
0.315	99.2	96.8	97.8	-
0.160	79.4	87.0	95.9	-
0.080	46.0	77.6	89.3	-
0.040	25.0	63.6	57.4	-
0.020	20.8	53.1	44.8	-
0.005	13.8	32.7	27.6	-
0.002	11.7	22.4	20.0	-

PHYSICAL PROPERTY TESTS				
Sample Number		TP17-01 BS2	TP17-03 BS1	TP17-05 BS1
Gravel, %		0.0	0.0	0.0
Sand, %		53.9	22.4	10.7
Silt & Clay, %		46.0	77.6	89.3
Natural Moisture Content, %		12.7	19.1	18.1
Liquid Limit, %		-	35.7	40.3
Plastic Limit, %		-	21.5	22.8
Plasticity Index, %		Non-plastic	14.2	17.5
Max. Dry Density:	Standard	1751 kg/m^3	1595 kg/m^3	1567 kg/m^3
Optimum Moisture Content %		16.1	22.0	22.8



Technician R. Cameron

APPENDIX F:
ELECTRICAL RESISTIVITY ANALYSIS

Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm

Test Location: EL Smith Solar Farm: Traverse 1 - 326538E / 5927528N (12U)

Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1

Project No.: 110219883

Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V

Orientation (°): East-West

Test Instrument Settings: Meters

Current Weather Condition: Cloudy/Windy

Previous Two Days Weather Condition: Windy, sunny, light showers overnight

Surface Soil Type/Condition: Dry silty clay, covered with grasses, 75mm rootmat/topsoil

Date: 6/27/2017

Time Start: 11:00 AM

Time Finish: 12:40 AM

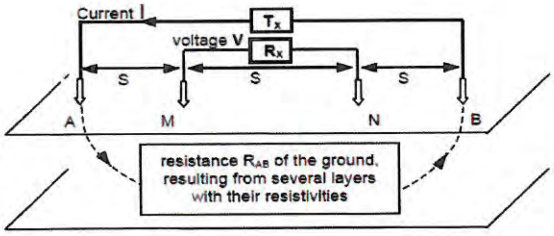
Air Temperature Start: 18 C

Air Temperature Finish: 20 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1556/1558	5.0	64.2	3.80	155.15	40.83	0.17
0.5	**0.3**	**0.8**	5.0	0.5	1555	5.0	39.9	4.64	58.93	12.70	0.32
1.0	**0.5**	**1.5**	5.0	1.0	1554	5.0	39.5	7.42	46.65	6.29	0.13
2.0	**1.0**	**3.0**	10.0	2.0	1553	10.0	49.6	11.11	43.86	3.95	0.12
3.0	**1.5**	**4.5**	15.0	3.0	1552	15.0	59.4	11.43	36.01	3.15	0.03
5.0	**2.5**	**7.5**	15.0	5.0	1550	15.0	83.8	13.29	35.45	2.67	0.14
10.0	**5.0**	**15.0**	15.0	10.0	1549	15.0	111.5	18.05	32.04	1.78	0.08
15.0	**7.5**	**22.5**	15.0	15.0	1548	15.0	98.4	20.49	21.40	1.04	0.05
20.0	**10.0**	**30.0**	15.0	20.0	1547	15.0	73.8	32.89	19.31	0.59	0.08
25.0	**12.5**	**37.5**	15.0	25.0	1546	15.0	45.0	62.30	17.84	0.29	0.09
30.0	**15.0**	**45.0**	15.0	30.0	1545	15.0	29.7	104.29	16.44	0.16	0.00
40.0	**20.0**	**60.0**	15.0	40.0	1544	15.0	14.6	281.76	16.39	0.06	0.07

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm

Test Location: EL Smith Solar Farm: Traverse 1 - 326538E / 5927528N (12U)

Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1

Project No.: 110219883

Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V

Orientation (°): North-South

Test Instrument Settings: Meters

Current Weather Condition: Cloudy/Windy

Previous Two Days Weather Condition: Windy, sunny, light showers overnight

Surface Soil Type/Condition: Dry silty clay, covered with grasses, 75mm rootmat/topsoil

Date: 6/27/2017

Time Start: 11:00 AM

Time Finish: 12:40 AM

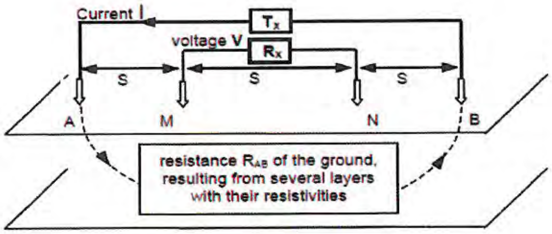
Air Temperature Start: 18 C

Air Temperature Finish: 20 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1570	5.0	79.1	3.72	187.46	50.39	0.12
0.5	**0.3**	**0.8**	5.0	0.5	1569	5.0	40.3	4.32	55.33	12.81	0.22
1.0	**0.5**	**1.5**	5.0	1.0	1568	5.0	40.5	7.25	46.74	6.45	0.09
2.0	**1.0**	**3.0**	10.0	2.0	1567	10.0	48.5	9.05	34.96	3.86	0.00
3.0	**1.5**	**4.5**	15.0	3.0	1566	15.0	60.6	14.10	45.35	3.22	0.11
5.0	**2.5**	**7.5**	15.0	5.0	1565	15.0	70.4	17.72	39.69	2.24	0.25
10.0	**5.0**	**15.0**	15.0	10.0	1564	15.0	96.9	17.89	27.59	1.54	0.12
15.0	**7.5**	**22.5**	15.0	15.0	1563	15.0	90.7	22.52	21.68	0.96	0.15
20.0	**10.0**	**30.0**	15.0	20.0	1562	15.0	82.3	29.82	19.54	0.66	0.13
25.0	**12.5**	**37.5**	15.0	25.0	1561	15.0	64.5	42.47	17.44	0.41	0.09
30.0	**15.0**	**45.0**	15.0	30.0	1560	15.0	45.9	67.87	16.52	0.24	0.09
40.0	**20.0**	**60.0**	15.0	40.0	1559	15.0	22.4	153.39	13.69	0.09	13.70

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm

Test Location: EL Smith Solar Farm: Traverse 1 - 326538E / 5927528N (12U)

Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1

Project No.: 110219883

Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V

Orientation (°): Northeast-Southwest

Test Instrument Settings: Meters

Current Weather Condition: Cloudy/Windy

Previous Two Days Weather Condition: Windy, sunny, light showers overnight

Surface Soil Type/Condition: Dry silty clay, covered with grasses, 75mm rootmat/topsoil

Date: 6/27/2017

Time Start: 2:50 PM

Time Finish: 3:45 PM

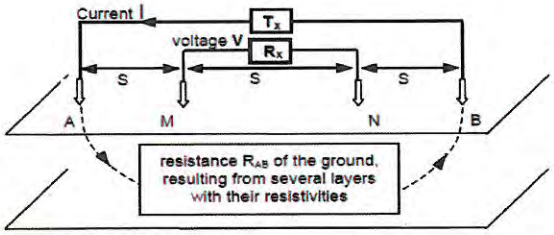
Air Temperature Start: 18 C

Air Temperature Finish: 20 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1582	5.0	86.6	4.24	233.75	55.13	0.23
0.5	**0.3**	**0.8**	5.0	0.5	1581	5.0	50.4	4.03	64.68	16.05	0.00
1.0	**0.5**	**1.5**	5.0	1.0	1580	5.0	40.7	6.21	40.26	6.48	0.27
2.0	**1.0**	**3.0**	10.0	2.0	1579	10.0	46.9	9.04	33.74	3.73	0.11
3.0	**1.5**	**4.5**	15.0	3.0	1578	15.0	60.7	11.32	36.47	3.22	0.15
5.0	**2.5**	**7.5**	15.0	5.0	1577	15.0	106.6	12.30	41.73	3.39	0.00
10.0	**5.0**	**15.0**	15.0	10.0	1576	15.0	111.7	15.21	27.05	1.78	0.00
15.0	**7.5**	**22.5**	15.0	15.0	1575	15.0	98.4	20.59	21.50	1.04	0.09
20.0	**10.0**	**30.0**	15.0	20.0	1574	15.0	68.5	35.51	19.35	0.54	0.00
25.0	**12.5**	**37.5**	15.0	25.0	1573	15.0	43.7	59.50	16.53	0.28	0.00
30.0	**15.0**	**45.0**	15.0	30.0	1572	15.0	26.4	118.61	16.64	0.14	0.00
40.0	**20.0**	**60.0**	15.0	40.0	1571	15.0	14.7	278.61	16.32	0.06	0.06

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm

Test Location: EL Smith Solar Farm: Traverse 2 - 326589E / 5927344N (12U)

Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1

Project No.: 110219883

Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V

Orientation (°): North-South

Test Instrument Settings: Meters

Current Weather Condition: Sunny, light showers at end of day

Previous Two Days Weather Condition: Sunny, dry

Surface Soil Type/Condition: Topsoil/Rootmat (100mm thick), silty clay (damp)

Date: 6/27/2017

Time Start: 3:30 PM

Time Finish: 5:30 PM

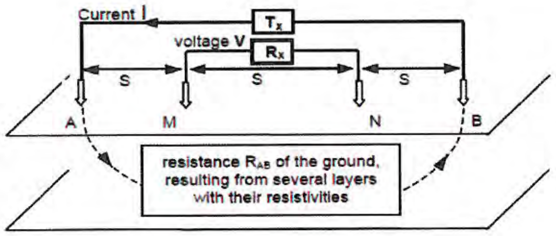
Air Temperature Start: 15 C

Air Temperature Finish: 18 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1606	5.0	58.8	4.72	176.48	37.39	0.14
0.5	**0.3**	**0.8**	5.0	0.5	1605	5.0	46.1	4.25	62.36	14.67	0.19
1.0	**0.5**	**1.5**	5.0	1.0	1604	5.0	45.1	4.75	34.04	7.17	0.09
2.0	**1.0**	**3.0**	10.0	2.0	1603	10.0	53.8	9.80	41.96	4.28	0.00
3.0	**1.5**	**4.5**	15.0	3.0	1602	15.0	70.2	10.89	40.60	3.73	0.04
5.0	**2.5**	**7.5**	15.0	5.0	1601	15.0	91.4	11.83	34.41	2.91	0.24
10.0	**5.0**	**15.0**	15.0	10.0	1600	15.0	122.5	14.91	29.07	1.95	0.06
15.0	**7.5**	**22.5**	15.0	15.0	1599	15.0	116.7	20.25	25.06	1.24	0.08
20.0	**10.0**	**30.0**	15.0	20.0	1598	15.0	97.8	25.90	20.15	0.78	0.00
25.0	**12.5**	**37.5**	15.0	25.0	1597	15.0	75.8	38.34	18.49	0.48	0.00
30.0	**15.0**	**45.0**	15.0	30.0	1596	15.0	57.8	57.24	17.56	0.31	0.04
40.0	**20.0**	**60.0**	15.0	40.0	1595	15.0	31.4	133.85	16.70	0.12	0.00

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm
Test Location: EL Smith Solar Farm: Traverse 2 - 326589E / 5927344N (12U)
Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1
Project No.: 110219883
Testing Company: Stantec Consulting Ltd.

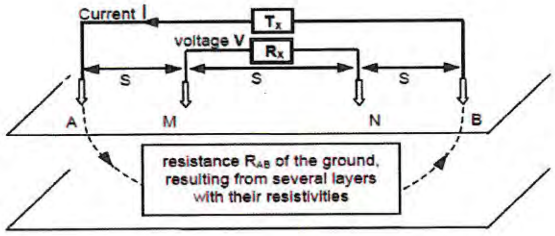
Test Instrument: SYSCAL Junior: 400V
Orientation (°): East-West
Test Instrument Settings: Meters
Current Weather Condition: Sunny, light showers at end of day
Previous Two Days Weather Condition: Sunny, dry
Surface Soil Type/Condition: Topsoil/Rootmat (100mm thick), silty clay (damp)

Date: 6/27/2017
Time Start: 3:30 PM
Time Finish: 5:30 PM
Air Temperature Start: 15 C
Air Temperature Finish: 18 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1594	5.0	47.0	5.52	165.13	29.91	0.00
0.5	**0.3**	**0.8**	5.0	0.5	1593	5.0	47.2	5.08	76.20	15.00	0.18
1.0	**0.5**	**1.5**	5.0	1.0	1592	5.0	38.5	5.90	36.19	6.13	0.08
2.0	**1.0**	**3.0**	10.0	2.0	1591	10.0	52.0	8.46	35.00	4.14	0.05
3.0	**1.5**	**4.5**	15.0	3.0	1590	15.0	73.6	10.36	40.43	3.90	0.14
5.0	**2.5**	**7.5**	15.0	5.0	1589	15.0	93.8	12.21	36.44	2.98	0.10
10.0	**5.0**	**15.0**	15.0	10.0	1588	15.0	123.9	15.62	30.78	1.97	0.10
15.0	**7.5**	**22.5**	15.0	15.0	1587	15.0	130.8	17.27	23.97	1.39	0.07
20.0	**10.0**	**30.0**	15.0	20.0	1586	15.0	114.0	23.87	21.66	0.91	0.10
25.0	**12.5**	**37.5**	15.0	25.0	1585	15.0	98.1	30.67	19.15	0.62	0.00
30.0	**15.0**	**45.0**	15.0	30.0	1584	15.0	94.4	35.11	17.58	0.50	0.08
40.0	**20.0**	**60.0**	15.0	40.0	1583	15.0	88.3	48.43	17.01	0.35	0.07

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm

Test Location: EL Smith Solar Farm: Traverse 3 - 326763E / 5927378N (12U)

Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1

Project No.: 110219883

Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V

Orientation (°): North-South

Test Instrument Settings: Meters

Current Weather Condition: Sunny, Light Showers towards the end of the day

Previous Two Days Weather Condition: Sunny, light rain showers overnight

Surface Soil Type/Condition: Topsoil/Rootmat (100mm thick), silty clay

Date: 6/28/2017

Time Start: 10:15 AM

Time Finish: 11:45 AM

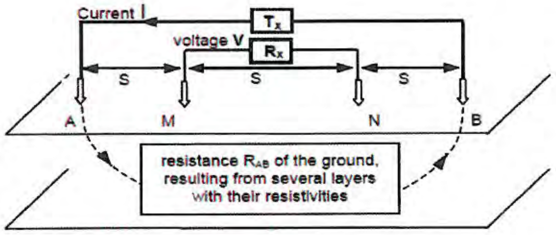
Air Temperature Start: 18 C

Air Temperature Finish: 20 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1630	5.0	61.7	2.89	113.62	39.31	0.07
0.5	**0.3**	**0.8**	5.0	0.5	1629	5.0	69.5	3.65	80.63	22.09	0.36
1.0	**0.5**	**1.5**	5.0	1.0	1628	5.0	70.4	4.37	48.92	11.19	0.17
2.0	**1.0**	**3.0**	10.0	2.0	1627	10.0	71.8	6.39	36.51	5.71	0.00
3.0	**1.5**	**4.5**	15.0	3.0	1626	15.0	76.2	10.05	40.61	4.04	0.30
5.0	**2.5**	**7.5**	15.0	5.0	1625	15.0	78.8	12.12	30.38	2.51	0.00
10.0	**5.0**	**15.0**	15.0	10.0	1624	15.0	71.2	19.43	22.00	1.13	0.00
15.0	**7.5**	**22.5**	15.0	15.0	1623	15.0	66.1	27.74	19.45	0.70	0.10
20.0	**10.0**	**30.0**	15.0	20.0	1622	15.0	51.7	41.59	17.12	0.41	0.00
25.0	**12.5**	**37.5**	15.0	25.0	1621	15.0	38.6	66.33	16.29	0.25	0.00
30.0	**15.0**	**45.0**	15.0	30.0	1620	15.0	29.0	105.20	16.16	0.15	0.09
40.0	**20.0**	**60.0**	15.0	40.0	1619	15.0	18.1	226.52	16.34	0.07	0.04

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm

Test Location: EL Smith Solar Farm: Traverse 3 - 326763E / 5927378N (12U)

Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1

Project No.: 110219883

Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V

Orientation (°): East-West

Test Instrument Settings: Meters

Current Weather Condition: Sunny, Light Showers towards the end of the day

Previous Two Days Weather Condition: Sunny, light rain showers overnight

Surface Soil Type/Condition: Topsoil/Rootmat (100mm thick), silty clay

Date: 6/28/2017

Time Start: 10:15 AM

Time Finish: 11:45 AM

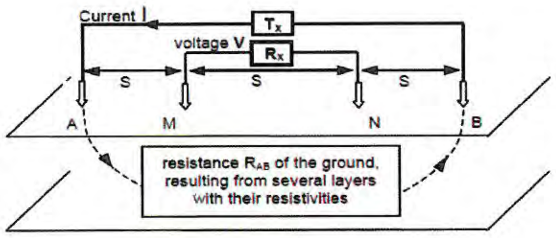
Air Temperature Start: 18 C

Air Temperature Finish: 20 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1618	5.0	70.5	3.98	178.7	44.90	0.08
0.5	**0.3**	**0.8**	5.0	0.5	1617	5.0	59.0	3.46	65.00	18.79	0.08
1.0	**0.5**	**1.5**	5.0	1.0	1616	5.0	59.0	4.16	39.03	9.38	0.12
2.0	**1.0**	**3.0**	10.0	2.0	1615	10.0	68.2	7.27	39.46	5.43	0.19
3.0	**1.5**	**4.5**	15.0	3.0	1614	15.0	82.9	8.49	37.34	4.40	0.22
5.0	**2.5**	**7.5**	15.0	5.0	1613	15.0	82.7	12.18	32.08	2.63	0.10
10.0	**5.0**	**15.0**	15.0	10.0	1612	15.0	70.8	19.58	22.05	1.13	0.08
15.0	**7.5**	**22.5**	15.0	15.0	1611	15.0	57.1	31.32	18.98	0.61	0.10
20.0	**10.0**	**30.0**	15.0	20.0	1610	15.0	44.0	48.93	17.15	0.35	0.09
25.0	**12.5**	**37.5**	15.0	25.0	1609	15.0	33.4	77.45	16.46	0.21	0.06
30.0	**15.0**	**45.0**	15.0	30.0	1608	15.0	27.2	113.74	16.40	0.14	0.05
40.0	**20.0**	**60.0**	15.0	40.0	1607	15.0	18.8	216.32	16.19	0.07	0.00

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm
Test Location: EL Smith Solar Farm: Traverse 4 - 326763E / 5927634N (12U)
Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1
Project No.: 110219883
Testing Company: Stantec Consulting Ltd.

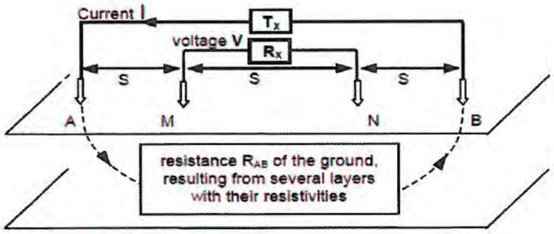
Test Instrument: SYSCAL Junior: 400V
Orientation (°): North-South
Test Instrument Settings: Meters
Current Weather Condition: Sunny, Light Showers towards the end of the day
Previous Two Days Weather Condition: Sunny, light rain showers overnight
Surface Soil Type/Condition: Topsoil/Rootmat (100mm thick), silty clay (moist)

Date: 6/28/2017
Time Start: 2:00PM
Time Finish: 3:00PM
Air Temperature Start: 20 C
Air Temperature Finish: 18 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1641	5.0	98.0	3.96	246.92	62.35	0.21
0.5	**0.3**	**0.8**	5.0	0.5	1640	5.0	65.0	5.37	110.95	20.66	0.26
1.0	**0.5**	**1.5**	5.0	1.0	1639	5.0	76.2	5.16	62.61	12.13	0.23
2.0	**1.0**	**3.0**	10.0	2.0	1638	10.0	92.9	8.23	60.85	7.39	0.14
3.0	**1.5**	**4.5**	15.0	3.0	1637	15.0	103.4	8.24	45.21	5.49	0.20
5.0	**2.5**	**7.5**	15.0	5.0	1636	15.0	108.9	9.68	33.53	3.46	0.09
10.0	**5.0**	**15.0**	15.0	10.0	1635	15.0	131.2	13.32	27.80	2.09	0.09
15.0	**7.5**	**22.5**	15.0	15.0	1634	15.0	120.8	17.59	22.53	1.28	0.13
20.0	**10.0**	**30.0**	15.0	20.0	1633	15.0	101.0	25.04	20.12	0.80	0.10
25.0	**12.5**	**37.5**	15.0	25.0	1632	15.0	80.7	34.86	17.9	0.51	0.00
30.0	**15.0**	**45.0**	15.0	30.0	1631	15.0	65.1	50.29	17.38	0.35	0.00
40.0	**20.0**	**60.0**	15.0	40.0	1630	15.0	41.1	101.92	16.65	0.16	0.00

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm

Test Location: EL Smith Solar Farm: Traverse 4 - 326763E / 5927634N (12U)

Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1

Project No.: 110219883

Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V

Orientation (°): East-West

Test Instrument Settings: Meters

Current Weather Condition: Sunny, Light Showers towards the end of the day

Previous Two Days Weather Condition: Sunny, light rain showers overnight

Surface Soil Type/Condition: Topsoil/Rootmat (100mm thick), silty clay (moist)

Date: 6/28/2017

Time Start: 3:00PM

Time Finish: 4:00 PM

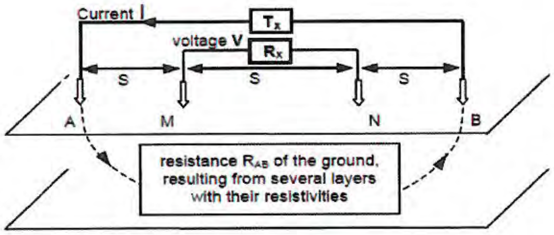
Air Temperature Start: 20 C

Air Temperature Finish: 18 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1653	5.0	91.0	4.07	235.88	57.96	0.15
0.5	**0.3**	**0.8**	5.0	0.5	1652	5.0	77.8	4.06	100.60	24.78	0.24
1.0	**0.5**	**1.5**	5.0	1.0	1651	5.0	78.1	3.63	45.09	12.42	0.16
2.0	**1.0**	**3.0**	10.0	2.0	1650	10.0	96.4	5.59	42.89	7.67	0.26
3.0	**1.5**	**4.5**	15.0	3.0	1649	15.0	99.0	9.12	47.88	5.25	0.18
5.0	**2.5**	**7.5**	15.0	5.0	1648	15.0	110.0	9.97	34.90	3.50	0.16
10.0	**5.0**	**15.0**	15.0	10.0	1647	15.0	133.9	13.21	28.13	2.13	0.00
15.0	**7.5**	**22.5**	15.0	15.0	1646	15.0	123.1	18.74	24.47	1.31	0.15
20.0	**10.0**	**30.0**	15.0	20.0	1645	15.0	97.2	26.35	20.39	0.77	0.13
25.0	**12.5**	**37.5**	15.0	25.0	1644	15.0	77.4	37.91	18.68	0.49	0.09
30.0	**15.0**	**45.0**	15.0	30.0	1643	15.0	56.0	59.36	17.64	0.30	0.09
40.0	**20.0**	**60.0**	15.0	40.0	1642	15.0	32.0	128.94	16.40	0.13	0.00

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

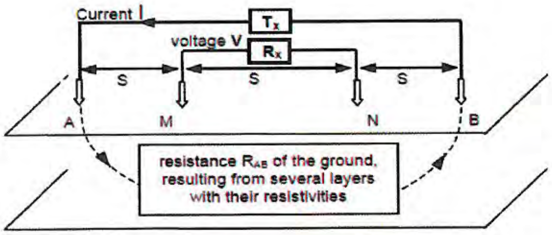
Project Name: EL Smith Solar Farm
Page: 1 of 1
Test Location: EL Smith Solar Farm: Traverse 5 - 326684E / 5927827N (12U)
Project No.: 110219883
Tested By: Lawrence Onwude and Craig Unterschultz
Testing Company: Stantec Consulting Ltd.

Test Instrument: SYSCAL Junior: 400V
Orientation (°): North-South
Date: 6/28/2017
Test Instrument Settings: Meters
Time Start: 4:35 PM
Current Weather Condition: Cloudy, windy
Time Finish: 5:45 PM
Previous Two Days Weather Condition: Sunny, light rain showers overnight
Air Temperature Start: 15 C
Surface Soil Type/Condition: Dry silty clay, covered with grass, 75 mm rootmat
Air Temperature Finish: 18 C

Electrode Spacing [S] (m)	**Voltage Distance from Midpoint (m)**	**Current Distance from Midpoint (m)**	**Recommended Maximum Probe Depth (cm)**	**Current and Voltage Lead Separation Distance (m)**	**Memory No.**	**Field Electrode Penetration Depth (cm)**	**Apparent Resistivity (ohm·m)**	**Current [I] (mA)**	**Voltage [V] (mV)**	**Resistance (ohm)**	**Quality Value (Q)**
0.25	**0.1**	**0.4**	5.0	0.3	1677	5.0	57.3	4.95	180.45	36.45	0.28
0.5	**0.3**	**0.8**	5.0	0.5	1676	5.0	58.1	4.72	87.34	18.50	0.32
1.0	**0.5**	**1.5**	5.0	1.0	1675	5.0	61.0	4.40	42.74	9.71	0.27
2.0	**1.0**	**3.0**	10.0	2.0	1674	10.0	63.1	2.27	11.4	5.02	1.26
3.0	**1.5**	**4.5**	15.0	3.0	1673	15.0	79.5	9.27	39.13	4.22	0.11
5.0	**2.5**	**7.5**	15.0	5.0	1672	15.0	99.1	11.23	35.44	3.16	0.24
10.0	**5.0**	**15.0**	15.0	10.0	1671	15.0	120.3	6.66	12.75	1.91	0.30
15.0	**7.5**	**22.5**	15.0	15.0	1670	15.0	118.4	20.06	25.20	1.26	0.05
20.0	**10.0**	**30.0**	15.0	20.0	1669	15.0	101.6	21.93	17.73	0.81	0.10
25.0	**12.5**	**37.5**	15.0	25.0	1668	15.0	78.0	35.6	17.67	0.50	0.07
30.0	**15.0**	**45.0**	15.0	30.0	1667	15.0	61.0	53.56	17.32	0.32	0.04
40.0	**20.0**	**60.0**	15.0	40.0	1666	15.0	36.3	113.09	16.32	0.14	0.05

Notes:

Configuration of the Test Setup:



Wenner 4-Point Resistivity Testing - Field Sheet

Project Name: EL Smith Solar Farm
Test Location: EL Smith Solar Farm: Traverse 5 - 326684E / 5927827N (12U)
Tested By: Lawrence Onwude and Craig Unterschultz

Page: 1 of 1
Project No.: 110219883
Testing Company: Stantec Consulting Ltd.

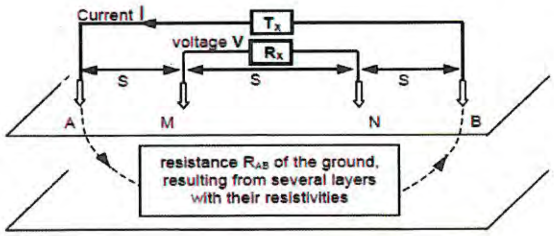
Test Instrument: SYSCAL Junior: 400V
Orientation (°): East-West
Test Instrument Settings: Meters
Current Weather Condition: Cloudy, windy
Previous Two Days Weather Condition: Sunny, light rain showers overnight
Surface Soil Type/Condition: Dry silty clay, covered with grass, 75 mm rootmat

Date: 6/28/2017
Time Start: 4:35 PM
Time Finish: 5:45 PM
Air Temperature Start: 15 C
Air Temperature Finish: 18 C

Electrode Spacing [S] (m)	Voltage Distance from Midpoint (m)	Current Distance from Midpoint (m)	Recommended Maximum Probe Depth (cm)	Current and Voltage Lead Separation Distance (m)	Memory No.	Field Electrode Penetration Depth (cm)	Apparent Resistivity (ohm·m)	Current [I] (mA)	Voltage [V] (mV)	Resistance (ohm)	Quality Value (Q)
0.25	**0.1**	**0.4**	5.0	0.3	1665	5.0	83.9	4.02	214.98	53.48	0.00
0.5	**0.3**	**0.8**	5.0	0.5	1664	5.0	53.1	4.94	83.42	16.89	0.19
1.0	**0.5**	**1.5**	5.0	1.0	1663	5.0	52.3	4.92	40.95	8.32	0.11
2.0	**1.0**	**3.0**	10.0	2.0	1662	10.0	72.3	7.28	41.93	5.76	0.29
3.0	**1.5**	**4.5**	15.0	3.0	1661	15.0	84.6	11.46	51.44	4.49	0.00
5.0	**2.5**	**7.5**	15.0	5.0	1660	15.0	102.2	11.57	37.66	3.25	0.00
10.0	**5.0**	**15.0**	15.0	10.0	1659	15.0	141.8	14.19	32.02	2.26	0.24
15.0	**7.5**	**22.5**	15.0	15.0	1658	15.0	134.6	17.16	24.51	1.43	0.10
20.0	**10.0**	**30.0**	15.0	20.0	1657	15.0	104.0	25.63	21.21	0.83	0.11
25.0	**12.5**	**37.5**	15.0	25.0	1656	15.0	75.3	37.65	18.04	0.48	0.06
30.0	**15.0**	**45.0**	15.0	30.0	1655	15.0	60.1	54.19	17.27	0.32	0.00
40.0	**20.0**	**60.0**	15.0	40.0	1654	15.0	38.1	109.41	16.58	0.15	0.00

Notes:

Configuration of the Test Setup:



APPENDIX F

Vegetation Tables

Table 1 Plant Community/Land Unit Descriptions

Plant Community/Land Unit	Map Code	Description
Upland Plant Community		
Aspen Poplar Woodland Alliance	AP	This alliance also has a deciduous-dominated canopy, but is typically mixed with both aspen and balsam poplar (*Populus balsamifera*) species. Occasionally paper birch (*Betula papyrifera*) may be dominant or co-dominant in some stands. Minor components of spruce (*Picea* sp.) may also occur in the canopy. This plant community is characteristically found in lower slope positions along streams and riverbanks or lake margins, or in wet, depressional areas on moderately to imperfectly drained soils.
Aspen Woodland Alliance	AW	The canopy of this woodland alliance is composed primarily of aspen (*Populus tremuloides)*, but may have minor components of coniferous species (often spruce). This plant community is characteristic of a wide variety of sites from steep slopes to gradual to moderate (level) areas to depressions and low-lying areas, but these sites are typically are not very wet, occupying well to moderately well drained soils.
Balsam Poplar Woodland Alliance	PB	The canopy of this woodland alliance is composed primarily of balsam poplar, but can also have inclusions of aspen, paper birch and sometimes minor spruce components. Willow species (*Salix* sp.) can also form a major component of the shrub layer, as seen through openings in the forest crown, or even make up canopy level structure in some stands. These communities commonly occur on level areas adjacent to wetlands, lakes, rivers or in low-lying areas (link in between sand dunes) or wet and nutrient rich substrates. These sites are typically found on moderately well to imperfectly drained soils, and can be derived from a fluctuating water table or continuous water source (soil is wet for a longer portion of the growing season).
Mixed Deciduous and Evergreen Woodland Alliance	MX	This upland woodland alliance has a mixed forest canopy of both deciduous and coniferous species. The deciduous component is often dominated by aspen, balsam poplar, and paper birch, while the coniferous component is typically dominated by white spruce (*Picea glauca*). This alliance is typically found on well to moderately well drained upland soils with submesic to subhygric moisture conditions. However, some sites can be found in more low-lying areas or near water courses where they can receive nutrient rich seepage or flood waters for a portion of the growing season. As a result, slope and aspect are variable on these sites.

Plant Community/Land Unit	Map Code	Description
White Spruce Woodland Alliance	SW	This woodland alliance is dominated by white spruce, although minor components of balsam fir (*Abies balsamea*), aspen, balsam poplar, paper birch or even black spruce (*Picea mariana*) can occur in some stands. In this area, communities of this alliance are found in more middle to lower slope positions or in depressions where additional moisture and cooler temperatures prevail. It can sometimes be classified as a white spruce swamp but is still generally considered to be an upland community. This woodland alliance is perhaps more common further north into the Boreal Forest Natural Area, but in the Parkland Natural Region it is perhaps less common and, at times, can be considered locally rare.
Tall Shrubland Alliance	TSA	This upland shrubby alliance typically includes aspen, choke cherry (*Prunus virginiana*), prickly rose (*Rosa acicularis*), wild red raspberry (*Rubus idaeus*) or willow. These communities are typically between 1.5 to 5 m in height and can represent younger, shrub-level successional stages of other upland woodland alliance communities, usually from some form of disturbance (either natural or anthropogenic). Some communities form when beavers, pathogens or insect outbreaks remove large portions of the forest canopy allowing the shrub layer to develop. These sites can be found in a variety of locations, from dry, steep, south facing slopes with rapid soil drainage to well to moderately well drained upland clearings and open (level) woodlands.
Short Shrubland Alliance	SS	This shrubby community type is similar to the Tall Shrubland Alliance described above; however, the shrub layer is typically shorter than 1.5 m in height. It often includes groves of snowberry (*Symphoricarpos albus*) or buckbrush (*Symphoricarpos occidentalis*) in addition to aspen, choke cherry, prickly rose, wild red raspberry and/or willow.
Water Land Unit		
Open Water	OW	This land unit is considered open water greater than 2 m deep, including ponds, lakes, rivers and flooded areas, which are not part of any natural ephemeral to semi-permanent wetland or anthropogenic dugout or reservoir.
Agricultural Land Unit		
Cultivated Land	CL	This unit includes all cultivated lands used for agronomic, annual crops, such as barley, wheat or oats, and hayfields used for bailing or silage in the fall. Narrow features such as windrows, roads and ditches may also be included within this agricultural land unit.
Green Space	GS	This unit includes areas created or maintained by man, currently used as green space. Some areas in this map unit include the following: parks, campgrounds, cemeteries, golf courses, ribbon development and recreational areas.

Plant Community/Land Unit	Map Code	Description
Industrial Development	IL	This unit includes all general industrial and/or oil & gas development, including plant sites, mine sites, well sites and other geophysical activities. It may or may not contain vegetated lands.
Perennial Pasture	PP	Perennial pasture includes land that is, or was, used for grazing livestock. It can include reclaimed lands or farmland planted with cultivated grasses and/or legumes that may be harvested at least once a year; however, these areas are typically rarely cultivated.
Residential	RR	This unit includes all settled areas. It also includes new subdivisions where land clearing has occurred (future residences).
Transportation	TR	This unit includes all roads, trails, highways, rail lines and rail yards that may or may not be vegetated. Areas cleared and/or maintained in association with transportation rights-of-way are also included.

Table 2 Comprehensive Species List

Provincial Scientific Name	**Provincial Common Name**	**Plant Form**
Dryopteris carthusiana	narrow spinulose shield fern	Fern
Achillea millefolium	common yarrow	Forb
Actaea rubra	red and white baneberry	Forb
Agrimonia striata	agrimony	Forb
Anemone cylindrica	long-fruited anemone	Forb
Anemone virginiana var. *alba*	Virginia anemone	Forb
Apocynum cannabinum	Indian hemp	Forb
Astragalus eucosmus	elegant milk-vetch	Forb
*Cirsium arvens**	creeping thistle	Forb
Cypripedium parviflorum	yellow lady's-slipper	Forb
Cypripedium parviflorum var. *pubescens*	large yellow lady's-slipper	Forb
Disporum trachycarpum	fairybells	Forb
Equisetum arvense	common horsetail	Forb
Erigeron canadensis	horseweed	Forb
Erigeron philadelphicus	Philadelphia fleabane	Forb
Fragaria virginiana	wild strawberry	Forb
Galeopsis tetrahit	hemp-nettle	Forb
Galium aparine	cleavers	Forb
Galium boreale	northern bedstraw	Forb
Galium triflorum	sweet-scented bedstraw	Forb
Geum aleppicum	yellow avens	Forb
Geum rivale	purple avens	Forb
Glycyrrhiza lepidota	wild licorice	Forb
Heracleum maximum	cow parsnip	Forb
Hieracium triste	slender hawkweed	Forb
Lappula squarrosa	bluebur	Forb
Lathyrus ochroleucus	cream-colored vetchling	Forb
*Linaria vulgaris**	common toadflax	Forb
Maianthemum canadense	wild lily-of-the-valley	Forb
Maianthemum stellatum	star-flowered Solomon's-seal	Forb
Medicago lupulina	black medick	Forb
Medicago sativa	alfalfa	Forb
Melilotus alba	white sweet-clover	Forb
Melilotus officinalis	yellow sweet-clover	Forb
Monotropa uniflora	Indian-pipe	Forb

Table 2 Comprehensive Species List

Provincial Scientific Name	**Provincial Common Name**	**Plant Form**
Osmorhiza depauperata	spreading sweet cicely	Forb
Osmorhiza longistylis	smooth sweet cicely	Forb
Oxytropis splendens	showy locoweed	Forb
Plantago major	common plantain	Forb
Polygala senega	seneca snakeroot	Forb
Pyrola asarifolia	common pink wintergreen	Forb
Sanicula marilandica	snakeroot	Forb
Senecio vulgaris	common groundsel	Forb
Sinapis arvensis	wild mustard	Forb
Sisyrinchium montanum	common blue-eyed grass	Forb
Solidago altissima	tall goldenrod	Forb
*Sonchus arvensis**	perennial sow-thistle	Forb
Sonchus asper	prickly annual sow-thistle	Forb
Stellaria calycantha	northern stitchwort	Forb
Symphyotrichum ciliatum	rayless aster	Forb
Symphyotrichum ciliolatum	Lindley's aster	Forb
Symphyotrichum puniceum var. *puniceum*	purple-stemmed aster	Forb
*Tanacetum vulgare**	common tansy	Forb
Taraxacum officinale	common dandelion	Forb
Thlaspi arvense	stinkweed	Forb
Tragopogon dubius	common goat's-beard	Forb
Trifolium hybridum	alsike clover	Forb
Trifolium pratense	red clover	Forb
Trifolium repens	white clover	Forb
*Tripleurospermum inodorum**	scentless chamomile	Forb
Vicia americana	wild vetch	Forb
Vicia cracca	tufted vetch	Forb
Viola canadensis	western Canada violet	Forb
Viola nephrophylla	bog violet	Forb
Bromus inermis	smooth brome	Graminoid
Calamagrostis canadensis	bluejoint	Graminoid
Carex deweyana	Dewey's sedge	Graminoid
Carex eburnea	bristle-leaved sedge	Graminoid
Elymus trachycaulus	slender wheatgrass	Graminoid
Phleum pratense	timothy	Graminoid

Table 2 Comprehensive Species List

Provincial Scientific Name	Provincial Common Name	Plant Form
Poa palustris	fowl bluegrass	Graminoid
Poa pratensis	Kentucky bluegrass	Graminoid
Schizachne purpurascens	purple oat grass	Graminoid
Brachythecium salebrosum	moss	Moss
Ceratodon purpureus	purple horn-toothed moss	Moss
Eurhynchium pulchellum	elegant beaked moss	Moss
Haplocladium microphyllum	moss	Moss
Pylaisiella polyantha	moss	Moss
Artemisia campestris	plains wormwood	Shrub
Corylus cornuta	beaked hazelnut	Shrub
Elaeagnus commutata	silverberry	Shrub
Lonicera involucrata	bracted honeysuckle	Shrub
Ribes oxyacanthoides	northern gooseberry	Shrub
Ribes triste	wild red currant	Shrub
Rosa acicularis	prickly rose	Shrub
Rosa woodsii	common wild rose	Shrub
Rubus idaeus	wild red raspberry	Shrub
Rubus pubescens	dewberry	Shrub
Salix sp.	willow species	Shrub
Shepherdia canadensis	Canada buffaloberry	Shrub
Symphoricarpos albus	snowberry	Shrub
Symphoricarpos occidentalis	buckbrush	Shrub
Viburnum edule	low-bush cranberry	Shrub
Viburnum opulus	high-bush cranberry	Shrub
Acer negundo	Manitoba maple	Tree
Amelanchier alnifolia	saskatoon	Tree
Aralia nudicaulis	wild sarsaparilla	Tree
Cornus canadensis	bunchberry	Tree
Cornus stolonifera	red-osier dogwood	Tree
Picea glauca	white spruce	Tree
Populus balsamifera	balsam poplar	Tree
Populus tremuloides	aspen	Tree
Prunus pensylvanica	pin cherry	Tree
Prunus virginiana	choke cherry	Tree
Salix exigua	narrow-leaf willow	Tree

Table 2 Comprehensive Species List

Provincial Scientific Name	Provincial Common Name	Plant Form
Sorbus scopulina	western mountain-ash	Tree
Lonicera dioica	twining honeysuckle	Vine

Note:
* Indicates species is listed as a noxious weed in the Alberta Weed Control Regulation

APPENDIX G

Solar Glare Analysis Report

Solar Glare Analysis Report – E.L. Smith Solar Farm

EPCOR Utilities Inc., Edmonton, Alberta

Version 4.1

Confidential

15 January 2018

Delivered to: Nathaniel Papay, EPCOR Utilities Inc.

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Document Purpose

This report provides an assessment of glare hazard from the E.L. Smith Solar Farm located at the E.L. Smith Water Treatment Plant, Edmonton, Alberta, Canada.

Document History

E.L. Smith Solar Farm Glare Analysis

Version	Date	Comments
1.0	20 June, 2017	Initial Version for Client Review
2.0	08 August, 2017	Updated for limitations of analysis, glare comparison and update on Alberta Transportation requirements and evaluation of topo data.
2.1	16 August, 2017	Updated report references and example bulb methodology
3.0	11 December, 2017	Included valley and forest effects, added section on lake comparison, added potential impact of clouds and weather patterns into the analysis.
4.0	11 January 2017	Updated to include Stantec rendering and associated assumptions
4.1	15 January 2018	Updated Table of Contents and references

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Glossary

Abbreviation	Term
After-image	Visual image that persists after the stimulus that caused it has stopped.
AUC	Alberta Utilities Commission
Azimuth	Horizontal angle of the Sun around an object. North is 0°, east is 90°, south is 180°, and west is 270°.
FP	Flight path
kW_{DC}	Kilowatts Direct Current
mrad	Measure of angle, 1/1000th of a radian
MW_{DC}	Megawatts Direct Current
OP	Observation point
Subtended Angle	Size of an object divided by the distance from the observer.
W_{DC}	Watts Direct Current
WTP	Water Treatment Plant

1 INTRODUCTION

EPCOR Utilities Inc. (EPCOR) is developing a solar photovoltaic project (Project) at the E.L. Smith Water Treatment Plant on the southwest side of Edmonton, Alberta. The Project is located along the bank of the South Saskatchewan River in the River Valley Cameron area. Part of Anthony Henday Drive runs to the south of the Project. The Project is expected to have a total capacity of up to 15 MW_{DC}.

Photovoltaic (PV) solar modules are designed to convert sunlight into electricity; however, up to 10 percent of the sunlight may be reflected into the surrounding areas[1]. In certain situations, the reflected sunlight can produce a glint (a momentary flash of bright light) and glare (a continuous source of bright light) that may result in an ocular impact to individuals.

Solas Energy Consulting Inc. (Solas) was retained by EPCOR to conduct a glare analysis for observation points at nearby residences, and from major roadways near the Project. Solas performed an analysis from residential locations, non-residential facilities, and multiple points along major roadways and interchanges near the Project.

This report documents the potential for solar glare from the Project at the observation points.

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[1] Solar Glare Hazard Analysis Tool (SGHAT) User's Manual v 1.0, Ho and Sims, Sandia National Laboratories, 2013.

2 PROJECT DESCRIPTION

The Project, with a capacity of up to 15 MW_{DC}, is a ground-mounted and fixed-angle solar PV array located on a greenfield site situated within the property of the E.L. Smith Water Treatment Plant (WTP). The approximate location of the Project is shown in Figure 1. The Project will be connected to the distribution system, and the electricity produced will be sold to the grid.

The Project is in the South Saskatchewan River valley. The WTP buildings are northwest of the proposed solar array. The Project is within one kilometre of residential communities at higher elevations to the east and west. This includes Henderson Estates to the east and Cameron Heights to the west. Anthony Henday Drive is located approximately 500 metres from the south end of the Project. Much of the land surrounding the Project is covered by trees. Solas conducted a site visit and estimated the range of tree heights to be between 15 to 30 feet tall along the ridges lying east and west of the Project.

There are no helipads or airport landing strips within three kilometres of the Project:

- Misericordia Community Hospital heliport is 5.5 km away;
- University of Alberta/Stollery Children's Hospital heliport is 8 km away;
- Grey Nuns Community Hospital heliport is 12 km away;
- Royal Alexandra Hospital heliport is 12.5 km away;
- Parkland Airport is 14 km away; and
- Edmonton International Airport is 18 km away.

Figure 1: Location of the Project: E.L. Smith Solar Farm and proximity to Anthony Henday Dr. (Highway 216) and the South Saskatchewan River.

3 PROJECT ASSUMPTIONS

The Project is located on approximately 62 acres of land. Solas assumed a constant elevation for the entire site to emulate the approximate grading that will occur during construction. A change of grade may modify the results from the glare analysis.

The type of PV modules has not yet been finalized. The PV modules will be mounted on racks in landscape position. The modules are designed to face due south (180 degrees azimuth), at a fixed tilt angle of 33 degrees.[2]

Approximate locations of the vertices of the solar array were used in the analysis as exact coordinates were not available. The bottom of the modules is assumed to be 1.0 metre (3.28 feet) above the ground while the top of the modules is assumed to be 3.6 metres (11.81 feet) above the ground.

The model assumes the reflective surface lies in a plane defined by the array vertices, so the analysis was completed at the top and bottom elevations to determine glare due to different parts of the modules. The analysis was also run at an elevation of 2.3 metres (7.55 feet) to help identify trends in the frequency and size of glare. The analysis was completed as if the Project will be installed as a single array.

Detailed input parameters and assumptions can be found in Appendix A.

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[2] Data provided by the EPCOR

4 GLARE REGULATIONS AND RECEPTORS

At the time of writing, there are no Canadian federal, provincial or municipal regulations or requirements that concern glare from solar projects. In the United States, the Federal Aviation Administration stipulates that any glare occurring along the flight landing path of an aircraft must have a low potential of producing after-image[3]. Glare occurring outside of 50 degrees of the pilot's line of sight is not considered to be a risk.

Alberta Transportation requires developers to obtain a roadside development permit for construction of structures near provincial highways. If a proposed development is to be located within 300 metres of a provincial highway right-of-way, or within 800 metres of the centre point of an intersection between a provincial highway and another public road, a roadside development application must be made to Alberta Transportation. The proposed Project will not be located within these boundaries, so it will not require a roadside development permit from Alberta Transportation.

Transport Canada TP1247E *Aviation Land Use in the Vicinity of Aerodromes* prepared by the Flight Standards division of the Standards Branch of the Civil Aviation Directorate of Transport Canada, offer guidelines useful for glare reports. The guidelines indicate "*The analysis of glare should involve a review of the position of the aircraft for both landing and take-offs as well as performing a circling approach… The designer should review the positioning and orientation of the panels in relation to the control tower to ensure that adverse reflection will not be produced.*" There are no helipads or airport landing strips within three kilometres of the Project.

Multiple observation points were selected to assess the potential glare on nearby residents and vehicle driving routes. Observation points for residences near the Project were evaluated at an elevation of 1.83 metres (6 feet) above ground level to mimic an individual standing at a window on the main floor, and at 4.88 metres (16 feet) above ground level to mimic a person standing at a window on the second floor. Observers standing at a window or balcony on the third story of a building were evaluated at 7.92 metres (26 feet) above ground level. Observation points on roads were evaluated at an elevation of 1.22 metres (4 feet) to mimic a driver sitting in a small truck or passenger vehicle. Observation points on bike paths were evaluated at an elevation of 1.22 metres (4 feet) to mimic an individual riding a bicycle.

Solas analyzed the potential for glare at the observation points shown in Figure 2. Sixteen observation points were evaluated. These include locations east, west and south of the Project.

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[3] https://www.federalregister.gov/documents/2013/10/23/2013-24729/interim-policy-faa-review-of-solar-energy-system-projects-on-federally-obligated-airports

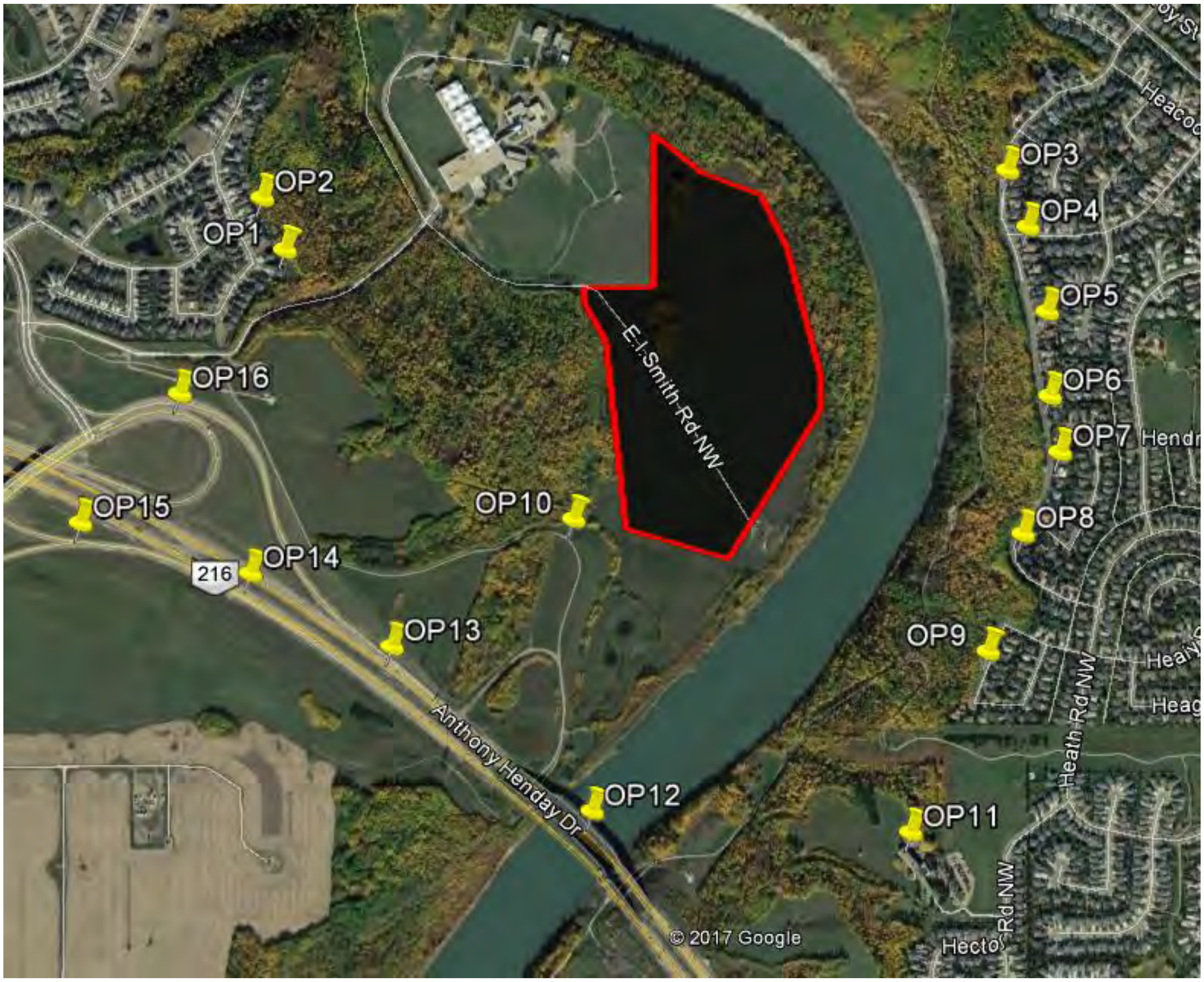

Figure 2: E.L. Smith Solar Farm Array with Observation Points Identified

Table 1 lists the observation points used in the analysis. The table also identifies the number of vehicles travelling along Anthony Henday Drive (Highway 216) and lists the connecting ramps west of the Project.[4]

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[4] http://www.transportation.alberta.ca/mapping/2016/TM/20000008.pdf

Table 1: Description of Observation Points

Observation Point Number	Location	Description	Daily Traffic (Number of Vehicles)
OP1	Residence	Second floor (4.88 metres)	N/A
OP2	Residence	Third floor (7.92 metres)	N/A
OP3	Residence	Second floor (4.88 metres)	N/A
OP4	Residence	Second floor (4.88 metres)	N/A
OP5	Residence	Second floor (4.88 metres)	N/A
OP6	Residence	Second floor (4.88 metres)	N/A
OP7	Residence	Second floor (4.88 metres)	N/A
OP8	Residence	Second floor (4.88 metres)	N/A
OP9	Residence	Second floor (4.88 metres)	N/A
OP10	Pathway	Walking/bike path (1.22 metres)	N/A
OP11	Non-Residential Facility	Third floor (7.92 metres)	N/A
OP12	Anthony Henday Drive	Westbound on South Saskatchewan River Bridge (1.22 metres)	40,260
OP13	Anthony Henday Drive	Westbound (1.22 metres)	40,260
OP14	Anthony Henday Drive	Eastbound (1.22 metres)	40,250
OP15	Anthony Henday Drive	Eastbound on-ramp (1.22 metres)	2,730
OP16	Anthony Henday Drive	Westbound on-ramp (1.22 metres)	1,600

5 GLARE PREDICTION METHOD

The impact of glare depends on the interaction between the position of the sun, the tilt of the solar modules, the reflectivity of the surface of the modules, the size of the project and relative location of the driving path or the observer. The screening effect from existing or proposed hedgerows or other objects has not been considered in this evaluation.

The sun's position is described using the angle of elevation and solar azimuth. The angle of elevation is the angle between the horizon and the centre of the sun. The azimuth is measured by convention as the angle from true north in a clockwise direction.

The glare analysis was performed using the Forge Solar Glare Gauge[5] software tool. The tool uses project inputs and solar positioning calculations to determine if glare will occur at identified observation points. If glare is found, the tool calculates the retinal irradiance (brightness) and subtended angle (size divided by distance) of the glare source. These two factors predict ocular hazards ranging from temporary after-image to retinal burn. Minor topographic features are not always identified in Glare Gauge due to the resolution of the topographic contours from Google Earth.

"Green" rated glare indicates a low potential for after-image, "yellow" rated glare indicates the potential for after-image exists, and "red" rated glare indicates the potential for retinal damage. Glare that is beyond 50 degrees from a driver's line-of-sight does not constitute a safety hazard.[6]

The amount of light reflected by a solar module depends on the angle of incidence of the sunlight on the module as illustrated in Figure 3.

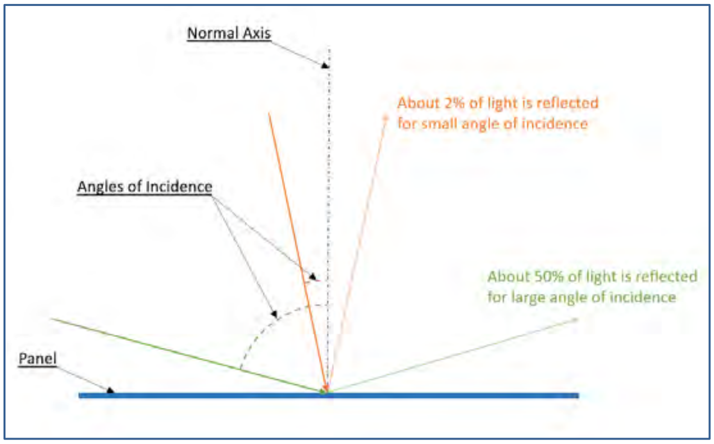

Figure 3: Reflected Light and Angle of Incidence on the PV module

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[5] Copyright, Sims Industries, 2015

[6] SGHAT_Users_Manual_v2-F.pdf

Approximately 10 percent of sunlight is reflected from a solar module on average[7], which is about the same as open water[8]. Anti-reflection coating on the solar module can reduce the reflection to one to two percent on average. The software models the reflectivity for each angle of incidence based on experiments performed by Sandia National Laboratories for a variety of different module constructions[9]. Very little light is reflected when the sun is nearly perpendicular to the module, but more light is reflected when the sun is at a shallow angle to the module.

Solas uses Google maps to define the location and size of the PV arrays, characteristics of the PV array, and position of observers. Solas' analysis included modelling for the valley effect where the river banks block sunlight reaching the Project during the early morning and evening hours.

Additionally, Solas modelled the effect of forested areas partially blocking any solar module glare at the observation points. Solas considered the forested areas between observation points and the array to be semi-permanent features that are unlikely to be removed. Glare from the solar array is partially obscured as it passes through the trees and foliage, effectively reducing the size of the glare spots seen at the observation points. Solas' analysis used conservative estimates for foliage in the summer and winter seasons. Summer was defined to include June through September, while winter months included August through May.

Solas completed the glare analysis at residences at the main floor and second floor. Some residences near the project have a third-floor balcony. These were also modelled.

5.1 Limitations of the Model

This analysis aims to provide an indication of the glare that may be produced by the proposed solar PV array. The prediction methods employed in the analysis have uncertainty. The following lists some of the limitations inherent in the analysis.

- The base model assumes clear skies at all times. The model does not use historical weather pattern data. This results in a total cumulative duration of glare that is likely higher than what will occur over the course of a year.
- Shading is not considered in the model.
- Obstructions such as foliage, structures, and hills between the arrays and observation points are not modelled by Forge Solar's Glare Gauge software tool.
  - Separate analysis is performed to evaluate the impact of topographical features available in Google Earth on the predicted glare such as the valley effect.
  - The impact of trees and foliage is taken into account through further analysis conducted outside of Glare Gauge.

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[7] Lasnier and Ang, 1990, Photovoltaic Engineering Handbook. Taylor & Francis, New York.

[8] US EPA, 2013, AERSURFACE User's guide, EPA-454/B-08-001.

[9] Sandia National Laboratories, 2014, Solar Glare Hazard Analysis Tool (SGHAT) User's Manual v. 2F, Appendix E

- Ocular and perceived hazards differ from person to person, depending on multiple environmental, optical, and human factors.
- Changes in site and array elevation from the assumptions may change the results of the analysis.

6 ANALYSIS RESULTS

The Project does not reveal any red-grade glare. Yellow-grade glare has been identified at the residences east and west of the Project, as well as the pathway southwest of the array. Driving paths have a very low potential of being affected. Third floor balconies show similar or worse glare than lower floors at the same location. Higher annual durations of green-grade glare originate from the bottom of the modules (1.0 metre), while higher annual durations of yellow-grade glare originate from the top of the modules (3.6 metres).

The results and level of glare for the observation points are summarised as minutes per year in Table 2. Time of day is provided in standard time year-round.

The results of the Forge Solar and high-resolution topographic analysis suggest that the following locations have some yellow-grade glare:

- OP1 – Residence (west of array, second floor) – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 2 minutes per year at this location. The glare occurs in April around 6:45 a.m. standard time for up to 1 minute.
- OP3 – Residence (east of array, second floor) – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 30 minutes per year at this location. The glare occurs from late March to early April around 6:30 p.m. standard time for up to 5 minutes at a time.
- OP4 – Residence (east of array, second floor) – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 33 minutes per year at this location. The glare occurs from late March to early April around 6:30 p.m. standard time for up to 6 minutes at a time.
- OP5 – Residence (east of array, second floor) – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 42 minutes per year at this location. The glare occurs from late March to early April around 6:30 p.m. standard time for up to 7 minutes at a time.
- OP6 – Residence (east of array, second floor) – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 40 minutes per year at this location. The glare occurs from late March to early April around 6:30 p.m. standard time for up to 7 minutes at a time.
- OP7 – Residence (east of array, second floor) – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 36 minutes per year at this location. The glare occurs from late March to early April around 6:30 p.m. standard time for up to 6 minutes at a time.
- OP8 – Residence (east of array, second floor) – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 25 minutes per year at this location. The glare occurs from late March to early April around 6:30 p.m. standard time for up to 5 minutes at a time.

- OP10 – Walking/Bike Path – There is potential for temporary after-image (Yellow-grade glare) from the modules for a total of 6,966 minutes (approximately 116 hours) per year at this location. The glare occurs from March to September around 7 a.m. standard time for up to 43 minutes at a time.

The following observation points are predicted to have some green-grade glare:

- OP2 – Residence (west of array, third floor) – There is low potential for temporary after-image (green-grade glare) from the modules for a total of 733 minutes (approximately 12 hours) per year at this location. The glare occurs from March to April, and August to September, around 7 a.m. standard time for up to 23 minutes at a time.
- OP9 – Residence (east of array, second floor) – There is low potential for temporary after-image (green-grade glare) from the modules for a total of 2,241 minutes (approximately 37 hours) per year at this location. The glare occurs from May to early August around 6 p.m. standard time for up to 30 minutes at a time.

This analysis predicts that the remainder of the observation points will not be affected by glare from the Project. Both OP11 (Justice Staff Training Centre) and OP12 (westbound Anthony Henday Drive) are not expected to experience any glare. Terrain blocks the view of the array for OP13, OP14, OP15 and OP16. Drivers on Anthony Henday Drive will not be affected by glare from the array.

Table 2: Glare Hazard by Driving Path and Observation Point, in Minutes per Year

Location	OP#	Hazard Level	Module Elevation			Location	OP#	Hazard Level	Module Elevation		
			1.0m	2.3m	3.6m				1.0m	2.3m	3.6m
Residence - West of array - Second floor	OP1	G	1,917	1,859	1,841	Residence - East of array - Second floor	OP9	G	2,241	2,221	2,191
		Y	2	2	2			Y	-	-	-
		R	-	-	-			R	-	-	-
Residence - West of array - Third floor	OP2	G	718	733	710	Pathway - Walking/bike path	OP10	G	52	52	52
		Y	-	-	-			Y	6,966	6,483	6,030
		R	-	-	-			R	-	-	-
Residence - East of array - Second floor	OP3	G	723	695	690	Justice Staff Training Centre - Third floor	OP11	G	-	-	-
		Y	25	26	30			Y	-	-	-
		R	-	-	-			R	-	-	-
Residence - East of array - Second floor	OP4	G	2,165	2,168	2,133	Anthony Henday Dr - South Sask. River Bridge	OP12	G	-	-	-
		Y	27	29	33			Y	-	-	-
		R	-	-	-			R	-	-	-
Residence - East of array - Second floor	OP5	G	5,318	5,269	5,232	Anthony Henday Dr - Westbound	OP13	G	-	-	-
		Y	41	41	42			Y	-	-	-
		R	-	-	-			R	-	-	-
Residence - East of array - Second floor	OP6	G	5,871	5,805	5,752	Anthony Henday Dr - Eastbound	OP14	G	-	-	-
		Y	36	39	40			Y	-	-	-
		R	-	-	-			R	-	-	-
Residence - East of array - Second floor	OP7	G	5,935	5,882	5,811	Anthony Henday Dr - Eastbound on-ramp	OP15	G	-	-	-
		Y	34	35	36			Y	-	-	-
		R	-	-	-			R	-	-	-
Residence - East of array - Second floor	OP8	G	5,838	5,777	5,717	Anthony Henday Dr - Westbound on-ramp	OP16	G	-	-	-
		Y	19	21	25			Y	-	-	-
		R	-	-	-			R	-	-	-

Figure 4 shows the observation points that Solas predicts will be impacted by glare from the solar array at the E.L. Smith WTP. Each point is colour-coded to match the intensity level of the strongest glare observed, with blue representing points that are not predicted to experience glare. On the west side of the Project the residential location OP1, and the bike pathway OP10 will have yellow level glare. On the east side of the Project, the residential locations OP3, 4, 5, 6, 7, 8 will have yellow level glare.

*Figure 4: Observation Points Predicted to be affected by Glare**

*Blue – no glare predicted; Green – green-grade glare predicted; Yellow – yellow-grade glare predicted

Table 2 indicates that residences on both the east and west of the array, as well as people using the bike path to the southwest, will be affected by glare from the Project. Drivers using Anthony

Henday Drive, as well as people at the non-residential facility to the southeast, will not likely experience glare from the Project. Four observation points (OP13-16) are located on Anthony Henday Drive above the valley and to the southwest of the Project.

Residents east and west of the Project will be able to see the glare from the array, but it will be partially obstructed by the forested areas. Users of the walking/bike path, represented by OP10, will experience unobstructed glare from the Project. The view of the array from roads southwest of the Project is blocked by the hill leading into the valley, so glare will not affect that area. Observation points 13, 14, 15, and 16 did not require further analysis.

A summary of the cumulative duration of yellow-grade glare predicted at each observation point with an unobstructed or partially obstructed view of the Project is provided in Figure 5 below. OP10 shows the highest annual exposure to yellow-grade glare at up to 6,966 minutes of glare per year. The rest of the observation points, located at the second floor of residences above the valley to the east and west of the array, are not expected to experience more than 42 minutes of yellow-grade glare per year.

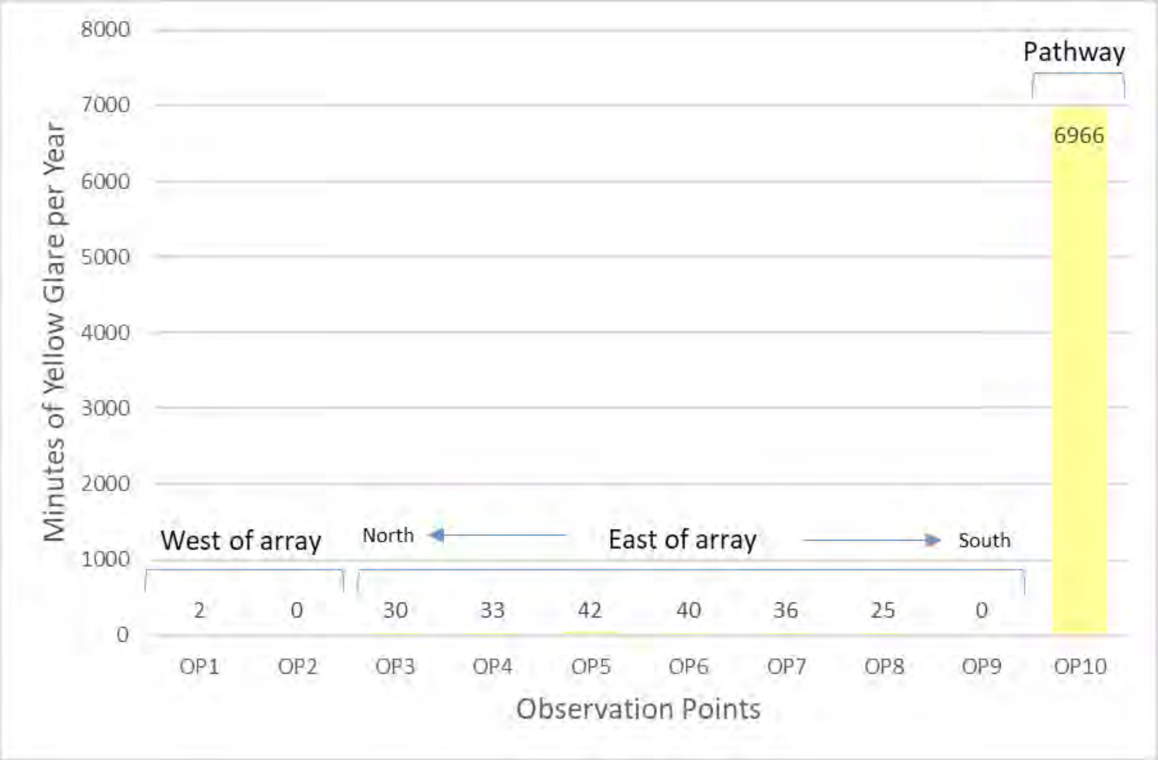

Figure 5: Annual Yellow-grade glare at Observation Points with Views of the Project

Table 3 below shows the timeframes for the occurrence of glare. Only the highest-intensity glare for each case and location is reported in the table. Cells are colour-coded to match the intensity level. The time of day, dates, and duration of the glare is also listed in the table. Most of the observation points have more green-grade glare than yellow-grade glare.

The results demonstrate that yellow-grade glare will be present from late March to early April for short durations around 6:45 a.m. standard time, or 6:30 p.m. standard time, depending on the residential location. Green-grade glare at residences is more extensive, predicted to occur between March and September around 7:00 a.m. or 6:00 p.m. standard time, depending on the location of the observation point in relation to the array. The pathway to the southwest of the Project (OP10) is predicted to experience yellow-grade glare for a longer duration between March and September around 6:30-7:45 a.m. standard time.

Table 3: Time of Day, Dates, and Duration of Glare for the Highest Level of Glare at each Observation Point

		Module Height Above Ground Level		
Location		**1.0m**	**2.3m**	**3.6m**
OP1	Time of Day Dates Duration	6:46 AM - 6:47 AM 3 Apr-4 Apr Up to 1 min.	6:46 AM - 6:47 AM 3 Apr-4 Apr Up to 1 min.	6:46 AM - 6:47 AM 3 Apr-4 Apr Up to 1 min.
OP2	Time of Day Dates Duration	6:40 AM - 7:11 AM 25 Mar-25 Apr; 18 Aug-17 Sep Up to 23 mins.	6:40 AM - 7:12 AM 25 Mar-25 Apr; 17 Aug-17 Sep Up to 23 mins.	6:40 AM - 7:10 AM 26 Mar-24 Apr; 18 Aug-17 Sep Up to 23 mins.
OP3	Time of Day Dates Duration	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 5 mins.	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 5 mins.	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 5 mins.
OP4	Time of Day Dates Duration	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 5 mins.	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 5 mins.	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 6 mins.
OP5	Time of Day Dates Duration	6:28 PM - 6:34 PM 26 Mar-5 Apr Up to 7 mins.	6:28 PM - 6:34 PM 26 Mar-5 Apr Up to 7 mins.	6:28 PM - 6:34 PM 26 Mar-6 Apr Up to 7 mins.
OP6	Time of Day Dates Duration	6:28 PM - 6:33 PM 26 Mar-5 Apr Up to 6 mins.	6:28 PM - 6:33 PM 26 Mar-5 Apr Up to 6 mins.	6:28 PM - 6:34 PM 26 Mar-5 Apr Up to 7 mins.
OP7	Time of Day Dates Duration	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 6 mins.	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 6 mins.	6:28 PM - 6:33 PM 26 Mar-4 Apr Up to 6 mins.
OP8	Time of Day Dates Duration	6:28 PM - 6:32 PM 26 Mar-1 Apr Up to 4 mins.	6:28 PM - 6:32 PM 26 Mar-2 Apr Up to 4 mins.	6:28 PM - 6:32 PM 26 Mar-4 Apr Up to 5 mins.
OP9	Time of Day Dates Duration	5:36 PM - 6:15 PM 10 May-2 Aug Up to 30 mins.	5:37 PM - 6:16 PM 10 May-2 Aug Up to 30 mins.	5:37 PM - 6:16 PM 10 May-2 Aug Up to 30 mins.
OP10	Time of Day Dates Duration	6:37 AM - 7:42 AM 23 Mar-19 Sep Up to 43 mins.	6:37 AM - 7:40 AM 24 Mar-19 Sep Up to 40 mins.	6:38 AM - 7:37 AM 24 Mar-18 Sep Up to 38 mins.

Respectively, Section 6.1 and 6.2 describe the glare hazard for the two most affected areas:

1. walking/bike path southwest of the Project (OP10), and
2. residences on Heffernan Drive NW. OP7 is described as it experiences the most glare.

6.1 Walking/Bike Path Southwest of the E.L. Smith Solar Farm

OP10 represents pedestrians or cyclists that could be travelling in either direction on the paved pathway southwest of the Project. The trail is located on a hill that overlooks the field and valley where the Project is to be built. Figure 6 illustrates the time of day and seasonality for glare hazard for OP10 from the module elevation of 1.0 metre (the bottom of the modules). The potential for after-image from yellow-grade glare occurs around 6:30-7:45 a.m. standard time from March to September. The effects of green-grade glare are considered negligible as it has a low risk of after image.

Figure 6: Time of Glare Hazard for Observation Point 10 – Bike Path

Figure 7 shows the daily duration for each level of glare experienced at OP10. This observation point experiences up to 43 minutes of glare, with most of it being classified in the yellow category.

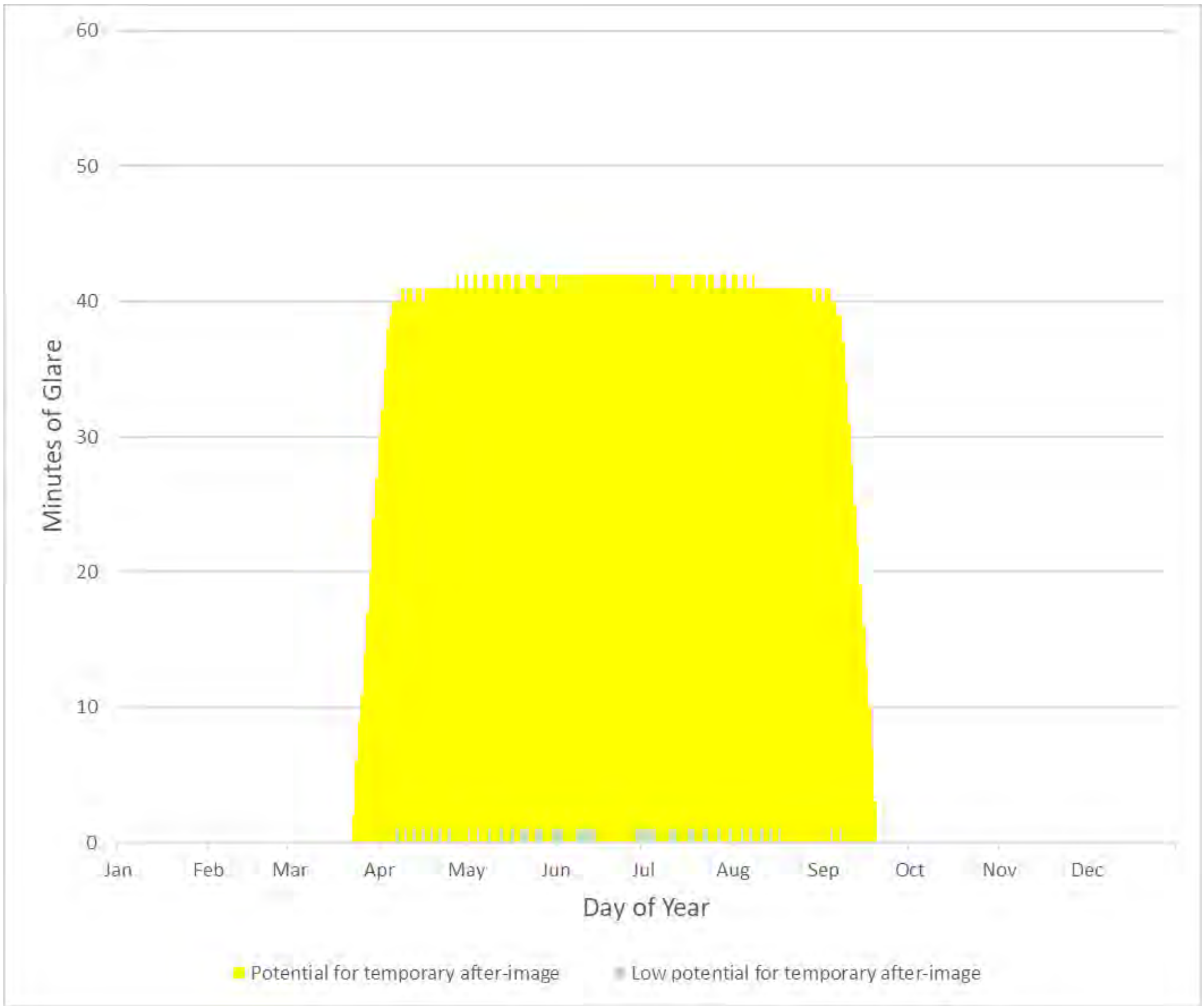

Figure 7: Daily Duration of Glare at OP10

Figure 8 below depicts the areas of the array that will produce glare that will be seen at OP10 in a one-year period. For OP10, glare comes from the south one-third of the array, with more of it being concentrated in the southwest corner of the layout. The glare spot will be about 118 metres away from the observation point at the closest.

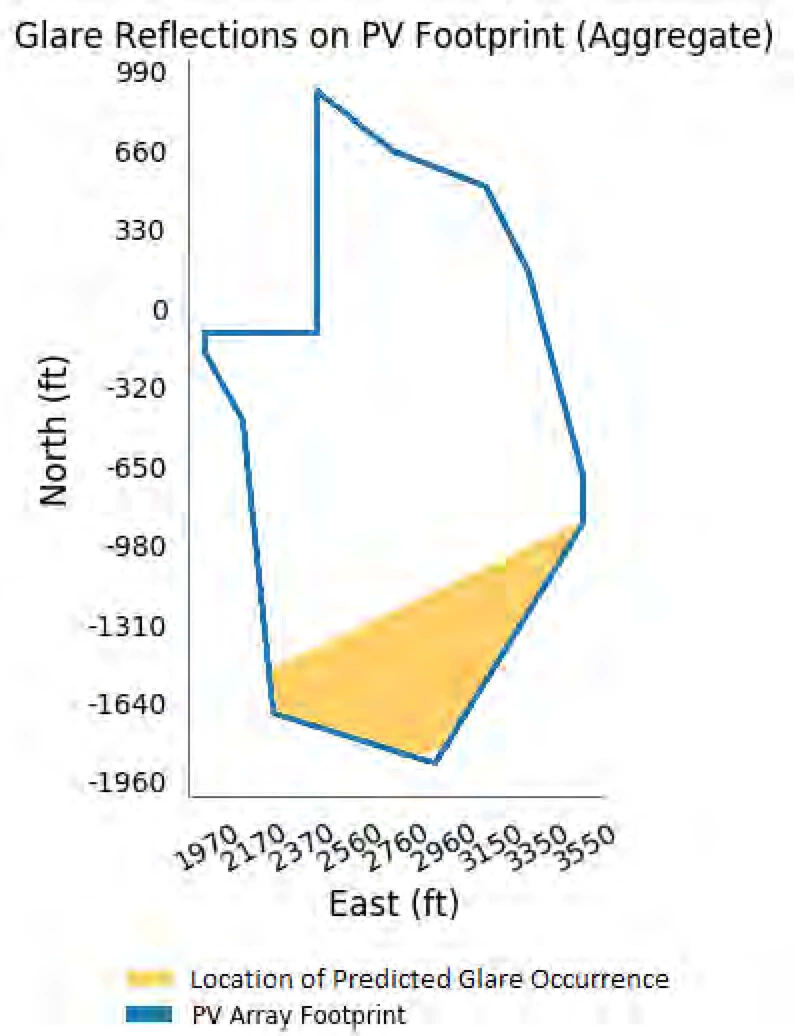

Figure 8: Location of Glare on the Array as seen from OP10

Figure 9 below plots the glare hazard according to the size of the glare spot (Subtended Source Angle), brightness of the glare (Retinal Irradiance), and the glare level (green, yellow, and red zones). The size and brightness of the glare spots are displayed using logarithmic scales. At OP10, the glare is 500 times dimmer than staring at the sun but will appear up to 10 times bigger than the perceived diameter of the sun viewed from the same location. From OP10, which is about 300 metres from the centre of the glare area, the glare will be about 26 metres (85 feet) wide.

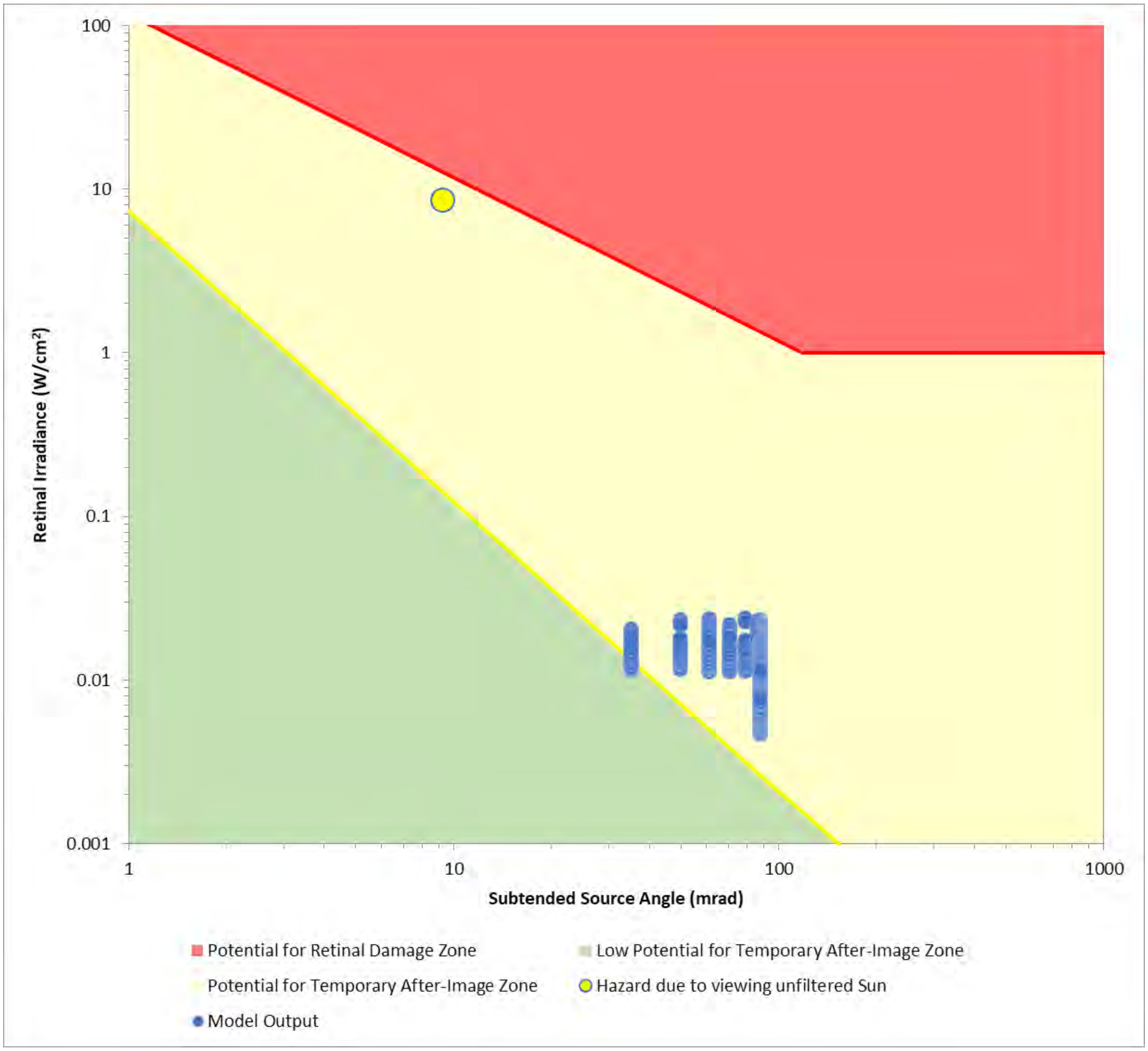

Figure 9: Log-Log Hazard Plot for OP10 – Bike Path

6.2 Residences along Heffernan Drive NW

The residences along Heffernan Drive NW Edmonton were evaluated for potential glare impacts. Most of the residences have reduced glare impacts as a result of the treeline between the residences and the solar PV array. OP7 is located at a residence near Hegler Crescent NW and experiences the most glare of the observation points along Heffernan Drive NW, followed closely by OP6 which is 100 metres to the north, and OP8 which is 175 metres to the south. OP3 is approximately 560 metres north on Heffernan Drive NW and experiences eight times less glare than OP7. OP9 is about 420 metres south on Hedley Way NW and experiences nearly three times less glare compared to OP7.

Figure 10 illustrates the time of day and seasonality for glare hazard for OP7 at 1.0-metre elevation. The potential for after-image from yellow-grade glare occurs around 6:30 p.m. standard time in late March and early April. Low potential for temporary after-image from green-grade glare is predicted to occur between 5:30-6:30 p.m. standard time from March to September.

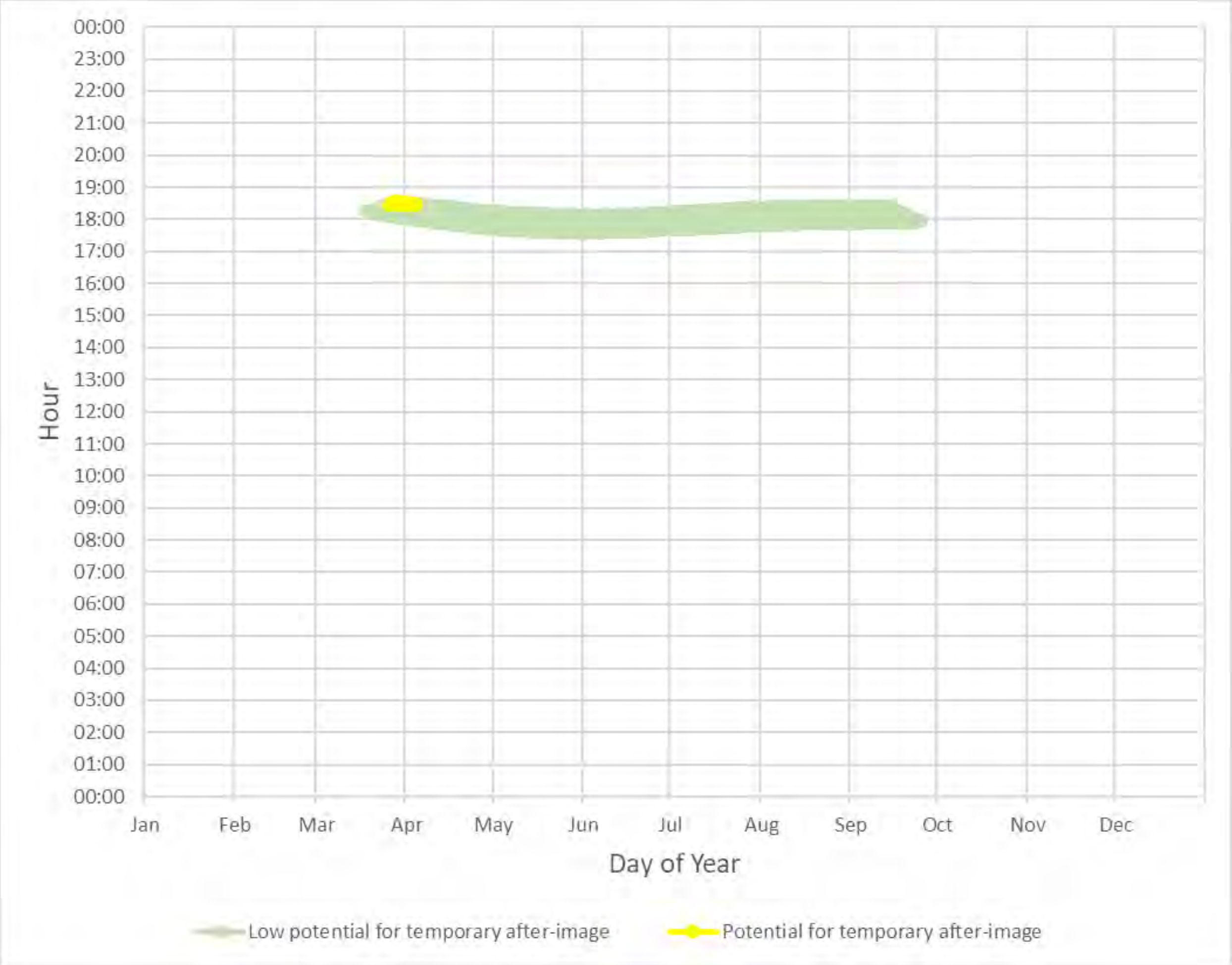

Figure 10: Time of Glare Hazard for Observation Point 7

Figure 11 shows the daily duration for each level of glare experienced at OP7. This observation point experiences up to 6 minutes of yellow-grade glare and 35 minutes of green-grade glare.

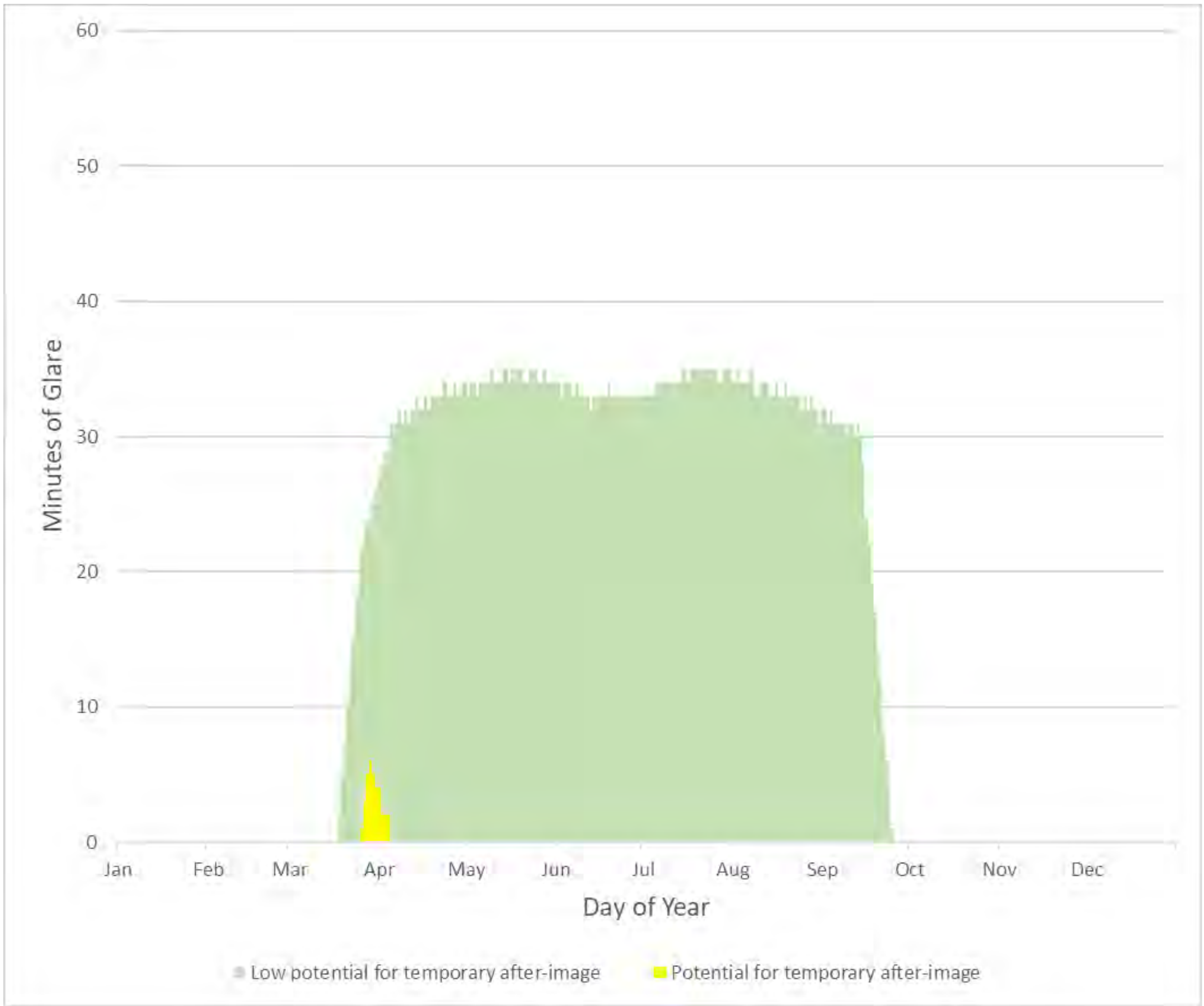

Figure 11: Daily Duration of Glare at OP7

Figure 12 depicts the areas of the array that will produce glare that will be seen at OP7 in a one-year period. For OP7, glare comes from a large portion of the middle of the array, with it occurring more frequently in the north and east parts of the layout. At the closest, the glare spot will be about 475 metres away from the observation point.

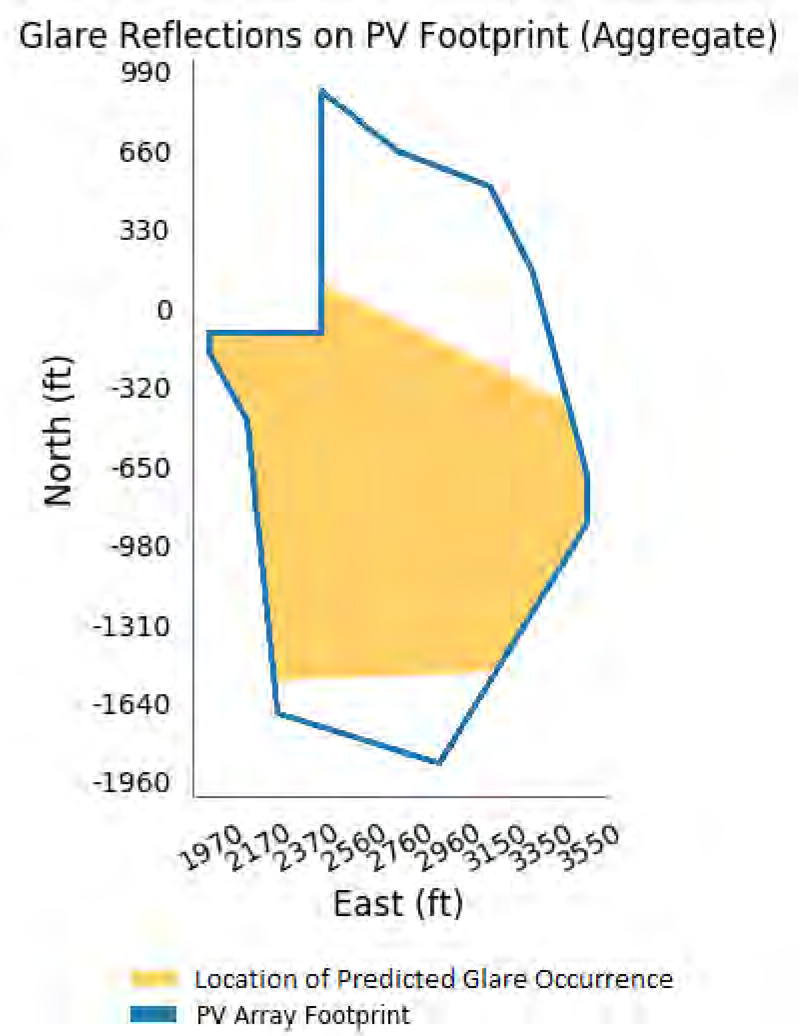

Figure 12: Location of Glare on the Array as seen from OP7

Figure 13 plots the glare hazard according to the size of the glare spot (Subtended Source Angle), brightness of the glare (Retinal Irradiance), and the glare level (green, yellow, and red zones). The size and brightness of the glare spots are displayed using logarithmic scales. At OP7, the glare is 800 times dimmer than staring at the sun. In the winter, the glare spot will appear up to three times bigger than the perceived diameter of the sun viewed from the same location, while it will appear about the same size as the sun in the summer. From OP7, which is about 700 metres from the centre of the glare area, the glare will be about 62 metres (203 feet) wide. Due to the glare being partially obstructed by foliage, the glare spot will appear up to six metres wide in the winter or 19 metres wide in the summer.

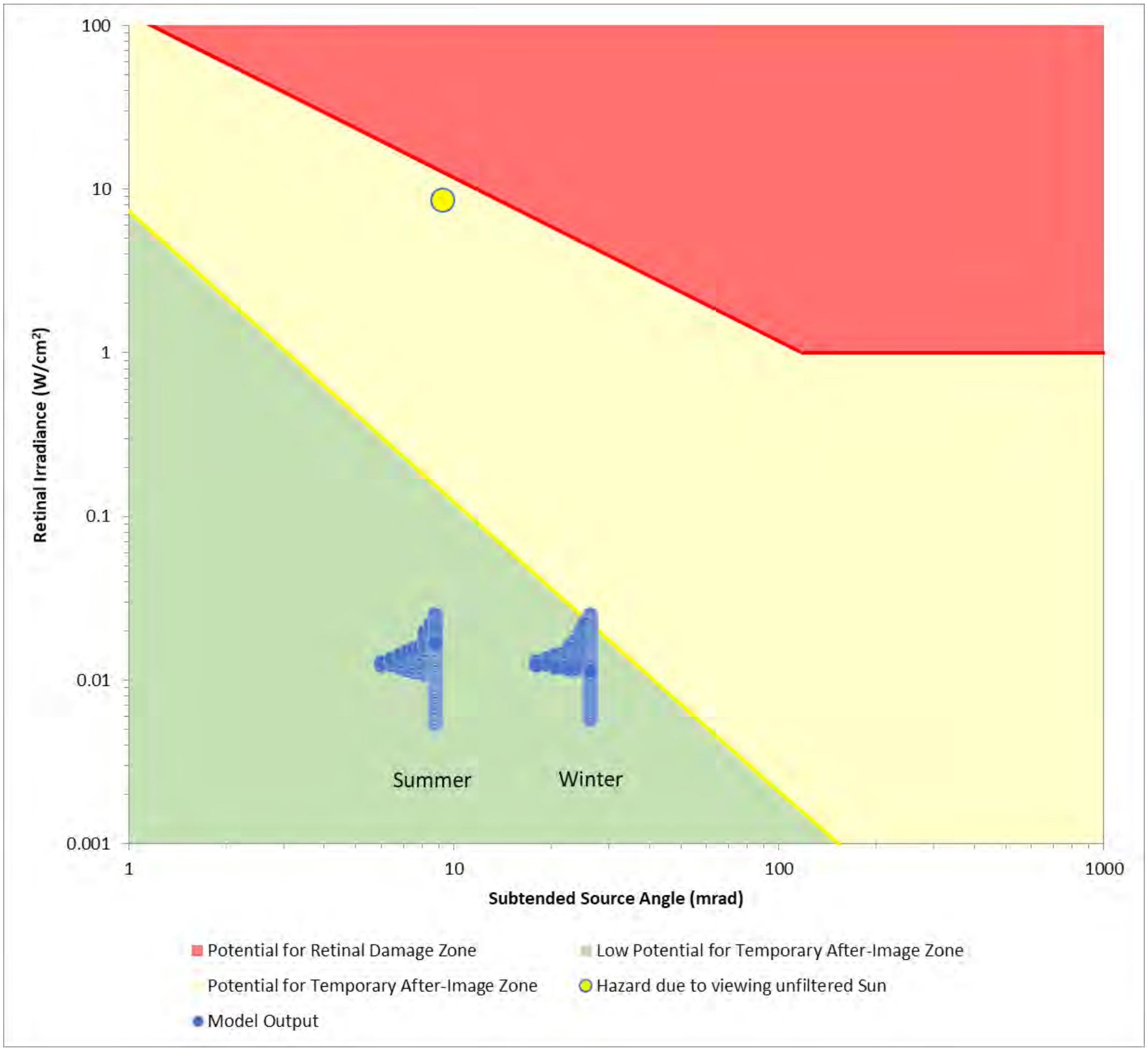

Figure 13: Log-Log Hazard Plot for OP7

The glare from the solar array is mitigated by the trees along the ridges located east and west of the Project. Any glare along Heffernan Drive and Cameron Ravine Drive will be observed while outdoors and as bright spots through the trees. The brightness of the glare will vary based on the density of the tree foliage during the spring, summer and fall. For this analysis, summer was defined as June through September as the timeframe for tree foliage. The analysis assumed conservative foliage levels. The brightness of the glare will be further reduced when observed through windows.

6.3 Comparison to a Lake

Solas completed an additional analysis of the Project site to compare the amount of glare from the solar array to that of a lake of the same size and location. Table 4 shows the annual duration of glare expected at each observation point from the Project and the lake. The lake case is predicted to have more yellow and green-grade glare than the Project for OP1-9. At OP10, the Project is expected to produce approximately 21 hours of additional yellow-grade glare relative to a lake. In total for all ten observation points, a lake would be expected to produce 73 percent more yellow-grade glare and 55 percent more green-grade glare than the Project.

Table 4: Glare Hazards from the Project and a Simulated Lake

Location	OP#	Hazard Level	Glare Duration (minutes)		Highest Glare
			Solar Modules	Lake	
Residence - West of array - Second floor	OP1	G	1,917	2,004	Lake
		Y	2	-	Project
		R	-	-	
Residence - West of array - Third floor	OP2	G	733	1,759	Lake
		Y	-	-	
		R	-	-	
Residence - East of array - Second floor	OP3	G	723	5,564	Lake
		Y	30	2,622	Lake
		R	-	-	
Residence - East of array - Second floor	OP4	G	2,168	5,976	Lake
		Y	33	1,793	Lake
		R	-	-	
Residence - East of array - Second floor	OP5	G	5,318	6,977	Lake
		Y	42	904	Lake
		R	-	-	
Residence - East of array - Second floor	OP6	G	5,871	8,222	Lake
		Y	40	594	Lake
		R	-	-	
Residence - East of array - Second floor	OP7	G	5,935	7,266	Lake
		Y	36	391	Lake
		R	-	-	
Residence - East of array - Second floor	OP8	G	5,838	6,622	Lake
		Y	25	261	Lake
		R	-	-	
Residence - East of array - Second floor	OP9	G	2,241	3,410	Lake
		Y	-	130	Lake
		R	-	-	
Pathway - Walking/bike path	OP10	G	52	-	Project
		Y	6,966	5,735	Project
		R	-	-	

7 GLARE-MITIGATING FEATURES

Solas' simulations through Glare Gauge predicted glare from the array using base assumptions. Solas completed additional analyses to model real-world features that could reduce the glare impact.

7.1 Cloud Cover and Typical Weather Patterns

The Glare Gauge model assumes that clear skies are present for every day of the year. This resulted in glare durations that are likely higher than experienced by observers. Using data normalized over a 30-year period, the fraction of possible daylight hours categorized as bright sunshine was obtained for each month of the year for the Edmonton International Airport. This reference point was the closest to the Project and believed to be somewhat representative.

Solas adjusted the predicted annual duration of yellow-grade glare at each observation point to account for the potential of cloudy days. Clouds reduce reflection by diffusing sunlight. For this analysis, Solas conservatively assumed that yellow-grade glare is downgraded to the green hazard level on cloudy days. On many days, the cloud cover may be sufficient to eliminate the glare completely. Figure 14 shows the comparison between glare assuming clear skies and glare assuming cloud cover that is experienced in a typical year. Due to cloud cover, yellow-grade glare is reduced by 45 percent for the period between March and September.

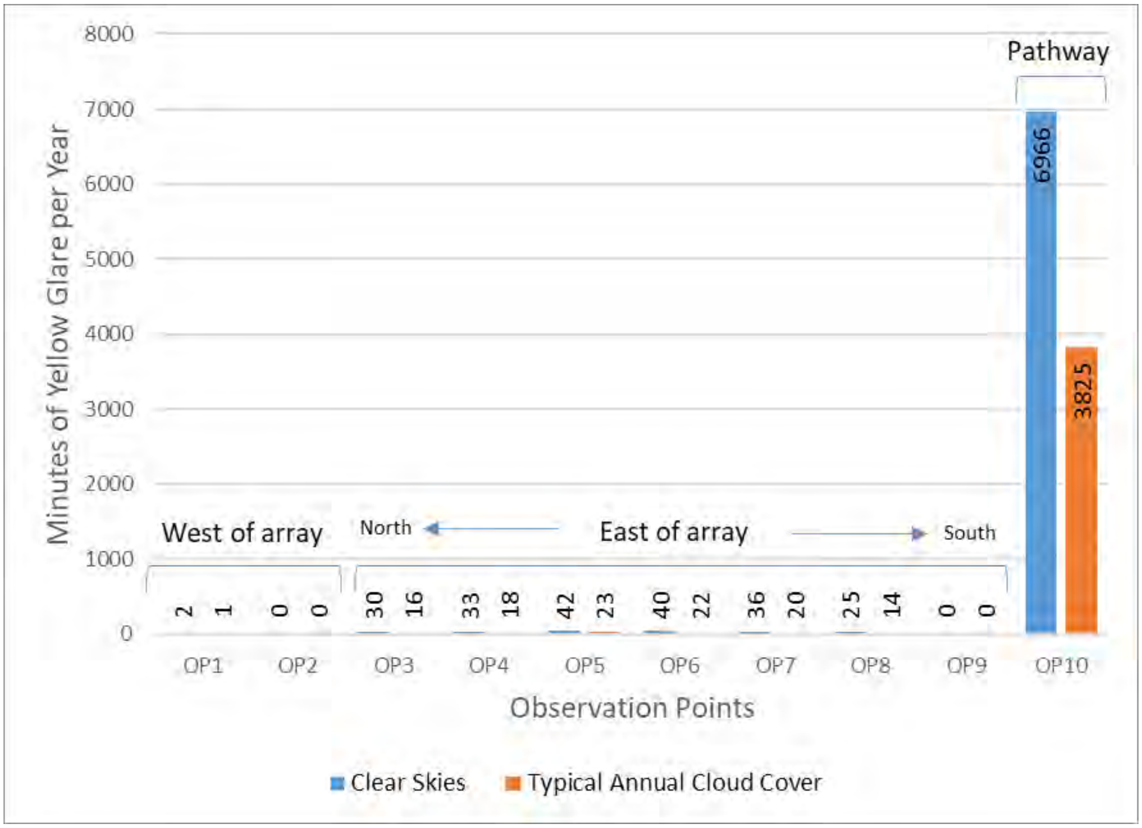

Figure 14: Reduction in Yellow-grade glare due to Typical Cloud Cover

Confidential

8 ARTISTIC RENDERING

Stantec Inc. was recruited by EPCOR to create an artistic rendering of the glare on the solar panels as viewed from the pathway near OP10. EPCOR provided a photograph of the area of the proposed solar development from a height of four feet above the path (54 feet above the array). EPCOR also provided the physical details of the proposed solar array including location, elevation and tilt angle. Solas provided Stantec with the location, estimated size and estimated brightness of the glare spot for the specific time: May 28 at 8:05 a.m. Mountain Daylight Time (7:05 a.m. Mountain Standard Time). Stantec's final artistic rendering of potential glare, as viewed from the pathway, is shown in Figure 15.

Figure 15: Stantec's Artistic Rendering of the proposed solar array and potential glare on May 28 at 8:05 a.m. MDT

9 CONCLUSIONS AND DISCUSSION

Based on the assumptions, the results of the analysis of the Project indicate that there is likely no incidence of red-grade glare. Drivers using Anthony Henday Drive will not experience glare from the array. Natural obstructions that surround the Project will help to completely or partially mitigate glare at most observation points. Residences at higher elevations to the east and west of the Project, as well as the pathway to the southwest, are predicted to be affected by limited number of minutes of glare from the array. The walking/bike path will have the most yellow-grade glare, while residences toward the south end of Heffernan Drive NW will experience green-grade glare.

Assuming clear skies all year, the paved walking/bike trail at OP10 is predicted to experience up to 6,966 minutes of yellow-grade glare each year. The glare is reduced to 3,825 minutes when typical annual cloud cover is taken in to account. The glare will be present between March and September for up to 43 minutes each day, occurring between 6:30 a.m. and 7:45 a.m. standard time. The glare at this observation point will look much dimmer than the sun but will appear larger.

Yellow-grade glare is expected to affect residents near OP7 along Heffernan Drive NW. Between late March and early April, OP7 is predicted to observe up to six minutes of yellow-grade glare around 6:30 p.m. standard time. In a one-year period, up to 36 minutes of yellow-grade glare could be observed at this location. Green-grade glare is expected from March to September between 5:30 p.m. and 6:30 p.m. standard time for up to 35 minutes daily. Approximately 560 metres north on Heffernan Drive NW at OP3, about eight times less glare is expected. OP9 is 420 metres south of OP7 and is predicted to receive approximately one-third the amount of OP7. The forested area between the observation points and the Project mitigate the glare expected to be produced by the array.

Glare predicted to be produced by the solar array is mainly categorized in the “green” level. This indicates that there is low potential for an after-image to be experienced if an observer looks at a glare spot. The size and intensity of the glare spot and resulting after-image are dependent on the distance between the observer and the array. An increase in the distance between the observer and array will decrease the impact and after-image created by the glare. The after-image an observer may experience could temporarily appear as a slightly darker or discoloured spot or line in the observer’s vision. Though inconvenient, it is not likely that glare at the green or yellow hazard levels will significantly impair a cyclist’s vision at OP10.

The Glare Gauge software tool reported that some of the observation points, except for Anthony Henday Drive crossing the South Saskatchewan River Bridge (OP12) and the non-residential facility southeast of the Project (OP11), are predicted to experience glare from the PV array. Further analysis found that observation points on Anthony Henday Drive southwest of the Project (OP13-16) have completely obstructed views of the array, and therefore the glare predicted in the model is not a hazard at those points. Existing trees and foliage provide partial glare mitigation for the observation points with views of the array that are not obstructed by terrain. As the glare occurs entirely between March and October, the foliage on deciduous trees will create a mitigating effect. The effect of foliage in each season has been incorporated in the analysis and is reflected in the results.

Since the Project is located in a valley, the terrain surrounding the site was analyzed to calculate the impact of shading on predicted glare. When the sun is at lower elevation angles, its light may be blocked by the river banks. Obstruction of incident sunlight reduced the number of minutes of glare experienced in the early morning and late evening.

Cloud cover and typical weather patterns provide a variable source of glare mitigation. Clouds may diffuse incident sunlight, lessening the impact of reflections from the solar modules. The impact of cloud cover was assessed using weather data normalized over a 30-year period. Since glare may not be fully mitigated by clouds, yellow-grade glare was assumed to be downgraded to green-grade glare. Approximately 45 percent of glare was downgraded due to cloud cover for this location.

Solas completed a comparison of the glare from the Project to glare from a lake of the same size and same location. The simulation revealed that in total for all observation points, a lake would be expected to produce 73 percent more yellow-grade glare and 55 percent more green-grade glare than the Project. However, observers on the pathway at OP10 would observe more yellow-grade glare from the solar PV array than from a lake.

The analysis at residential observation points was conducted at the topmost floor of the building since lower floors would observe similar or less intense glare. Viewing the Project from a house interior will reduce the glare impact.

Based on the information associated with the geographic configuration of the solar modules, the Project has a low potential to result in hazardous glare conditions.

Appendix A Forge Solar Modelling Assumptions

Axis tracking: Fixed

Array Azimuth: 180 degrees (due south)

Module tilt: 33 degrees

Module material: Smooth glass without Anti-Reflective coating

Vary reflectivity with sun position? Yes

Ground elevation: 632 m (2075 feet)

Height above ground: 1.0 m, 2.3m, and 3.6 m (3.82 feet, 7.55 feet, and 11.81 feet)

Appendix B Required Obstruction Height Analysis

Forge Solar's Glare Gauge software does not take obstructions between the array and observation points into account when performing a glare analysis. Solas completed additional analyses on all observation points to determine if the glare would be obstructed by the terrain, which includes the hills and trees surrounding the valley in which the array is located.

Solas calculated the required height of an obstruction between the observation point and the solar array to block the glare. The required height was compared to the actual height of the terrain or trees between the array and each observation point. Table 5 shows the results of the obstruction analysis.

Table 5: Observation Points with Obstructed Lines-of-Sight

Observation Point	Height of Obstruction above Array (m)	Height of Glare Mitigation Required (m)	Height Difference (m)	Glare Obstruction
OP1	50.8	49.0	-1.8	Partial – Trees
OP2	53.9	53.2	-0.7	Partial – Trees
OP3	48.1	44.4	-3.6	Partial – Trees
OP4	52.6	44.7	-7.9	Partial – Trees
OP5	54.2	50.5	-3.7	Partial – Trees
OP6	54.8	49.3	-5.4	Partial – Trees
OP7	54.8	50.1	-4.7	Partial – Trees
OP8	56.9	46.8	-10.1	Partial – Trees
OP9	52.6	51.6	-1.0	Partial – Trees
OP10	9.7	14.3	4.6	None
OP13	34.0	30.0	-4.0	Full – Terrain
OP14	47.8	36.2	-11.6	Full – Terrain
OP15	42.6	31.9	-10.7	Full – Terrain
OP16	40.1	35.3	-4.8	Full – Terrain

Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm – Wildlife Addendum

January 2020

Prepared for:

EPCOR Water Services Inc.

Prepared by:

Stantec Consulting Ltd.
Edmonton, AB

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Environmental Scientist, Associate

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LIST OF FIGURES

1.0 INTRODUCTION AND SCOPE OF THE ADDENDUM

EPCOR Water Services Inc. (EPCOR) has retained Stantec Consulting Ltd. (Stantec) to complete a Municipal Environmental Impact Assessment (MEIA) for the proposed E.L. Smith Solar Farm (the Project) within NW 3-52-25 W4M and SW 10-52-25 W4M, Edmonton, Alberta. The Project includes permitting, constructing and operating a 12 Megawatt (MW) solar farm to supply power to the E.L. Smith Water Treatment Plant (WTP). The Project will include: the installation of solar panels, inverter stations, and new underground electrical circuits; fence upgrades/extensions; the construction of an access road; and revegetation.

The MEIA, dated February 2019, examined the potential effects of construction and operation of the Project on specific valued ecosystem components (VECs) including: terrain and soils; surface water bodies and hydrology; vegetation species and communities; wildlife species and habitat; viewscape; and heritage resources (Stantec 2019).

This MEIA formed part of the rezoning and plan amendment application put forward to City Council in June 2019. City Council deferred a decision regarding the application, pending additional consultation with the Enoch Cree Nation and documentation to assist City Council in determining whether a river valley location for the project is deemed essential. In the time following the Council hearing EPCOR has initiated components of the Project's draft Wildlife Mitigation and Monitoring Plan (WMMP) to begin the collection of pre-construction data on wildlife habitat use and distribution within the LAA. EPCOR will continue to collect information prior to, during, and post-construction as part of the WMMP. EPCOR used initial findings from the WMMP and additional wildlife baseline survey data to increase the confidence with respect to wildlife species conclusions (as detailed in the MEIA) and to address outstanding questions put forward by the City of Edmonton.

This addendum includes additional wildlife data collected since the submission of the MEIA and a review of the wildlife effects assessment and conclusions based on the additional data. The addendum is to be read in conjunction with the MEIA, however conclusions outlined in this addendum supersede those of the MEIA.

2.0 BASELINE CONDITIONS

This section provides additional information on baseline conditions pertaining to wildlife and should be read in conjunction with the MEIA. The intent of the field survey results outlined in this section is to provide additional description of the baseline conditions.

2.1 BREEDING BIRD SURVEY

Two breeding bird surveys were conducted in 2019 to support the data collected in 2017. Two survey visits were conducted on June 13 and 24, 2019 at four stations in the PDA and adjacent LAA. Figure 2-1 displays the location of breeding bird survey stations. Twenty-three species (refer to Table 2-1 below) were observed during two breeding bird surveys conducted in June 2019 following provincial *Sensitive Species Inventory Guidelines* (GOA 2013); two of the species observed are species of management concern (SOMC); common yellow throat (*Geothlypis trichas*) and least flycatcher (*Empidonax minimus*) (see Table 2-1). All of the bird species observed in 2019 are species known to occur in open and deciduous habitats in the Edmonton region (Federation of Alberta Naturalists [FAN] 2007). All of the species present could be breeding within the local assessment area (LAA; FAN 2007). Red-eyed vireo (*Vireo olivaceus*) was the most commonly observed species in the PDA, followed by clay-colored sparrow (*Spizella pallida*) and yellow warbler (*Dendroica petechia*).

Twenty species were detected in the aspen poplar woodland alliance vegetation community and thirteen species were observed in the perennial pasture. Within the perennial pasture vegetation community that makes up the bulk of the PDA, savannah sparrows (*Passerculus sandwichensis*) were the most abundant species observed in in 2019, as they were in 2017. Red-eyed vireo were the most abundant species in the aspen poplar woodland alliance, followed by yellow warbler and cedar waxwing (*Bombycilla cedrorum*). Overall, Shannon Index of diversity scores (Shannon 1948; a measure of species richness and evenness) for the aspen poplar woodland alliance vegetation community was higher in both 2017 and 2019 (2.2 and 2.7, respectively) than in the perennial pasture (1.4 and 2.2, respectively). A higher diversity score generally indicates higher species richness and evenness, while lower diversity scores generally indicate lower species richness with few species making up the bulk of observations.

Table 2-1 Breeding Birds Detected in the LAA in 2019

Common Name	Scientific Name	Alberta Wild Species Rank[1]	Wildlife Act[2]	SARA[3]
American crow	*Corvus brachyrhynchos*	secure	N/A	Not assessed
American goldfinch	*Spinus tristis*	*secure*	N/A	*Not assessed*
American robin	*Turdus migratorius*	*secure*	N/A	*Not assessed*
Black-capped chickadee	*Poecile atricapillus*	*secure*	N/A	*Not assessed*
Brewer's blackbird	*Euphagus cyanocephalus*	*secure*	N/A	*Not assessed*
Cedar waxwing	*Bombycilla cedrorum*	*secure*	N/A	*Not assessed*
Chipping sparrow	*Spizella passerina*	*secure*	N/A	*Not assessed*
Clay-colored sparrow	*Spizella pallida*	*secure*	N/A	*Not assessed*
Common yellowthroat	*Geothlypis trichas*	*sensitive*	N/A	*Not assessed*
Dark-eyed junco	*Junco hyemalis*	*secure*	N/A	*Not assessed*
European starling	*Sturnus vulgaris*	*exotic*	N/A	*Not assessed*
Gray catbird	*Dumetella carolinensis*	*secure*	N/A	*Not assessed*
Least flycatcher	*Empidonax minimus*	*sensitive*	N/A	*Not assessed*
Northern flicker	*Colaptes auratus*	*secure*	N/A	*Not assessed*
Red-eyed vireo	*Vireo olivaceus*	*secure*	N/A	*Not assessed*
Red-tailed hawk	*Buteo jamaicensis*	*secure*	N/A	*Not at risk*
Savannah sparrow	*Passerculus sandwichensis*	*secure*	N/A	*Not assessed*
Song sparrow	*Melospiza melodia*	*secure*	N/A	*Not assessed*
Tree swallow	*Tachycineta bicolor*	*secure*	N/A	*Not assessed*
Vesper sparrow	*Pooecetes gramineus*	*secure*	N/A	*Not assessed*
White-throated sparrow	*Zonotrichia albicollis*	*secure*	N/A	*Not assessed*
Winter wren	*Troglodytes hiemalis*	*secure*	N/A	*Not assessed*
Yellow warbler	*Dendroica petechia*	*secure*	N/A	*Not assessed*

NOTES:
[1] AEP 2017; [2] GOA 2017a; [3] Government of Canada 2019

2.2 MIGRATORY WATERBIRD SURVEY

A migratory waterbird survey was conducted in the LAA during the fall migration period of 2019 to support the data collected in 2017 (Stantec 2019) and assess use of the PDA and adjacent river by waterbirds during migration (see Figure 4.0 in the MEIA for the location of the migratory waterbird surveys). Two survey visits were completed on September 18 and October 23, 2019. Surveys were conducted from three stations within the North Saskatchewan River (NSR) valley (see Figure 2-1). During fall migration surveys, Canada goose (*Branta canadensis*), mallard (*Anas platyrhynchos*), and spotted sandpiper

(*Actitis macularius)* were observed in the LAA. During the second visit, flocks of migrating Canada goose were observed travelling over the PDA but no observations of waterbirds using the PDA or adjacent NSR were made. Other wildlife observations included migratory songbirds and raptors (see Table 2-2). One mallard and one common goldeneye (*Bucephala clangula*) were incidentally observed on the NSR during the snow track survey on November 12, 2019.

Table 2-2 Migratory Birds Detected in the LAA During Fall Migratory Bird Surveys

Common Name	**Scientific Name**	**Count**	
		Visit 1	**Visit 2**
Canada goose	*Branta canadensis*	5	286
Mallard	*Anas platyrhynchos*	6	-
Swainson's hawk	*Buteo swainsoni*	1	-
Red-tailed hawk	*Buteo jamaicensis*	3	-
Spotted sandpiper	*Actitis macularius*	1	-
Pileated woodpecker	*Dryocopus pileatus*	1	-
Song sparrow	*Melospiza melodia*	5	-
Dark-eyed junco	*Junco hyemalis*	2	-

2.3 REPTILES

No species-specific surveys for reptiles were conducted in 2019; however, between 2017 and 2019 a total of 15 site visits by wildlife biologists have been completed for wildlife surveys in all active reptile seasons (i.e., spring, summer and fall). No incidental observations of reptiles were recorded in the LAA in 2017 or 2019 during these surveys.

2.4 REMOTE CAMERA PROGRAM

Eleven remote cameras were deployed in 2019 to gather information on the relative abundance and distribution of medium and large mammals in the LAA (see Figure 2-1). Cameras were deployed on July 12 and 22, 2019 and project personnel retrieved the memory cards on October 23, 2019. Cameras were checked for maintenance and left in-place once between deployment and retrieval of the memory cards. Table 2-3 provides a summary of the remote camera sampling effort for this addendum.

Table 2-3 Summary of 2019 Remote Camera Monitoring Effort for E.L. Smith Solar Farm

Remote Camera ID	Site Description	Previous Maintenance Date	Retrieval Date	Last Functional Date	Number of Active Days[1]	Total Photos Taken	Camera Status
EPC01	Top of slope in deciduous forest	2019/07/12	2019/10/23	2019/10/23	104	815	Active
EPC02	Bottom slope along existing access road in deciduous forest	2019/07/12	2019/10/23	2019/10/23	104	2,660	Active
EPC03	Mid-slope in deciduous forest	2019/07/12	2019/10/23	2019/10/23	104	1,765	Active
EPC04	Bottom of slope in deciduous forest close to edge of perennial pasture	2019/07/12	2019/10/23	2019/10/23	104	4,619	Active
EPC05	Top of forested river bank at narrowest portion between existing E.L. Smith WTP and river.	2019/07/12	2019/10/23	2019/10/23	104	14,082	Active
EPC06	Top of river bank in deciduous forest	2019/07/12	2019/10/23	2019/10/23	104	5,175	Active
EPC07	In perennial pasture facing proposed mitigation area	2019/07/22	2019/10/23	2019/10/23	94	1,435	Active
EPC08	In perennial pasture on existing trail along low fence	2019/07/22	2019/10/23	2019/10/23	94	2,036	Active
EPC09	In perennial pasture along old access road	2019/07/22	2019/10/23	2019/10/23	94	3,489	Active
EPC10	On existing E.L. Smith WTP fence facing deciduous treed area	2019/07/22	2019/10/23	2019/10/23	94	1,553	Active
EPC11	Mid-river bank in deciduous forest at narrowest portion between existing E.L. Smith WTP and river.	2019/07/22	2019/10/23	2019/08/15	25	655	Active [2]

NOTES:

[1] Calculated as the number of days between ‘previous maintenance date’ and ‘last functional date’.

[2] Camera EPC11 malfunctioned and no photos were collected from August 15th - October 23rd.

All of the remote cameras had false triggers or ‘extra images’ as a result of wind-blown vegetation, rain fall, wildlife remaining in the camera frame, and sunlight refracted off the camera lens. This results in detections that can consist of hundreds of images that are not relevant to the analysis. False triggers and 'extra images' are expected when using remote cameras; measures such as positioning were taken to reduce the number of false triggers.

Ten of the 11 cameras were operational during the entire monitoring period. Camera EPC11 malfunctioned and did not collect data from August 15 to October 23. Collectively, the remote cameras sampled for 1,025 days, or approximately 24,600 hours.

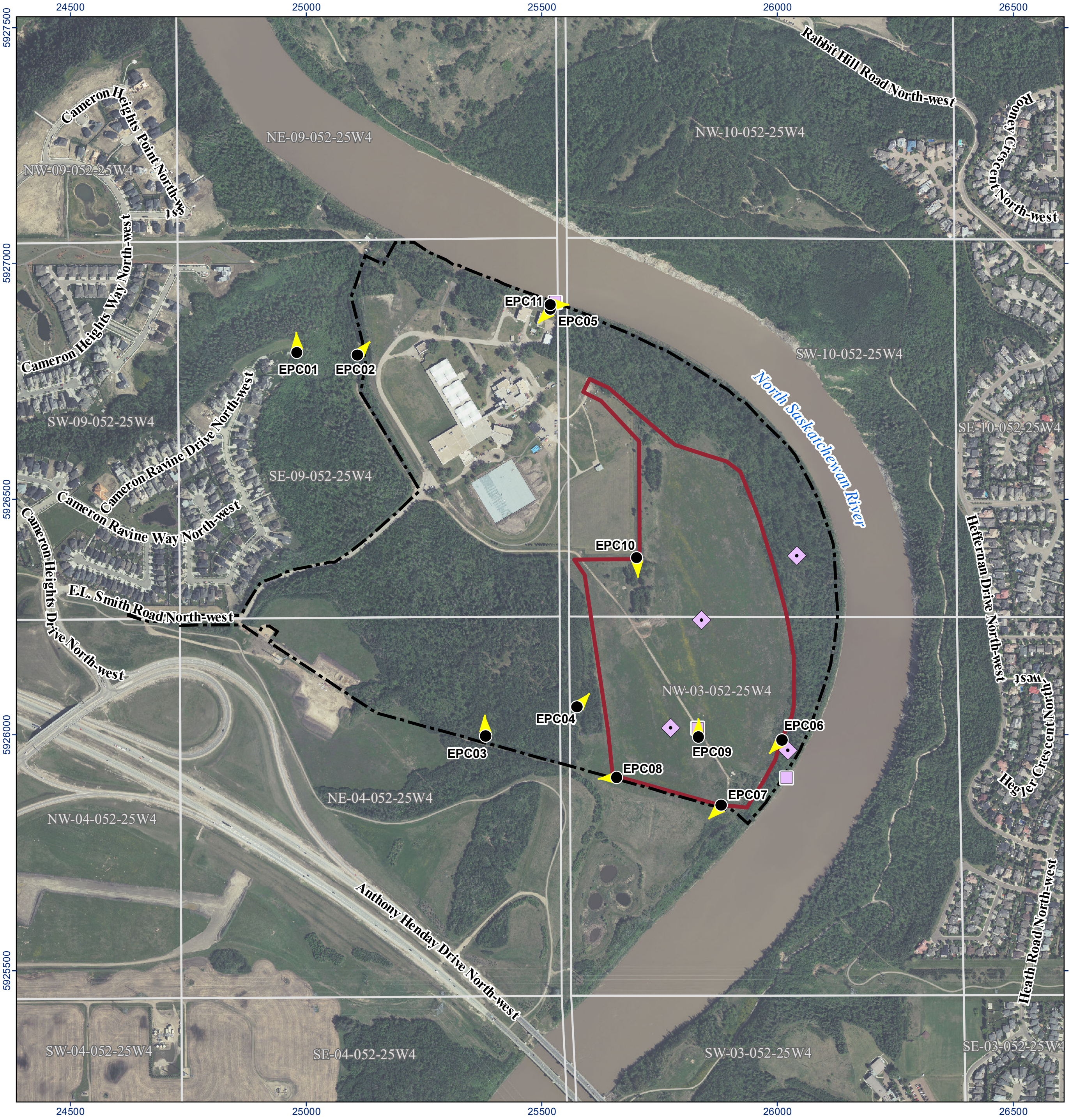
Table 2-4 provides the number of human and wildlife detections within the E.L. Smith remote camera program. A detection is defined as one or more images of the same subject not separated by more than two minutes. If more than two minutes elapsed between images a new detection was recorded.

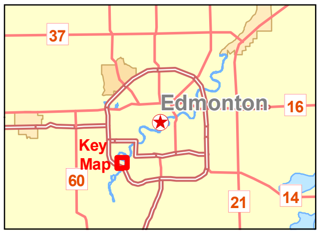
Excluding the images from the camera tests, humans were detected 685 times within the program area, primarily hikers and cyclists. Human activity was observed at all but one camera (EPC11) which is located north of the low lift pumphouse in a clearing adjacent to the river. Camera EPC06 at the southeast tip of the PDA and EPC02 along a gravel trail at the northwest corner of the existing E.L. Smith WTP had the greatest number of human observations.

Coyote and white-tailed deer were the most frequently detected mammals with 752 and 1,806 detections, respectively. White-tailed deer were detected at every camera location, with the highest number of detections at EPC06 at the southeast tip of the PDA . There were 11 detections of elk, all along the south edge of the PDA and up along the west side of the PDA, and one detection of moose at EPC02 on the west side of the existing E.L. Smith WTP. Domestic dogs were detected 76 times.

Other wildlife detected on the cameras include American crow, porcupine, and snowshoe hare.

Two cameras are within the PDA, EPC09 and ECP10; both of which recorded modest detections of coyote and white-tailed deer. Approximately 50% of coyote detections were along the west side of the existing E.L. Smith WTP and 30% at the southeast tip of the PDA. White-tailed deer detections were relatively evenly distributed across the camera locations, with detections at: both the north and south end of the PDA; along the west slope of the river valley; and along the eastern edge adjacent to the river. Overall, both white-tailed deer and coyote (species for which there is sufficient information to assess) were observed more frequently (normalized by total active camera days) on cameras in aspen parkland woodland communities (approximately 1.82 and 0.86 observations per active camera day, respectively) than in perennial pasture (1.51 and 0.17 observations per active camera day, respectively).





- ▭ Project Development Area
- ● Remote Camera Location
- ➤ Remote Camera View Direction
- ◆ Breeding Bird Survey Station
- ■ Migratory Bird Survey Station
- ▬ ▪ ▬ EPCOR Property Boundary
- ☐ Quarter Section

0 125 250 metres

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Notes

1. Coordinate System: NAD 1983 3TM 114

2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.

3. Background: City of Edmonton, 2017

Stantec

Project Location
SW¼ 10-52-25 W4M and
NW¼ 03-52-25 W4M
Edmonton, Alberta

Prepared by SB on 2019-12-03
TR by SM on 2019-12-04
IR Review by EL on 2019-12-04

Client/Project 110219883
E.L. Smith Solar Farm
Municipal Environmental Impact Assessment
– Addendum

Figure No.
2-1

Title
Remote Camera and Bird Survey Locations

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Table 2-4 Summary of Human and Wildlife Detections from the 2019 Remote Camera Monitoring Effort in the E.L. Smith Solar Farm LAA

Species	Number of Detections per Camera											
	EPC01	EPC02	EPC03	EPC04	EPC05	EPC06	EPC07	EPC08	EPC09	EPC10	EPC11	Total
Humans												
Recreational -Cyclist	-	122	-	2	9	69	21	82	-	-	-	305
Recreational - Foot	10	45	4	4	38	136	13	33	10	1	-	294
Worker - Foot	-	10	-	-	-	50	-	-	4	-	-	64
Worker - Vehicle	-	17	-	-	4	-	-	-	3	2	-	26
Domestic Dog	1	22	-	1	6	16	2	27	1	-	-	76
Wildlife - Birds												
American Crow	2	-	-	-	-	-	-	-	-	-	-	2
Wildlife – Mammals												
Coyote	101	273	29	11	25	227	15	32	16	14	9	752
Elk	-	-	2	1	-	2	2	4	-	-	-	11
Moose	-	1	-	-	-	-	-	-	-	-	-	1
Porcupine	1	-	-	-	-	13	-	-	-	-	-	121
White-tailed deer	22	138	77	425	207	257	124	95	222	233	37	1,834
Snowshoe Hare	4	3	10	-	-	-	-	-	-	-	-	17
Unknown[1]												
Animal	1	-	-	-	3	-	1	-	-	-	-	5
Bird	-	-	-	-	-	-	-	-	1	-	-	1
False Trigger	16	27	18	61	670	36	7	7	43	11	6	902

NOTES:

[1] Photograph(s) are insufficient to identify what triggered the camera (e.g., blurred movement, shadows, very small portion of animal visible)

2.5 SNOW TRACK SURVEY

A snow track survey was completed on the Project PDA and adjacent LAA within the NSR valley to gather baseline information on winter-active terrestrial wildlife species richness and relative abundance. Winter track surveys are the preferred survey method in Alberta for mammals because they are non-invasive and can detect a broad range of species or species groups (ESRD 2013).

Track data were collected using linear transects based on methods described by RIC (2006) for a standard line-intercept survey and were used to calculate species-specific indices of relative abundance. Survey methods followed ESRD (2013) for non-linear disturbance, where applicable (shorter transects were used because of the small size of Project), except for survey timing which was chosen to take advantage of an early snowfall. Transects were positioned to sample habitat types available within the LAA in the NSR valley including the PDA.

Species-specific tracks observed within 1 m of either side of the transect center line were recorded for each segment. The track period, or number of days since the last track-obliterating event (i.e., greater than 1 cm snowfall or average daily windspeed of over 30 km/h; ABMI 2014) was calculated for each transect to standardize track counts. Although the tracks of mule deer (*Odocoileus hemionus*) and white-tailed deer (O*docoileus virginianus*.) can be difficult to differentiate, based on past observations within the LAA all deer tracks were assumed to be white-tailed deer. Where necessary, tracks were back-tracked to obtain more visible tracks and aid identification.

Track counts are presented as a standardized index of relative abundance (km-days) calculated following Thompson et al. (1989):

$$\text{Track Counts} = \frac{\sum \text{Tracks Observed}}{\sum \text{Transect length surveyed (km)} \times \text{ Track Period (days)}}$$

Standardized track counts were calculated for each species or species group observed.

Two snow track survey visits were completed on November 12, 2019 and January 24, 2020. For the November 12, 2019 visit the last track obliterating snowfall was approximately 0900 on November 9. 2019. Snow condition was soft with an average snow depth of approximately 10 cm and complete snow coverage. Temperatures between the last snowfall and the survey ranged from -20ºC to 1ºC.

For the January 24, 2020 survey visit, the last track obliterating snowfall was approximately 1200 on January 22, 2020. Snow condition was soft and average snow depth was approximately 30 cm with complete snow coverage. Temperatures between the last snowfall and the survey ranged from -12 ºC to 1ºC.

For both visits, five transects were completed ranging from 175 m to 1175 m in length depending on the width of the NSR valley and existing barriers (e.g., existing fence at E.L. Smith WTP; see Figure 2-2). A total of approximately 2.73 km was surveyed during the first visit and approximately 2.68 km was surveyed during the second.

Tracks from nine species or species groups were identified including deer, coyote (*Canis latrans*), red fox (*Vulpes vulpes*), snowshoe hare (*Lepus americanus*), red squirrel (*Tamiasciurus hudsonicus*), short-tailed weasel (*Mustela erminea*) small rodents (mice, voles), porcupine (*Erethizon dorsatum*) and human. Tables 2-5 and 2-6 display standardized track counts by habitat type for each species observed during the survey visits.

White-tailed deer was the most commonly identified species across all habitat types during both the first and second visit (76.86 tracks/km*day and 63.07 tracks/km*day, respectively), followed by coyote (38.28 tracks/km*day) during the first visit and snowshoe hare (39.81 tracks/km*day) during the second (see Tables 2-5 and 2-6). Track counts for white-tailed deer during the first survey visit were likely influenced by timing the survey during the breeding period when deer, particularly males, are more active relative to the timing of most snow track surveys (e.g., between December 1 and March 31; ESRD 2013).

Some differences in habitat use were evident between the two survey visits. In treed habitats, standardized track counts for most species were higher during the second survey visit than the first. For shrubby and open areas, standardized track counts were lower during the second survey. During the second survey visit, much less evidence of human use (foot or bicycle tracks) was observed than during the first visit. Species richness was higher in treed habitats than shrubby and grassland habitats during both survey visits (see Tables 2-5 and 2-6). During both survey visits, incidental observations were made of white-tailed deer and coyote tracks moving through the constriction between the NSR and the existing E.L. Smith WTP lower pump house to the north of the PDA.

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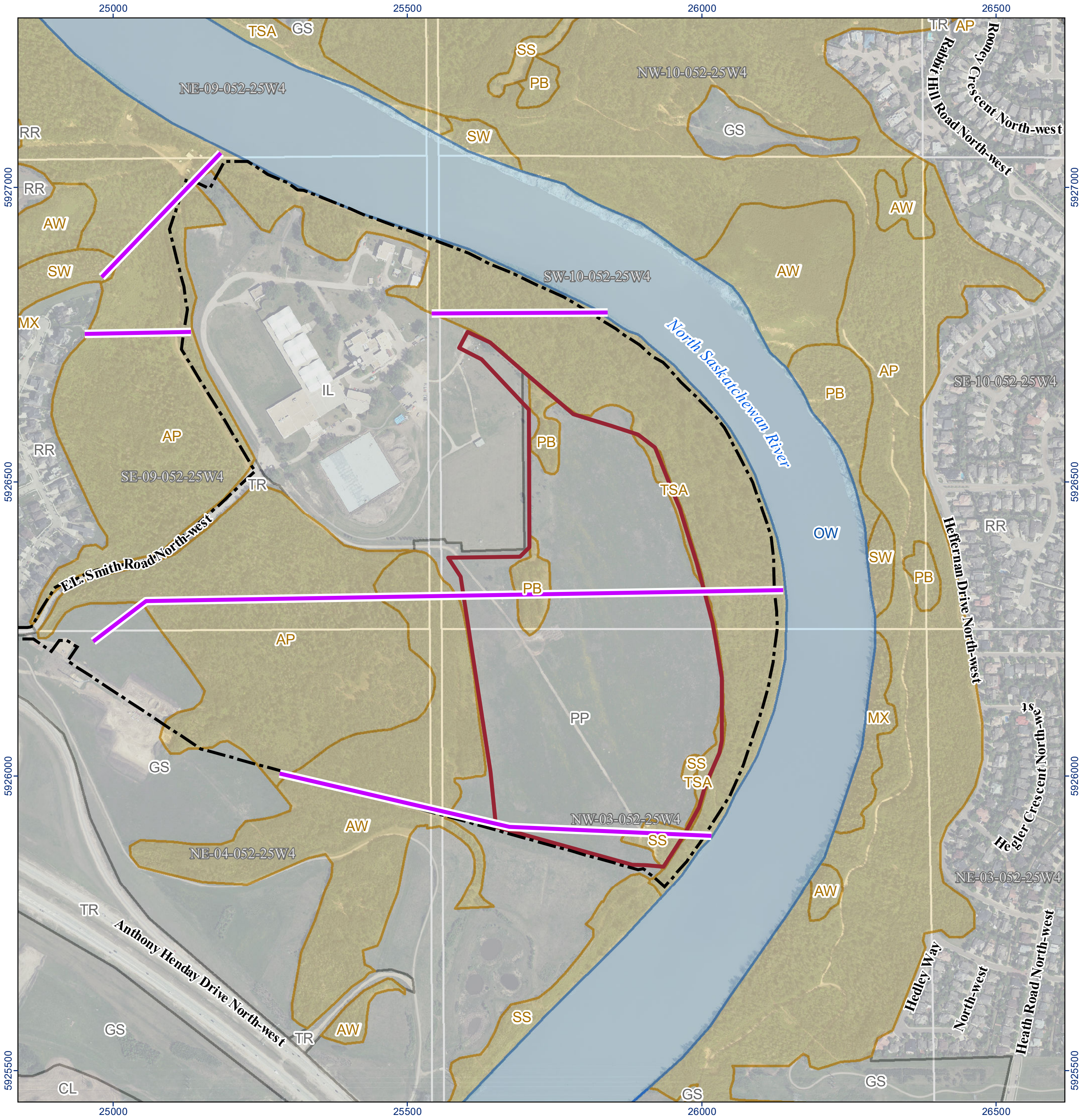

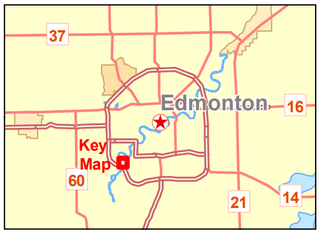

▢ Project Development Area

━ Snow Track Transect

Water

▢ OW - Open Water

Upland

▢ AP - Aspen Poplar Woodland

▢ AW - Aspen Woodland

▢ MX - Mixed Deciduous and Evergreen Woodland Alliance

▢ PB - Balsam Poplar Woodland Alliance

▢ SS - Short Shrubland Alliance

▢ SW - White Spruce Woodland Alliance

▢ TSA - Tall Shrubland

Anthropogenic

▢ CL - Cultivated Land

▢ GS - Green Space

▢ IL - Industrial Development

▢ PP - Perennial Pasture

▢ RR - Residential

▢ TR - Transportation

▬ ▪ ▬ EPCOR Property Boundary

▢ Quarter Section

0 125 250 metres

(At original document size of 8.5x11)
1:10,000

N

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
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Project Location
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TR by XX on 2019-12-XX
IR Review by XX on 2019-12-XX

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Figure No.
2-2

Title
Snow Track Transect Locations

Table 2-5 Standardized Counts of Tracks Observed During the Snow Track Survey November 12, 2019

Vegetation Type		White-tailed Deer	Coyote	Snowshoe hare	Red squirrel	Small rodent	Red fox	Porcupine	Human	Total distance sampled (m)	Km*days sampled	Number of Species or Species Groups Observed
Treed Habitat	Aspen Poplar Woodland Alliance	46.23	13.11	31.54	9.38	0.73	2.71	3.61	6.99	1400	4.47	8
	Aspen Woodland Alliance	100.94	18.38	29.52		-	-		24.79	450	1.39	4
	Balsam Poplar Woodland Alliance	83.07	115.02	-	-	-		-	-	50	0.16	2
	White Spruce Woodland Alliance	12.31	-	12.31	-	-	-	-	-	25	0.08	2
	All Treed Habitat	58.71	24.15	25.45	5.21	0.40	1.51	2.01	9.39	1925	6.10	8
Shrubland Habitat	Tall Shrubland Alliance	102.24	127.80	-	-	51.12	-	-	-	25	0.08	3
	Short Shrubland Alliance	168.83	38.96	-	-	12.99	-	-	-	50	0.15	3
	All Shrubland Habitat	135.53	50.64	-	-	9.28	-	-	-	75	2.25	3
Grassland Habitat	Perennial Pasture	109.53	37.62	-	-	13.92	-	-	-	625	1.94	3
	Green Space (Upper Field)	57.51	76.68	-	-	-	-	-	-	100	0.31	2
	All Grassland Habitat	92.19	83.38	-	-	32.05	-	-	-	725	0.23	3
All Habitats Types[1]		76.86	38.28	16.36	3.35	6.83	0.97	1.29	6.04	2725	8.59	8

[1] Standardized count for All Habitat Types is derived from raw data and is not an average of the standardized counts for each vegetation type presented in this table.

Table 2-6 Standardized Counts of Tracks Observed During the Snow Track Survey January 24, 2020

Vegetation Type		White-tailed Deer	Coyote	Snowshoe hare	Red squirrel	Short-tailed weasel	Small rodent	Red fox	Porcupine	Human	Total distance sampled (m)	Km*days sampled	Number of Species or Species Groups Observed
Treed Habitat	Aspen Poplar Woodland Alliance	48.80	10.66	23.21	6.79	8.42	8.42	0.18	2.05	0.56	1325	2.72	9
	Aspen Woodland Alliance	32.91	26.72	77.77	1.62	-	3.24	-	-	1.62	450	0.87	6
	Balsam Poplar Woodland Alliance	160.00	-	-	-	-	-	-	-	-	50	0.10	1
	White Spruce Woodland Alliance	152.38	190.48	285.71	-	-	-	-	-	-	25	0.05	3
	All Treed Habitat	69.13	33.02	61.92	4.13	4.68	5.40	0.10	1.14	0.67	1850	3.74	9
Shrubland Habitat	Tall Shrubland Alliance	100.00	40.00	-	-	-	-	-	-	-	25	0.05	2
	Short Shrubland Alliance	31.58	5.26	-	5.26	-	5.26	-	-	-	100	0.19	4
	All Shrubland Habitat	65.79	22.63	-	2.63	-	2.63	-	-	-	125	0.24	4
Grassland Habitat	Perennial Pasture	34.62	9.56	-	-	-	0.96	-	-	-	625	1.22	3
	Green Space (Upper Field)	60.00	13.33	-	-	-	-	-	-	-	75	0.15	2
	All Grassland Habitat	43.08	10.81	-	-	-	0.64	-	-	-	700	1.37	3
All Habitats Types1		63.07	26.78	39.81	3.03	3.01	3.98	0.06	0.73	0.43	2675	5.36	9

1 Standardized count for All Habitat Types is derived from raw data and is not an average of the standardized counts for each vegetation type presented in this table.

2.6 SPECIES OF MANAGEMENT CONCERN

Two species of management concern were observed in the LAA in 2019; common yellowthroat and least flycatcher (both listed as *sensitive* by AEP [2017]). Common yellowthroat is a warbler species which generally nests in riparian thickets and grassy marshes ((Boreal Songbird Initiative 2015). It is common and widespread in Alberta but is experiencing a population decline, likely due to conversion of wetland habitats to agriculture (AEP 2017). The PDA does not contain wetland or riparian habitat. Least flycatcher breeds in open deciduous and mixed forest and forest edges (Boreal Songbird Initiative 2015; Cornell University 2019). The species is undergoing a decline in Alberta possibly due to habitat changes on its wintering range (AEP 2017). Approximately 5% of the PDA (1.2 ha) comprises deciduous forest (see MEIA Section 4.3.4).

A Fish and Wildlife Information Management Tool (FWMIT) search in September 2019 did not identify any new species of management concern observed within 1 km of the PDA since 2017.

3.0 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS

This section utilizes the new baseline data discussed in Section 2.0 to evaluate Project interactions to re-assess potential effects based on the Project interactions previously discussed in the MEIA (Stantec 2019). The only valued ecosystem component (VEC) considered for this review was the wildlife VEC, as the new baseline data being considered consists exclusively of new wildlife survey data.

3.1 WILDLIFE SPECIES AND HABITAT

3.1.1 Potential Environmental Effects

The Project's potential interactions with wildlife species and habitat remain as identified in the MEIA (Stantec 2019); change in wildlife habitat availability and suitability, change in wildlife movement, and change in wildlife mortality risk.

3.1.2 Mitigation Measures

The mitigation measures for avoiding or reducing potential effects to wildlife habitat availability and suitability, movement and mortality risk listed in the MEIA were reviewed in the context of the new baseline data for this addendum (see Table 6-7 in the MEIA; Stantec 2019). Constraints posed by Project design specifications (e.g., perimeter fencing) informed the original selection of mitigation measures proposed in the MEIA which include measures for providing wildlife habitat and connectivity for wildlife movement through the PDA, both within and outside the fenced portion. Key mitigation measures to reduce effects to wildlife habitat availability include reseeding the current agronomic vegetation inside the fenced area to native species and revegetating approximately 3.0 ha of the PDA outside the fence with native trees and shrubs. Tree and shrub plantings will result in a net gain of 0.7 ha of treed and shrubby habitat types within the PDA. Key mitigation measures to address potential effects to wildlife movement across the PDA focus on providing habitat connectivity in both the fenced and unfenced portions of the PDA. This includes the replacement of agronomic vegetation with native plant species and a 40 m wide strip of revegetated trees and shrubs through the southern portion of the PDA to provide structural connectivity between treed habitat along the NSR to that along the valley slope.

Remote camera and snow track data collected in 2019 and 2020 demonstrates medium and large sized wildlife use and move through the PDA. Because Project specifications require that the solar farm be entirely fenced and therefore inaccessible to medium and large wildlife, mitigation measures to reduce effects to movement for these wildlife groups need to target portions of the PDA outside of the fenced area. Because mitigation measures proposed in the MEIA include a net gain in native grassland and forest habitat availability and provide connectivity through the PDA to accommodate arboreal and grassland associated species, no additional mitigation measures are proposed in this addendum.

Mitigation measures are not intended to 'minimize' potential effects; however, they are designed to avoid (where possible) or reduce potential effects to wildlife identified in Stantec 2019. As such, mitigation measures identified in the MEIA will act to constrain effects spatially (e.g., avoid direct habitat disturbance outside the Project footprint), temporally (e.g., reduce potential effects during key seasonal periods), or reduce the magnitude of the effect through design, construction methods, or operational procedures.

3.1.3 Summary of Potential Residual Effects on Wildlife Species and Habitat

This section summarizes any identified changes to the predictions of potential residual effects of the Project on wildlife habitat availability and suitability, wildlife movement, and wildlife mortality risk from those identified in the MEIA (Stantec 2019).

3.1.3.1 Change in Wildlife Habitat Availability and Suitability

Construction

As identified in the MEIA, disturbance to wildlife habitat during construction activities will be mitigated by siting the Project in areas of low suitability habitat and moderate environmental sensitivity (e.g., perennial pasture; see MEIA Section 4.4.5) and scheduling construction activities to occur outside of sensitive wildlife periods (e.g., primary nesting periods for migratory birds and Key Wildlife Biodiversity Zone (KWBZ) restricted activity periods (RAPs)). Perennial pasture is considered relatively low suitability habitat in the Parkland region due to the lower likelihood of wildlife species to occur in this habitat, particularly SOMC. For example, bird species richness and overall Shannon-Weiner diversity scores were lower in perennial pasture habitats than in aspen poplar woodland alliance vegetation communities in 2017 and 2019 and both bird SOMC observed were associated with areas of woody vegetation rather than perennial pasture. Forested habitats tend to have a variety of vegetated strata and may support a higher diversity of wildlife. For example, forests may provide breeding habitat for ground-, shrub- and canopy-nesting birds while perennial pasture has a single stratum and generally supports primarily ground nesting birds.

Medium and large mammals may fulfill some of their lifecycle requirements in perennial pasture, for example ungulate foraging or canid hunting. However, forested habitats, which compose approximately 5% of the PDA and are largely not directly affected by this project, may provide cover from predators, and a wider variety of habitats and microhabitats for denning, bedding, foraging, and raising young. Data from the breeding bird and snow track surveys indicate that forested areas within the PDA contain a higher species richness of birds and mammals than the open perennial pasture. Fencing the PDA will result in loss of habitat for medium and large mammals, however, for most species present in the LAA (i.e., birds, small mammals) the PDA will remain accessible.

The magnitude of effects on wildlife habitat from Project construction is predicted to be low and is not expected to have a measurable effect on long-term wildlife populations in the LAA. Although most changes in habitat will be limited to the PDA, sensory disturbance will extend into portions of the LAA, which may result in temporary local shifts in wildlife distribution. Potential effects on wildlife from direct habitat loss will occur from a single event (i.e., during fencing, vegetation removal and construction) and be long-term in duration. Potential indirect effects from sensory disturbance during construction will be short-term. Overall, the change in habitat is considered reversible because the residual loss or alteration of habitat can be reversed through habitat reclamation following decommissioning.

Operations

Effects of operations on wildlife habitat availability and suitability are not expected to change from that identified in the MEIA. While Project operation and occasional maintenance activities have the potential to reduce habitat effectiveness within the Project footprint and adjacent LAA through sensory disturbance, wildlife in the area are likely habituated to some degree of human activity associated with urban environments and may be more resilient to this type of disturbance. For example, white-tailed deer and coyote were detected immediately adjacent to the existing E.L. Smith WTP in numerous locations during the camera program and snow track survey.

The mitigation measure to restore vegetation within the PDA to a native plant community may benefit wildlife that can access the fenced area such as ground-nesting songbirds and small mammals (see Stantec 2019, Table 6-7). The Alberta Biodiversity Monitoring Institute identifies perennial pastures and other non-native plant communities in the Prairie and Parkland Regions as having reduced local biodiversity and providing lower nutritional value for grazing wildlife relative to native vegetation (ABMI 2015). While existing treed patches within the PDA will be removed, the mitigation measure to plant 3.0 ha of native trees and shrubs will result in a net gain of 0.7 ha of treed habitat types within the PDA once the plantings establish.

The effects on wildlife habitat during operations are predicted to be adverse and extend into the LAA through some indirect sensory disturbance. The magnitude of the effect is predicted to be low because there will be a net gain of tree and shrub habitat and restoration to a native seed mix in the PDA; which will still be available to some wildlife to live out portions of their lifecycle and because Project operation will not generate intense noise or other sensory disturbance. Overall, the change to wildlife habitat availability and suitability during Project operation is reversible and expected to return to baseline conditions after decommissioning.

3.1.3.2 Change in Wildlife Movement

Construction

Wildlife passage through the LAA is facilitated along the forested valley slope to the north and west of the PDA; both coyote and deer were observed at both the north and south end of the valley slope west of the existing E.L. Smith WTP and tracks for both species were identified throughout the valley slope. Effects to this movement corridor during construction will be limited as noise and other sensory disturbances to wildlife are not expected to exceed existing disturbance from adjacent residential development and noise from Anthony Henday Drive. Preliminary camera and snow track data show medium and large mammal use of both open and forested areas in the LAA and no medium or large mammal is solely associated with the PDA. 2019 and 2020 baseline surveys demonstrate wildlife passage adjacent to the existing and active E.L. Smith WTP including the point of narrowest constriction between the WTP and the NSR. As identified in the MEIA, during construction, urban-adapted wildlife currently using the LAA are expected to move successfully through the river valley within and around the permanent footprint of the PDA along the treed valley slope. Sensory disturbance may deter some wildlife from travelling between to the PDA and the NSR. These individuals may deflect back and not pass the PDA at all or may be directed up the valley slope to move through the NSR valley past the PDA. Wildlife are anticipated to habituate to the change in habitat over time and wildlife movement adjacent to the PDA is expected to resume during operations.

Fencing erected during construction will restrict or prevent movement within and across the fenced portion of the PDA for certain groups of wildlife such as large and medium sized mammals (e.g., deer and coyotes). Fencing is not expected to affect movement of small mammals (e.g., mice, voles, shrews), amphibians, and reptiles as the fence is anticipated to be standard 5 cm (2 inch) chain link fencing, which is adequate to allow passage of these wildlife groups. However, mitigation measures initiated during the construction phase, including a strip of treed and shrubby vegetation across the PDA outside of the fenced area connecting treed habitat patches along the NSR with those on the valley slope, are expected to facilitate movement for wildlife such as medium and large mammals and arboreal species such as black-capped chickadee or least weasel across the PDA.

Preliminary camera and snow track data show medium and large mammal use of both open and forested areas in the LAA and no medium or large mammal is solely associated with the PDA. As identified in the MEIA, during construction, urban-adapted wildlife currently using the LAA are expected to move successfully through the river valley within and around the permanent footprint of the PDA, both in the 100 m vegetated buffer along the NSR and above the PDA along the treed valley slope.

During construction, potential effects on wildlife movements are predicted to be adverse and extend into the LAA (primarily into the 100 m buffer along the NSR). As a result of information gathered during the 2019 and 2020 baseline studies which demonstrate medium and large mammal use of and movement through the PDA, the expected magnitude of the potential effect to wildlife movement has been changed from low to a magnitude of low to moderate (see Table 6-8 in the MEIA for residual effects description criteria). This magnitude rating accounts for the effects of fencing that will allow for passage of smaller wildlife groups but will interfere with movements of larger wildlife groups. However, as stated in the MEIA, no Project effects to species diversity or wildlife movement corridors are expected (refer to magnitude definitions in Table 6-8 of Stantec 2019).

Although most changes in wildlife movement will be limited to the PDA, sensory disturbance will extend into the LAA, which may result in temporary local shifts in wildlife movement patterns. Potential direct effects of construction on wildlife movement will occur from a single event and be long-term in duration. Potential indirect effects from sensory disturbance during construction will be short-term. Overall, the change in wildlife movement is considered reversible because the residual loss or alteration of habitat can be reversed through habitat reclamation following decommissioning.

Operations

Project operation and maintenance activities are not expected to change from those identified in the MEIA. As identified in the MEIA, solar panels, and supporting infrastructure, emit negligible amounts of noise and no lighting will be added in the PDA. Overall, as identified above and in Section 2.0, wildlife in the area are habituated to some degree of human activity associated with urban environments (e.g., the adjacent WTP, Anthony Henday Drive, residential neighborhoods). During baseline surveys, many mammal observations were recorded immediately adjacent to the existing E.L. Smith WTP, adjacent to the residential neighbourhood, and within 1 km of Anthony Henday Drive.

The approximately 40 m wide strip of native trees and shrubs that will be revegetated along the south edge of the PDA outside of the fenced area will provide additional structural connectivity between the forested area immediately adjacent to the river and the forested valley slope and is expected to facilitate movement wildlife such as medium and large mammals and arboreal species such as black-capped chickadee or least weasel. It is also expected to provide a visual and noise buffer for the Project, reducing potential indirect effects of infrastructure on wildlife movement.

In contrast to information provided in the original MEIA, data from the remote camera program and snow track survey show that mammals, particularly white-tailed deer and coyotes, use the 30 m wide area north of the PDA between the E.L. Smith WTP lower pump house and the NSR (e.g., Cameras EPC 05 and 11). This suggests that narrow constrictions of this size are not a barrier to wildlife, and that wildlife currently using the LAA will use habitats and traverse immediately adjacent to an active industrial facility that has active human and vehicle use throughout the day. It is therefore likely that wildlife species are successfully using the NSR as effective passage through the LAA, even if it is as narrow as 30 m wide. Wildlife passage through the LAA is also effectively facilitated along the valley slope to the north and west of the PDA where use by medium and large mammals occurs at relatively high rates. Changes to wildlife movements from the Project during operations are not expected to extend beyond the LAA as the movement corridor through the LAA along the NSR valley is expected to remain intact during operations.

During operation, the Project will not provide physical or sensory obstructions to wildlife movement outside of the PDA. Wildlife movement is expected to continue throughout the LAA with no barrier to gene flow. The solar farm will remain fenced through the operation phase which will allow for passage of smaller wildlife groups but will interfere with movements of larger wildlife groups. However, after mitigation there will be a net gain of native tree and shrub species in the PDA which will provide structural connectivity of treed habitat types across the PDA and mitigate effects to movement between the NSR and the valley slope for medium and large wildlife and arboreal species. In addition to a net gain in trees and shrubs, non-native vegetation will be replaced with native seed mix, effectively increasing potential habitat values for some small mammals and birds. As such, no native wildlife species are expected to be lost from the LAA as a result of the Project. Based on data gathered during 2019 and 2020 baseline studies which show current medium and large mammal use of the PDA, and taking into account mitigation measures, the potential effect to wildlife movement during Project operation has been changed from low magnitude to a magnitude of low to moderate.

Overall, potential effects to wildlife movement due to Project operations are expected to be adverse in direction, low to moderate in magnitude and extend into the LAA. Effects will be continuous for the lifetime of the Project but return to baseline conditions upon Project decommissioning and reclamation.

3.1.3.3 Change in Wildlife Mortality Risk

Construction

Change in wildlife mortality risk during construction is not expected to change from that identified in the MEIA. Fencing of the Project footprint and timing of clearing outside of the breeding bird period is anticipated to mitigate potential risks to wildlife mortality during this phase of the Project.

The potential residual effect of Project construction related to mortality risk is considered adverse in direction and low magnitude because the Project is unlikely to have a measurable effect on wildlife abundance in the LAA. The change in mortality risk due to construction is limited to the PDA, will occur as a single event and is short-term.

Operations

Effects of operations on wildlife mortality risk are not anticipated to change from those identified in the MEIA. During operations, the Project may increase the risk of mortality primarily due to the potential for birds to collide with solar panels or become entrapped underneath the solar panels (see details of this potential effect as provided in the MEIA). Waterfowl movements in the NSR documented during 2017 and 2019 baseline surveys were relatively low and great numbers of waterfowl are not anticipated breed, roost or stage in the LAA. The NSR does not provide abundant breeding or roosting habitat for migratory waterfowls relative to other water bodies in the region (e.g., Big Lake). Migratory waterfowl surveys in the LAA recorded some waterfowl flocks migrating high overhead but recorded relatively little use of the LAA, including the NSR. Overall, the potential risk of mortality to birds due to interactions with solar facilities is poorly understood; however, there is not known to be large concentrations of waterfowl using the LAA during spring or fall migration. Small flocks of migrating songbirds were identified in both years along the forested portions of the NSR, including American robins, black-capped chickadees, and white-breasted nuthatches.

Change in the mortality risk for wildlife, particularly birds, during operations is predicted to be adverse and moderate in magnitude (i.e., a measurable change in wildlife mortality risk is possible, but it is unlikely to change local wildlife populations) as the Project is in proximity to breeding bird and waterfowl breeding and loafing habitat. Potential residual effects to wildlife mortality risk will largely be limited to the PDA and occur continuously through the life of the Project. Mortality risk is expected to return to baseline levels following Project decommissioning.

3.1.4 Prediction Confidence

Prediction confidence for the change in wildlife habitat availability and suitability has not changed from that identified in the MEIA (i.e., remains as high). Wildlife communities and their habitat associations in central Alberta, and within the City of Edmonton, are well documented and additional baseline data provides additional insight into wildlife habitat use in the LAA. The primary effect to terrestrial wildlife will be a result of direct habitat loss from fencing of the PDA, and this effect and potential mitigation measures are well known.

Prediction confidence for the change in wildlife movement has not changed from that identified in the MEIA (i.e., remains as moderate). There is considerable information on interactions of urban wildlife and infrastructure and the additional baseline data provides more insight with regards to wildlife movement within the LAA, particularly for medium and large mammals. However, there is still limited information about the effect of solar facilities specifically related to movement for birds and small mammals.

Prediction confidence for the change in wildlife mortality risk has not changed from that identified in the MEIA (i.e., remains as low). Existing information on the potential for bird mortalities associated with solar facilities is extremely limited. Of the data that does exist, none of it is in a similar ecological context to Edmonton, and therefore the applicability of the data to a photo-voltaic solar facility in Edmonton is unknown. Even with the additional baseline data, wildlife mortality risk as it relates to solar farms is still unknown.

4.0 MONITORING

A WMMP will be developed in consultation with regulatory agencies (e.g., AUC, AEP, COE) to assess the implementation and ongoing effectiveness of proposed mitigation measures and to identify potential risks for wildlife species and habitat. The monitoring program will continue to gather baseline information, including data gathered for this Addendum, and will be conducted through construction and operation of the Project. The WMMP will include wildlife mortality monitoring (as per the Wildlife Directive for Alberta Solar Energy Projects (GOA 2017b), remote camera wildlife habitat-use monitoring, winter snow track surveys and other potential monitoring programs as identified by regulators. Post-construction monitoring programs are 'intended to assess the effectiveness of mitigation efforts and identify any ongoing wildlife risks…' (GOA 2017b). The purpose of monitoring is then to 'determine whether additional or modified operational mitigation is required' (GOA 2017b). Results of the monitoring program will be provided to AEP and the COE. An annual monitoring report will be submitted to COE and AEP and will include all documented mortality and other findings. EWSI will discuss these results with the regulators to determine if additional mitigation measures are required.

In addition, a vegetation monitoring program will be implemented to monitor the effectiveness of vegetation management programs including the conversion of the PDA to native plant communities and tree-planting outside the PDA.

5.0 SUMMARY AND CONCLUSION

This addendum included additional baseline wildlife data collected in 2019, including remote camera, breeding bird, bird migration, and snow track survey data. Effects were reassessed based on the additional data collected.

Based on the additional data, potential residual effects remain the same as the original MEIA except for the magnitude with respect to change in wildlife movement (see Table 5, below). The additional baseline data shows that medium and large sized mammals (e.g., coyotes and deer) are using the PDA and the installation of the fencing will interfere with the movement of those wildlife groups. As such, the magnitude was changed from low (no change to wildlife habitat, or mortality risk) to low-to-moderate (change to wildlife movement may occur for medium and large mammals but movement for other wildlife is unlikely to be affected. No loss of wildlife movement corridors is anticipated).

Table 5-1 Wildlife Species Effects Assessment Summary

	Change in Wildlife Habitat Availability and Suitability		**Change in Wildlife Movement,**		**Change in Wildlife Mortality Risk**	
	MEIA	**Addendum**	**MEIA**	**Addendum**	**MEIA**	**Addendum**
Direction	C: Adverse O: Adverse	C: Adverse O: Adverse	C: Adverse O: Adverse	C: Adverse O: Adverse	C: Adverse O: Adverse	C: Adverse O: Adverse
Magnitude	C: Low O: Low	C: Low O: Low	C: Low O: Low	C: Low – Moderate O: Low – Moderate	C: Low O: Moderate	C: Low O: Moderate
Geographic Extent	C: LAA O: LAA	C: LAA O: LAA	C: LAA O: LAA	C: LAA O: LAA	C: PDA O: PDA	C: PDA O: PDA
Frequency	C: Single-Event O: Continuous	C: Single-Event O: Continuous	C: Single-Event O: Continuous	C: Single-Event O: Continuous	C: Single-Event O: Continuous	C: Single-Event O: Continuous
Duration	C: Long O: Long	C: Long O: Long	C: Long O: Long	C: Long O: Long	C: Short O: Long	C: Short O: Long
Reversibility	Reversible	Reversible	Reversible	Reversible	Reversible	Reversible
Prediction Confidence	High	High	Moderate	Moderate	Low	Low

Some key considerations from this addendum include:

- Species richness for birds and mammals is higher in aspen poplar woodland alliance communities than in perennial pasture, supporting the claim that the PDA provides lower suitability habitat for wildlife
- Evidence of mammal use was observed throughout the PDA, including at previously identified pinch points, suggesting that wildlife in the area currently use narrow corridors adjacent to the existing E.L. Smith WTP and that development of the Project is unlikely to prevent wildlife movement along the NSR.

- Mitigation measures proposed in the MEIA were reviewed considering additional baseline information gathered in 2019 and 2020, particularly evidence of medium and large mammal use of the PDA. The mitigation measures presented in the MEIA take Project design components, such as fencing, into account. Proposed mitigation measures include planting a 40 m strip of treed and shrubby vegetation outside the fenced portion of the PDA which will provide structural connectivity between the forested areas adjacent to the NSR and those along the valley slope and are expected to mitigate the effect to wildlife movement, including medium and large wildlife and arboreal species such as black-capped chickadee or least weasel, through the PDA. No new mitigation measures are considered necessary to address movement of medium and large sized wildlife through the PDA.
- Based on evidence gathered during the 2019-2020 baseline field surveys showing medium and large mammal use of and movement through the PDA, the predicted residual effect to wildlife movement has been changed from low magnitude to a magnitude of low to moderate. This change reflects how the facility fence around most of the PDA will be impermeable to medium and large sized wildlife and may affect movement of those species across the PDA. The change in magnitude also considers mitigation measures such as the creation of an area of structural connectivity between treed areas along the NSR to those along the valley slope which is expected to facilitate wildlife movement through the PDA.

Overall, the findings of this addendum concur with the original MEIA in that potential adverse effects of the Project can be avoided, reduced or controlled using a combination of standard and Project-specific environmental mitigation measures. The WMMP will be implemented prior to and during construction and operation to evaluate the effectiveness of mitigation measures. Based on monitoring results, mitigation measures will be adapted as required in consultation with regulators.

6.0 LIMITATIONS AND QUALIFICATIONS

In conducting the investigation and rendering our conclusions, Stantec gives the benefit of its best judgment based on its experience and in accordance with generally accepted professional standards for this type of investigation. This report was submitted with the best information to date and on the information provided. The conclusions made within this report are a professional opinion, not a certification of the PDA's environmental condition, and no other warranty, expressed or implied, is made. This report has been prepared for the exclusive use of EPCOR for the purposes of assessing the potential environmental effects on the PDA of the proposed Project and recommending measures to mitigate potential effects. Stantec accepts no responsibility for damages, if any, suffered by any other third party as a result of decisions made or actions based on this report. Our conclusions are limited by the following:

- Wildlife surveys were completed during the dates specified and conditions may vary outside those times
- Field surveys to verify the presence of species listed within ACIMS and/or FWMIS databases were conducted on the dates specified and presence or absence of said species outside of the survey dates cannot be verified
- Some of the information contained within this report was provided by agencies and organizations external to Stantec. While Stantec cannot guarantee the information provided by external parties, this information has been assumed to be correct
- The information contained within this report is based on the design available at the time of report preparation. Design drawings may continue to be modified and added as the detailed design process continues but are intended to not depart significantly from the information presented in this report. Should significant changes to the drawings be made in the future, an amendment to this report may be required
- The investigation was limited to those parameters specifically outlined in this report

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E.L. Smith WTP Solar Farm Project Wildlife Monitoring and Mitigation Plan

Wildlife Monitoring and Mitigation Plan

August 2020

Prepared for:

EPCOR Water Services Inc.

Prepared by:

Stantec Consulting Ltd.

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Abbreviations

AEP	Alberta Environment and Parks
COE	City of Edmonton
EPCOR	EPCOR Water Services Inc.
FWMIS	Fisheries and Wildlife Management Information System
GPS	global positioning system
km	kilometre
m	metre
MW	megawatt
WMMP	Wildlife Monitoring and Mitigation Plan
PV	photovoltaic
Stantec	Stantec Consulting Ltd.
the Project	E.L. Smith WTP Solar Project
WTP	water treatment plant

1.0 INTRODUCTION

The following outlines the Wildlife Monitoring and Mitigation Plan (WMMP) for the proposed E.L. Smith WTP Solar Farm Project (the Project) located in Edmonton, Alberta.

1.1 PROJECT DESCRIPTION

The proposed E.L. Smith WTP Solar Farm Project is a solar photovoltaic (PV) facility located in the North Saskatchewan River (NSR) valley (see Figure 1), on the west side of Edmonton, Alberta beside the existing E.L. Smith Water Treatment Plant (WTP). It has a gross generation capacity of approximately 12 megawatts (MW) alternating current (AC) and occupies approximately 25.7 ha.

Habitat within the Project Area consists primarily of perennial pasture. There are also trees adjacent to the Project Area along the NSR and the upper valley slope. The site is just downstream of where Anthony Henday Freeway and the Transportation and Utility Corridor cross the NSR. Residential communities occur in the uplands to the edge of the NSR valley.

The Project will consist of a ground-mount solar power system with installation of parallel rows of solar panels mounted on racking and anchored to the ground using an embedded pile system. Each solar panel will be approximately two metres wide by one metre high and has been designed to absorb sunlight instead of reflecting it, therefore minimal glare is expected. Each row of solar panels will be four panels high and multiple panels long. Solar panels will be raised approximately one metre above ground and rows will likely be spaced five to ten metres apart. The rows will span the width of the project development area (PDA), face south at a fixed angle and will be supported by a racking system that is secured to the ground using embedded piles, approximately ten metres deep. The Project will include approximately four inverter stations to house electrical infrastructure for electrical connector systems. A new underground AC cable, installed using open trench methodology, will run from the inverter stations to an existing interconnection/substation located to the north of the PDA.

Project construction is anticipated to commence in spring or summer 2021 and take approximately six months to complete.

1.2 POTENTIAL EFFECTS TO WILDLIFE

1.2.1 Potential Sources of Mortality

There are four primary sources of potential mortality that may be observed at a solar PV facility: 1) the collector field (i.e., solar panels); 2) linear features (e.g., collector lines and perimeter fences); 3) buildings (e.g., inverters); and 4) background sources (i.e., natural mortality sources such as predation). Considering that project design incorporates buried collector lines and fences will be chain link, collector lines and fences are not considered a source of potential mortality for the Project during operations. This WMMP assumes an equivalent potential for mortality for the remaining sources of mortality across the Project Area.

The WMMP incorporates methods to sample all sources of potential mortality to determine where mitigation or avoidance efforts would be most effective, should mortality rates require mitigation. While review by AEP is not required for solar projects within urban areas, to ensure that Project effects to wildlife mortality risk are suitably monitored, this WMMP follows the standards outlined in the *Post-Construction Survey Protocols for Wind and Solar Energy Projects* (AEP 2020) and the *Wildlife Directive for Solar Energy Projects* (GOA 2017) and will comply with AUC Rule 033 (AUC 2019)

1.2.2 Potential Effects on Wildlife Habitat Connectivity

The City of Edmonton (COE) identifies the NSR as providing terrestrial and arboreal connectivity for wildlife within the city (Solstice 2017). The NSR has been designated provincially as a Key Wildlife and Biodiversity Zone (KWBZ) indicating that it contains the topographic and site productivity conditions for higher levels of biodiversity and winter ungulate habitat (GOA 2015). The Project's permanent footprint avoids the KWBZ although a portion of the PDA planned for habitat enhancement overlaps it. The Project is in the vicinity of existing disturbance including a cleared area with perennial pasture, the Anthony Henday freeway bridge over the NSR, and the fenced E. L. Smith WTP and residential development. Current wildlife use of the Project Area and movement through the NSR valley is assumed to be adapted to existing disturbance. The Project will be surrounded by a chain link fence that will tie into the existing fence at the E.L. Smith WTP. The increased distance of fencing parallel to potential movement corridors in the NSR valley may affect terrestrial wildlife habitat connectivity.

1.3 PURPOSE OF THE WMMP

The primary purpose of the WMMP for the proposed Project is to evaluate the mortality risk to birds using empirical data collected during the monitoring program to identify risks and estimate mortality rates. This WMMP is designed with consideration of the provincial protocols (AEP 2020) and monitoring methods used at PV projects in the southwestern U.S. (Huso et al. 2016). Objectives of the mortality monitoring program are to 1) evaluate spatial or temporal/seasonal patterns of wildlife mortality; 2) evaluate which species and taxonomic groups are at risk of mortality 3) estimate total bird mortality and the effect of environmental factors to determine if operational mitigation is required. Although the mortality assessments focus largely on potential bird mortality, all observed fatalities will be recorded.

The secondary goal of the WMMP is to evaluate Project effects to habitat connectivity for terrestrial wildlife within the Project LAA, primarily within the NSR valley. The objective of the habitat connectivity monitoring program is to evaluate rates of habitat use for terrestrial wildlife within the LAA in response to Project construction and operation.

Details of the WMMP are summarized in Table 1.

Results of the mortality monitoring and wildlife habitat connectivity monitoring will be evaluated using an adaptive management process to determine if additional operational mitigation measures are required.

Table 1 Post-Construction Monitoring Plan Components and Proposed Execution

Plan Component	Proposed Execution	Comments
Mortality Monitoring - Bird Carcass Searches		
Duration	Three years post-construction	Annual reports will be submitted to COE and AEP for review of the mortality assessment.
Timing	March 1 to November 15	Encompassing the spring and fall bird migrations, as well as the breeding bird period within the Parkland Natural Region.
Frequency	Every week during the spring and fall migration periods; bi-weekly during the summer breeding period	Weekly from March 1 to May 15 and August 15 to November 15; bi-weekly from May 16 to August 14
Extent (Sample Size)	~33% of the solar array	The Project will produce more than 10 MW; therefore, one third of the Project Area will be monitored (AEP 2020). The solar array will be stratified into sampling units of approximately equal area. Sampling units will be randomly selected to cover the geographic distribution of the PDA. The search area will include portions of both the panel array and the perimeter fence.
Searcher Efficiency Trials	Three trials per searcher, one per season, each year	Additional trials to be conducted if staff changes (searchers) occur. A minimum of 20 carcasses per trial.
Carcass Removal Trials	Three trials, one per season	A minimum of 20 carcasses per trial. Carcasses will be checked on days 1, 2, 3, 4, 7, 10, 14 and 28.
Wildlife Habitat Connectivity Monitoring - Remote Camera Program		
Duration	Five years including one year pre-construction, the construction year and three years post-construction	Annual reports will be submitted to COE and AEP for review of the wildlife habitat connectivity monitoring program
Timing	Year-round	Cameras will be left in place once initially deployed
Frequency	Continuous	Camera capture data is gathered continuously between camera deployment and retrieval, barring camera malfunction or loss.
Extent (Sample Size)	Total of eleven EPCOR cameras.	Camera stations will be positioned in suitable habitat within the Habitat Connectivity Study Area
Wildlife Habitat Connectivity Monitoring – Snow Track Survey		
Duration	Five years including one year pre-construction, the construction year and three years post-construction	Annual reports will be submitted to COE and AEP for review of the wildlife habitat connectivity monitoring program
Timing	December 1 – March 31	Survey window may be extended if suitable conditions exist
Frequency	Two visits per year	One early winter and one late winter survey visit when suitable conditions exist.
Extent (Sample Size)	Five transects totaling approximately 2,700 m	Transects will sample habitat types representative of the study area.

1.4 ROLES AND RESPONSIBILITES

This section lays out the roles and responsibilities of EPCOR, COE and AEP as they relate to the WMMP.

1.4.1 EPCOR

As the Project proponent, EPCOR will implement the WMMP and Project mitigation measures for wildlife and wildlife habitat and report the outcomes to the relevant regulator.

1.4.2 City of Edmonton

The COE is the primary regulator for the Project because it is within Edmonton's municipal boundary. COE will receive and review yearly post-construction wildlife monitoring reports and provide comments on potential adaptive management measures.

1.4.3 Alberta Environment and Parks

The Government of Alberta, through the Ministry of Environment and Parks (AEP), is the primary managing body for wildlife in the province and has provided directives and protocols related to solar energy projects and their post-construction monitoring (GOA 2017 and AEP 2020). Although the Project is within a municipality, wildlife and wildlife mortality is the jurisdiction of AEP. As such, AEP will receive and review yearly post-construction wildlife mortality monitoring (i.e., carcass search) reports and provide guidance on mortality thresholds, as they become available, and on adaptive management measures.

2.0 MORTALITY MONITORING – CARCASS SEARCH

2.1 DURATION

Bird carcass surveys will be conducted during periods of greater potential risk (i.e., spring migration, breeding season and fall migration; see Table 1) for three years (GOA 2017).

2.2 TIMING

The current schedule plans for construction to commence in Spring 2021. Therefore, surveys could commence as early as spring through fall of 2021. However, this schedule is subject to change. As outlined in the AEP (2020) protocol, surveys will commence the week of March 1 and continue through to November 15 to include the periods of highest bird activity (Table 1).

2.3 FREQUENCY

AEP (2020) requires surveys to be conducted weekly during the spring and fall migratory periods (defined as March 1 to May 15 and August 16 to November 15 in the Parkland Natural Region) and once every two weeks during the summer breeding period (May 16 to August 15).

2.4 EXTENT (SAMPLE SIZE)

The objective of a sample is to provide an estimate of a parameter that can be used to provide inference about a target population (i.e., Project's solar array). Although a PV energy project can be largely contiguous compared to individual wind turbines at a wind energy project, a sampling design can be developed where the solar project is divided into sampling units similar to sampling unique wind turbines. Because the Project will produce greater than 10 MW, carcass searches are proposed at approximately 33% of the solar array (GOA 2017). Given the homogenous distribution of available wildlife habitat in the PDA (Stantec 2018), sampling units will be randomly selected to sample units across the PDA.

2.5 SURVEY METHODS

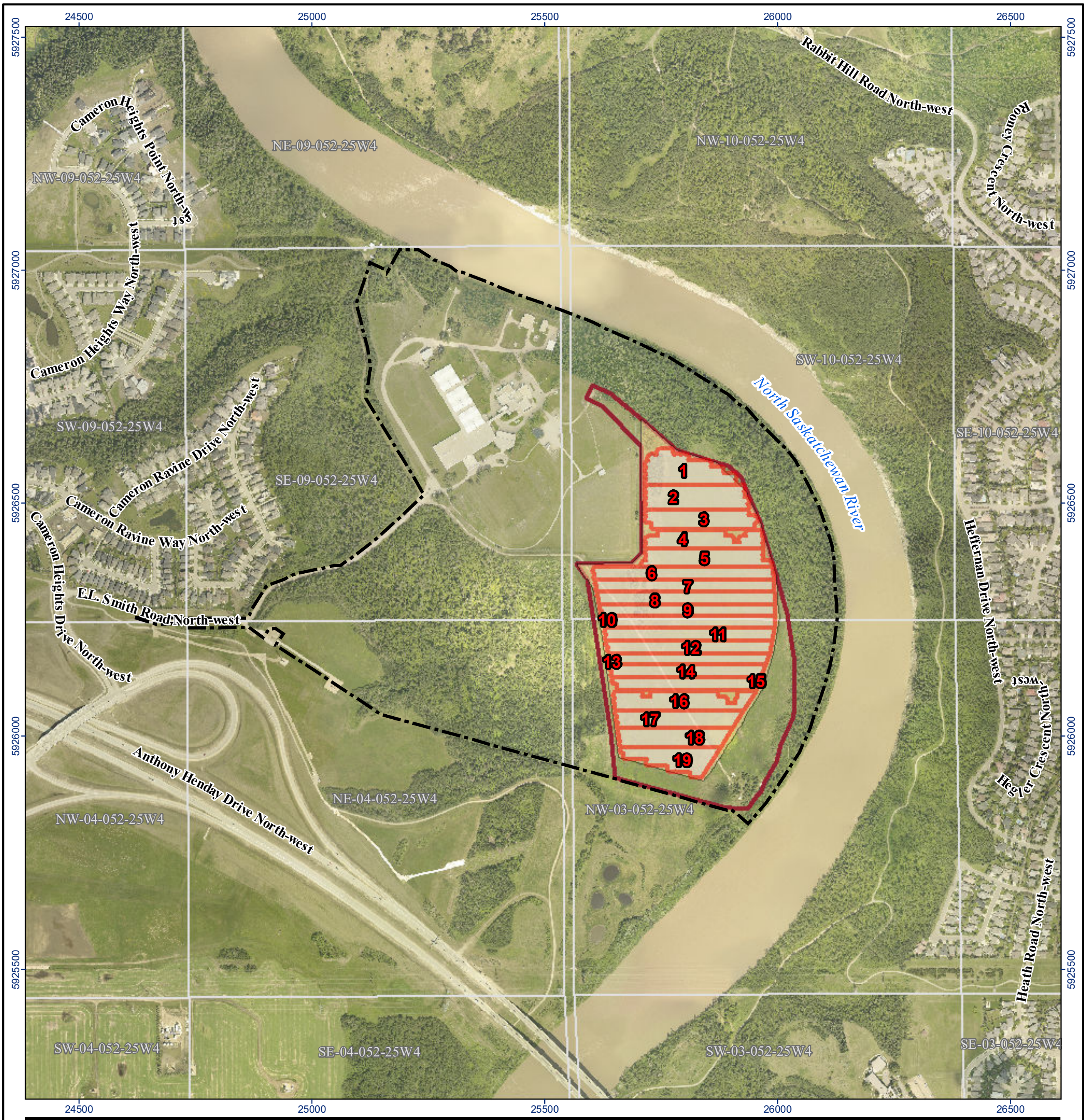
The survey methods used for the mortality monitoring program will be consistent with methods provided in AEP (2020) and will be conducted under a valid Permit and Collection License issued by AEP. Carcass searches at renewable energy facilities are typically executed by walking systematically spaced transects within search plots around a sample of turbines or solar panels. Rows of panels are approximately 5 m apart; therefore, a single transect will be sufficient to cover off the spacing between rows (i.e., a single pass between the rows will be conducted).

Searchers will walk down rows in an alternating fashion (e.g., every third row) or within randomly chosen blocks (see Figure 1), uniformly distributed throughout the facility, to achieve the 33% sample proposed above (see Sample Size). Figure 1 illustrates a potential sample layout with 17 searchable blocks of relatively equal area. Searches for incidental carcasses will also be conducted along adjacent portions of fencing; carcasses found incidentally we be recorded but will not be included in the mortality rate calculation. Ground conditions will be evaluated as construction nears completion and the most appropriate survey methods will be implemented to meet the goals and objectives of the WMMP and ensure the safety of field technicians.

All specimens found during the carcass searches should be recorded in the field, including spatial data (collected by a global positioning system [GPS] or comparable device). Carcasses will then be labeled, bagged and frozen for further analysis by a wildlife biologist. Following analysis of carcasses collected, all specimens (not including species at risk) will be re-frozen and submitted to AEP (Twin Atria Building) unless they are needed for searcher efficiency or carcass removal trials. Complete data records for all specimens will be submitted to AEP in the appropriate format for uploading into Fisheries and Wildlife Management Information System (FWMIS).

Carcasses found incidentally (i.e., in non-survey sampling units) while traveling the PDA should also be collected. Observations of wildlife mortality will be recorded, and carcasses collected regardless of whether they are thought to be a result of solar PV panel or other sources (e.g., vehicle collision). Carcasses will be collected, bagged, tagged, and provided to AEP except if used in carcass persistence or searcher efficiency trials. Incidentals will also be documented in reporting.

Likely cause of death will be determined for all carcasses found. If all mortalities were caused by collision, the location of the carcass and nearby signs (e.g., tracks, stains or feathers on collectors) would suggest the likely cause, however, the nearest potential mortality source may not necessarily be the cause (Huso et al. 2016). This may be the case for injured or stranded birds that may seek shelter in a location different from their arrival point (e.g., along fence lines) or for background mortality (e.g., a predated carcass beneath a good perch). For each carcass found, searchers will record signs of injury, likely source of mortality, and confidence in determination.



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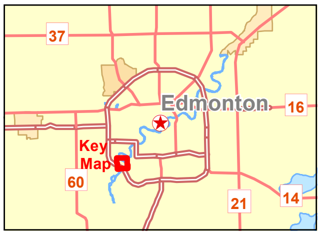

- 🟥 Carcass Search Block
- ▬ · ▬ EPCOR Property Boundary
- 🟧 Permanent Footprint
- 🟥 Project Development Area
- ☐ Quarter Section

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Stantec

Project Location
SW¼ 10-52-25 W4M and
NW¼ 03-52-25 W4M
Edmonton, Alberta

Prepared by SJ on 2020-07-10
TR by SM on 2020-07-10
IR Review by EL on 2020-07-10

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Wildlife Mitigation Monitoring Plan

Figure No.
1

Title
Carcass Search Sampling Units

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Background: City of Edmonton, 2019

2.6 SEARCHER EFFICIENCY TRIALS

Searcher efficiency trials will be completed in accordance with AEP (2020). The trials will test each individual involved in searching for carcasses, using a subset of sampling units and visibility types. Searcher efficiency trials involve the distribution of marked carcasses within the search area without searchers being aware of the locations. The frequency for which carcasses are detected is used to correct detection probability to reflect the efficiency of carcass detection by each searcher. A minimum of three searcher efficiency trials, incorporating at least 20 carcasses per searcher, will be conducted each year; one trial per season. The trials will be timed randomly and in various visibility types (e.g., easy, moderate and difficult) depending on what is available in the search area. Carcasses used for the trials depend on availability; however, as the objective of the searcher efficiency trial is to test the searcher's ability to detect carcasses it is preferable to use only small sized carcasses.

The trials are intended to determine detection probability under varying vegetation conditions and the potential for birds to hide if injured (indirect mortality; individuals that survive a collision but are unable to take flight). All carcasses kept for searcher efficiency trials will be submitted to AEP at the end of each year, except those removed by scavengers. If insufficient carcasses are collected on-site to complete the searcher efficiency trials, AEP should be contacted to supply additional carcasses, where possible. If AEP is unable to supply additional carcasses, EPCOR will be required to obtain suitable alternatives of similar size and colour to native birds for the purposes of searcher efficiency trials.

2.7 CARCASS REMOVAL TRIALS

Carcass removal trials will be conducted following methods outlined in AEP (2020) to correct for carcasses that may be missed during carcass searches due to scavenger removal or carcass decomposition. As part of the carcass removal trial, a minimum of 20 carcasses will be laid out per season per year in the search area, georeferenced by GPS, and either monitored by remote camera or checked on days 1, 2, 3, 4, 7, 10, 14, and 28 to determine carcass persistence rates as per AEP (2020). Where possible, carcass removal trial inspections will be completed in conjunction with carcass surveys. Three carcass removal trials will be conducted, one per season in spring, summer, and fall. If insufficient carcasses are collected on-site to complete the carcass removal trials, AEP should be contacted to supply additional carcasses, where possible. If AEP is unable to supply additional carcasses, EPCOR will be required to obtain suitable alternatives of similar size and colour to native birds for the purposes of carcass removal trials.

2.8 ANALYSIS

Analysis of data collected for the mortality monitoring program will follow methods recommended in the provincial protocol (AEP 2020). Mortality estimates will be calculated using the Huso (2011) estimator, a fatality estimator approved by AEP (2020), and consider relevant updates (Huso et al. 2012), revisions (e.g., bleed-through) or modifications (if necessary to accommodate the distance-sampling based estimate of searcher efficiency in the solar arrays), as well as 90% confidence using bootstrapping (Manly 1997). The use of the Huso (2011) estimator is consistent with the standard for mortality rate calculation in Alberta (GOA 2017). The Huso (2011) estimator uses a binomial model to estimate the probability of carcass detection. The binomial carcass detection model could be used to calculate mortalities at Project linear features (fence, overhead lines) or during conventional transect surveys of panel rows.

Bootstrapping is a computer simulation technique that uses resampling methods to calculate variances and confidence intervals for parameter estimates when distributional assumptions might not be met (Manly 1997). Bootstrapping is used to generate estimates of variance for each variable, including searcher efficiency, probability of a carcass persisting to the next search, adjusted search interval and observed mortalities from a sample of the facility. From these bootstrap samples, the probability of available and detected carcasses will be calculated and applied to the bootstrapped found fatalities. The lower 5th and upper 95th percentiles of the bootstrap replicates provide estimates of the lower limit and upper limit of an approximate 90% confidence interval on all parameter estimates.

The estimator or statistical method may be substituted at the time of analysis, concordant with the field methods used, should an alternate analysis be determined to provide a more accurate or effective mortality estimate compared to the methods described in Huso et al. (2012). Any substitution of estimator or statistical analysis will be done in consultation with COE and AEP and include the provision of a rationale for the deviation from the approved WMMP.

3.0 WILDLIFE HABITAT CONNECTIVITY MONITORING

3.1 REMOTE CAMERA PROGRAM

3.1.1 Study Area

Habitat use of medium and large sized terrestrial wildlife will be monitored within the Habitat Connectivity Study Area (HCSA; see Figure 2) which encompasses the west side of the NSR valley from north of the E. L. Smith WTP to the Transportation Utility Corridor. Habitat within the HCSA consists of perennial pasture occupying most of the valley bottom with forested areas adjacent to the NSR and along the valley slope. The existing, fenced, E.L. Smith WTP occupies a portion of the valley bottom. Within the HCSA, the open perennial pasture of the proposed Project Area and the adjacent forested areas are expected to provide connectivity for terrestrial wildlife, particularly small, medium and large sized mammals. The completed Project will be fenced, providing a barrier to wildlife movement through the central open portion of the HCSA.

3.1.2 Survey Methods

The remote camera monitoring program was initiated in the summer of 2019 to gather baseline data on wildlife use of the HCSA. Cameras will remain in place through construction and for three years post-construction to monitor effects to wildlife habitat use. A total of eleven remote cameras were deployed for the monitoring program. Remote camera stations were selected to assess wildlife activity on potential movement routes on either side of the Project Area at the north and south ends of the HCSA as well as at locations in and immediately adjacent to the Project Area (see Figure 2). Cameras were positioned to monitor established wildlife trails, the project footprint and planned habitat connectivity mitigation sites (e.g., planted tree corridor) and may be fine-tuned or repositioned in the field as required to accommodate Project infrastructure. If available, data from COE remote cameras in the HCSA will be incorporated into the analysis but are not considered necessary for the success of the program. Remote cameras will be left in place year-round and will sample continuously.

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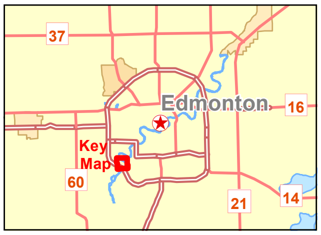

- ● Remote Camera Location
- ➤ Remote Camera View Direction
- -·- EPCOR Property Boundary
- 🟨 Permanent Footprint
- 🟥 Project Development Area
- 🟩 Revegetation Area (Meadows)
- 🟩 Revegetation Area (Trees and Shrubs)
- ☐ Quarter Section

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Notes
1. Coordinate System: NAD 1983 3TM 114
2. Data Sources: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Background: City of Edmonton, 2019

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Project Location
SW¼ 10-52-25 W4M and
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Edmonton, Alberta

Prepared by SJ on 2020-07-10
TR by SM on 2020-07-10
IR Review by EL on 2020-07-10

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Wildlife Mitigation Monitoring Plan

Figure No.
2

Title
Remote Camera Locations

At each station, the remote camera was placed in a metal enclosure and bolted to a tree or attached to a fence with hose clamps in an orientation that provides a clear image of passing wildlife while reducing false triggers (e.g. from solar glare or blowing vegetation). Vegetation was trimmed as necessary for suitable camera placement. At each station the following information was recorded:

- Camera ID
- Date and time of deployment
- Universal Transverse Mercator (UTM) coordinates
- Camera height
- Camera orientation
- Site description of where the camera was deployed (e.g., dominant vegetation)

Once in place, each camera was tested to ensure it was angled correctly to capture photographs of medium to large sized animals. Each camera was locked in place to prevent theft. Cameras will be visited approximately every six months to retrieve memory cards and to perform camera maintenance such as battery replacement and vegetation trimming to prevent false triggers.

3.1.3 Analysis

Camera data is used to determine the relative abundance of medium and large animals within the HCSA. For camera programs, relative abundance is the count of the number of animal detections at a site. Relative abundance indices (RAIs) are commonly produced from remote camera data by dividing the number of detections by survey effort (e.g., number of camera days) to calculate a capture rate. Analysis of RAI data assumes that sampling is standardized so that the probability of detecting wildlife species is believed to be consistent across survey stations. Baseline RAIs are compared to post-construction RAIs to determine if an effect to wildlife habitat connectivity through the HCSA had occurred. If possible, data from COE cameras in other locations with appropriate site characteristics (e.g., COE cameras at Big Island and Oleskiw) may be used to establish a control to which post-construction RAIs can be compared. Preliminary baseline results from the camera program are reported in MEIA Wildlife Addendum (Stantec 2020).

3.2 SNOW TRACK SURVEYS

3.2.1 Study Area

Snow track surveys to monitor species richness, habitat use and relative abundance of winter-active mammals will be conducted within the HCSA (see Section 5.1). Habitat types within the HCSA include perennial pasture, coniferous and deciduous forest and deciduous shrubby areas.

3.2.2 Survey Methods

Snow track survey program is designed to gather baseline information on winter-active terrestrial wildlife species richness and relative abundance. Snow track surveys are the preferred survey method in Alberta for mammals because they are non-invasive and can detect a broad range of species or species groups (ESRD 2013).

Snow track data is collected using linear transects based on methods described by RIC (2006) for a standard line-intercept survey and used to calculate species-specific indices of relative abundance. Survey methods follow ESRD (2013) for non-linear disturbance, where applicable; however, shorter transects are used to accommodate the small project size.

Data collected includes snow depth, coverage and condition, mean temperature and time of last snowfall. The track period, or number of days since the last track-obliterating event (i.e., greater than 1 cm snowfall or average daily windspeed of over 30 km/h; ABMI 2014) is calculated to standardize track counts. Species-specific tracks observed within 1 m of either side of the transect center line are recorded for each segment. Tracks are identified to species whenever possible. The tracks of some wildlife groups (e.g., small mammals such as mice, voles and shrews) are too similar to reliably distinguish and are identified to the group level. Where necessary, tracks are back-tracked to obtain more defined tracks and aid identification.

The snow track survey program was initiated during the winter of 2019/2020 to provide baseline information prior to the expected start of construction. Five transects were established ranging between 175 m and 1175 m in length for a total length of approximately 2700 m. Transects were positioned to sample representative habitat types available within the HCSA in the NSR valley including the PDA.

3.2.3 Analysis

Snow track data is summarized by species and habitat. Track counts for each species group are presented as a standardized index of relative abundance (tracks/km-days) calculated following Thompson et al. (1989):

$$\text{Track Counts} = \frac{\sum \text{Tracks Observed}}{\sum \text{Transect length surveyed (km)} \times \text{ Track Period (days)}}$$

Baseline track counts are compared to track counts during project construction and operation to estimate changes to relative abundance of winter-active mammals within the HCSA. Baseline survey results are provided in the MEIA Wildlife Addendum (Stantec 2020).

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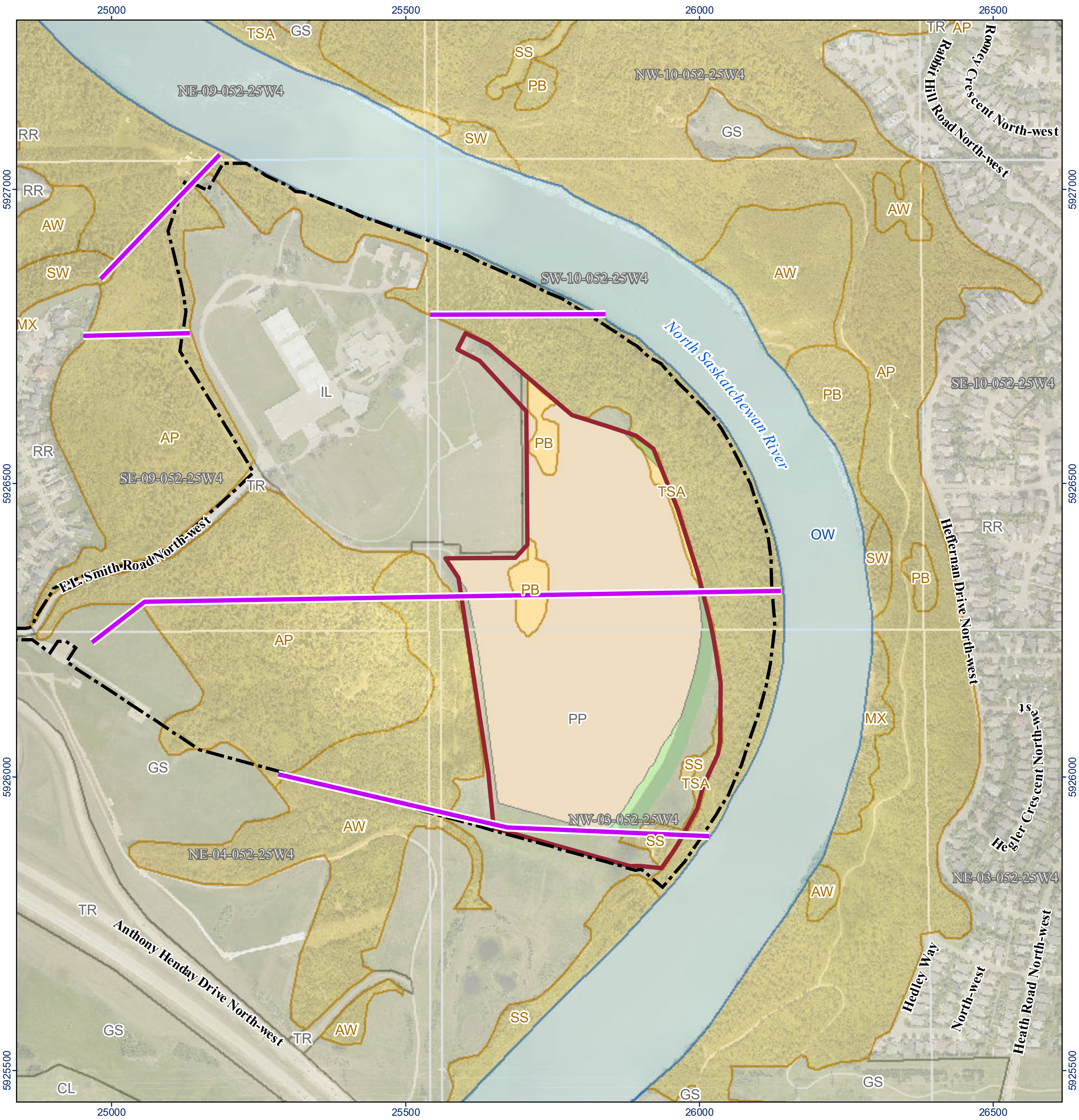

- Snow Track Transect
- EPCOR Property Boundary
- Project Development Area
- Permanent Footprint
- Revegetation Area (Meadows)
- Revegetation Area (Trees and Shrubs)

Anthropogenic

- CL - Cultivated Land
- GS - Green Space
- IL - Industrial Development
- PP - Perennial Pasture
- RR - Residential
- TR - Transportation

Upland

- AP - Aspen Poplar Woodland
- AW - Aspen Woodland
- MX - Mixed Deciduous and Evergreen Woodland Alliance
- PB - Balsam Poplar Woodland Alliance
- SS - Short Shrubland Alliance
- SW - White Spruce Woodland Alliance
- TSA - Tall Shrubland

Water

- OW - Open Water
- Quarter Section

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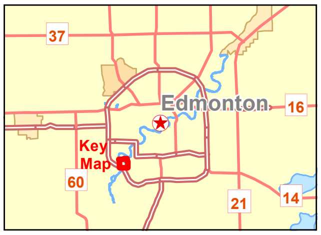

Notes
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Figure No.
3

Title
Snow Track Transect Locations

4.0 REPORTING

Annual reports will be developed separately for mortality monitoring and wildlife habitat connectivity monitoring to ensure timely delivery to the appropriate regulators. In accordance with AEP 2020, the mortality monitoring reports will be provided to AEP and COE while the habitat connectivity reports will be provided only to the COE.

4.1 MORTALITY MONITORING

Results for each year of post-construction mortality monitoring will be provided to the COE and AEP in a summary report. The report will include a detailed summary of methods, analysis, and results, including:

- methods and rationale for any deviation from AEP (2020)
- a figure showing the search area and location of any carcasses found
- quantification of search effort, search area, searcher efficiency rate and carcass persistence rate and description of the model used to calculate carcass removal and searcher efficiency
- uncorrected mortality rate for birds expressed as number of mortalities/MW/year
- corrected mortality rates per Huso (2011), and applicable updates (Huso et al. 2012) or acceptable alternative
- summary of species killed including location, condition, and likely cause of death
- comparison of estimated fatality rates based on pre-construction surveys to fatality rates based on post-construction surveys
- raw data, which will be submitted to FWMIS

To facilitate timely decision making and to allow the results of each year's monitoring to influence the next year's program, each post-construction mortality monitoring report should be submitted to COE and AEP by January 31 of the year following data collection.

Results for each year of post-construction mortality monitoring will inform the design and execution of successive years if any changes are deemed necessary through consultation with COE and AEP. Any proposed modifications to the monitoring plan will be determined in consultation with COE and AEP and approved in writing.

4.2 WILDLIFE HABITAT CONNECTIVITY MONITORING

Results for each year of baseline and post-construction wildlife habitat connectivity monitoring will be provided to the COE in a summary report, and will include the following:

Remote Camera Program

- raw camera capture data, which will be submitted to FWMIS
- summary of monitoring results from baseline to most recent full year of post-construction
- quantification of survey effort including number of active days and photos taken

- camera locations and camera status
- summary of total detections of all wildlife species and RAIs

Snow Track Surveys

- raw data, which will be submitted to FWMIS
- summary of monitoring results from baseline to most recent full year of post-construction
- quantification of survey effort including transect lengths and distance sampled in each habitat type
- transect locations
- summary of track counts for each species or species group by habitat type.

To facilitate timely decision making and to allow the results of the first year's monitoring to influence the next year's program, the annual wildlife habitat connectivity monitoring reports should be submitted to COE by June 31 following the second (i.e., late-winter) snow track survey of the season.

Pre-construction baseline habitat connectivity data will be used to establish the reference conditions for the WMMP. Through consultation with COE, results for each year of post-construction wildlife habitat connectivity monitoring will inform the design and execution of the program in successive years if any changes are deemed necessary. Any proposed modifications to the monitoring plan will be determined in consultation with COE and approved in writing.

5.0 ADAPTIVE MANAGEMENT

Mortality

Following the completion of the first year of post-construction data collection, the mortality monitoring results will be examined in the context of documented species mortalities and the status and trends of their regional populations. Acceptable mortality thresholds suitable for solar projects in Alberta have not yet been developed by AEP. Upon completion of each year's monitoring, the results will be discussed with the AEP regional wildlife biologist to gain their feedback on whether an acceptable threshold has been crossed, assuming no relevant guidelines have been released by that time. The COE will be welcome to participate in these discussions if they so wish.

EPCOR will use an ongoing adaptive management approach where mortality monitoring outcomes will be assessed to identify the need and opportunity for additional mitigation and monitoring. Mitigation options, if necessary, will be explored with the COE and AEP and may include the use of bird deterrents. If new mitigation measures are required, the mortality monitoring program may be extended to assess their efficacy.

Wildlife Habitat Connectivity

Following the completion of the first year of post-construction monitoring, results of the wildlife habitat connectivity monitoring program will be examined to determine if changes to habitat use by terrestrial wildlife in the HCSA may have occurred. Where necessary, additional appropriate mitigation measures will be developed. Mitigation measures may include additional vegetation management, barriers to sensory stimuli or modifications to maintenance activity to promote wildlife use and movement around the Project. If results for wildlife habitat connectivity monitoring indicate that additional mitigations are necessary, connectivity monitoring may be extended to assess their efficacy.

6.0 REFERENCES

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E.L. Smith WTP Solar Farm Adaptive Management Framework

August 28, 2020

Prepared for:

EPCOR Water Services Inc.

Prepared by:

Stantec Consulting Ltd.

August 28, 2020

1.0 INTRODUCTION

1.1 BACKGROUND / REGULATIONS

The following Adaptive Management Framework (the Framework) has been developed to support regulation 4 I (i) (the Regulation) in the final draft of Direct Development Control Provision River Valley Cameron (LDA17-0283). The Regulation was developed to provide a process in which how potential adverse residual effects of the EPCOR Water Services Inc. (EPCOR) E.L. Smith WTP Solar Farm Project (the Project) on wildlife mortality risk and habitat connectivity will be deemed acceptable by the City of Edmonton (COE). Based on the Regulation, this Framework outlines the process to identify, through the annual monitoring program review, whether unacceptable residual effects to bird mortality and wildlife habitat connectivity have occurred where the construction and operational mitigation measures were not successful. If such impacts are found to have occurred, then a Biodiversity Offsetting Plan would be developed.

Previous work undertaken for the Project, during both the design phase and the preparation of the Environmental Impact Assessment (EIA), has incorporated measures to:

(i) avoid (e.g., alter the Project footprint to stay outside the Key Wildlife and Biodiversity Zone along the North Saskatchewan River and site the Project predominately in non-native perennial pasture);
(ii) minimize (e.g., mitigation measures for wildlife and wildlife habitat during construction activities); and
(iii) restore (e.g., planting of trees in river valley adjacent to the Project) (see Figure 1 below).

The purpose of the Regulation is to outline EPCOR's further commitment to preparing and implementing an Adaptive Management Framework for the Project, focused on the operational phase and the Project's associated effects. Options to reduce effects through operational mitigation measures and/or restore additional native habitat will be evaluated as part of the adaptive management component of the Project's Wildlife Monitoring and Mitigation Plan (WMMP). This Framework outlines how EPCOR will consider options for potential biodiversity offsets if, after application of the adaptive management component of the WMMP, post-construction monitoring indicates the Project's residual effects on wildlife mortality and habitat connectivity are deemed unacceptable and not in alignment with Government of Alberta wildlife management guidelines (where applicable).

Currently the COE and the Government of Alberta do not have a legislated process for the implementation of biodiversity offsets, outside of the Water Act. The Federal Government has produced guidance around the implementation of conservation allowances (i.e., biodiversity or conservation offsets), but this guidance has only been applied to projects under federal jurisdiction (Environment Canada 2012).[1] Therefore, what EPCOR has committed to considering as part of the Framework is a project-specific initiative that has no precedent for implementation in the Province of Alberta, although it has been proposed for federally-regulated projects.

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[1] Environment Canada. 2012. Operational Framework for Use of Conservation Allowances. Available at: https://www.canada.ca/en/environment-climate-change/services/sustainable-development/publications/operational-framework-use-conservation-allowances.html

2.0 FRAMEWORK OVERVIEW

2.1 GOALS AND OBJECTIVES

The Framework outlines the decision-making process for the implementation of biodiversity offsets for the Project, and how decision-making is reliant on the adaptive management process within the WMMP. The results of the WMMP will identify where additional mitigation measures for the Project will require further development and consideration during the operational phase. If during or following post-construction monitoring, and following the implementation of adaptive management process, it is determined that biodiversity offsets are needed based on consultation with COE, EPCOR will develop a Biodiversity Offsetting Plan specific to the adverse residual effects that cannot be avoided or sufficiently reduced, and are deemed unacceptable. To facilitate this, the Framework outline steps to aid the determination of ‘unacceptability’.

EPCOR believes this process follows best practices implemented internationally and provides a logical process to reduce the Project’s effects on wildlife in the Project Area and within the City of Edmonton.

2.2 PRINCIPLES

One of the key aspect of the Framework is to agree on the decision-making process on how to determine if a Biodiversity Offset Plan is necessary based on the Project’s residual effects on mortality and habitat connectivity (after application of adaptive management and as determined through monitoring). This decision-making process requires an agreed upon set of principles to ensure effective communication and understanding of roles and responsibilities, including:

- The Adaptive Management Framework, and potential Biodiversity Offsetting Plan (the Plan), will be a joint EPCOR-COE endeavor
- Will meet or exceed the technical scope and detail of other frameworks/plans in the region
- If development of a Plan is required, the Plan will be scientifically rigorous in design and implementation, and will rely on the results from the Project’s WMMP monitoring studies
- Decisions made using the Framework will be reported readily and transparently

2.3 KEY CONSIDERATIONS OF FRAMEWORK

The majority of land cover disturbed by the proposed Project will not directly result in loss of native wildlife habitat (i.e., primarily non-native perennial pasture is impacted).[2] The implementation of biodiversity offsets has almost exclusively focused on non-human altered land cover (i.e., native or natural areas such as grasslands, forests, undisturbed wetlands). This is because modified habitats (i.e., human-altered land cover) requiring biodiversity offsets should have high or significant biodiversity value in order to require offsets (IFC 2012)[3]. Based on the EIA prepared by Stantec (2019), the Project was not predicted to have

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[2] Approximately 2.3 ha of treed habitat is proposed to be developed; however, 3.0 ha of treed habitat will be restored outside the Project footprint.

[3] International Finance Corporation (IFC). 2012. Performance Standard 6: Biodiversity Conservation and Sustainable Management of Living Natural Resources.

high magnitude adverse effects on wildlife. In addition, based on the land cover impacted by the Project and baseline survey results, the Project Area is not predicted to have high biodiversity value. However, EPCOR recognizes that the Project is located in the North Saskatchewan River Valley in Edmonton, which is a provincially significant natural area and regional biological corridor (COE 2008)[4]. As a result, EPCOR is implementing the WMMP and its adaptive management approach and further including the implementation of biodiversity offsets as a possible option. The need for offsets should be based on the results of the WMMP and the conclusions of the EIA.

As discussed in the Regulation, the focus of the Framework will be on determining whether the effects of the Project on bird mortality and wildlife habitat connectivity are unacceptable, following the implementation of construction and operational mitigation measures.

2.4 APPLYING THE MITIGATION HIERARCHY

This Framework includes consideration of the internationally-accepted mitigation hierarchy process, which is a set of guidelines, established through the International Finance Corporation's Performance Standard 6, meant to help development projects prepare for impacts and, in some cases, aim to achieve no net loss of biodiversity if required by existing legislation (IFC 2012). The hierarchy follows avoidance, minimization, restoration and offsets in order to reduce development impacts and control any negative (or adverse) effects on the environment (Figure 1; CSBI 2015)[5]. In the case of the Project and the Regulation, the focus is specifically on wildlife. As outlined above, implementation of the mitigation hierarchy has been underway since the beginning of the Project. However, EPCOR recognizes that there may be additional opportunities for potential restoration and offset opportunities, based on the outcomes of the WMMP. The use of monitoring and adaptive management to determine and evaluate mitigation requirements is in alignment with how the majority of renewables projects in Alberta are planned (as required in the *Wildlife Directive for Alberta Solar Energy Projects* [GOA 2017])[6], which requires the development of mitigation measures during construction and operation, as well as WMMP to determine if additional operational mitigation is needed. The Wildlife Directive for solar projects in Alberta does not outline a process for compensation (i.e., biodiversity offsets).

Following the completion of each year of monitoring, as outlined in the WMMP, the results will be submitted to AEP and reviewed by EPCOR and the COE in consideration of the mitigation hierarchy and the WMMP's adaptive management approach to determine whether the effects that were reported could be minimized using additional mitigation measures. Any additional mitigation measures will be developed by EPCOR and provided to AEP and the COE for review and comment.

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[4] City of Edmonton (COE). 2008. Biodiversity Report. City of Edmonton. Edmonton.

[5] Cross Sector Biodiversity Initiative (CSBI). 2015. A Cross-sector Guide for Implementing the Mitigation Hierarchy. Prepared by The Biodiversity Consultancy. 87pp.

[6] Government of Alberta (GOA). 2017. Wildlife Directive for Alberta Solar Energy Projects. Available at: https://open.alberta.ca/publications/directive-aep-fish-and-wildlife-2017-no-5

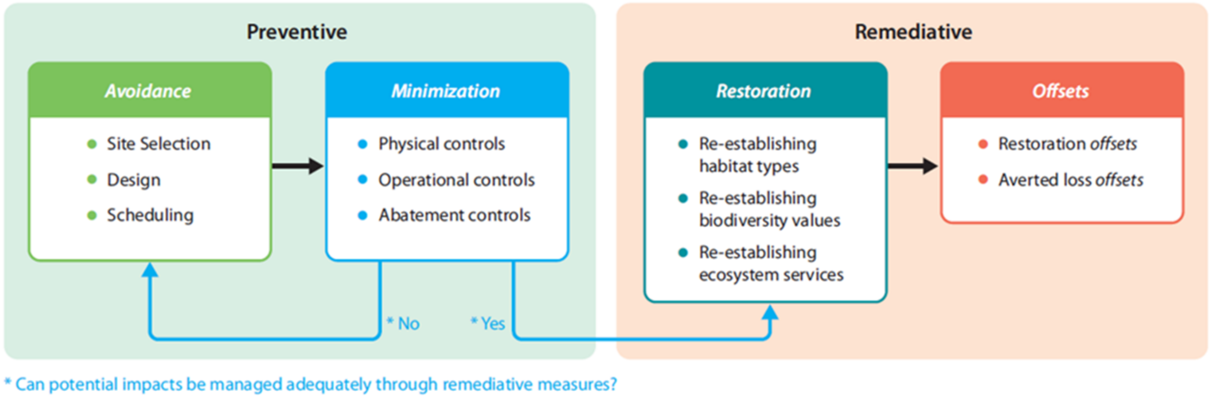

Figure 1 **Implementation of the Mitigation Hierarchy (CSBI 2015)**

2.5 IMPLEMENTING THE FRAMEWORK

Based on the objectives and principles outlined for the Framework, a step-by-step flowchart has been developed to show how the decision-making process should flow once monitoring results from the Annual WMMP report are completed (see Figure 2).

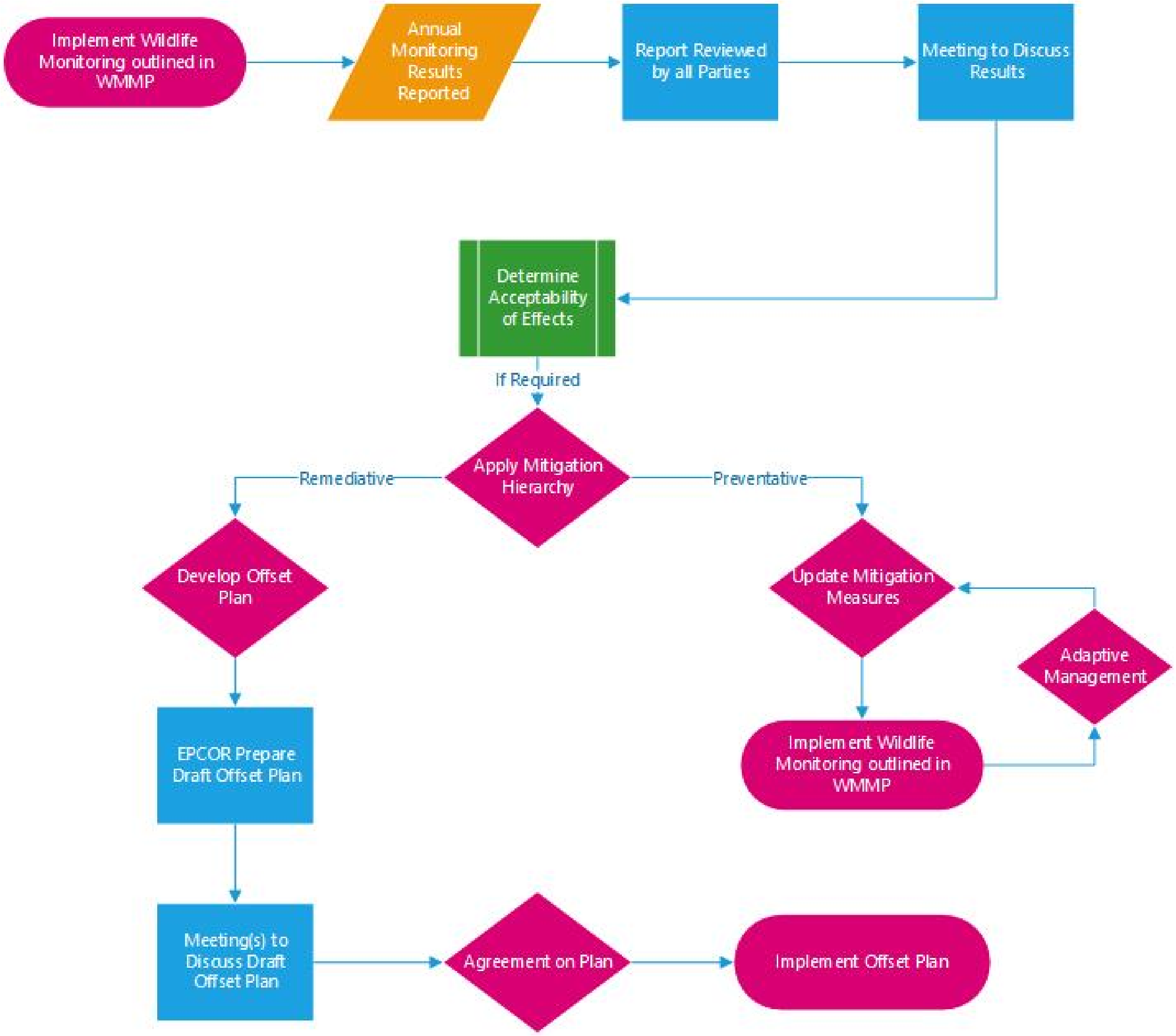

Figure 2 Step-by-Step Process for Implementing Biodiversity Offsets

For the purposes of the Framework, the potential contents of a Biodiversity Offsetting Plan have not been included or discussed. The development of a Plan would be a collaborative process between EPCOR and the COE.

3.0 DETERMINING NEED FOR BIODIVERSITY OFFSETS

As outlined in the Regulation, the decision on whether biodiversity offsets are needed is based on a determination on whether the Project's adverse residual effects to bird mortality and wildlife habitat connectivity based on post-construction monitoring (i.e., during the operational phase) are unacceptable. This would be mean that all construction and operational mitigation measures implemented for the Project (including those previously committed to in the EIA and any future new measures) were not successful. If such impacts are found to have occurred, a Biodiversity Offsetting Plan will be submitted to Urban Growth and Open Space Strategy outlining the specific Biodiversity Offsetting actions as appropriate.

From EPCOR's perspective, the determination of acceptability should not equate to complete elimination of effects such that the Project's residual effects are nil or negligible. For this reason, the discussions around the determination of acceptability will need to consider various factors including:

- Residual effects predictions in the EIA
- Results of the WMMP (e.g., number of bird fatalities, change in remote camera results from baseline to operation)
- Local and regional datasets to compare against any changes observed
- Review of current relevant literature and scientific research
- Precedent and results from other wildlife monitoring programs in Alberta, Canada, and worldwide (renewable energy, etc.)

As this process is unique for renewable energy projects, EPCOR acknowledges that the determination of acceptability (or unacceptability) will require open and effective communication with the COE. In addition, as wildlife management is under the jurisdiction of the Government of Alberta, EPCOR will also review the results of the WMMP with Alberta Environment and Parks – Wildlife Management (AEP-WM); specifically to request AEP-WM's opinion on the fatality results and whether they are consistent with and within acceptable limits of other renewables projects in Alberta.

4.0 CONCLUSION

This Adaptive Management Framework for EPCOR's E.L. Smith WTP Solar Farm, which focuses on the decision-making process for implementing biodiversity offsets, is one of the first developed in Canada. Because of this, it highlights EPCOR's commitment to being environmentally-conscious stewards in the application of their projects and operations. EPCOR looks forward to working with the COE on making the Project as environmentally sustainable as possible while providing the citizens of Edmonton with clean power for decades to come.

EPCOR PROVIDING MORE

Memorandum

DATE: March 18, 2020

TO: Travis Pawlyk, Director, Planning Coordination, Urban Form and Corporate Strategic Development, City of Edmonton

Kim Petrin, Branch Manager, Development Services, Urban Form and Corporate Strategic Services, City of Edmonton

FROM: Craig Bonneville, Director, Gold Bar Wastewater Treatment Plant, EPCOR

Cc: Guy Bridgeman, Senior Vice President, EPCOR

Stephanie McCabe, Deputy City Manager, City of Edmonton

SUBJECT: **E.L. Smith Solar Farm Project – COE review of MEIA addendum and SLS**

On March 3, 2020, EPCOR Water Services Inc. ("EWSI") was provided a copy of a February 27, 2020 City's Open Space Network and Assembly Unit (herein refered to as the "Open Spaces team") technical review of the E.L. Smith Solar Project Site Location Study ("SLS") and Municipal Environmental Impact Assessment ("MEIA") Wildlife Addendum. EWSI's comments on the Open Spaces team's technical review are summarized in this memo and are detailed in the attached version of the Open Spaces team technical review (refer to EWSI's comments in the endnotes of Attachment 1). Stantec has also prepared its own letter detailing its comments on the Open Spaces team's technical review of the MEIA and Wildlife Addendum, a copy of which is also included as Attachment 2.

E.L. Smith Solar Project Land Development Application Process

For background and context, the following provides a summary of key developments in the regulatory approval process for EWSI's Land Development Application ("LDA") for the E.L. Smith Solar Project (the "Project").

- In March 2018, in support of its LDA, EWSI submitted a draft MEIA, prepared by independent environmental consulting firm Stantec Consulting. Based on feedback from City Administration, this MEIA was finalized and resubmitted February 22, 2019.
- In June 2019, in support of its LDA, EWSI resubmitted a final version of its Site Location Analysis and Justification ("SLAJ") report (also revised for City feedback) to supplement the MEIA and to provide the City with an opportunities and constraints analysis outlining the

rationale for the Project based on institutional, financial, environmental and social considerations.

- On June 17, 2019, the City held a public hearing where:
  - City Administration presented a report to City Council summarizing its review of the Project and indicating its support. In this report City Administration concluded that, because EWSI is a private entity and the Project is sited on privately owned land, the Project did not need City Council to determine whether it is "deemed essential" in the river valley as is set out in section 3.5.1 and 3.5.3 of the North Saskatchewan River Valley Area Redevelopment Plan ("NSRV ARP").[1]
  - City Council deferred a decision regarding the LDA and passed a motion[2] which requested City Administration to complete "*work and reporting necessary to allow Council to fully consider whether the location* [of the E.L. Smith Solar Project] *within the River Valley should be deemed essential by Council."* EWSI understands that through this motion, Council is seeking information to allow it to determine if the Project would meet the "essential" standard if that standard had applied.[3]
- Over the summer of 2019, EWSI met with and exchanged emails with City Administration to discuss the response to the City Council motion. Through these discussions, City Administration requested EWSI provide:
  - additional remote camera monitoring of wildlife at the Project site and winter tracking monitoring;
  - an updated triple bottom line analysis (HDR Consulting) to include the Open Spaces team's proposed additional ecosystem value references from the economic literature; and
  - a repackaged SLAJ based on a typical Site Location Study format to facilitate a hypothetical "essential" assessment of the Project.
- On August 9, 2019, EWSI received the "E.L. Smith Solar Farm – Site Loctaion Study Terms of Reference" from City Administration, which EWSI used as its template from which it prepared a Site Location Study to address the City Council motion.
- On January 23, 2020, EWSI met with City Administration to affirm its approach and content of EWSI's SLS and Stantec's Wildlife Addendum to the MEIA and the scope and timelines

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[1] Administration Report Rezoning & Plan Amendment River Valley Cameron, June 17, 2019 at p 11.

[2] The other part of Council's motion included directing City Administration to work with EPCOR and Enoch First Nation to continue engagement activities and return to a future Public Hearing. This motion is separately addressed by EPCOR through a memo issued to City Administration Februry 2020, entitled "*Enoch Cree Nation Re-Engagement Summary Report*"

[3] http://sirepub.edmonton.ca/sirepub/mtgviewer.aspx?meetid=2264&doctype=MINUTES

of the City's review process.

- On January 31, 2020, EWSI filed its E.L. Smith Solar Project SLS and Stantec filed its Wildlife Addendum to the MEIA, dated January 2020.
  - The SLS reflects the format outlined in the Open Spaces team's August 9, 2019 SLS Terms of Reference and is consistent with the approach discussed with City Administration at the January 23, 2020 meeting. The SLS includes an October 2019 HDR Addendum Report which provides an updated break-even analysis of the Project using both HDR's recommended ecosystem values as well as the Open Spaces team's recommended ecosystem values from economic literature.

    Using both sets of values HDR's conclusions remain the same as in its original report: "*for the offsite solar alternative to be the preferred alternative, decision makers would have to (i) place a very high ecosystem value on the E.L. Smith site and (ii) believe that the project development at E.L. Smith would result in adverse impacts to the ecosystem that are high in magnitude. The high ecosystem valuation for the E.L. Smith project site is not supported by the literature. The potential for adverse ecosystem impacts that are high in magnitude are not supported by the MEIA.*"[4]
  - The Wildlife Addendum to the MEIA includes the results of additional camera monitoring. Stantec's overall assessment of the Project remains - *potential adverse effects of the Project can be avoided, reduced or controlled using a combination of standard and Project-specific environmental mitigation measures* [5].

EPCOR's Response to the Open Spaces Team's Technical Review

In assessing the E.L. Smith Solar Project, the City must balance the need to protect the NSR Valley under the NSRV ARP and satisfy emerging goals set out under *ConnectEdmonton* and other policy documents including Edmonton's *Community Energy Transition Strategy*. The Project is consistent with the relevant goals, objectives, and policies of the NSRV ARP. The MEIA demonstrates that, the potential environmental impacts are limited and that effective mitigations have been designed where available. Furthermore, any potential residual effects are far outweighed by the significant benefits to the City of Edmonton achieved through a large scale renewable energy project which demonstrates the City's leadership action on climate change in a cost-effective and responsible manner.

EWSI submits that the E.L. Smith Solar Project meets the "essential" test based on the evaluation of the financial, institutional, environmental and social considerations in the SLS. The E.L. Smith Solar Project will reduce Edmonton's dependence on conventional energy and

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[4] HDR SVA of the E.L. Smith Solar Project – Addendum Report, January 31, 2020.

[5] Wildlife Addendum to MEIA for the E.L. Smith Solar Project, Stantec, December 4, 2019

make its water operations more resilient to climate change. There can be no assurance that an off-site location will have reduced potential effects to wildlife as it will depend on the particular ecological characteristics of a selected site. EWSI is not considering moving the Project to an offsite location due to the significant additional costs to ratepayers, the missed opportunity for incorporating a grant-funded micro-grid system and battery and the missed education and research opportunities. In addition to these reasons, the existing Alberta Utility Commission regulatory approval requires that the Solar Farm be located next to the Water Treatment Plant so that the majority of the energy generated is consumed on site.

While EPCOR appreciates the thorough review by the Open Spaces team, and has over the course of the Project worked together to materially improve the E.L. Smith Solar Farm Project, the Open Spaces team's technical review, as written, applies a standard that was not provided to EWSI, unfairly disregards many of the important planned mitigations and benefits of the Project and disregards the conclusions of independent experts. EPCOR provides its general concerns with the technical report and its primary concerns with SLS and MEIA below. Detailed comments are included in Attachment 1 to this memo.

- **The Open Spaces team's comments ignore the conclusions from third-party experts** (Stantec, HDR), including the conclusion of the MEIA that environmental impacts are limited and that effective mitigations have been designed. The Open Spaces team's technical review replaces the expert third party analysis completed by Stantec with the opinions of the Open Spaces team. Stantec determined that the originally proposed mitigations remain effective yet the Open Spaces team has concluded they are insufficient because they did not change in response to the additional information derived from the additional study performed on this Project. With respect to the HDR Triple Bottom Line Study, the Open Spaces team fails to accept the methodology or conclusion of this study and characterizes the analysis as a financial evaluation when the consultant's approach was clearly to consider financial, environmental and social impacts of the Project.

- **The Open Spaces team's technical review of the "essential" standard utilizes twenty new "criteria" which are unique to the Project and not previously shared with EWSI and have not been used for other City "essential" tests**. The twenty new criteria were provided not to EWSI as part of the terms of reference for the SLS provided by the Open Spaces team]to EWSI on August 9, 2019 and reflects the arbitrary nature of the technical review.

  Similarly, the technical review assessed the SLS, MEIA and Wildlife Addendum utilizing the International "Union for Conservation of Nature ("IUCN") Policy for Biodiversity Offsets" as the standard to meet, which is not identified in the Bylaw, the TOR nor has been adopted into any policy by the City of Edmonton.

The Open Spaces team's comments on EWSI's SLS are unreasonably critical and its assessment of the Project does not provide City Council with an objective basis to assess whether the Project meets the "essential" test.

- **The Open Spaces team's technical review incorrectly states that EWSI's SLS does not provide any new information** when in fact (and in conjunction with discussion with City Administration) EWSI added significant additional information including updated information in HDR's Triple Bottom Line addendum report in accordance with City requests, new wildlife snow tracking surveys and new wildlife camera monitoring field data. The City's own strategy document *ConnectEdmonton* along with Council's August 2019 declaration of a "climate emergency" and the related "Getting to 1.5^{o}C report to Council reflect new and relevant considerations referenced in the SLS.

- **The Open Spaces team's technical review is critical of "hypothetical" alternative locations being used to compare with the Project** and suggests that the essential test can only be completed if a full environmental assessment is done for an alternative site. This is inconsistent with previous essential tests where the City has evaluated projects against hypothetical alternatives. It is unreasonable to require that a MEIA be completed on an alternative site. Furthermore, EWSI's conclusions would not be materially different using a specific brownfield location within Edmonton as opposed to a hypothetical offsite location, as suggested in the Open Spaces team's technical review. EWSI evaluated the Project against a hypothetical offsite solar farm location which was based on very conservative estimates for land purchase costs in rural areas near Edmonton. As such, if EWSI had used a specific brownfield site located within Edmonton as an offsite location as the Open Spaces team's comments suggest, the land costs would likely be similar or higher and EWSI's overall conclusion (that the E.L. Smith Project is $16 million (40%) lower than an offsite solar farm location) would not be materially different.

- **The Open Spaces team's technical review does not acknowledge that developing the Project at this site will significantly reduce costs for Edmonton ratepayers.** The Open Spaces team's five financial criteria excluded the largest financial benefit of the Project which is the savings to the E.L. Smith Water Treatment Plant from reduced conventional power purchase costs from the grid and the associated wires costs. Further, the Open Spaces team does not acknowledge $10 million in federal government grant funding for a micro-grid and battery system as a financial benefit of locating the Project at the E.L. Smith site.

- **The Open Spaces team's technical review does not acknowledge the significant potential for enhancing education and awareness of large scale renewable energy in Edmonton.** Moving the Project to an offsite location, not connected to the E.L. Smith Water Treatment Plant, would not provide the same community integration, education and research opportunities for the city of Edmonton. While some of the community integration objectives, such as a demonstration site, may be available at an off-site solar farm located within the city of Edmonton, the accessibility, level of use and effectiveness of an alternative location, while unknown, is likely to be less impactful at an offsite location. The $10 million in federal grant funding for the the micro-grid system and battery is ***only*** available at the E.L. Smith site due to its connection to the E.L. Smith Water Treatment Plant. This micro-grid system and battery provides additional education and research opportunities. EWSI is partnering with the University of Alberta and NAIT on research and training, providing a unique opportunity to study intermittent generation with industrial load in a “behind the meter” setting.

The Open Space’s team’s technical review of Stantec’s MEIA and the more recent Wildlife Addendum to the MEIA is essentially unchanged from previous comments, ignores the conclusions of independent experts and continues to be unreasonable. Stantec has provided its own assessment of the Open Spaces team’s technical review as a separate memo (Attachment 2). EWSI’s key issues with the Open Spaces team’s technical review of the MEIA are reiterated below.

- **The Open Spaces team’s technical review inaccurately states that EWSI has *missed opportunities to reduce adverse environmental effects predicted from the project by maintaining the full scope and size of the proposal and not exploring mitigation options that avoid or minimize the physical impacts.*** This statement is unreasonable and ignores the numerous mitigations identified in the MEIA and most notably EWSI’s additional modifications to the Project size which resulted in an overall reduction in size from 62 acres down to 54 acres (a 15% reduction) ensuring a minimum 100 meter buffer along the river for wildlife connectivity, revegetation of a treed buffer along the southern boundary and replacing of “non-native perennial pasture” with “native seed mix” as detailed in the SLS and MEIA.

- **The Open Spaces team inaccurately asserts that wildlife connectivity / movement will be impacted for generations.** Stantec’s additional field data from camera monitoring and winter tracking confirms that wildlife is successfully using narrow corridors adjacent to the E.L. Smith Water Treatment Plant as effective passage through the area and therefore, development of the Project is unlikely to prevent wildlife movement along the North Saskatchewan River[6]. Furthermore, the planned mitigations to revegetate approximately 40 metres of native trees and shrubs along the south edge of the site will provide additional structural connectivity and reduce the indirect effects of the Project on wildlife movement. There will be a **minimum** 100 meter buffer along the river to mitigate impacts on wildlife movement.

- **The Open Spaces team implies that the Provincial Wildlife Directive should apply**. Alberta Environment and Parks determined that the wildlife directive does not apply to projects within urban areas[7]. This decision was further supported by the Alberta Utilities Commission’s approval of the Project in its February 20, 2019 Decision (23418-D01-2019) where the AUC concluded that *it is satisfied that the social and environmental impacts would*

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[6] Wildlife Addendum to MEIA for the E.L. Smith Solar Project, Stantec, December 4, 2019.

[7] April 30, 2018 Letter from Alberta Environment and Parks, Attachment 8 to the SLS.

not be significant[8].

- **The Open Spaces team asserts that the lack of bird mortality studies for a similar location is a fundamental flaw.** As indicated in the MEIA, there are no known studies on bird mortality in a comparable location and, as such, EWSI is proposing a post-construction monitoring program followed by development of additional mitigation measures as required (an adaptive management strategy). Professional biologists and site-specific bird migration data have concluded that this location is not considered to be a location with high densities of staging or migrating birds.
- **The Open Spaces team asserts that biodiversity will be harmed.** Stantec has indicated that EWSI's plan to transition the project site from "non-native perennial pasture" to "native seed mixes" is expected to ***improve*** the vegetative biodiversity providing greater habitat variability for insects and animals.

Based on the existing and new information presented since the June 2019 public hearing, EPCOR submits that the E.L. Smith Solar Project is appropriately sited next to the E.L. Smith Water Treatment Plant on the basis of social, environmental, financial and institutional considerations. The Project will bring the City of Edmonton closer to achieving its climate change targets. We hope that administration will consider this information in their report in response to the motions passed by Council at the June 2019 public hearing.

Kind regards,

Craig Bonneville
Director Gold Bar Wastewater Treatment Plant
EPCOR Water Services Inc.

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[8] http://www.auc.ab.ca/regulatory_documents/ProceedingDocuments/2019/23418-D01-2019.pdf#search=23418%2DD01%2D2019

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February 27, 2020

RE: Technical review of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020 and the report titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020

This technical review is intended to address Council's June 17, 2019 motion for City Administration to complete "*work and reporting necessary to allow Council to fully consider whether the location* [of the E. L. Smith Solar Farm] *within the River Valley should be deemed essential by Council.*"[1]

Given this direction from Council, two technical reports associated with the E. L. Smith Solar Farm proposal have been reviewed by City Administration's relevant subject matter experts following the direction provided in Section 3.5.3 of North Saskatchewan River Valley and Ravine System ARP (Bylaw 7188) which states:

> "*It is a policy of this Plan that all proposals for the development of a major facility ... shall be subject to an environmental impact screening assessment as outlined in Schedule D, and a detailed site location study detailing costs, and social, environmental and institutional constraints which make a River Valley location essential must be prepared for Council approval.*"

This review was completed in accordance with standard review practices for Bylaw 7188 and comments reflect the standards that a public project would be held accountable to.[i]

This document is divided into the following sections:

A. Summary of technical review findings
B. Review of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020
C. Review of the EIA addendum titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020
D. Review of the *Sustainability Value Analysis of the E.L. Smith Solar Farm Project – SLAJ Addendum Report dated January 2020*
E. Administration's outstanding review items of "*Municipal Environmental Assessment for the E. L. Smith Solar Farm (February 2019)*"
F. Literature Cited

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[1] Part 2 of a 2 part Council motion from the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890. Refer to Section 3.7 of the June 17, 2019 Council minutes: http://sirepub.edmonton.ca/sirepub/mtgviewer.aspx?meetid=2264&doctype=MINUTES

Section A: Summary of technical review findings

Summary of review findings of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020

Following the June 17, 2019 Council motion Administration provided a Terms of Reference (TOR) for the Site Location Study (SLS). While the submitted SLS was formatted to follow the provided SLS TOR, the information and recommendations that were included were those previously provided under the Site Justification Analysis Report (SLAJ) that was submitted with the last council report, and did not provide any additional or new information[ii]. City administration provides our assessment and evaluation of the SLS as outlined below:

- The site location analysis provided only considers hypothetical locations[iii] in providing an analysis for potential sites outside of the river valley location.
- This hypothetical analysis has resulted in a predetermination of the E.L. Smith location primarily based on the financial benefit from the "behind the meter" option, which focused on a financial evaluation for the justification of EPCOR water services 2017-2021 Performance Based Rate (PBR)[iv].
- Alternatives for non-river valley locations should not be limited by the scope of the work, and should provide equal consideration for the environmental or social constraints which form part of the evaluation for a River Valley location being deemed essential[v].
- The justification for a river valley location being deemed essential would be more applicable if actual alternatives were included, such as the utilization of degraded lands (e.g. brownfield sites), co-location of solar panels with underutilized land (including industrial and agricultural land etc), and other similar locations that have been a common practice both nationally and internationally for utility-scale solar farms.

In an attempt to objectively quantify the costs and "*social, environmental and institutional constraints which make a River Valley location essential*" Administration utilized 20 Criteria[vi] for evaluation divided equally between the four constraint categories identified in Bylaw 7188 (i.e. Financial, Social, Environmental and Institutional). These criteria were based on benefits and constraints that were identified within the SLS by the proponent and also from environmental impacts identified within the Environmental Impact Assessment.

Constraint that makes a RV location essential	**Summary rationale for Constraint Evaluation that makes a RV location essential***
Financial	Administration evaluated the financial constraint against five criteria[vii]. Three of the five criteria that supported the River Valley being essential were linked to cost savings from: tax benefits associated with being a municipal owned corporation and reduced operational and land purchase costs. The impacts to the average ratepayer is not clearly articulated within the SLS provided as the offsite comparisons are hypothetical.[viii]

Social	Of the five social constraints that were evaluated, none were identified as making a RV location essential for this project and one constraint was not able to be evaluated due to lack of information. Some social constraints, such as aesthetics, are believed to be improved with the absence of industrial infrastructure in the natural setting of the River Valley, regardless of design.
Environmental	Of the five environmental constraints evaluated, none were identified by either the proponent or other parties that would make a RV location essential for the proposed infrastructure.
Institutional	Of the five major institutional criteria assessed that relate to this project, it was shown that the project only supports one constraint: the City's goal of increasing locally produced energy (the project would add 0.28%[2] to Edmonton's total 10% goal). However, if locally is defined as the Edmonton area, then an argument could be made that the River Valley is not essential to achieve this goal.

*Further details and supporting information related to the conclusions above are detailed in Section B of this review.

Based on the constraints analysis above, the potential for adverse environmental effects are not considered to be outweighed by the other assessed financial, social and institutional constraints and only the financial aspects could justify deeming the project as essential.

Summary of review findings of the EIA addendum titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020

Upon review of the January 2020 Wildlife Addendum to the February 22, 2019 draft EIA[ix], technical reviewers from Administration conclude the following:

1. With the exception of a few study gaps, the wildlife addendum collected additional wildlife baseline information that was requested by Administration to address outstanding EIA review items[3].
2. The baseline information collected supports Administration's original conclusions about negative impacts to biodiversity in the area, specifically around:
    - Habitat loss and fragmentation and an overall net loss of 19.7 ha of habitat (most notably for medium to large wildlife) and indirect effects due to sensory disturbance.
    - Connectivity impacts, in particular increased adverse impacts to the existing passage along the river through lengthening, and blockage of wildlife access to the river through the open field.
3. The additional work completed does not address previously outlined concerns around reducing future wildlife mortality due to avian collisions and entrapment.
4. Despite new baseline information, the report has identified no additional mitigation opportunities to reduce environmental impacts through the application of the mitigation hierarchy (avoid, minimize, restore and offset).

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[2] ETAC E.L. Smith Solar Letter, dated January 22, 2019

[3] "*Open Space Strategy outstanding review items of Municipal Environmental Assessment for the E. L. Smith Solar Farm*" dated February 2019 (dated August 19, 2019)

Given the above, the Municipal Environmental Impact Assessment (MEIA) and Addendum have missed opportunities to reduce adverse environmental effects predicted from the project by maintaining the full scope and size of the proposal and not exploring mitigation options that avoid or minimize the physical impacts[x]. Background and supporting information related to each of the four conclusions above are detailed in Section C of this review.

Section B: Review of “*E.L. Smith Solar Project Site Location Study*” dated January 31, 2020

Following the June 17, 2019 Council motion Administration provided a Terms of Reference for the Site Location Study (SLS). While the submitted SLS was formated to follow the provided SLS TOR, the information and recommendations that were included were those previously provided under the Site Justification Analysis Report (SLAJ) formerly submitted with the last council report. No new information has been provided[xi].

In an attempt to objectively quantify the costs and “*social, environmental and institutional constraints which make a River Valley location essential*” Administration selected 20 Criteria[xii] for Evaluation divided equally between the four constraint categories identified in Bylaw 7188 (i.e. Financial, Social, Environmental and Institutional). These criteria were based on benefits and constraints that were identified within the SLS by the proponent and also from environmental impacts identified within the EIA.

See pages 6-9 for Table 2: *River Valley Location Deemed Essential Test- Constraints Analysis Table (Criteria for Evaluation)*

River Valley (RV) Location Deemed Essential Test- Constraints Analysis (Criteria for Evaluation)

Constraints		Potential criteria for Evaluation of E.L.Smith Solar Farm Project	River Valley Location Deemed Essential			Remarks
			Yes	No	Unknown	
Financial[xiii]	1	Cost Saving through tax exemptions because of onsite Power Consumption (Back of Meter option available)	√			[1]Onsite power consumption was permitted to operate this project on a non-taxable basis considering EWSI as a municipally owned entity. The impacts to average ratepayers are not clearly articulated within the SLS provided as the offsite comparisons are hypothetical.
	2	Cost saving for Land Purchase	√			Potential cost for land purchase was not outlined in the SLS. So this review assumes other Epcor properties are not available for solar use.
	3	Operational cost saving	√			Proximity of the site to the water treatment facility
	4	Grant funding ($10 million) from NRCan to enhance the E.L. Smith Project			√	Unable to assess: while the Battery Energy Storage System (BESS) is mentioned in the SLS, no details of other project costs/constraints are provided[xiv]. Therefore, related benefits are uncertain until the project is fully evaluated
	5	HDR evaluation of financial benefit from their Ecosystem Valuation and conclusion based on the break even analysis			√	[2]Unable to assess: This analysis is based on multiple assumptions and scenarios that potentially have variable preference and can result in different conclusions based on an individual stakeholders perspectives.[xv]
Financial Constraints Evaluation			3	0	2	
Social	1	Project promotes and connects Edmontonians and Albertans to their history and diverse cultural heritage.			√	Given the ongoing conversation with ENOCH Nation it is yet unclear if there are confirmed partner commitments to move forward with the proposed plan at this specific RV site. Administration is unaware of the opportunities the project provides and is unable to provide an objective evaluation[xvi]
	2	The E.L. Smith Solar Project provides significant potential for enhancing research and education of large scale renewable energy in Edmonton.		√		The ability for a solar farm to have significant potential for enhancing research and education is not dependent on a river valley location. Research and educational opportunities will not be lower in an Edmonton based off-site location[xvii]. Parking access and visitor facilities would not be as constrained at a tableland location with fewer geotechnical constraints.

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[1] *It is important to note that financial benefits from back of the meter can only be applied to this facility because it is a municipally owned corporation.*[xviii] *In addition to supporting Council's motion of applying the "deemed essential" decision to this Municipally owned corporation it should be highlighted that such financial incentives are not available to private business/industry if they look to obtain comparable financial benefits in the future. Therefore, this project can not be considered as a standard since such financial benefits are not applicable in those cases and should be considered a one off in securing such benefits that can not be scaled up to promote solar farm projects for local renewable energy production.*

[2] *City administration's previous evaluation of this report determined that* "Understanding the complete ecosystem valuation (ecological, aesthetic, and social) of E.L. Smith Solar Farm through site investigation following scientifically proven standard method was not a scope of the HDR report. Therefore, the relative findings and comparative analysis as presented within the SLAJ and

HDR report should be considered with precaution.*" (Please see City Administration's March 2019 previous review comments and recommendations on the SLAJ-HDR Addendum report)*

	3	The E.L. Smith Solar Project provides significant potential for enhancing awareness of large scale renewable energy in Edmonton.		√		The ability for a solar farm to have significant potential for enhancing awareness is not dependent on a river valley location. Although this location provides high visibility and awareness to the project, no other locations outside the RV were evaluated
	4	Project provides significant social benefits from locating within the River Valley for improving Edmontonians quality of life including recreational experience		√		Approval of this project does not result in the building of any new trails or recreational infrastructure and technical documents provided do not assess the cumulative impacts of such trails on the area. The City utilizes many other methods to complete access and trail networks within other areas of the RV, therefore this social constraint is not dependent on the approval of a solar farm at this RV site.
	5	Project provides significant social benefits from locating within the River Valley for improving Edmontonians quality of life including aesthetic experience		√		The ability for a solar farm to have significant aesthetic value is not dependent on a river valley location. Indeed, aesthetics was a concern expressed by local communities and in public consultation documents. Many Edmontonians have expressed the River Valley as the jewel of Edmonton, although there are varying aesthetic values, locating them in the RV would not improve the, well documented, aesthetic values of many Edmontonians.
Social Constraints Evaluation			0	4	1	
Environmental		No Environmental constraints were identified in the submitted reports that make a RV location essential for this major facility. There were however multiple adverse impacts outlined in the submitted EIA documentation that will impact the ability "*to ensure preservation of the natural character and environment of the North Saskatchewan River Valley and its Ravine System*" (Goal #1, Bylaw 7188):				
	1	Project ensures preservation of areas which have potential wildlife habitat		√		An overall net loss of 19.7 ha of open meadow habitat (most notably for medium to large wildlife) and indirect effects due to sensory disturbance will result from this project should a RV location be chosen. See Section C.2a (below) for more details.
	2	Project ensures the maintenance of local and regional wildlife connectivity		√		Increased adverse impacts to the existing wildlife corridor/passage along the river through its lengthening by 220% from what currently exists are expected and not mitigated for. There will also be a wildlife barrier to access the river through the tame meadow which is proposed to be fenced. See Section C.2b for more details.
	3	Project does not result in wildlife mortality		√		Based on a review of existing scientific literature, the wildlife Addendum, and as confirmed in the original EIA, this project is expected to result in increased wildlife mortality in the area due to bird collisions with solar collectors. See Section C.3 for more details.

	4	Project meets “Site Selection criteria” (100.1 Standards) in preventing significant negative effects on wildlife following the Wildlife Directive for Alberta Solar Energy Project-AEP		√		[3]Wildlife Directive and 100.1 Standard was not applied to this project citing AUC Rule 007 that solar project review by AEP Wildlife biologist is not required when solar energy projects are located within urban areas. Therefore, no technical review on wildlife impacts was completed by Provincial Biologists during the Provincial review process. The Wildlife Directive states that “solar energy projects should not be sited in valleys of large permanent watercourses...”.
	5	Preservation of Native Vegetation: Project planned for the river valley and ravine system ensured that natural vegetation be preserved.		√		Project was not able to protect the remaining forested parkland vegetation, tame meadow and associated habitat within the project area. This could have been achieved through the adoption of primary mitigation measures.
Environmental Constraints Evaluation			0	5	0	
Institutional	1	River Valley ARP goals and objectives: Project supports the preservation, natural character and environment of the river valley and provides opportunities for recreational, aesthetic and cultural activities.		√		The project has adverse environmental impacts that remain unmitigated (see above and Section C.4). Building of recreational infrastructure is outside of the scope of this project. Natural character and aesthetics of the RV will be impacted by the introduction of industrial infrastructure.
	2	The Way We Grow and Breathe: Project will compliment multifunctional network of park and open space (green networks) that supports healthy ecosystems and diverse wildlife habitats, and meets the needs of communities present and future by connecting people with year-round opportunities to learn, commute, recharge, recreate, gather and celebrate.		√		Edmonton’s current MDP directs administration to “*Protect, preserve and enhance the North Saskatchewan River Valley and Ravine System as Edmonton’s greatest natural asset*” (Objective 7.3.1). The project will reduce the potential available open space and RV habitat (> 30 years) and negatively impact the green network and associated functions that are not found outside of the River Valley. There are a few opportunities for research and education on solar infrastructure related to this project, but a RV location is not required for this and Breathe, nor the MDP, does not prioritize green energy education at the expense of ecological, wellness and celebration networks.
	3	Community Energy Transition Strategy: Project aligns with the City’s ambition of generating 10% Edmonton’s electricity locally and to reduce greenhouse gas emission.	√			The project would contribute 0.28% to Edmonton’s total 10% goal of increasing locally produced energy. However, if locally is defined as the Edmonton area, then an argument could be made that the River Valley is not essential to achieve this
	4	Edmonton City Plan-Greener as We Grow: The project committed for good design and conscious decisions to preserve and protect our environment, promote climate resilience		√		[4]With appropriate mitigation measures to avoid, reduce, minimize and offset environmental impacts the project would promote sustainable development that generates renewable energy and protect the natural character of the river valley ecosystem. Currently the project does not provide such

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[3] *Wildlife Directive for Alberta Solar Energy Projects- Government of Alberta 2017 “100.1.1 Solar energy projects and temporary work spaces must be sited to avoid or minimize their occurrence in important wildlife habitats. Generally, solar energy projects should not be sited in areas of native grasslands, native parkland, old growth forest stands, named water bodies, valley breaks (including coulees), valleys of large permanent watercourses and the eastern slope region.” This Directive ensures that off-site locations will have reduced effects on wildlife if an alternative site is reviewed. Please refer to the Wildlife Directive for Alberta Solar Energy Projects for details*

[4] *June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890, Administration presented to Council that “Epcor has verbally agreed to collaboratively assist Administration in the development of a biodiversity offset framework which is intended to follow the mitigation hierarchy of avoid, minimize, restore and offset.”*

		and strengthen our ecological systems.				solutions. There has been no evaluation to determine if the project will result in overall net gains in climate resilience and therefore is unknown at this time.
	5	Draft Ribbon of Green: The project area is listed under a broader category of “Active/Working Landscape” and is consistent with the Draft-Ribbon of Green Classification.			√	The draft Ribbon of Green has not yet been finalized or shared with the City Council. The draft RoG classification is intended to facilitate expansion of the wastewater treatment functionality. Should the area not be required for facility expansion, the area is to be re-evaluated to determine the appropriate land use classification[xix].
Institutional Constraints Evaluation			1	3	1	
Cumulative summary of Constraints Analysis			**4**	**12**	**4**	

Section C: Review findings of the EIA addendum titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020

Upon review of the January 2020 wildlife addendum to the February 22, 2019 draft EIA, technical reviewers from Administration conclude the following:

1. With the exception of a few study gaps, the wildlife addendum collected additional wildlife ***baseline information*** that was requested by Administration to address outstanding EIA review items (see Section D).
2. The baseline information collected supports Administration's original conclusions about ***negative impacts to biodiversity*** in the area, specifically around:
    a. Habitat loss and fragmentation with an overall net loss of 19.7 ha of habitat (most notably for medium to large wildlife) and indirect effects due to sensory disturbance.
    b. Connectivity impacts: in particular increased adverse impacts to the existing passage along the river through its lengthening and blockage of wildlife access to the river through the open meadow
3. The additional work completed does not address previously outlined concerns around reducing future ***wildlife mortality*** due to bird collisions of the project
4. With this new baseline information, technical reviewers from Administration feel there are ***missed mitigation opportunities*** to further reduce environmental impacts through the application of the mitigation hierarchy (avoid, minimize, restore and offset).

Given the above, technical reviewers within Administration have not found that the Municipal Environmental Impact Assessment (MEIA) as submitted avoids, or significantly reduces, the adverse environmental effects predicted to result from the project. Background and supporting information related to each of the four conclusions above are listed below.

1) Summary of baseline information

Both the Municipal Environmental Impact Schedule A (Bylaw 7188) and the Alberta Utilities Commission Rule 007 (AUC 2017) requires that proponents of solar farm projects ensure that environmental information, effects and mitigation are addressed in the application. These documents and best management practices dictate that pre-construction wildlife surveys are key components to inform appropriate site selection and mitigation of impacts to wildlife and wildlife habitat from the construction and operation of solar energy projects.

Administration's previous review of this projects EIA[4] outlined that the report was incomplete because wildlife assessments were not completed for many of the species expected in the area. As such, the Administration requested further biodiversity information and monitoring to fill in this gap (see Section D). Most of Administration's requests were completed with the exception of:

- Wildlife trail camera placement within the corridor along the river to assess existing use of this corridor by wildlife

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[4] December 2019, "*Second Circulation Comments on AA18-13 EL Smith Solar Farm EIA and SLAJ Report, NW 3-52-25 W4M and SW 10-52-25 W4M, Edmonton, Alberta*"

- Temporary wildlife trail camera placement at the center of the tame meadow
- Summer browse/pellet counts
- Descriptions of proposed native seed mix to be used under the solar panels

From the additional biodiversity monitoring that was completed, the following wildlife information was found:

Birds:

- 23 bird species were identified; some species used both forested and tame meadow while others specialized in one vegetation community (e.g. savannah sparrow found within the tame meadow area)
- two species of management concern were identified:
    - common yellow throat which live in thick, tangled vegetation in a wide range of habitats but are most common in wet areas, which tend to have dense vegetation low to the ground.
    - least flycatcher which breeds in deciduous or mixed forests and occasionally in coniferous stands with a preference for breeding sites near clearings or edges.
- Species diversity scores were not shown to be statistically different between the forested and tame meadow vegetation communities

Medium-large mammals:

- Urban adapted mammal species: coyote and deer were detected across the Local Area of Assessment (LAA) in both the forested and tame meadow area
- Large ungulates:
    - Elk was found along the south edge of the LAA in both the forested and tame meadow area
    - Moose was detected at one site, along an existing access road
    - Because there was no monitoring site within the corridor along the river, it was not possible to determine if urban sensitive species such as moose and elk utilize this area for movement
- Other medium mammals found included porcupine and red fox
- Track counts showed:
    - high deer use of both forested and tame meadow areas depending on season
        - Tame meadow areas were more highly used in the November 2019 sampling session, with the report suggesting this is likely due to deer use of the open meadow during ungulate rut
        - Forested areas had higher track counts in the January 2020 sampling session, likely a result of deer utilizing this habitat for shelter during cold periods
    - Number of species observed was similar for both forested and tame meadow habitat when sampling effort is taken into account (i.e. 1.3 species/km days sampled for each habitat type)

Other:

- Small mammals: no species specific surveys were completed, but track counts identified snowshoe hare, red squirrel, short tailed weasel, and small rodents (mice and voles)
- Bats: no species specific surveys completed
- Reptiles: no species specific surveys completed

2) Negative impacts to biodiversity

a) Habitat loss and fragmentation

With this new baseline biodiversity monitoring data, technical reviewers are better able to review the potential impacts of the project on wildlife habitat in the area. Contrary to the EIA suggestion that the tame field provides "*low suitability habitat for wildlife species*", this baseline data supports Administration's December 2018 conclusions that such meadow openings within the river valley's forest matrix are important habitat for wildlife. In particular, this baseline data:

- Provides evidence that both bird and mammals species utilize the tame meadow
- Of the large mammal species with enough information to analyze (i.e. deer) both the forested and meadow habitat is used for different life history requirements (e.g. browse, shelter) in different seasons
- More urban sensitive species such as moose and elk were detected in the area, highlighting the role that the site has in maintaining regional wildlife connectivity and migration for species that are not known to stay locally (i.e. non-resident species)
- Shows urban adapted mammal species (coyote and deer) were detected across the Local Area of Assessment (LAA)
- Identifies wildlife species (e.g. least flycatcher) that benefit from the edge habitat created between the forested and tame meadow habitat types
- Shows number of species observed was similar for both forested and tame meadow habitat when sampling effort is taken into account (i.e. 1.3 species/km days sampled)

The Province defines wildlife habitat as "*the terrestrial and aquatic environments and **associated ecosystem elements** that in combination provide the requirements of food, shelter and space needed to support self-sustaining populations of wildlife.*" This tame meadow area, while disturbed, has been demonstrated to be a key matrix component of the City's ecological network that is surrounded by one of the Edmonton Region's best remaining biodiversity core areas.

With respect to this project, there will be significant long term (>30 years) habitat loss in the form of a tame meadow area that, given the current configuration of the existing fence, is permeable to both terrestrial and aerial wildlife. As such, It is unclear how a net of only 0.7 ha of new forest plantings will offset the net loss of 19.7 ha of tame meadow habitat currently used by native wildlife.

In addition, the EIA outlines that indirect effects (e.g. sensory disturbance) on habitat are "*predicted to be adverse and extend into the LAA*" for the duration of the project (30 years). This conclusion is supported by research which has shown that the construction and operation of solar farm infrastructure has resulted in habitat loss and fragmentation in other areas (BLM and DOE 2012). Solar energy infrastructure and associated construction and operational activities can result in decreased habitat quality and/or lead to avoidance of the area by some wildlife species. Additionally, it can attract more urban adapted species, such as magpies or ravens (Knight and Kawashima 1993, Kristan and Boarman 2003, Lovich and Enne 2011), potentially compounding the loss of more sensitive wildlife from the area.

The draft EIA does make the following statement "*The removal of perennial pasture and replacement with approved native seed mix is expected to increase habitat function and species diversity for small mammals during operations.*" However, it is not clear what mechanism or research supports that a naturalized seed mix is going to be better (or worse) than the tame meadow which is currently present. Confounding this hoped for outcome is the fact that there is no discussion on how a native seed mix (or its associated small mammal population) responds to being shaded by solar panels or solar infrastructure maintenance. More information is required if the EIAs statement is to be supported.

In August 2019, the Administration did request further information on the proposed native seed mix and what wildlife the proposed mix was to support. No further information has been provided in the EIA addendum or was submitted through other materials.

b) Connectivity impacts

Now that site-specific wildlife surveys have been conducted to assess pre-development wildlife use of this area, it has been confirmed that, with respect to wildlife movement, the meadow is highly permeable to both terrestrial and arboreal wildlife movement as evidenced by the presence of moose, deer, elk coyote, and other wildlife. It also confirms that the following statements in the EIA are not supported by ground truthed site specific surveys, indeed, many of the statements are in opposition to what is now known about the use of the site:

- ”*...existing movements of wildlife through the PDA may be limited.*”
- “*...the lower pump house north of the PDA and E.L. Smith WTP likely limits movement of wildlife along the NSR currently.*”
- “*...the narrow passage underneath the highway may effectively prohibit many wildlife species from crossing under the Henday.*”
- Suggestion on page 4.5 that the project area is not part of the ecological network and does not provide an ecological linkage function.

The February 2020 EIA wildlife addendum only suggests an update to one of the EIAs conclusions: it estimates an increase in the expected adverse magnitude of effects of the project on wildlife movement in the area. However, no new mitigation proposals are submitted.

With respect to impacts to wildlife connectivity specifically along the river corridor, this technical review concurs with the analysis outlined in the draft EIA that the development of the proposed solar infrastructure (fence and panels), will have a significant impact to wildlife connectivity within the area for the extent of the project’s life (>30 years) - “***primarily at the 100 m buffer along the NSR***” (page 6.16). This is because there will be an increase in length of the corridor from 0.56 km (existing length of corridor) to 1.8 km (post construction). This results in a lengthening of the blockage of wildlife access to the river by 220% and provides limited avenues for escape for wildlife for almost 2 km along the proposed river ”corridor”. Again, however, no new proposed mitigation measures have been included in the EIA addendum to address this project’s impacts on wildlife connectivity.
This will negatively impact both local and regional connectivity for multiple to tens of generations of wildlife (>30 years) depending on the natural history characteristics (e.g. life expectancy, habitat preferences, urban adaptability) of the wildlife species in question. These impacts have not been adequately addressed in this draft EIA, therefore, the claim that the “*project preserves existing ecological connectivity*” is not supported.

In the absence of having completed any wildlife monitoring within the existing 0.56 km river corridor (i.e. no camera and limited track transects were placed within the center of the corridor), the EIA (page 6.18) does attempt to provide literature support for continued use of a lengthened 1.8 km corridor and refers to research about how coyotes and deer utilize urban environments and then

attempts to suggest that this shows that 100m wide corridors are used by wildlife in general. However, the conclusion drawn is inappropriate for this area because:

- the scientific references used do not assess 1.8 km long, 100m wide corridors, the research was only assessing wildlife use of buffers between urban environments that was next to habitat patches
- the references are limited to only two urban adapted species (coyote and deer) and are not likely applicable for some of the more urban-avoiders now shown to use the project site (e.g. moose, elk)
- Therefore, the conclusions drawn based on these references that all wildlife movement between habitat patches can be accommodated within 100m corridors is not supported by the studies referenced.

Currently, there is no site-specific data, or support, that wildlife species will use a 1.8km long-100 m wide buffer for movement along, or access to, the river. As noted in the draft EIA, the project is located "*within the NSR Valley which is a provincially significant Natural Area and a regional biological corridor*." The area's significance to regional biodiversity and connectivity has been reaffirmed in multiple planning documents (Ribbon of Green 1992, GeoWest 1993, Natural Connections 2007, Breathe 2017). The Province of Alberta also identifies the significance of this area and classifies the North Saskatchewan River Valley as a Key Wildlife Biodiversity Zone (KWBZ, ESRD 2015). The "*KWBZ is ... identified for its contribution to wildlife migration corridors. The zones are intended to prevent loss and fragmentation of habitat, maintain migration corridors, prevent vehicle access, prevent sensory disturbance during energetically stressful periods for wildlife, and prevent barriers to wildlife corridors*"

Important climate resilience consideration

Maintaining ecological connectivity is recognized as a key strategy for climate change resiliency (Heller and Zavaleta, 2009; Hilty et al., 2006; Stein et al., 2014), in particular, maintaining or restoring riparian corridors (Crist 2013). As the climate continues to change local and regional species will experience increased stress and continued habitat loss. As such, Path 5 of Climate Resilient Edmonton[5] sets the City on a path to prepare for changing ecosystems, with Goal 10 outlining the need to ensure "*Edmonton's natural ecosystems continue to provide essential ecosystem goods and services such as clean air, clean water, and biodiversity.*" Therefore, projects that encourage continued anthropogenic fragmentation of important biodiversity corridors, as is found in the River Valley, should also be viewed with a lense to impact the City's ability to achieve its climate resilience as well as biodiversity goals.

Important cumulative impact consideration: potential impact of future recreational trails

Another item to consider with respect to the impact of future wildlife use in the project area is with respect to recreational trails. Specific to connectivity, research has shown that edge effects of trail development reduces wildlife use of an area within at least 100 m of trails (see "Figure 5"; reproduced from Lenth, Knight, and Brennan 2008. Natural Areas Journal). Because of this depth of edge effect it is expected that there will be a large percentage of the area within the 1.8 km-100m wide corridor that will become unsuitable for species of wildlife should a trail be located within any remaining wildlife corridor (even though the habitat may be otherwise suitable).

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[5] Climate Resilient Edmonton: Adaptation Strategy and Action Plan (2019)

This issue will be further compounded should a wildlife impermeable fence further impede the ability of wildlife to move safely away from human recreational use to avoid human/wildlife conflict in proximity of the trail. Therefore, both the Administration and Council should consider impacts of future recreational trails on wildlife connectivity and habitat use as a cumulative impact to this project.

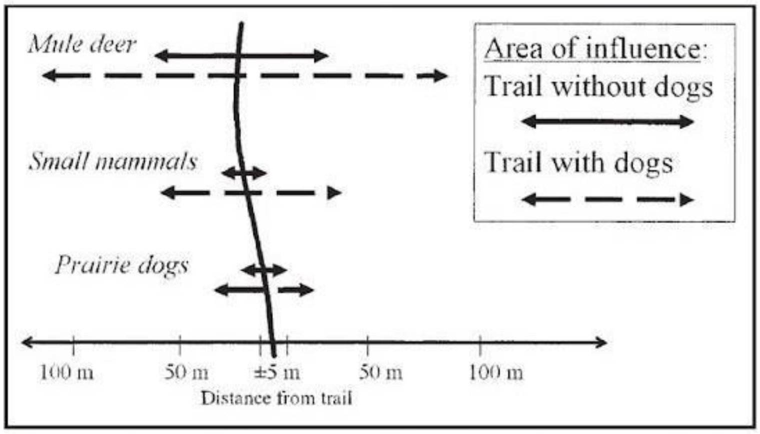

Figure 5. Conceptual diagram of the effects of recreationists alone or recreationists with dogs on mule deer and small mammal activity and prairie dog burrow location within a trail corridor in a protected area.

3) Continued Wildlife mortality

Based on a review of existing scientific literature, the wildlife Addendum, and as confirmed in the original EIA, this project is expected to result in increased wildlife mortality in the area due to bird collisions with solar collectors. We also concur with the draft EIA conclusion that the few mitigation measures that do exist around preventing bird mortality have not been proven to be effective at this time.

Contrary to what is stated in the Wildlife EIA addendum (page 3.7), increased research in recent years has documented that wildlife mortality does occur at multiple solar energy projects across North America (Kagan et al. 2014, Walston Jr. et al. 2016). Most research has focused on the risk to birds due to collision with solar collectors where they are either killed on impact or are stranded after impact and die from predation, injuries, dehydration or starvation (Kagan et al. 2014, Huso et al. 2016, Walston Jr. et al. 2016). It is thought that waterbirds in particular are attracted to solar farm areas as the polarised light reflected off of panels may be similar to light reflecting off water (Horvath et al. 2009, Kagan et al. 2014). However, song birds have also died due to collisions and stranding, likely as a result of foraging for insects that are attracted to solar collectors and congregate in areas with warmer temperatures above the panels (Horvath et al. 2009, Hernandez et al. 2014, Kagan et al. 2014).

The mortality impacts of solar farms become that much more important to consider when solar projects are proposed in important wildlife zones. It is also important to note that the Local Area of Assessment is in immediate proximity to known waterfowl breeding and loafing habitat. By being surrounded by natural upland, water bodies and arboreal corridors, a solar farm at this location may

increase the likelihood of the solar farm being viewed as aquatic habitat. In addition, the surrounding natural habitat will also be attractive to avian predator populations which are known to increase their use of an area when above-ground structures associated with solar farm infrastructure can act as perches (Helzer 1999, Barber et al. 2010,Lovich and Enne 2011, BLM and DOE 2012, Grippo et al. 2014). Research on mortality sinks around solar farms has yet to be studied.

The draft EIA does indicate that the project will "*increase the risk of mortality primarily due to the potential for birds to collide with solar panels.*" However, it then goes on to suggest that the implementation of two untested mitigation measures will be used until such point when "*mortalities are documented to be above acceptable limits.*" Despite this commitment, Administration has not yet received the following documents requested in our August 2019 comments (Section D):

- Prepare wildlife monitoring and mitigation plan which is to be approved prior to the project being constructed
- Within this plan, define how "unacceptable risk" will be measured by the project
- Propose additional mitigation measures prior to project construction

4) Missed mitigation opportunities

Despite supporting the Administration's findings about the negative impacts of the project to habitat, ecological connectivity, and wildlife mortality, the EIA wildlife addendum articulates that no new mitigation measures will be required and none are proposed. Therefore, this conclusion does not address City Administration's recommendation to mitigate the predicted long term adverse effects on habitat loss and fragmentation, connectivity and wildlife mortality.

At the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890, Administration presented to Council that "*Epcor has verbally agreed to collaboratively assist Administration in the development of a biodiversity offset framework which is intended to follow the mitigation hierarchy of avoid, minimize, restore and offset.*"[6]

Global practice[7] in the exploration and implementation of biodiversity offsets starts with a demonstration that all reasonable steps have been taken within the mitigation hierarchy prior to moving on to offsetting.[xx] After it has been illustrated that steps to avoid and minimize ecosystem impact and biodiversity loss have been incorporated into a project's design, the project can then proceed to the final step of the mitigation hierarchy which is called offsetting. Conservation actions that are not designed to result in No Net Loss and preferably Net Gain are not considered biodiversity offsets.

Given the direction above, the following mitigation review is provided in an order of priority that aligns with the IUCN's recommendations of:

I. Avoid;
II. Minimize;
III. Restore/rehabilitate and offset

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[6] Administration's presentation to Council at the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890. Refer to timestamp 6:33:40 of the June 17, 2019 Council minutes: http://sirepub.edmonton.ca/sirepub/mtgviewer.aspx?meetid=2264&doctype=MINUTES

[7] Biodiversity Offsets: Effective Design and Implementation (http://www.oecd.org/env/resources/Biodiversity%20Offsets_Highlights_for%20COP12%20FINAL.pdf)

I. Avoid: move project site to an area that reduces impact to the North Saskatchewan River Valley which is a Provincial Key Wildlife Biodiversity Zone

The literature is clear that the most important factor to consider in the review of significant solar infrastructure is appropriate site placement because biodiversity impacts are highly site-specific. As with any infrastructure project, well-sited solar infrastructure minimizes impact on biodiversity and limits the need for mitigation measures. For example, research back to the 1990's points to the fact that solar energy infrastructure has inherently low impacts on wildlife when integrated into an existing anthropogenic footprint such as on rooftops.[8]

The Province of Alberta also has clear guidelines that solar projects should be sited to avoid or minimize their occurrence in important wildlife habitats. Areas such as native parkland and "*valleys of large permanent watercourses*" (e.g. North Saskatchewan River Valley) should be avoided in order to avoid or minimize solar power infrastructure in Provincially mapped Key Wildlife and Biodiversity Zones - such as the area of the LAA. This Directive ensures that off-site locations will have reduced effects on wildlife if an alternative site is reviewed. Municipally, the City of Edmonton also has multiple Bylaws and Policies that speak to the prioritization of nature conservation and restoration within the North Saskatchewan River Valley including the area in question.

Given the IUCN Policy on Biodiversity Offsets,[9] scientific research of solar farm impacts on biodiversity, Provincial guidelines and Municipal Policy direction, from an environmental perspective the best scenario is one in which the solar farm footprint is moved outside of the River Valley which is Edmonton's key wildlife and biodiversity zone. Such avoidance will:

- Continue to enable the City to work towards achieving its renewable energy generation goals while also reducing greenhouse gas emissions;
- Show no net loss in wildlife habitat and connectivity
- As supported by the literature, result in reduced mortality of avian wildlife due to lower waterbird abundance in brown field or agricultural areas

Mitigation measures proposed for this project that support "avoidance":

- No avoidance mitigations have been proposed for this project
- Specifically, the Site Location Study provided was limited in its analysis and did not consider viable alternative location opportunities including utilization of degraded lands (e.g. brownfield sites, co-location of solar panels with underutilized land including industrial and agricultural land etc.) which is a common practice both nationally and internationally for utility scale solar farm site selection (see Section B for more details).[xxi]
- It has been mentioned that the long-term plan for this site is for future water treatment operation expansions as the City grows with the conclusion being that the site will eventually be disturbed, so there is no value to protecting it now. However, temporal avoidance of negative impacts to this site (of >30 years) while water treatment processes and infrastructure become more efficient and less ecologically invasive could eventually lead to permanent avoidance, or a reduced infrastructure footprint in the future, while allowing the site to act as habitat in its current (or restored) state until such time as water treatment expansion is required.

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[8] A detailed reference list that supports this review can be found in Administration's Second Circulation Comments on AA18-13 EL Smith Solar Farm EIA and SLS

[9] https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_059_EN.pdf

- It is noted that the project proponent is exploring a competitive procurement for new renewable power from a wind farm in southern Alberta for the remainder of grid sourced electricity used by Water Services[10]. By procuring additional renewable power from this source negative environmental impacts related to renewable energy generation at this site can be avoided.

II. Minimize: reduce the size of the project footprint

Should it be determined (through Council approval of the site location) that a River Valley location is required, the next step in the mitigation hierarchy is to minimize project impacts. Such impacts would be most effectively minimized by reducing the footprint of the solar farm[11]. This would:

- Reduce wildlife mortality by reducing the size of the perceived solar "lake";
- Limit habitat loss due to retention of a portion of the tame meadow;
- Enable the creation of a wider bigger buffer along the valley edge to maintain more effective wildlife movement; Corridor along the NSRV that is wide enough to offset the trail edge effects of human use on biodiversity;
- Similarly, widen the vegetated buffer along the south edge of the site

Current mitigation measures proposed for this project that support mitigation through "minimization":

- A 100m setback from the river is proposed:
    - Due to the lack of site-specific data collection, it is unknown if urban-sensitive wildlife (e.g. elk, moose, some medium mammals) will use a lengthened 1.8 km long corridor (a 220% increase from the original corridor length), especially if a formal recreational trail is developed within it for the future.
- A 40 metre vegetated buffer along the south edge of the site was proposed:
    - This review took into consideration that it will take 30-50 years for this buffer to mature and become effective as the proposed forested wildlife corridor.
    - Site specific information currently shows that only urban adapted wildlife species use the 30m pinch point to the NE of the existing Plant, putting caution into evaluating the effectiveness of a 40m buffer for use by urban sensitive species.
- See Section C2b for supporting details

III. Restore/rehabilitate and offset

The IUCN Policy on Biodiversity Offsets indicate that "*Only after applying the earlier steps in the mitigation hierarchy should biodiversity offsets be employed to address the residual impact in order to achieve at least No Net Loss and preferably a Net Gain at the project level. Conservation actions intended to achieve offset outcomes must result in a direct measurable biodiversity gain equivalent to the residual loss arising from the impacts on biodiversity associated with a project in order to be considered a biodiversity offset. Conservation actions that are not designed to result in No Net Loss and preferably Net Gain are not biodiversity offsets.*"

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[10] Epcor Water Services Inc. Water Services & Drainage Services 2020 Annual Operational Plans (Page 33), accessed from http://sirepub.edmonton.ca/sirepub/cache/2/pdo0hprlwm2bb0i3h3ibvfz0/91052702232020063820732.PDF

[11] Original 2017 proposal was for a 5MW facility. Other options include reducing to 10MW or less.

Using these guidelines, the following options were explored for their ability to provide "restoration and biodiversity offsets" that would result in biodiversity gain for the project:[xxii]

- Onsite restoration/biodiversity offset options:
    - Avoidance (as above) and restoration of a portion of the existing tame meadow;
    - Restoration/enhancement of current "pinch points" of the site (e.g. the impacted area to the NE of the existing power plant)
    - Commitment for long term protection of restored tame meadow, surrounding natural areas, and widened river buffer;
    - Allowance for wildlife movement to the River from forested areas, potentially through a W-E corridor
- Offsite restoration/biodiversity offset options:
    - Improve connectivity/habitat at other Epcor owned sites within the river valley
    - Identification and protection of currently unprotected and previously cleared sites within the River Valley in order to gain a favourable offset ratio.
    - protection of currently unprotected sites within the River Valley or tablelands in order to gain a favourable offset ratio.
    - Such biodiversity offsets would potentially see local increases in biodiversity in an area away from the project's area of impact
    - Long term biodiversity protection would be ensured if restored areas were held in protected area status

Current mitigation measures proposed for this project that support "restore/rehabilitate and offset" do not meet the standard of No Net Loss are therefore not considered as biodiversity offsets[xxiii].

For example:

- The project proposes a net gain of 0.7 ha of new forest plantings.
    - Taking this net gain of potential habitat into account, the project does not offset the net loss of 19.7 ha of tame meadow habitat currently used by native wildlife.
- While a vegetation plan was mentioned as a mitigation measure, neither the EIA nor the SLS provides information on the proposed revegetation of the fenced area that will exclude medium-large mammals. Given this, there is no ability for reviewers to assess how a native seed mix (or its associated small mammal population) responds to being shaded by solar panels and other solar infrastructure.
- There is mention in the SLS that the proponents propose to transfer 12.7 hectares (31.5 acres) of sloped forested land to the City for permanent protection. While permanent protection improves the long term certainty of biodiversity conservation for this parcel , the City has not yet assessed the status of these lands, nor is there any agreement in place for a land transfer. Ownership of land does not constitute a biodiversity offset under IUCN standards however; the City has not yet developed its own biodiversity offsets and long term protection of key corridors could be considered when the City initiates formal biodiversity offsets standards.

Important notes on monitoring plans:

- They are not considered a mitigation tool
- Rather they are required under a Biodiversity Offset Framework to monitor for "*direct measurable biodiversity gain equivalent to the residual loss arising from the impacts on biodiversity associated with a project*"

- As such, the project commits that "*Wildlife monitoring (during and post construction) as well as vegetation monitoring will be implemented to evaluate the effectiveness of and to adapt the mitigation measures and an annual monitoring report will be provided to the City and Alberta Environment and Parks*"
- The SLS indicates that the wildlife monitoring and mitigation plan is to be approved prior to the project being constructed.

Section D: Review findings of Sustainability Value Analysis of the E.L. Smith Solar Farm Project – SLAJ Addendum Report dated January 2020

EPCOR though this addendum report acknowledge a broader range of literature that was suggested by City reviewers through previous revision These studies include ecosystem valuation of forest and grassland ecosystems in the close proximity of urban areas that have considered social and recreational values of specific ecosystems that was not considered previously in the HDR report. The break even analysis presented with an addendum report did not acknowledge social and recreational values given the assumption that the E.L. Smith site is a restricted access, fenced and maintained for the potential future expansion and not available for recreation.

Outcomes of one scenario that consider ecosystem valuation including social and recreational values would significantly reduce the projected benefit of the project (From $18.7 million differences to $2-3 million for high end ecosystem values as shown under Table 3, Page 8). Although EPCOR suggested literature for additional reference (Table 3, Page 8 of HDR Addendum Report) but did not consider potential outcomes of those scenarios for consideration under the summary and recommendation section of the addendum report[xxiv].

Our outstanding comments in review of site justification analysis still remain the same. Understanding the complete ecosystem valuation (ecological, aesthetic, and social) of E.L. Smith Solar Farm through site investigation following scientifically proven standard methods was not a scope of the HDR report. Therefore, the relative findings and comparative analysis as presented within the SLAJ and HDR report should be considered with precaution (Please see City Review Memo on SLAJ 2019 for more detailed review comments).

The HDR report considered the E.L. Smith Solar Farm Project site predominantly represents the grassland Ecosystem for the valuation estimates[xxv]. The prairie grassland ecosystems in general were identified for lower ranges of valuation estimates as compared to other ecosystems. In our opinion, the E.L. Smith Solar Farm Site is a part of Aspen Parkland Ecoregion that supports a transitional grassland ecoclimate. Most of the parkland ecoregion is now farmland but in its native state, the landscape was characterized by trembling aspen, mixed tall shrubs, and intermittent grassland. The majority of the project site is visibly disturbed but given the intact natural forest habitat within its surrounding areas and remnant forested patch inside the E.L.Smith Solar site, this location should be treated as a Aspen Parkland ecosystem as compared to the prairie grassland.

(Note: E.L. Smith Solar Farm EIA and associated biophysical assessment have identified the majority of wildlife/bird species are associated with the Aspen Poplar Woodland Alliance vegetation community that was detected within the PDA).

Section E: Administration’s outstanding review items of “*Municipal Environmental Assessment for the E. L. Smith Solar Farm (February 2019)*”

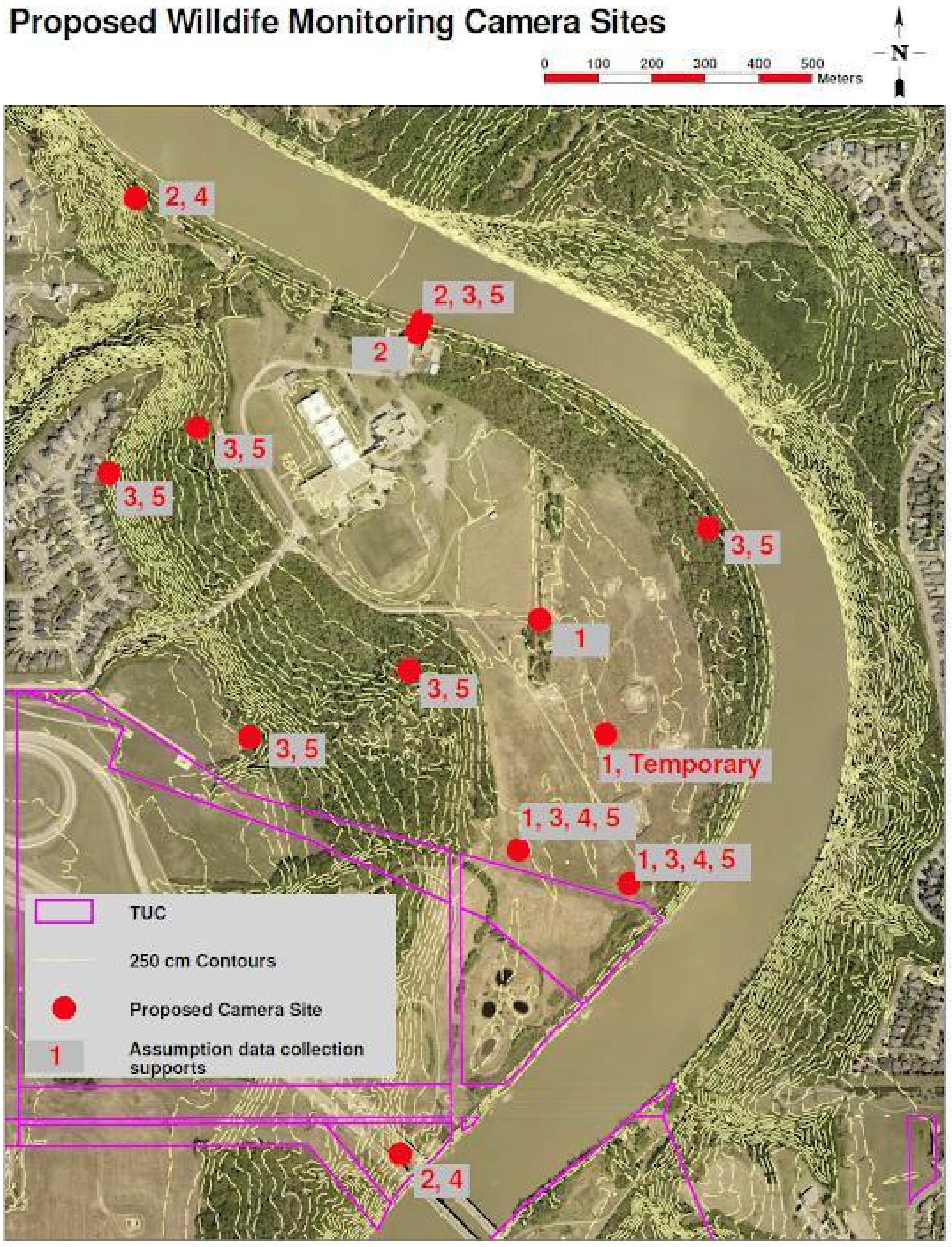
Open Space Strategy outstanding review items of *Municipal Environmental Assessment for the E. L. Smith Solar Farm”* dated February 2019
August 19, 2019

Outstanding Issue	**Gap**	**Approach proposed to date**	**CoE Mitigation Review Approach*** **
Impact on Habitat Loss and Fragmentation	-See Key Assumption 1* -Conclusion III, IV, V (Bullet 1)** -Issue: B, C, F (f)**	-Camera grid -Winter tracking -Summer browse and pellet counts -Proposed native seed mix: monitor to ensure its effectiveness **-Other approaches can also be proposed for consideration**	Propose mitigation measures in the following order: 1) Avoid impact, 2) Minimise impact, 3) Restore and 4) Offset impacts.
Impact on Connectivity	-See Key Assumptions 2-5* -Conclusion III, IV, V (Bullet 2)** -Issue: D, F (a-e)** -Assess movement between slope and riparian habitat -Impact of fence on other species, like ground nesting birds	-Camera grid -Winter tracking -Summer browse and pellet counts **-Other approaches can also be proposed for consideration**	Propose mitigation measures in the following order: 1) Avoid impact, 2) Minimise impact, 3) Restore and 4) Offset impacts.
Impact on Wildlife Mortality	-Conclusions II, IV, V (Bullet 3)**	-Prepare monitoring plan -Define unacceptable risks -Commit to public release of reports -CoE to be considered regulatory agency **-Other approaches can also be proposed for consideration**	Propose mitigation measures in the following order: 1) Avoid impact, 2) Minimise impact, 3) Restore and 4) Offset impacts.
Other	-Conclusion I** -Issue A, C, E, G** -Public confusion that recreational trail construction and approval is part of this project -Lack of clarity of trail location and impact	-Update based on baseline data review -Clearly state location of trail easement has not been determined, trail building is not part of this project, and that cumulative impacts of project and any future trail remains to be assessed (especially if proposed through corridor on east of PDA)	Update based on obtained information

*Document title: “Proposed Epcor Solar Wildlife Camera Monitoring Plan” (June 13, 2018)
**Document title: “*Urban Analysis review of wildlife assessment and results outlined in the report titled Municipal Environmental Assessment for the E. L. Smith Solar Farm” dated February 2019*” (March 12, 2019)
***See also:

- mitigation comments in Administrations December 6,2018 comments; ensure outstanding comments are addressed

- Administrations April 2019 comments which state: "*...it is the assessment of this review that it has not been demonstrated that the proposed mitigation measures will minimize the predicted long term adverse effects on: Habitat loss and fragmentation, ...Connectivity, ...and Wildlife mortality due to bird collisions with solar collectors...*"; ensure additional mitigation measures are explored and presented



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[i] The statement is absolutely not correct since the review utilized a standard of review that is not outlined in Bylaw 7188 nor in the Terms of Reference for E.L. Smith Solar Farm Project (TOR) that was provided by the Open Spaces team to EWSI on August 9, 2019 to prepare the SLS. The Open Spaces team's technical review invents a standard of review for the "essential" test using twenty "criteria" which are unique to the Project, were not provided to EWSI in advance and have not been used for other City essential tests. The twenty "criteria" were not included in the terms of reference for the SLS provided by the Open Spaces team to EWSI on August 9, 2019.

The Environmental Impact Assessments and field work completed to date by Stantec far exceed anything outlined in Schedule D of the Bylaw and includes work that is not typical nor ever done for public projects (winter snow track surveys, wildlife camera monitoring, triple bottom line analysis).

Additionally, this technical review assessed the SLS, MEIA and Wildlife Addendum utilizing the IUCN Policy for Biodiversity Offsets as the standard to meet which is not identified in the Bylaw, the TOR nor has been adopted into any policy by the City of Edmonton.

[ii] The statement that EWSI's Site Location Study (SLS) did not include any new information from the EWSI's June 2019 Site Location Analysis and Justification Report is not correct. Significant new information included in the SLS includes the following:

The SLS included updated information in the institutional constraints evaluation to reflect the latest policy and planning documents issued by the City of Edmonton such as the "ConnectEdmonton" strategic plan for 2019-2028. The Project clearly aligns with the City's Climate Resilience goal sited under this strategic plan by expanding on renewable energy generation to mitigate climate change. The Project also directly aligns with this strategic plan because it will contribute to expanding renewable energy sources in Edmonton and will further serve as an example to educate businesses and residents about the importance of individual environmental responsibilities.

In addition, the SLS also included a new reference to City Council's August 27, 2019 declared climate emergency and direction to City Administration to bring back a revised Community Energy Transition Strategy in 2020 with a more aggressive ten-year action plan to achieve a 1.5 degree global average temperature increase. The Getting to 1.5^{O}C report, presented to City Council in August 2019, emphasized the importance of renewable energy sources in achieving these goals. The E.L. Smith Solar Project, if approved, would not only contribute towards Edmonton's Community Energy Transition Strategy but would also provide significant potential for enhancing education and awareness of large scale renewable energy in Edmonton.

In the Financial Constraints section of the SLS, EWSI provided updated information on HDR's Triple Bottom Line study. The HDR Triple Bottom Line study was updated with an Addendum to included references to additional ecosystem values that the Open Spaces team requested be included.

Furthermore, in the SLS, EWSI also provided updated information on additional wildlife data collected and reported in Stantec's Wildlife Addendum to the MEIA, which demonstrated evidence of mammal use observed throughout the Project area and that wildlife is successfully using narrow corridors adjacent to the E.L. Smith Water Treatment Plant as effective passage through the area. Therefore, Stantec concluded that development of the Project is unlikely to prevent wildlife movement along the North Saskatchewan River.

Finally, the SLS included new information about the importance of the E.L. Smith site to meeting the current water demand of both Edmonton and surrounding regional communities. As well, the use of the site in the future to expand water treatment facilities to meet future water demand growth.

[iii] The Open Spaces team's technical review is critical of "hypothetical" alternative locations being used to compare with the Project and suggests that the essential test can only be completed if a full environmental assessment is done for an alternative site. This is inconsistent with previous essential tests where the City has evaluated projects against hypothetical alternatives. It is unreasonable to require that a MEIA be completed on an alternative site. Furthermore, EWSI's conclusions would not be materially different using a specific brownfield location within Edmonton as opposed to a hypothetical offsite location, as suggested in the Open Spaces team's technical review. EWSI evaluated the Project against a hypothetical offsite solar farm location which was based on very conservative estimates for land purchase costs in rural areas near Edmonton. As such, if EWSI had used a specific brownfield site located within Edmonton as an offsite location as the Open Spaces team's comments suggest, the land costs would likely be similar or higher and EWSI's overall conclusion (that the E.L. Smith Project is $16 million (40%) lower than an offsite solar farm location) would not be

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materially different.

EWSI looked at eight alternatives to the Project which were presented in detail in its report to Utility Committee August 2018 (attached to the SLS) and HDR looked at five alternatives in its Triple Bottom Line Report. In other public project SLS's that EWSI reviewed and which were accepted by City Administration, the proposed Project is compared to hypothetical alternatives.

[iv] The HDR Triple Bottom Line Report evaluated the Project, not just on a financial basis, but on a triple bottom line basis which considers environmental, social and financial considerations. Refer to Attachment 2A of the SLS, page 9 of 41 where HDR states: *"The triple bottom line framework reflects a holistic view of the project that takes into account not just the economic and financial aspects, but social and environmental impacts as well."*

[v] As stated in EWSI's comments above, there were several alternatives evaluated and 5 of which were evaluated by HDR on a financial, environmental and social basis.

[vi] EWSI was provided a Terms of Reference from the Open Spaces team, from which it developed its Site Location Study. However, the 20 criteria were not included in this Terms of Reference. Had EWSI been aware of the 20 criteria, it would have had the opportunity to address each directly in its SLS. These 20 criteria are unique to this Project, as such, EWSI could not have determined the 20 criteria from review of previous SLS's reviewed by City Administration.

[vii] The Open Spaces team's 5 financial criteria did not include the largest financial benefit of the Project which is the savings to the E.L. Smith Water Treatment Plant from reduced conventional power purchase costs from the grid and the associated wires costs. These financial benefits are detailed in EWSI's August 2018 Report to Utility Committee attached to its SLS.

[viii] The financial impact to ratepayers is discussed in the August 2018 Report to Utility Committee (page 4 of 5) which concludes that the E.L. Smith Solar Project is 40% ($16.6 million net present value) lower in cost to Edmonton water ratepayers compared to an offsite solar option.

[ix] The Municipal Environmental Impact Assessment ("MEIA") prepared by Stantec dated February 22, 2019, was the final engineering authorized version and not a "draft" version as stated numerous times in this technical review. This MEIA was the final version that was submitted after a number of reviews by the Open Spaces team and was then accepted by the City as the final version to include in the June 2019 Public Hearing.

[x] This statement is unreasonable and ignores the numerous mitigations identified in the MEIA and most notably EWSI's additional modifications to the Project size which resulted in an overall reduction in size from 62 acres down to 54 acres (a 15% reduction) ensuring a minimum 100 meter buffer along the river for wildlife connectivity, revegetation of a treed buffer along the southern boundary and replacing of "non-native perennial pasture" with "native seed mix" as detailed in the SLS and MEIA.

[xi] This statement is not correct. See EWSI comments above.

[xii] See EWSI's comments above regarding the 20 criteria.

[xiii] See EWSI's comments above regarding the financial criteria.

[xiv] As stated in the SLS, the BESS is funded by $10 million federal government grant. There are no additional costs to the ratepayer. This $10 million in grant funding from NRCAN to enhance the E.L. Smith Solar Project with a micro-grid system and approximately 4 MW Battery Energy Storage System will be lost if the Project is moved to an offsite location as this funding is only available to the E.L. Smith site due to its connection to load from the E.L. Smith Water Treatment Plant. As such, the $10 million in grant funding reflects a significant financial benefit of the Project which is not available at an offsite location.

[xv] HDR's triple bottom line analysis utilizes a break-even approach to attempt to monetize the environmental/social (ecosystem) value and this approach allows the decision maker (City Council) to assess the ecosystem value of the E.L. Smith land. However, HDR provides some guideance to the decision maker in their overall conclusion (page 4 of 21 of Attachment 2A to the SLS): "*From an overall evaluation perspective, if additionality and having local generation are required, then really there are two alternatives: (i) the Solar project at E.L. Smith and (ii) the offsite local solar farm. The Solar project at E.L. Smith can be developed at a much lower financial cost with both these alternatives providing equivalent emission reduction benefits. Decision-makers will have to determine whether the*

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project development at E.L. Smith could result in very significant ecosystem damages as highlighted in the breakeven analysis. This would seem implausible given the evidence in the economic literature and the findings of the Environmental Evaluation by Stantec Consulting."

[xvi] In light of re-engagement report with Enoch Cree Nation that was submitted to the City on Feb. 27, 2020 this will need to be re-visited as the commitments to Enoch include finalizing an MOU that will reconnect Enoch members with the land, water through ceremony, traditional harvesting, Indigenous naming and other activities to be determined.

[xvii] EWSI respectfully disagrees with this statement. While some of the community integration objectives, such as a demonstration site, may be available at an off-site solar farm located within the City of Edmonton, the accessibility and level of use, and thus the resulting effectiveness, of an alternative location while unknown, is likely to be less impactful at a location outside of the NSR Valley and offsite of the E.L. Smith Water Treatment Plant. An offsite solar farm will not be connected to EWSI operations and, as such, the opportunity to study renewable generation with industrial load in a behind-the-meter setting will not exist. Furthermore, as the $10 million grant funding for BESS is only applicable to a solar farm at the E.L. Smith WTP site, the associated research opportunities and experience with behind-the-meter smart grid systems will not be available at an offsite location.

[xviii] The statement that the financial benefits from "behind the meter" can only be applied to this facility because it is a municipally owned corporation is inaccurate. In accordance with EWSI's compliance under section 95(9) of the Electric Utilities Act, the tax savings are derived from EWSI being a municipally owned corporation and these savings are only available if the Project is located at the E.L. Smith site and if the majority of generation from the Project is used on site by the E.L. Smith Water Treatment Plant. Furthermore, as noted above, the largest financial benefit is related to the reduced conventional power and wires charges at the E.L. Smith Water Treatment Plant. These wires cost savings would also be available to a privately-owned company.

[xix] The Ribbon of Green draft classification is to facilitate expansion of water treatment and not wastewater treatment functionality. The Project fully aligns with the classification as the Project is an interim use until lands are needed for expansion. As stated in the SLS, E.L. Smith water treatment plant provides water to not only 65% of the Edmonton population but also approximately 190,000 regional customers around Edmonton. Expansion at E.L. Smith will be to support future long term growth both of Edmonton and of regional communities.

[xx] As stated in this sentence, there is a global practice for biodiversity offsets but as stated elsewhere in this document, the City has not adopted this global practice nor put into policy or bylaw any of its own standards for a biodiversity offset framework. It is for this reason that EWSI committed to work with City Administration as they develop their framework.

The review comments in this entire Section 4, incorrectly imply that EWSI must or has previously committed to meet this global practice (IUCN Policy for Biodiversity Offsets) or that EWSI has agreed to apply the IUCN No Net Loss framework for this Project. The assessment of the Project to this global policy is not part of the Bylaw nor standard practice by City Administration nor previously agreed upon with the City or provided in the TOR provided to EWSI.

[xxi] See EWSI's comments above regarding following the Terms of Reference provided by the Open Spaces team and following past practice for evaluation of alternatives.

[xxii] See EWSI's comments above regarding biodiversity offset framework and policy.

[xxiii] See EWSI' comments above regarding biodiversity offset framework and policy.

[xxiv] HDR considered the Open Spaces team's ecosystem values in its report and noted that the values reflected parks or recreational sites following concluding comments which indicate that even if the Open Spaces team's recommended ecosystem values are included in the analysis, the outcome of the analysis indicates that the E.L. Smith development still provides net public benefits:

In this review, HDR did not consider any valuations for grassland sites that are designated as "parks" as the E.L. Smith site is a restricted fenced site that is not available for recreation. As the site is contained within an urban forest, we note that recent valuations for urban forests in Canada are as high as $21,310 (in 2018$).

Additional sources of literature has been provided to be considered in this triple bottom line analysis. The range of ecosystem values from this literature ranges between $3,468 per hectare per year and $48,616. The values in these additional sources of literature are

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broadly consistent with that reported in the original HDR report for various biomes. However, the majority of this literature were not initially included in HDR's literature review as: (i) the review is not indicative of grassland ecosystem valuations but rather reflects a variety biomes; and (ii) the review is generally focused on parks or recreational sites.

HDR conducted economic analysis to determine the benefits of project development at E.L. Smith (as opposed to off-site solar) considering a wide range of assumptions including all ecosystem valuations as identified in the additional literature. Regardless of which of these assumptions are leveraged, including the high value of $48,616 per hectare per year, the CBA outcomes indicate that the E.L. Smith development provides net public benefits.

[xxv] This statement is incorrect. As indicated on Table 3 of the HDR Addendum Report (page 9 of 25 of Attachment 2B to the SLS), the HDR analysis includes Urban Forests as well as grassland sites as ecosystem value estimates from the economic literature. Furthermore, in the original HDR Report, (page 41 of 41 of Attachment 2A to the SLS), the HDR analysis include grasslands, woodlands, urban forests as comparator ecosystem value estimates from the economic literature.

Stantec

Memo

Date: March 11, 2020

Reference: Response to the City of Edmonton Technical Review of Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm – Wildlife Addendum

This document is a response to the City of Edmonton (the City) document dated February 27, 2020, titled "RE: Technical review of "*E.L. Smith Solar Project Site Location Study*" dated January 31, 2020 and the report titled "*Municipal Environmental Impact Assessment for the E.L. Smith Solar Farm – Wildlife Addendum*" dated January 2020". This document discusses the comments and statements made regarding the Municipal Environmental Impact Assessment (MEIA) Addendum produced by Stantec Consulting Ltd. (Stantec), other documentation is prepared by EPCOR Water Services Inc (EPCOR) to address the remainder of the comments.

Stantec has reviewed the City's comments in Section C of their response and would like to respond to certain assertions that have been made. These have been grouped by the topics below. Attachment A provides additional comments on specific comments made by the City in an endnote format.

Negative Impacts to Biodiversity

There are several statements about the Project's negative impacts to biodiversity throughout the document. The term biodiversity refers to the variety of species found in a defined area. In the case of the MEIA and its addendum, the Local Assessment Area (LAA) is the area being studied and to which Project effects are assessed. The LAA set for this Project has not been contested by either the City of Edmonton or the Alberta Utilities Commission (AUC) throughout the regulatory process. It is Stantec's assessment that, although there may be some changes to species composition within the LAA, it is unlikely that there would be a measurable change in biodiversity within the LAA.

Local and Regional Connectivity Impacts

The City review document expresses that they concur with the MEIA's analysis that the project will have a significant impact to wildlife connectivity within the area for the extent of the project's life and continues to discuss negative impacts to local and regional connectivity. The MEIA did identify a moderate magnitude, negative effect to wildlife connectivity which reflects the change in the ability for wildlife to move across the Project Development Area (PDA). Within the Local Assessment Area (LAA) there is other existing forested habitat that can support wildlife movement on the upslope side of the Project area as well as a biodiversity core area mapped on the south/east side of the river within Terwillegar Park that will remain intact and largely unaffected by the proposed project. It is therefore Stantec's assessment that both regional connectivity and connectivity through and across the LAA will be maintained.

The MEIA makes no claim of the significance of the impacts to wildlife connectivity. The methodology for this study specifically does not incorporate significance determinations as the City of Edmonton does not currently have a framework for determination of significance in environmental assessments and in the past has not agreed with Provincially and Federally accepted means of determining significance. A significance determination was completed for the EE submitted and approved under the AUC's Rule 007 and determined the effects to wildlife were not anticipated to be significant.

No Change to Mitigation Measures

The City review document makes comment that no changes in mitigation measures were made with the submission of the addendum document and has indicated that the data contained therein warrants more mitigation.

Despite the change in magnitude regarding wildlife connectivity, no new mitigation measures were identified as an adverse effect on wildlife movement in the area was already predicted and mitigation measures for this effect had already been incorporated into the Project design.

The proponent has taken several measures to reduce the potential effects of the Project. The initial Project footprint was larger and extended the solar farm to the existing tree line along the east and to their property line along the southern boundary. They have implemented a minimum 100 m buffer along the river and have also proposed to plant a treed buffer along the southern boundary of their property line, as a result of recommendations of the environmental assessment. These mitigations are predicted to provide a reduction in the effects to wildlife movement while still resulting in a net overall negative effect.

IUCN Offsetting Discussions

Throughout the City review document reference is made regarding how the Project, the MEIA, and the mitigations contained therein do not follow the International Union for Conservation of Nature (IUCN) Policy on Biodiversity Offsets[1] and other biodiversity offsetting literature. The MEIA was written to be compliant with the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188) and in consideration of other City of Edmonton policies. The methodology and approach to mitigation measures are consistent with other applications made under Bylaw 7188. Stantec is not aware of IUCN Policy being applied by or within the City of Edmonton on other applications nor was a request made to apply these concepts to the Project documentation in advance of submission.

CLOSURE

While Stantec/EPCOR will not be submitting the MEIA for further administrative review we respectfully request that the above and attached be documented regarding our position.

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[1] International Union for Conservation of Nature. Policy on Biodiversity Offsets. https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_059_EN.pdf

ATTACHMENT A

City Comments Excerpt

Section C: Review findings of the EIA addendum titled "*Municipal Environmental Impact Assessment for the E. L. Smith Solar Farm - Wildlife Addendum*" dated January 2020

Upon review of the January 2020 wildlife addendum to the February 22, 2019 draft EIA, technical reviewers from Administration conclude the following:

1. With the exception of a few study gaps, the wildlife addendum collected additional wildlife ***baseline information*** that was requested by Administration to address outstanding EIA review items (see Section D).
2. The baseline information collected supports Administration's original conclusions about ***negative impacts to biodiversity***[1] in the area, specifically around:
    a. Habitat loss and fragmentation with an overall net loss of 19.7 ha of habitat (most notably for medium to large wildlife) and indirect effects due to sensory disturbance.
    b. Connectivity impacts: in particular increased adverse impacts to the existing passage along the river through its lengthening and blockage of wildlife access to the river through the open meadow
3. The additional work completed does not address previously outlined concerns around reducing future ***wildlife mortality*** due to bird collisions of the project[2]
4. With this new baseline information, technical reviewers from Administration feel there are ***missed mitigation opportunities*** to further reduce environmental impacts through the application of the mitigation hierarchy (avoid, minimize, restore and offset).

Given the above, technical reviewers within Administration have not found that the Municipal Environmental Impact Assessment (MEIA) as submitted avoids, or significantly reduces, the adverse environmental effects predicted to result from the project[3]. Background and supporting information related to each of the four conclusions above are listed below.

1) Summary of baseline information

Both the Municipal Environmental Impact Schedule A (Bylaw 7188) and the Alberta Utilities Commission Rule 007 (AUC 2017) requires that proponents of solar farm projects ensure that environmental information, effects and mitigation are addressed in the application[4]. These documents and best management practices dictate that pre-construction wildlife surveys are key components to inform appropriate site selection and mitigation of impacts to wildlife and wildlife habitat from the construction and operation of solar energy projects.

Administration's previous review of this projects EIA[4] outlined that the report was incomplete because wildlife assessments were not completed for many of the species expected in the area. As such, the Administration requested further biodiversity information and monitoring to fill in this gap (see Section D). Most of Administration's requests were completed with the exception of:

- Wildlife trail camera placement within the corridor along the river to assess existing use of this corridor by wildlife[5]

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[4] December 2019, "*Second Circulation Comments on AA18-13 EL Smith Solar Farm EIA and SLAJ Report, NW 3-52-25 W4M and SW 10-52-25 W4M, Edmonton, Alberta*"

- Temporary wildlife trail camera placement at the center of the tame meadow[6]
- Summer browse/pellet counts[7]
- Descriptions of proposed native seed mix to be used under the solar panels[8]

From the additional biodiversity monitoring that was completed, the following wildlife information was found:

Birds:

- 23 bird species were identified; some species used both forested and tame meadow while others specialized in one vegetation community (e.g. savannah sparrow found within the tame meadow area)
- two species of management concern were identified:
    - common yellow throat which live in thick, tangled vegetation in a wide range of habitats but are most common in wet areas, which tend to have dense vegetation low to the ground.
    - least flycatcher which breeds in deciduous or mixed forests and occasionally in coniferous stands with a preference for breeding sites near clearings or edges.
- Species diversity scores were not shown to be statistically different between the forested and tame meadow vegetation communities

Medium-large mammals:

- Urban adapted mammal species: coyote and deer were detected across the Local Area of Assessment (LAA) in both the forested and tame meadow area
- Large ungulates:
    - Elk was found along the south edge of the LAA in both the forested and tame meadow area
    - Moose was detected at one site, along an existing access road
    - Because there was no monitoring site within the corridor along the river, it was not possible to determine if urban sensitive species such as moose and elk utilize this area for movement[9]
- Other medium mammals found included porcupine and red fox
- Track counts showed:
    - high deer use of both forested and tame meadow areas depending on season
        - Tame meadow areas were more highly used in the November 2019 sampling session, with the report suggesting this is likely due to deer use of the open meadow during ungulate rut
        - Forested areas had higher track counts in the January 2020 sampling session, likely a result of deer utilizing this habitat for shelter during cold periods
    - Number of species observed was similar for both forested and tame meadow habitat when sampling effort is taken into account (i.e. 1.3 species/km days sampled for each habitat type)[10]

Other:

- Small mammals: no species specific surveys were completed, but track counts identified snowshoe hare, red squirrel, short tailed weasel, and small rodents (mice and voles)
- Bats: no species specific surveys completed
- Reptiles: no species specific surveys completed

2) Negative impacts to biodiversity

a) Habitat loss and fragmentation

With this new baseline biodiversity monitoring data, technical reviewers are better able to review the potential impacts of the project on wildlife habitat in the area. Contrary to the EIA suggestion that the tame field provides "*low suitability habitat for wildlife species*", this baseline data supports Administration's December 2018 conclusions that such meadow openings within the river valley's forest matrix are important habitat for wildlife. In particular, this baseline data:

- Provides evidence that both bird and mammals species utilize the tame meadow
- Of the large mammal species with enough information to analyze (i.e. deer) both the forested and meadow habitat is used for different life history requirements (e.g. browse, shelter) in different seasons
- More urban sensitive species such as moose and elk were detected in the area, highlighting the role that the site has in maintaining regional wildlife connectivity and migration for species that are not known to stay locally (i.e. non-resident species)
- Shows urban adapted mammal species (coyote and deer) were detected across the Local Area of Assessment (LAA)
- Identifies wildlife species (e.g. least flycatcher) that benefit from the edge habitat created between the forested and tame meadow habitat types
- Shows number of species observed was similar for both forested and tame meadow habitat when sampling effort is taken into account (i.e. 1.3 species/km days sampled)

The Province defines wildlife habitat as "*the terrestrial and aquatic environments and* ***associated ecosystem elements*** *that in combination provide the requirements of food, shelter and space needed to support self-sustaining populations of wildlife.*" This tame meadow area, while disturbed, has been demonstrated to be a key matrix component of the City's ecological network that is surrounded by one of the Edmonton Region's best remaining biodiversity core areas[11].

With respect to this project, there will be significant long term (>30 years) habitat loss in the form of a tame meadow area that, given the current configuration of the existing fence, is permeable to both terrestrial and aerial wildlife. As such, It is unclear how a net of only 0.7 ha of new forest plantings will offset the net loss of 19.7 ha of tame meadow habitat currently used by native wildlife[12].

In addition, the EIA outlines that indirect effects (e.g. sensory disturbance) on habitat are "*predicted to be adverse and extend into the LAA*" for the duration of the project (30 years). This conclusion is supported by research which has shown that the construction and operation of solar farm infrastructure has resulted in habitat loss and fragmentation in other areas (BLM and DOE 2012). Solar energy infrastructure and associated construction and operational activities can result in decreased habitat quality and/or lead to avoidance of the area by some wildlife species. Additionally, it can attract more urban adapted species, such as magpies or ravens (Knight and Kawashima 1993, Kristan and Boarman 2003, Lovich and Enne 2011), potentially compounding the loss of more sensitive wildlife from the area.

The draft EIA does make the following statement "*The removal of perennial pasture and replacement with approved native seed mix is expected to increase habitat function and species diversity for small mammals during operations*." However, it is not clear what mechanism or research supports that a naturalized seed mix is going to be better (or worse) than the tame meadow which is currently present[13]. Confounding this hoped for outcome is the fact that there is no discussion on how a native seed mix (or its associated small mammal population) responds to being shaded by solar panels or solar infrastructure maintenance. More information is required if the EIAs statement is to be supported.

In August 2019, the Administration did request further information on the proposed native seed mix and what wildlife the proposed mix was to support. No further information has been provided in the EIA addendum or was submitted through other materials.

b) Connectivity impacts

Now that site-specific wildlife surveys have been conducted to assess pre-development wildlife use of this area, it has been confirmed that, with respect to wildlife movement, the meadow is highly permeable to both terrestrial and arboreal wildlife movement as evidenced by the presence of moose, deer, elk coyote, and other wildlife. It also confirms that the following statements in the EIA are not supported by ground truthed site specific surveys, indeed, many of the statements are in opposition to what is now known about the use of the site[14]:

- "*...existing movements of wildlife through the PDA may be limited.*"
- "*...the lower pump house north of the PDA and E.L. Smith WTP likely limits movement of wildlife along the NSR currently.*"
- "*...the narrow passage underneath the highway may effectively prohibit many wildlife species from crossing under the Henday*."
- Suggestion on page 4.5 that the project area is not part of the ecological network and does not provide an ecological linkage function.

The February 2020 EIA wildlife addendum only suggests an update to one of the EIAs conclusions: it estimates an increase in the expected adverse magnitude of effects of the project on wildlife movement in the area. However, no new mitigation proposals are submitted[15].

With respect to impacts to wildlife connectivity specifically along the river corridor, this technical review concurs with the analysis outlined in the draft EIA that the development of the proposed solar infrastructure (fence and panels), will have a significant impact[16] to wildlife connectivity within the area for the extent of the project's life (>30 years) - "***primarily at the 100 m buffer along the NSR***" (page 6.16). This is because there will be an increase in length of the corridor from 0.56 km (existing length of corridor) to 1.8 km (post construction). This results in a lengthening of the blockage of wildlife access to the river by 220% and provides limited avenues for escape for wildlife for almost 2 km along the proposed river "corridor". Again, however, no new proposed mitigation measures have been included in the EIA addendum to address this project's impacts on wildlife connectivity[17]. This will negatively impact both local and regional connectivity[18] for multiple to tens of generations of wildlife (>30 years) depending on the natural history characteristics (e.g. life expectancy, habitat preferences, urban adaptability) of the wildlife species in question. These impacts have not been adequately addressed in this draft EIA, therefore, the claim that the "*project preserves existing ecological connectivity*" is not supported.

In the absence of having completed any wildlife monitoring within the existing 0.56 km river corridor (i.e. no camera and limited track transects were placed within the center of the corridor)[19], the EIA (page 6.18) does attempt to provide literature support for continued use of a lengthened 1.8 km corridor and refers to research about how coyotes and deer utilize urban environments and then

attempts to suggest that this shows that 100m wide corridors are used by wildlife in general. However, the conclusion drawn is inappropriate for this area because:

- the scientific references used do not assess 1.8 km long, 100m wide corridors[20], the research was only assessing wildlife use of buffers between urban environments that was next to habitat patches
- the references are limited to only two urban adapted species (coyote and deer) and are not likely applicable for some of the more urban-avoiders now shown to use the project site (e.g. moose, elk)[21]
- Therefore, the conclusions drawn based on these references that all wildlife movement between habitat patches can be accommodated within 100m corridors is not supported by the studies referenced.[22]

Currently, there is no site-specific data, or support, that wildlife species will use a 1.8km long-100 m wide buffer for movement along, or access to, the river[23]. As noted in the draft EIA, the project is located "*within the NSR Valley which is a provincially significant Natural Area and a regional biological corridor*." The area's significance to regional biodiversity and connectivity has been reaffirmed in multiple planning documents (Ribbon of Green 1992, GeoWest 1993, Natural Connections 2007, Breathe 2017). The Province of Alberta also identifies the significance of this area and classifies the North Saskatchewan River Valley as a Key Wildlife Biodiversity Zone (KWBZ, ESRD 2015). The "*KWBZ is ... identified for its contribution to wildlife migration corridors. The zones are intended to prevent loss and fragmentation of habitat, maintain migration corridors, prevent vehicle access, prevent sensory disturbance during energetically stressful periods for wildlife, and prevent barriers to wildlife corridors*"

Important climate resilience consideration

Maintaining ecological connectivity is recognized as a key strategy for climate change resiliency (Heller and Zavaleta, 2009; Hilty et al., 2006; Stein et al., 2014), in particular, maintaining or restoring riparian corridors (Crist 2013). As the climate continues to change local and regional species will experience increased stress and continued habitat loss. As such, Path 5 of Climate Resilient Edmonton[5] sets the City on a path to prepare for changing ecosystems, with Goal 10 outlining the need to ensure "*Edmonton's natural ecosystems continue to provide essential ecosystem goods and services such as clean air, clean water, and biodiversity.*" Therefore, projects that encourage continued anthropogenic fragmentation of important biodiversity corridors, as is found in the River Valley, should also be viewed with a lense to impact the City's ability to achieve its climate resilience as well as biodiversity goals.

Important cumulative impact consideration: potential impact of future recreational trails[24]

Another item to consider with respect to the impact of future wildlife use in the project area is with respect to recreational trails. Specific to connectivity, research has shown that edge effects of trail development reduces wildlife use of an area within at least 100 m of trails (see "Figure 5"; reproduced from Lenth, Knight, and Brennan 2008. Natural Areas Journal). Because of this depth of edge effect it is expected that there will be a large percentage of the area within the 1.8 km-100m wide corridor that will become unsuitable for species of wildlife should a trail be located within any remaining wildlife corridor (even though the habitat may be otherwise suitable).

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[5] Climate Resilient Edmonton: Adaptation Strategy and Action Plan (2019)

This issue will be further compounded should a wildlife impermeable fence further impede the ability of wildlife to move safely away from human recreational use to avoid human/wildlife conflict in proximity of the trail. Therefore, both the Administration and Council should consider impacts of future recreational trails on wildlife connectivity and habitat use as a cumulative impact to this project.

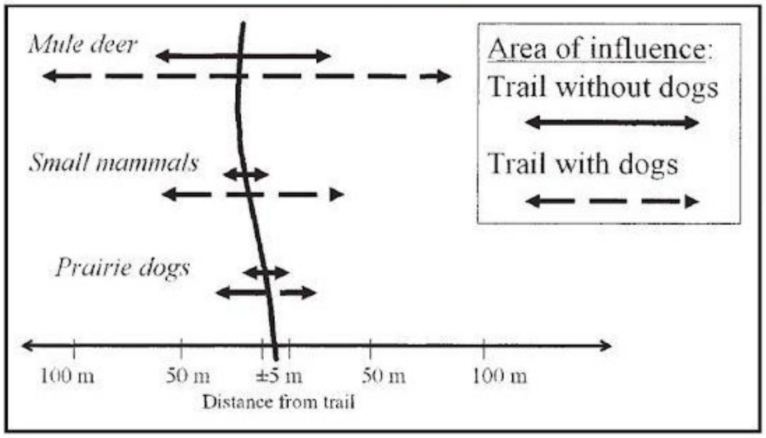

Figure 5. Conceptual diagram of the effects of recreationists alone or recreationists with dogs on mule deer and small mammal activity and prairie dog burrow location within a trail corridor in a protected area.

3) Continued Wildlife mortality

Based on a review of existing scientific literature, the wildlife Addendum, and as confirmed in the original EIA, this project is expected to result in increased wildlife mortality in the area due to bird collisions with solar collectors. We also concur with the draft EIA conclusion that the few mitigation measures that do exist around preventing bird mortality have not been proven to be effective at this time.

Contrary to what is stated in the Wildlife EIA addendum (page 3.7), increased research in recent years has documented that wildlife mortality does occur at multiple solar energy projects across North America (Kagan et al. 2014, Walston Jr. et al. 2016). Most research has focused on the risk to birds due to collision with solar collectors where they are either killed on impact or are stranded after impact and die from predation, injuries, dehydration or starvation (Kagan et al. 2014, Huso et al. 2016, Walston Jr. et al. 2016). It is thought that waterbirds in particular are attracted to solar farm areas as the polarised light reflected off of panels may be similar to light reflecting off water (Horvath et al. 2009, Kagan et al. 2014). However, song birds have also died due to collisions and stranding, likely as a result of foraging for insects that are attracted to solar collectors and congregate in areas with warmer temperatures above the panels (Horvath et al. 2009, Hernandez et al. 2014, Kagan et al. 2014).

The mortality impacts of solar farms become that much more important to consider when solar projects are proposed in important wildlife zones. It is also important to note that the Local Area of Assessment is in immediate proximity to known waterfowl breeding and loafing habitat. By being surrounded by natural upland, water bodies and arboreal corridors, a solar farm at this location may

increase the likelihood of the solar farm being viewed as aquatic habitat. In addition, the surrounding natural habitat will also be attractive to avian predator populations which are known to increase their use of an area when above-ground structures associated with solar farm infrastructure can act as perches (Helzer 1999, Barber et al. 2010,Lovich and Enne 2011, BLM and DOE 2012, Grippo et al. 2014). Research on mortality sinks around solar farms has yet to be studied.

The draft EIA does indicate that the project will “*increase the risk of mortality primarily due to the potential for birds to collide with solar panels.*” However, it then goes on to suggest that the implementation of two untested mitigation measures will be used until such point when “*mortalities are documented to be above acceptable limits*.” Despite this commitment, Administration has not yet received the following documents requested in our August 2019 comments (Section D):

- Prepare wildlife monitoring and mitigation plan which is to be approved prior to the project being constructed
- Within this plan, define how “unacceptable risk” will be measured by the project
- Propose additional mitigation measures prior to project construction

4) Missed mitigation opportunities

Despite supporting the Administration's findings about the negative impacts of the project to habitat, ecological connectivity, and wildlife mortality, the EIA wildlife addendum articulates that no new mitigation measures will be required and none are proposed[25]. Therefore, this conclusion does not address City Administration’s recommendation to mitigate the predicted long term adverse effects on habitat loss and fragmentation, connectivity and wildlife mortality.

At the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890, Administration presented to Council that “*Epcor has verbally agreed to collaboratively assist Administration in the development of a biodiversity offset framework which is intended to follow the mitigation hierarchy of avoid, minimize, restore and offset*.”[6]

Global practice[7] in the exploration and implementation of biodiversity offsets starts with a demonstration that all reasonable steps have been taken within the mitigation hierarchy prior to moving on to offsetting. After it has been illustrated that steps to avoid and minimize ecosystem impact and biodiversity loss have been incorporated into a project's design, the project can then proceed to the final step of the mitigation hierarchy which is called offsetting. Conservation actions that are not designed to result in No Net Loss and preferably Net Gain are not considered biodiversity offsets.

Given the direction above, the following mitigation review is provided in an order of priority that aligns with the IUCN’s recommendations of:

I. Avoid;
II. Minimize;
III. Restore/rehabilitate and offset

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[6] Administration’s presentation to Council at the June 17, 2019 public hearing held on Bylaw 18889 and Charter Bylaw 18890. Refer to timestamp 6:33:40 of the June 17, 2019 Council minutes: http://sirepub.edmonton.ca/sirepub/mtgviewer.aspx?meetid=2264&doctype=MINUTES

[7] Biodiversity Offsets: Effective Design and Implementation (http://www.oecd.org/env/resources/Biodiversity%20Offsets_Highlights_for%20COP12%20FINAL.pdf)

I. Avoid: move project site to an area that reduces impact to the North Saskatchewan River Valley which is a Provincial Key Wildlife Biodiversity Zone

The literature is clear that the most important factor to consider in the review of significant solar infrastructure is appropriate site placement because biodiversity impacts are highly site-specific. As with any infrastructure project, well-sited solar infrastructure minimizes impact on biodiversity and limits the need for mitigation measures. For example, research back to the 1990's points to the fact that solar energy infrastructure has inherently low impacts on wildlife when integrated into an existing anthropogenic footprint such as on rooftops.[8]

The Province of Alberta also has clear guidelines that solar projects should be sited to avoid or minimize their occurrence in important wildlife habitats. Areas such as native parkland and "*valleys of large permanent watercourses*" (e.g. North Saskatchewan River Valley) should be avoided in order to avoid or minimize solar power infrastructure in Provincially mapped Key Wildlife and Biodiversity Zones - such as the area of the LAA[26]. This Directive ensures that off-site locations will have reduced effects on wildlife if an alternative site is reviewed. Municipally, the City of Edmonton also has multiple Bylaws and Policies that speak to the prioritization of nature conservation and restoration within the North Saskatchewan River Valley including the area in question.

Given the IUCN Policy on Biodiversity Offsets,[9] scientific research of solar farm impacts on biodiversity, Provincial guidelines and Municipal Policy direction, from an environmental perspective the best scenario is one in which the solar farm footprint is moved outside of the River Valley which is Edmonton's key wildlife and biodiversity zone. Such avoidance will:

- Continue to enable the City to work towards achieving its renewable energy generation goals while also reducing greenhouse gas emissions;
- Show no net loss in wildlife habitat and connectivity
- As supported by the literature, result in reduced mortality of avian wildlife due to lower waterbird abundance in brown field or agricultural areas

Mitigation measures proposed for this project that support "avoidance":

- No avoidance mitigations have been proposed for this project
- Specifically, the Site Location Study provided was limited in its analysis and did not consider viable alternative location opportunities including utilization of degraded lands (e.g. brownfield sites, co-location of solar panels with underutilized land including industrial and agricultural land etc.) which is a common practice both nationally and internationally for utility scale solar farm site selection (see Section B for more details).
- It has been mentioned that the long-term plan for this site is for future water treatment operation expansions as the City grows with the conclusion being that the site will eventually be disturbed, so there is no value to protecting it now. However, temporal avoidance of negative impacts to this site (of >30 years) while water treatment processes and infrastructure become more efficient and less ecologically invasive could eventually lead to permanent avoidance, or a reduced infrastructure footprint in the future, while allowing the site to act as habitat in its current (or restored) state until such time as water treatment expansion is required.

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[8] A detailed reference list that supports this review can be found in Administration's Second Circulation Comments on AA18-13 EL Smith Solar Farm EIA and SLS

[9] https://portals.iucn.org/library/sites/library/files/resrecfiles/WCC_2016_RES_059_EN.pdf

- It is noted that the project proponent is exploring a competitive procurement for new renewable power from a wind farm in southern Alberta for the remainder of grid sourced electricity used by Water Services[10]. By procuring additional renewable power from this source negative environmental impacts related to renewable energy generation at this site can be avoided.

II. Minimize: reduce the size of the project footprint

Should it be determined (through Council approval of the site location) that a River Valley location is required, the next step in the mitigation hierarchy is to minimize project impacts. Such impacts would be most effectively minimized by reducing the footprint of the solar farm[11]. This would:

- Reduce wildlife mortality by reducing the size of the perceived solar "lake";
- Limit habitat loss due to retention of a portion of the tame meadow;
- Enable the creation of a wider bigger buffer along the valley edge to maintain more effective wildlife movement; Corridor along the NSRV that is wide enough to offset the trail edge effects of human use on biodiversity;
- Similarly, widen the vegetated buffer along the south edge of the site

Current mitigation measures proposed for this project that support mitigation through "minimization":

- A 100m setback from the river is proposed:
  - Due to the lack of site-specific data collection, it is unknown if urban-sensitive wildlife (e.g. elk, moose, some medium mammals) will use a lengthened 1.8 km long corridor (a 220% increase from the original corridor length), especially if a formal recreational trail is developed within it for the future.[27]
- A 40 metre vegetated buffer along the south edge of the site was proposed:
  - This review took into consideration that it will take 30-50 years for this buffer to mature and become effective as the proposed forested wildlife corridor.
  - Site specific information currently shows that only urban adapted wildlife species use the 30m pinch point to the NE of the existing Plant, putting caution into evaluating the effectiveness of a 40m buffer for use by urban sensitive species.[28]
- See Section C2b for supporting details

III. Restore/rehabilitate and offset

The IUCN Policy on Biodiversity Offsets indicate that "*Only after applying the earlier steps in the mitigation hierarchy should biodiversity offsets be employed to address the residual impact in order to achieve at least No Net Loss and preferably a Net Gain at the project level. Conservation actions intended to achieve offset outcomes must result in a direct measurable biodiversity gain equivalent to the residual loss arising from the impacts on biodiversity associated with a project in order to be considered a biodiversity offset. Conservation actions that are not designed to result in No Net Loss and preferably Net Gain are not biodiversity offsets*." [29]

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[10] Epcor Water Services Inc. Water Services & Drainage Services 2020 Annual Operational Plans (Page 33), accessed from http://sirepub.edmonton.ca/sirepub/cache/2/pdo0hprlwm2bb0i3h3ibvfz0/91052702232020063820732.PDF

[11] Original 2017 proposal was for a 5MW facility. Other options include reducing to 10MW or less.

Using these guidelines, the following options were explored for their ability to provide "restoration and biodiversity offsets" that would result in biodiversity gain for the project:

- Onsite restoration/biodiversity offset options:
    - Avoidance (as above) and restoration of a portion of the existing tame meadow;
    - Restoration/enhancement of current "pinch points" of the site (e.g. the impacted area to the NE of the existing power plant)
    - Commitment for long term protection of restored tame meadow, surrounding natural areas, and widened river buffer;
    - Allowance for wildlife movement to the River from forested areas, potentially through a W-E corridor
- Offsite restoration/biodiversity offset options:
    - Improve connectivity/habitat at other Epcor owned sites within the river valley
    - Identification and protection of currently unprotected and previously cleared sites within the River Valley in order to gain a favourable offset ratio.
    - protection of currently unprotected sites within the River Valley or tablelands in order to gain a favourable offset ratio.
    - Such biodiversity offsets would potentially see local increases in biodiversity in an area away from the project's area of impact
    - Long term biodiversity protection would be ensured if restored areas were held in protected area status

Current mitigation measures proposed for this project that support "restore/rehabilitate and offset" do not meet the standard of No Net Loss are therefore not considered as biodiversity offsets. For example:

- The project proposes a net gain of 0.7 ha of new forest plantings.
    - Taking this net gain of potential habitat into account, the project does not offset the net loss of 19.7 ha of tame meadow habitat currently used by native wildlife.[30]
- While a vegetation plan was mentioned as a mitigation measure, neither the EIA nor the SLS provides information on the proposed revegetation of the fenced area that will exclude medium-large mammals. Given this, there is no ability for reviewers to assess how a native seed mix (or its associated small mammal population) responds to being shaded by solar panels and other solar infrastructure.
- There is mention in the SLS that the proponents propose to transfer 12.7 hectares (31.5 acres) of sloped forested land to the City for permanent protection. While permanent protection improves the long term certainty of biodiversity conservation for this parcel , the City has not yet assessed the status of these lands, nor is there any agreement in place for a land transfer. Ownership of land does not constitute a biodiversity offset under IUCN standards however; the City has not yet developed its own biodiversity offsets and long term protection of key corridors could be considered when the City initiates formal biodiversity offsets standards.

Important notes on monitoring plans:

- They are not considered a mitigation tool
- Rather they are required under a Biodiversity Offset Framework to monitor for "*direct measurable biodiversity gain equivalent to the residual loss arising from the impacts on biodiversity associated with a project*"

- As such, the project commits that "*Wildlife monitoring (during and post construction) as well as vegetation monitoring will be implemented to evaluate the effectiveness of and to adapt the mitigation measures and an annual monitoring report will be provided to the City and Alberta Environment and Parks*"
- The SLS indicates that the wildlife monitoring and mitigation plan is to be approved prior to the project being constructed.

Stantec Comments

The comment numbers below correspond directly to the red superscript numbers inserted into the excerpt of the City response document above.

[1] The term biodiversity refers to the variety of species found in an area. In the case of the MEIA and its addendum, the Local Assessment Area (LAA) is the area being studied and to which Project effects are assessed. The LAA set for this Project has not been contested by either the City of Edmonton or the Alberta Utilities Commission (AUC) throughout the regulatory process. It is Stantec's assessment that, although there may be some shifts in relative abundance of species within the LAA, it is unlikely that there would be a measurable change in biodiversity within the LAA.

[2] The February 22, 2019 letter to Mr. Luke Cormier discusses in detail the issue of bird mortality at solar facilities and how there are no comparable sites to the Project with the combination of the technology being used, and the climate and ecosystems this facility is being proposed to be located in. Therefore, the proposed approach to address this uncertainty is to construct the facility, monitor bird mortality following provincial guidelines, and develop additional mitigation measures as necessary. The monitoring is not a mitigation measure in itself, but rather a means to identify environmental effects, develop appropriate mitigation measures (if necessary), and evaluate the success of mitigation measures (i.e., an adaptive management strategy).

[3] The proponent has taken several measures to reduce the potential effects of the Project. The initial Project footprint was larger and extended the solar farm to the existing tree line along the east and to their property line along the southern boundary. They have implemented a minimum 100m buffer along the river and have also proposed to plant a treed buffer along the southern boundary of their property line, as a result of recommendations of the environmental assessment. These mitigations are predicted to provide a reduction in the effects to wildlife movement while still resulting in a net overall negative effect.

[4] This is correct. An Environmental Evaluation (EE) was submitted to the AUC in parallel with the MEIA that was submitted to the City of Edmonton. The AUC has subsequently approved the project under Rule 007 following an evaluation of the EE and the other pertinent project documents.

[5] Three cameras (EPC05, EPC06, and EPC11) were placed in the forested edge along the North Saskatchewan River and four snow tracking transects were completed in this zone (refer to Figures 2-1 and 2-2 of the addendum). This coverage exceeds that which would typically be done for a project of this scale and Stantec is confident in the coverage and data received from these surveys. Additionally, remote camera data provided by a Principal Ecological Planner at City of Edmonton includes data from June/July 2018 within the forested edge along the NSR adjacent to the PDA. This data identified only white-tailed deer at this location.

[6] Camera EPC09 was placed in the center of the field.

[7] It is Stantec's understanding that the initial suggestion of summer pellet and browse surveys was suggested due to a perceived lack of coverage by the initially proposed 6 wildlife camera locations proposed for the addendum. In response, EPCOR elected to increase the total number of wildlife cameras from the original proposed 6 cameras to 11 cameras at the City's request (per communications with a City of Edmonton Principal Ecological Planner) to obtain better coverage. For the purposes of this study, it was determined that the pellet and browse study would produce similar information (e.g., estimates of ungulate relative density) to the camera and winter tracking program, but would not provide additional habitat use information for non-ungulate wildlife; which can be detected using cameras and winter tracking. Therefore, EPCOR did not complete browse or pellet surveys.

[8] At this time the proponent has not finalized their proposed native seed mix composition.

[9] See response to Comment 5.

[10] Stantec's evaluation of the data is that species richness is in fact greater in the forested areas than in the meadow. It is inappropriate to evaluate the data in the way that has been done in the City's comment as species richness doesn't increase in a linear fashion relative to the total survey effort; richness would be expected to increase in a diminishing fashion with increased survey effort as the total number of wildlife in Alberta is finite.

[11] Currently available and published City of Edmonton Ecological Network Map[1] shows the areas surrounding the PDA meadow as a Habitat Patch rather than a Biodiversity Core Area. The Biodiversity Core Area has been mapped as being on the east side of the river in Terwillegar Park.

[12] The proposed tree plantings are not intended to offset the habitat loss of the tame meadow habitat and neither the MEIA or the addendum make claims that it does. The tree plantings are meant to offset the tree clearing that is taking place and to add some structural connectivity across the south boundary of the PDA.

[13] A switch from tame pasture (with generally low plant diversity and five species of *noxious* weeds) to native seed mixes is expected to increase the vegetative biodiversity within the meadow itself, providing greater habitat variability for insects and small mammals. The mix of shaded and non-shaded areas around the solar panel infrastructure is predicted to result in microsites that may allow for greater diversity of vegetation species to establish.

[14] The addendum is intended to be read in conjunction with the MEIA and interpretation of the additional data is found within the addendum. The field data in question was not part of the field studies requested by the City at the time the MEIA was scoped and therefore these field studies were not completed in advance of the MEIA. As such, the data was not available. Conclusions in the MEIA had to be made on the best information available at the time.

[15] Despite the change in magnitude, new mitigation measures were not submitted as an adverse effect on wildlife movement in the area was already predicted and mitigation measures for this effect had already been incorporated into the Project design.

[16] The MEIA methodology for this Project specifically does not incorporate significance determinations as the City of Edmonton does not currently have a framework for determination of significance in environmental assessments and does not agree with Provincially and Federally accepted means of determining significance. A significance determination was completed for the EE submitted and approved under the AUC's Rule 007 and determined the effects to wildlife were not anticipated to be significant.

[17] See response to Comment 15.

[18] It is Stantec's assessment that while the proposed Project will affect connectivity across the PDA, wildlife will still continue moving through the LAA and beyond. The corridor on the upslope side of the PDA will remain intact and is wider than that of the corridor along the river's edge. Wildlife on the south side of the river

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[1] https://www.edmonton.ca/city_government/documents/PDF/Ecological_Network_Map.pdf

will likely continue using the mapped biodiversity core area on that side of the river unhindered by this Project. Stantec therefore does not agree that local and regional connectivity will be "negatively impacted" for generations.

[19] See response to Comment 5.

[20] It should be noted that the Project as proposed incorporates a 100m buffer at its narrowest point. The buffer continually widens as it approaches the water treatment plant and is wider than 100m for the majority of its length along the proposed solar farm.

[21, 22] The conclusions in the MEIA and its addendum are not based solely on the efficacy of the narrower, river side wildlife corridor. Within the LAA there is other existing forested habitat that can support wildlife movement on the upslope side of the Project area. This area is where moose and elk were recorded by the remote camera program. There is no evidence that either the moose or elk were utilizing the narrow pinch point passageway between the low lift pumphouses and the river and therefore if they are moving into the City through the LAA on the north side of the river, they may be passing through the wider forested area on the upslope side of the PDA. This slope is also identified by the City of Edmonton's Environmental Sensitivity Mapping as an effective movement corridor for both black-capped chickadee and coyote; species chosen because they 'can serve as good indicators of the connectivity now provided by the vegetated areas of the City, to help evaluate the role of such sites in Edmonton's ecological connectivity' (Solstice 2017). It is noted that the forested edge along the river valley is also identified as effectively facilitating coyote movement.

[23] As noted in the response to Comment 20, the proponent is not proposing to construct a 1.8km long, 100m wide corridor, 100m is the narrowest that corridor will be within the 1.8 km distance. It is not possible to produce site-specific data to support whether or not wildlife will utilize such a corridor, without first constructing it. The MEIA and its addendum predict that movement will be negatively affected, but not cease. This can only be proven through monitoring post construction should the regulator wish it. No amount of additional field surveys on site or literature searches will definitively prove how site-specific use will change post-construction.

[24] Cumulative environmental effects are the effect likely to result from the designated project, in combination with other physical activities that have been or will be carried out in certain and reasonably foreseeable future (i.e., projects that have been announced to be occurring), be taken into account in the environmental assessment. To fulfill this requirement, an assessment would need to provide a clear understanding of both the estimated cumulative effects on valued components from past, present and future projects, and the contribution of the project to the cumulative effects. The proponent cannot be held responsible for potential future projects planned for on private property that have not been designed, assessed, or approved.

[25] Refer to the response to Comment 15.

[26] The Directive being referred to excludes urban areas, which is what Alberta Environment and Parks has classified the proposed Project location as being. They issued correspondence dated April 30, 2018 supporting the project due to its "*limited impact to wildlife and wildlife habitat… reduced requirements for transmission infrastructure, and reduc[ed] pressure of development on locations with higher quality wildlife habitat value*". It should be noted that the Key Wildlife Biodiversity Zone (KWBZ) within the LAA does not comprise of the entire North Saskatchewan River Valley. In fact, only a very small area in the southeast corner of the PDA is contained within the KWBZ, most of the PDA falls outside of the KWBZ.

[27] Refer to responses to Comments 21, 22, and 23.

[28] It should be noted that the elk likely being referred to as “urban sensitive species” in this comment have already been found to cross the unimproved meadow area without any cover. There is no evidence that they would not continue to cross it if there were the addition of tree plantings.

[29] The MEIA was written to be compliant with the North Saskatchewan River Valley Area Redevelopment Plan (Bylaw 7188) and in consideration of other City of Edmonton policies. The methodology and approach to mitigation measures are consistent with other applications made under Bylaw 7188. Stantec is not aware of IUCN Policy being applied by or within the City of Edmonton on other applications nor was a request made to apply these concepts to the Project documentation in advance of submission.

[30] Refer to response to Comment 12.

EPCOR Water Services Inc. E.L. Smith Solar Farm Project

Enoch Cree Nation Re-Engagement Summary Report
February 2020

Introduction

During the June 2019 City of Edmonton public hearings on rezoning of lands adjacent to the E.L. Smith Water Treatment Plant (WTP) City Council passed a motion that referred this matter back to City Administration to, in part:

1. *Work with EPCOR Water and Enoch Cree Nation to continue engagement activities and return to a future Public Hearing. Engagement activities should include:*

    a. *Sharing archeological report and traditional knowledge to further interpret the findings and site history in consultation with Alberta Culture, Multiculturalism and Status of Women,*
    b. *Potential partnerships and collaborate on site interpretation, vegetation and harvesting, project naming and potential economic opportunities, and*
    c. *Offer to collaborate on the design and shared use of publicly accessible open space.*

Following these public hearings Enoch Cree Nation's Consultation Office and EPCOR Water Services Inc. established a bi-weekly working group and met regularly to work through these engagement activities and ensure Enoch Cree Nation's concerns were addressed. Since then there has been extensive sharing of archeological information, a project community open house at Enoch Cree Nation, sharing of project information and site visits with Enoch Elders and Knowledge Holders, exploration of potential partnerships and collaboration on design and shared use of publicly accessible spaces.

Outcomes

Following the June 2019 public hearings, the re-engagement with Enoch Cree Nation from July 2019 to February 2020 focused on the three key matters set out in the motion above:

1. Facilitation of full access to all archeological data, reports, and artifacts, including the first-ever archeological lab visit for a First Nation at Stantec's archeological lab in Calgary, Alberta, to allow for the independent interpretation of the findings and site history by the Enoch Consultation Office. As noted in a letter of support provided by Enoch Cree Nation (Appendix A), the Nation was "…met with patience, transparency and an effort to understand our concerns and address them." (Pg. 2),

2. Establishing potential partnerships and collaborate on site interpretation, vegetation and harvesting, project naming and potential economic opportunities. Enoch Cree Nation and EPCOR look forward to, in Enoch's words, "…walking forward together as partners at the E.L. Smith site – ensuring the water treatment plant can continue to provide life-giving water to the people of a growing region, including Enoch Cree

Nation, while reducing its environmental footprint, and re-connecting our community to our lands through ceremony, harvesting, naming, and protocols." (Pg. 3), and

3. An offer to collaborate on the design and shared use of the publically accessible open space. Enoch has stated that: "It has been more than 100 years since our people have had access to our former lands and we look forward to repatriating our ceremonies and people to the lands that our ancestors chose for us, and that contain spiritual significance to us." (Pg. 2) EPCOR and Enoch have agreed to work together to bring ceremony to the site and on finalizing a medicine harvesting protocol that will see Enoch members reconnect with their former lands.

Enoch Cree Nation Chief and Council, upon review of the recent joint work between the Enoch Consultation Office and EPCOR, has decided to give their support for the E.L. Smith solar farm project and to support the finalization of a memorandum of understanding (MOU) that would set the foundation for a renewed cooperative relationship between the two entities.

A copy of the Enoch Chief and Council motion that indicates support for both the solar farm project and continued dialogue on the MOU can be found in Appendix B.

The proposed MOU utilizes the *Enoch Cree Nation-City of Edmonton 2017 Memorandum of Understanding* as a framework for discussions and borrows similar language from this document. As of February 2020, Enoch Cree Nation and EPCOR are finalizing the wording of the MOU to be entered into that would:

- Set the foundation for a renewed cooperative relationship based on the spirit of reconciliation,
- Establish a process for engagement on future projects, initiatives and joint-endeavors at both the E.L. Smith and Rossdale water treatment plants, and
- Create a platform for meaningful, effective and transparent communication on issues of mutual interest.

EPCOR has committed to continued engagement and to work with Enoch Cree Nation as the proposed project progresses, including on key elements raised by the Nation such as:

- Bringing appropriate ceremony to the E.L. Smith water treatment plant site,
- Medicinal plant harvesting by Enoch Cree Nation members for traditional purposes (as part of the MOU),
- Opportunities for land-based learning by Indigenous youth, and
- Indigenous naming of the "E.L. Smith Solar Farm" (as part of the MOU).

Overview of Engagement with Enoch Cree Nation

From October 2017 to June 2019 engagement with Enoch Cree Nation was part of an overall Indigenous engagement strategy on the solar farm project. Although the project did not trigger a statutory duty to consult, EPCOR chose to notify 21 Indigenous Nations and communities about the plans for the proposed solar farm. 13 of the 21 chose to engage, including Enoch Cree Nation.

This first engagement, as summarized in a previous submission to the City of Edmonton entitled "Attachment 4 – Indigenous Consultation Summary" (Appendix E), included Enoch Cree Nation's participation in key activities such as:

- Sharing of project information, including invitations to meet, discuss, and ask questions about the project,
- Face-to-face meetings on the project,
- Participation by Enoch Cree Nation monitors in Stage Two archeological exploration of the project site, and
- A presentation and meeting with Enoch Chief and Council (January 28, 2019).

Highlights from the re-engagement with Enoch Cree Nation, from July 2019 to February 2020, include:

- Two archeological sharing sessions, including one at Stantec's archeological lab in Calgary, Alberta to review the full draft Historic Resources Impact Assessment report for the site and all collected and catalogued artifacts,
- Formation of a joint bi-weekly Enoch-EPCOR working group that held over 16 face-to-face meetings over 8 months,
- Site visits for Enoch Consultation Office team, Elders, and Knowledge Holders,
- Dialogue and drafting of a memorandum of understanding to formalize the long-term working relationship between Enoch and EPCOR,
- Community Meeting/Open House on the project hosted at Enoch Cree Nation on December 4, 2019, (generalized community feedback summarized in Appendix C),
- Drafting and submission of *Joint Report and Recommendations to the Enoch Chief and Council* by Enoch Consultation Office and EPCOR, and
- Joint Enoch Consultation Office and EPCOR presentation to Enoch Cree Nation Chief and Council on February 10, 2020.

Of note from the re-engagement is the joint report (Appendix D) from the Enoch Consultation Office and EPCOR that outlines the key issues discussed during the engagement and provides recommendations to support the continued dialogue on the MOU process and to support the solar farm project. The joint report aims to provide answers to important questions raised by Enoch Cree Nation, such as "what does the archeological evidence say?" and "was Sun Dance part of this site?" This report was submitted to Enoch Chief and Council for the February 10, 2020 meeting.

Next Steps

Engagement and discussions with Enoch Cree Nation are to continue not only through the life of the proposed project but into the long-term. This will be accomplished through the proposed MOU process, with deliberations on the contents of the MOU continuing into mid-2020.

The MOU as a vehicle for long-lasting cooperation was mutually recommended by both the Enoch Consultation Office and EPCOR during the bi-weekly working group meetings and establishes a series of principles and objectives that will in part:

- Acknowledge the mutual benefit of the continued operation of the E.L. Smith water treatment plant, which provides clean, safe water to those in the Edmonton metropolitan region and to Enoch Cree Nation, and
- Acknowledges and works to reconnect the peoples of Enoch Cree Nation with their ancestral lands and to the water through ceremony and initiatives to be developed collaboratively.

Additionally, when the MOU is finalized it is anticipated that no less than four addendums to the MOU will be discussed throughout 2020 and will aim to address the following matters:

- Engagement and consultation processes associated with projects causing ground disturbances at the water treatment plants,
- Communication and information sharing on matters of mutual interest,
- Historic resources and naming of the “E.L. Smith Solar Farm”, and
- Plant harvesting by Enoch Cree Nation members at the E.L. Smith water treatment plant for traditional purposes.

The MOU will also formalize an Enoch-EPCOR staff-level working group that will continue to lead the engagement between the Nation and EPCOR.

EPCOR also committed at the December 4, 2019 Community Meeting/Open House to showcasing the artifacts recovered from the project site with additional Elders in the community, including those at the Enoch Elder Centre. Planning for this visit is currently underway.

Appendices

Appendix A – Letter of Support from Enoch Cree Nation (February 18, 2020)
Appendix B – Enoch Cree Nation Chief and Council Motion 2019/2020 - #162
Appendix C – Enoch Open House Feedback (December 4, 2019)
Appendix D – Joint Report and Recommendation to the Enoch Cree Nation Chief and Council (February 10, 2020)
Appendix E – Attachment 4 – Indigenous Consultation Summary June 2019

February 18, 2020

Via email: slee@epcor.com

Mr. Stuart Lee
President & CEO
EPCOR
2000-10423 101 Street NW
Edmonton, AB T5H 0E8

Re: EPCOR E.L. Smith Water Treatment Plant Solar Farm Project

Dear Stuart,

I would like to thank you and your team for visiting Enoch Cree Nation last week to discuss the proposed E.L. Smith Water Treatment Plant Solar Farm Project and Memorandum of Understanding between EPCOR and Enoch Cree Nation.

In June of last year, new information was brought forward to our leaderships' attention that generated concerns regarding the solar project. Enoch tentatively withdrew support for the project to allow time for our consultation team to work with EPCOR and take a deeper investigation into the archaeological and cultural significance of the lands where the solar farm is located and address any potential adverse impacts of the project.

While our withdrawal of support may have created setbacks for the project, we were never met with frustration by your team.

Rather, we were met with patience, transparency and an effort to understand our concerns and address them.   Thank you for the integrity and leadership that EPCOR demonstrated in response to Enoch's concerns, and for your commitment to continue meaningful dialogue and consultation with our community.

Over the course of the past 8 months, EPCOR and Enoch representatives met more than 16 times to discuss and review the project. These engagements included dialogue with our Elders, traditional knowledge holders, leadership, and members at large (at a community open house). We have had the opportunity to examine, in-person, the archaeological findings from test pits dug at the proposed site, and undertake traditional protocol to seek full guidance in this matter.

One of the key considerations that arose during these engagements was the importance of access to the site for the purpose of re-establishing ceremony and introducing land-based learning opportunities for our children. The current site of the E.L Smith Water Treatment Plant and proposed solar project are located on our former reserve lands, illegally taken in 1908. It has been more than 100 years since our people have had access to our former lands and we look forward to repatriating our ceremonies and people to the lands that our ancestors chose for us, and that contain spiritual significance to us. We also look forward to naming the solar farm in a manner that honors the significance of the lands, our history and present relationships.

Another significant discussion was the commitment to employ Enoch Cree Nation environmental monitors during any ground disturbance. While we are satisfied that ground disturbance will be minimal, the presence of Enoch environmental monitors will shine light on the construction and ensure we have the ability to mitigate concerns in real-time. Our Nations' elders have provided valuable insight into how future archaeological artifacts should be handled and cared for and we look forward to bringing elders back home to the site to honor the land with appropriate protocols.

We are pleased that the course of our discussions has evolved to a commitment to deepen our relationship by way of a Memorandum of Understanding between EPCOR and Enoch Cree Nation. The MOU contemplates EPCOR and the Enoch Cree Nation walking forward together as partners at the E.L. Smith site – ensuring the water treatment plant can continue to provide life-giving water to the people of a growing region, including Enoch Cree Nation, while reducing its environmental footprint, and re-connecting our community to our lands through ceremony, harvesting, naming, and protocols. The MOU also helps ensure the Nation's engagement in future developments at the site, including partnering on future archeological investigations. Over the coming decades, it will be important for Enoch and EPCOR to have a strong, stable, close working relationship so that both can work together to uncover the history of these lands, and walk down that path of re-discovery together.

Finally, I would like to affirm our belief that green energy projects are critical to pathfinding a future for our young people that aligns with principles of stewardship, sustainability and climate leadership. In recent engagements with Enoch youth, Chief and Council have been directed to assert our position in favor of renewable energy projects and seek ways to promote the transition from a fossil-fuel based economy to a green economy.

It is for these reasons that we confirm our support of the E.L. Smith Solar Farm. We wish EPCOR success in attaining all the additional approvals required to realize this important project. We wish to thank EPCOR for the commitment to meaningful consultation and leadership in this process. We look forward to the future with EPCOR as a valued partner of Enoch Cree Nation.

Signed,

Michelle Wilsdon
Councillor – Office of the Chief
Enoch Cree Nation
780-270-8950
Michelle.wilsdon@enochnation.ca

Enclosure: Motion 2019/2020-#162 Approving support of the EPCOR E.L. Smith Water Treatment Plant Solar Farm Project

CC: Stuart Lee, President and CEO slee@epcor.com
Guy Bridgeman, Senior Vice President gbridgeman@epcor.com
Jed Johns, Manager of Government Relations jjohns@epcor.com
Enoch Cree Nation Chief and Council CandC@enochnation.ca
Enoch Cree Nation Consultation consultation@enochnation.ca

Motion 2019/2020 - #162

ENOCH CREE NATION

Chief & Council Meeting

DATE: February 10th, 2020

LOCATION: Council Chambers, Enoch, AB

Attendance: Chief William (Billy) Morin; Council: Amanda Morin, Lyle L. Morin, Ron A. Morin, Shane Morin, Cody Thomas, John Thomas Jr., Michelle Wilsdon, Nola Wanuch

Recording: Jody Donald

Elder Representative: Laurie McDonald

MCS: Michelle Wilsdon / Amanda Morin

Whereas the Enoch Cree Nation Chief & Council supports the development of EPCOR Water Services Inc.'s proposed solar farm project adjacent to the existing at E.L. Smith Water Treatment Plant, and supports continued dialogue on a memorandum of understanding between Enoch Cree Nation and EPCOR Water Services Inc. that recognizes the contributions of both entities and establishes a cooperative working relationship built on effective communication, respect and trust.

Note, this motion effectively rescinds Motion 2019/2020 - #36

Questions Called:

7 In Favour: Amanda Morin, Ron A. Morin, Shane Morin, Cody Thomas, John J. Thomas Jr., Nola Wanuch, Michelle Wilsdon

1 Opposed: Lyle L. Morin

0 Abstained

Absent: Ron V. Morin

MOTION CARRIED

E.L. Smith Solar Farm – Enoch Cree Community Open House/Community Meeting

December 4, 2019 | Enoch Cree Nation

Overview

- The open house was co-hosted by the Enoch Consultation Office and EPCOR, with staff from both present to answer questions of attendees.
- Attended by four (4) Council members from Enoch Cree Nation.
- Approximately 25 attendees to the community meeting were observed between 3:00pm-7:00pm at the River Cree Resort & Casino.
- One presentation was delivered at approximately 4:45pm: EPCOR provided history of the E.L. Smith Water Treatment Plant, Stantec provided an overview of the archeological program at the proposed solar farm site, and Enoch's Consultation Office provided Enoch's perspective on the site. A short question and answer period followed.
- Artifacts from the archeological program were made available for viewing, along with a copy of the draft final report for submission under the Historical Resource Act.
- A series of poster boards were on display throughout the community meeting room and included panels on the environmental program, archeological work, Indigenous engagement, overview of the solar farm project, and the post-1908 history of the water treatment plant site.
- Attendees were able to view any of the materials and panels with EPCOR, Stantec, and Enoch Consultation staff available to answer any questions.

Feedback provided during the event – What We Heard

- Would be beneficial to offer educational opportunities to schools in the area.
- Questions about archeological studies (scope and timing).
- Participant who took part in archeological studies found this very interesting and was grateful for the opportunity.
- Thankful for the opportunity to learn about the history of this site and desire to find out more.
- Encourage EPCOR to bring this information to older Elders at Enoch's Elder Lodge who may have been able to attend this event.
- General questions on the solar farm and how the energy is used.
- If a bison skull is found it should be smudged at the site before it is removed.
- Interest in the extent of the archeological artifacts that may still be out there.
- General positive feedback related to the idea of solar and its use.
- Question on the impacts of solar with no strong opinion on the project.
- Appreciation of opportunity to learn the history and no strong opinion on next steps.

JOINT REPORT AND RECOMMENDATION
TO ENOCH CREE NATION CHIEF AND COUNCIL

Presented: February 10, 2020

Enoch Cree Nation-EPCOR Proposed Memorandum of Understanding & E.L. Smith Water Treatment Plant Solar Farm Project

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Overview

Engagement with Enoch Cree Nation on the proposed E.L Smith solar farm project began in October 2017 with the sharing of an archeological backhoe testing summary and continued with subsequent site visits, archeological monitoring and regular communications.

Following the June 2019 public hearings on rezoning of lands adjacent to the E.L. Smith Water Treatment Plant (WTP) Enoch Cree Nation's Consultation Office and EPCOR Water Services Inc. have held bi-weekly working group meetings. Since then there has been sharing of archeological information, exploration of potential partnerships and collaboration on design and shared use of publicly accessible spaces.

The resulting discussions and information sharing have led to a recommendation from the working group on how to move forward in building a strong, long-term partnership between Enoch Cree Nation and EPCOR Water Services Inc. (EWSI):

> **Joint Recommendation:** That Enoch Cree Nation Chief and Council support continued dialogue on a memorandum of understanding that recognizes the contributions of both entities and establishes a cooperative working relationship built on effective communication, respect and trust.

Additionally, following the extensive sharing of archeological data, artifacts, and draft HRIA (Historical Resources Impact Assessment) report with Enoch Cree Nation, including additional site visits and engagements with Enoch community members, and Elders and Knowledge Keepers, the Enoch Consultation Office is recommending the following:

> **Enoch Consultation Office Recommendation:** That Enoch Cree Nation Chief and Council support the development of EPCOR Water Services Inc.'s proposed solar farm project adjacent to the existing at E.L. Smith Water Treatment Plant, and rescinds Motion 2019/2020 - #36.

Key Issues

1. What does the archeological evidence say?

   Archaeological investigations at the proposed solar farm site identified at least seven camp site occupations ranging between roughly 3,500 and 9,000 years before present. Excavations at the site found fragments from the skull area (skull, mandible, hyoid [tongue bone], teeth) of large ungulates such as bison, cow, moose, and wapiti.

A portion of these fragments, most of which were small, were identified as bison. One incomplete bison skull was identified during mechanical overburden removal in one of the excavation areas located centrally in the project site, approximately 80 cm below surface and in an upside down position. A second fragmented skull was found during topsoil stripping at a different excavation area located in the southern portion of project site.

A small sample of fire-broken rock or heat-modified cobbles (68 pieces), five macrofossil samples (gastropod shells), 42 floral samples (wood, seeds, berries, charcoal), and 27 soil or ash (volcanic or wood-fire) samples were also collected. Four archaeological features, including two fire pits, a post hole, and a collapsed, burned, temporary structure were also noted. The most numerous artifacts found were stone tools such as projectile points and scrapers, and bone tools.

The Enoch Cree Nation team was provided full access to archeological materials in the second half of 2019, including a lab visit to the Stantec offices in Calgary, access to the draft HRIA report, excavation records, and access to artifacts excavated and catalogued.

The independent review by Enoch's archeologist concluded that:

- The archeological artifacts found do not support a conclusion that significant ceremony took place at the site, or that the site was a significant processing location or long-term campground;
- There was an absence of artifacts that are normally associated with sites that have had significant Indigenous ceremonies – for example, the excavations did not find enormous quantities of fire-broken rock, bones with cultural markings, or bison skulls with red ochre markings; and
- The first few feet of soil at the site was previously cultivated by farmers. This obscures the most recent use (within the last couple of hundred years) of the site.

The proposed solar farm has been designed to minimize further land disturbance, including using a single post design for the solar panel racks (reducing ground disturbance), and using new panel racking technology that can support more panels per rack (reducing the overall number of racks needed).

As the Edmonton region grows, future expansion of the Water Treatment Plant is likely. The proposed MOU between Enoch and EPCOR contemplates working together to plan future archeological investigations, and to protect the integrity of historical resources that may be present elsewhere on the site.

2. Was Sun Dance part of this site? Reconnecting with the land through ceremony

EPCOR and the Enoch Consultation Office heard from community members who made references to others' oral histories speaking to possible Sun Dance ceremonies taking place at this site. Throughout our many discussions and engagements, such as the Enoch community meeting on December 4, 2019 at the River Cree Resort and Casino, we did not receive any specific stories or hear any direct oral histories on Sun Dance ceremonies taking place here.

While the archeological evidence, as reviewed by Enoch Consultation, does not currently support a conclusion that significant ceremony was practiced here, both EPCOR and Enoch Consultation take seriously the implication that individual or group ceremony may have occurred here in the past. An Enoch cultural advisor shared with us, “ceremony was practiced everywhere in Treaty 6.” It is also possible that new information will come to light in the future.

Re-establishing the Enoch Cree Nation’s connection to this land has been a priority in discussions with Enoch Consultation and EPCOR. The proposed MOU commits to working together to establish ceremony on the site as a way to “bring back” these essential spiritual practices to this land.

Several meetings on how, where, and what is appropriate for ceremony have taken place with Enoch Elders and Knowledge Keepers. This will continue with a lodge ceremony, led by an Enoch Elder, in the near future to seek direction on how to proceed in a balanced way. The Elder also agreed that a concurrent process, where EPCOR works with Enoch Cree Nation on the solar farm project specifics, and also seeks direction through ceremony, is respectful and can lead down a good path.

Additionally, the MOU speaks to an annual ceremony jointly planned between Enoch and EPCOR intended to recognize the work arising out of the MOU and to acknowledge the many ground disturbances caused through EPCOR’s operations and projects. Again, we are seeking direction in concert with an Enoch Elder as we plan for what type of ceremony may be appropriate (sweat lodge, pipe ceremony, tobacco offering, community offerings, pow-wow, round dance, etc.).

One of the inquiries from Enoch Chief and Council during EPCOR’s January 2019 presentation was the possibility for Indigenous naming of the proposed solar farm site. In addition to bringing ceremony to the site, EPCOR will be working with Enoch on naming through ceremony and is one of the proposed actions under a future addendum of the MOU.

3. <u>Access to the Site and to the Waterway: Medicine Harvesting</u>

EPCOR and Enoch Consultation has heard about the importance of having Enoch youth and Elders gain access to the site and eventually to the North Saskatchewan River, with one Knowledge Keeper teaching us that before the 1908 “surrender” that the reserve stretched to the river and it acted as a “highway to the water”. More recently, an Enoch Elder stressed the importance of having young people come learn about their peoples’ history on site. The Enoch-EPCOR working group has had deep discussions on how to facilitate this access and bring Enoch members back to this importance place.

Several initiatives are currently being discussed or planned to help address accessibility, this includes establishing a medicine/plant harvesting program for Enoch band members at the proposed E.L. Smith Solar Farm site. This program is currently taking shape in the form of an addendum to the proposed Enoch-EPCOR MOU, with preliminary plans underway to allow for the harvesting of medicines such as sweetgrass as soon as Summer 2020. Linking this program to Enoch's planned medicine walks is also under consideration.

Access to the waterway is an ongoing dialogue, with EPCOR interested in continuing the discussion on the best possible path forward. This may include future additions to the proposed MOU addendums with details to be worked out by the working group.

4. Climate and environment

The proposed E.L. Smith Solar Farm project also forms one of EPCOR's contributions to global action on climate change, as it will reduce the company's need for off-site power generation and reduce our greenhouse gas impacts. This project is also one initiative among many that are needed to be implemented to meet the principles set out in the Edmonton Declaration, which calls for the immediate and urgent action to limit global warming to 1.5 degrees Celsius.

Tackling the enormous social, economic, and environmental disruptions caused by climate change and working to limit global warming remains a significant priority for many peoples and Nations. Additional initiatives that support this environmental work include EPCOR's design of the site to support future trails that provide a continuous connection though the river valley trail system. The design of the Water Treatment Plant and solar farm are also consistent with the future creation of a provincial park at Big Island, a goal that EPCOR supports.

Additionally, several environmental mitigations have been enacted to reduce the project's footprint and establish a vegetation buffer around the site that also helps maintain animal movement. Some the major mitigations include:

- A setback of at least 100 metres from the river along the entire site;
- A 40 meter wide vegetated buffer around the south and south east ends of the project to provide additional wildlife structural connectivity; and,
- 7.4 acres will be revegetated with endemic trees and shrubs. This will increase the amount of vegetated habitat across the project site while also providing additional cover for wildlife.

5. Collaboration for the future

The E.L. Smith Water Treatment Plant currently provides clean, safe water to over one million people in the Edmonton metropolitan region, including to Enoch Cree Nation. The plant was built in 1976 and upgraded in 2008 to increase the reliability and capacity of the region's long-term water supply.

EPCOR's proposed solar farm project on the lands adjacent to the water treatment plant, is intended to be an *interim* use of these lands as the solar farm will have an approximate 25-30 year operational life. After this interim use, the long-term intention of these lands is for the likely expansion of the water treatment plant to accommodate a growing region (according to the City of Edmonton's *2017 Growth Monitoring Report*, Edmonton's population is projected to reach over two million people by 2066, a little over a million more than today).

The MOU contemplates EPCOR and the Enoch Cree Nation walking forward together as partners at the E.L. Smith site – ensuring the water treatment plant can continue to provide life-giving water to the people of a growing region, while reducing its environmental footprint, and re-connecting the Enoch Cree Nation and its people with their historic lands through ceremony, harvesting, naming, and protocols. The MOU also helps ensure the Nation's engagement in future developments at the site, including partnering on future archeological investigations. Over the coming decades, it will be important for Enoch and EPCOR to have a strong, stable, close working relationship so that both can work together to uncover the history of these lands, and walk down that path of re-discovery together.

The appendix on the following page summarizes the engagement between the Enoch Consultation Office and EPCOR, and with Elders, Knowledge Keepers and the community.

Appendix A: Summary of Recent Engagements with Enoch Cree Nation

October 5, 2017	Consultation email introducing project, including HRIA/Backhoe Testing archaeology summary, sent to Enoch Cree Nation Consultation Office
November 27, 2017	EPCOR met with Enoch Consultation Office to discuss Solar project
May 17, 2018	Enoch Cree Nation site visit: included Enoch Consultation staff and Enoch Elders
June 11-15, 2018	Enoch Cree Nation participated in Stage 2 Archaeology work, with two Elders present to monitor work
October 10, 2018	Stage 2 Archaeology Summary and notification of BESS funding emailed to Enoch Cree Nation
October 23, 2018	Closing Workshop for Stage 2 Archaeology: Enoch invited and confirmed attendance but no participants recorded
October 25, 2018	Teleconference between EPCOR and Enoch Consultation Office to confirm that Enoch was satisfied with engagement and opportunities thus far
November 13, 2018	Teleconference with Enoch Councillor to inquire about process for letter of endorsement from Enoch for solar farm project
December 14, 2018	Email follow up to Enoch Councillor to facilitate EPCOR presentation to Chief and Council
January 28, 2019	EPCOR Presentation to Enoch Chief & Council
February 26, 2019	Received Letter of Support from Enoch Cree Nation
April 9, 2019	Email to Enoch Consultation Staff and Enoch COO re: outstanding issues for E.L. Smith solar farm: reminder of agreed actions and confirm a meeting date to discuss
May 10, 2019	Face-to-face meeting with Enoch COO & Consultation Coordinator on follow up actions for solar farm: naming, harvesting agreement, etc.
June 3, 2019	EPCOR receives Enoch Cree Nation’s formal May 23, 2019 motion referencing the approval of a retraction letter for support of the solar farm
June 7, 2019	EPCOR meets face-to-face with Enoch Consultation Office to discuss latest developments on retraction letter and to review any outstanding issues
June 17-19, 2019	City of Edmonton Public Hearings on Re-Zoning of parcels of land at E.L. Smith WTP for solar farm project, results in motion requesting re-engagement with Enoch Cree Nation and to ensure sharing of archeological information, exploring potential partnerships and collaboration on design and shared use of publicly accessible spaces.
July 29, 2019	Archeological Sharing Session, participants included Enoch Consultation Office Enoch Elders and Knowledge Keepers, Stantec, Alberta Culture, & EPCOR
August 27, 2019	Initial Re-Engagement Kick-Off Meeting with Enoch Consultation Staff
September 10, 2019	Bi-weekly Enoch-EPCOR Working Group Meeting
September 16-17, 2019	Archeological Artifacts & Draft Final Report Sharing/Review with Enoch Consultation at Stantec Labs in Calgary, AB
September 24, 2019	Bi-weekly Enoch-EPCOR Working Group Meeting; Enoch Consultation informs EPCOR that they are recommending Enoch Cree Nation again support the solar farm project based on the sharing of archeological information and artifact
October 9, 2019	Bi-weekly Enoch-EPCOR Working Group Meeting
October 22, 2019	Bi-weekly Enoch-EPCOR Working Group Meeting
November 5, 2019	Bi-weekly Enoch-EPCOR Working Group Meeting; Discussion on re-establishment of ceremony at E.L. Smith WTP site with Enoch Consultation and an Enoch Elder
November 19, 2019	Bi-weekly Enoch-EPCOR Working Group Meeting; re-establishment of ceremony at E.L. Smith WTP site discussion with Enoch Consultation Office and three Enoch Elders
November 21, 2019	Enoch Consultation presents recommendation to Enoch Chief & Council; Council seeks outcome of planned Dec. 4th Community Meeting
December 4, 2019	Enoch Community Meeting/Open House at River Cree Resort & Casino; Attended by approximately 25 Enoch Cree Nation band members and/or employees
December 17, 2019	Bi-weekly Enoch-EPCOR Working Group Meeting
January 14, 2020	Bi-weekly Enoch-EPCOR Working Group Meeting
January 28, 2020	Bi-weekly Enoch-EPCOR Working Group Meeting (*1/2*); re-establishment of ceremony at E.L. Smith WTP site discussion with Enoch Consultation Office and Enoch cultural advisor
January 29, 2020	Bi-weekly Enoch-EPCOR Working Group Meeting (*2/2*); re-establishment of ceremony at E.L. Smith WTP site discussion with Enoch Consultation Office and an Enoch Elder
February 10, 2020	Joint Enoch Consultation Office and EPCOR Presentation to Enoch Chief and Council on proposed MOU and Solar Farm project

ATTACHMENT 4

INDIGENOUS CONSULTATIONS

1. EWSI's objective is to ensure Indigenous rights-holders are included as an audience of consideration during the planning stages of the Project. EWSI looked to agencies such as the provincial Aboriginal Consultation Office ("ACO") and ACT to provide guidance on the duty of EWSI to ensure Treaty rights are respected and Indigenous groups included in the consultation and planning phase of the Project. The ACO reviewed EWSI's Project and determined there was no *Duty to Consult* based on geographic location and that no First Nations or Metis Nations would experience an impact to Treaty rights based on the geographic location of the Project consequently requiring no further action from EWSI. ACT determined there is historical and cultural relevance to the proposed Project area due to the historical uses of Edmonton's river and river valley system and recommended EWSI to notify local Indigenous communities who have a recognized connection to previous projects within the city of Edmonton.

2. Although it was determined there was no duty for EWSI consult, EWSI has elected to implement a full program of consultation with Indigenous communities about the Project, the site and historical resources. EWSI designed its consultation process to include the 21 First Nations, Métis Nations and rights-holder communities that EWSI typically engages for work in the Rossdale area, and elected to achieve a greater level of engagement than the 'notification' level recommended by ACT.

Indigenous Groups Consulted

3. The 21 Nations and rights-holder communities included 17 First Nations, 2 Métis Nations, and representatives of franchised nations (Papaschase Cree Nation Society, and Michel Band). Each received notice of the project and an invitation to work with EPCOR to develop a consultation plan. EPCOR reached out via email and traditional mail and asked for expressions of interest in the project. Reminder emails and phone calls were made to the Nations/communities to ensure, as best EPCOR could, that they knew of the opportunity to participate.

4. The following Nations/communities received project information and were invited to meet, discuss the project, ask questions and begin consultation:

Michel Band	Papaschase Cree Nation Society	Paul Band
Enoch First Nation	Louis Bull Tribe	Montana First Nation
Samson Cree First Nation	Erminiskine Cree Nation	Blood Tribe
Siksika First Nation	Piikani First Nation	Cold Lake First Nation
Frog Lake First Nation	Alexander First Nation	Alexis First Nation
Horse Lake First Nation	Saddle Lake Cree Nation	Kehewin Cree Nation
Tsuu T'ina First Nation	Metis Nation of Alberta – Region #2	Metis Nation of Alberta – Region #4

5. Of these 21 Nations and communities, thirteen expressed different levels of desired engagement: to continue to be informed; meet to discuss project, site visits, and community presentations. The Michel Band and Cold Lake First Nation both expressed an interest in the project but only to the level where they requested to be kept up to date on project developments.

6. EWSI has met face-to-face with the following eleven First Nations and one rights-holder community group to discuss the project:

Papaschase Cree Nation Society	Paul Band	Siksika First Nation	Piikani First Nation
Enoch First Nation	Louis Bull Tribe	Montana First Nation	Tsuu T'Tina First Nation
Samson Cree First Nation	Erminiskine Cree Nation	Blood Tribe	

7. At each of these meetings, EWSI outlined the project details and scope, timelines, regulatory approvals needed and how someone could get involved if need-be in these proceedings. EWSI also communicated what was known at that time about the archaeological findings during the Stage One exploration directed by ACT.

8. Once ACT determined that Stage Two archaeological exploration should be conducted, EWSI invited those who had expressed interest in the project to participate in the Stage Two archaeological assessment. The nine Nations that elected to be involved in the Stage Two archeology included:

Enoch First Nation	Paul Band	Siksika First Nation
Montana First Nation	Louis Bull Tribe	Piikani First Nation
Samson Cree First Nation	Erminiskine Cree Nation	Blood Tribe

9. Representatives from these nine Nations worked directly alongside the archaeologists to see first-hand what was being found and share knowledge from their respective Nations. Collectively, they spent more than 500 hours onsite. These nine Nations have had the opportunity to be directly involved, discover artifacts as they excavated areas by hand, have direct access to the archaeologists and the ability to ask questions and share knowledge of the site.

10. In October of 2018, EWSI held a work-shop for these participants to come back together and share all that they saw, ask more questions of the archaeologists, provide information that they'd heard from their own Nations and Elders and discussed how findings intertwine with traditional knowledge. EWSI is committed to sharing knowledge and is interested in approaching this knowledge from both the perspectives of western science and Traditional knowledge. EWSI also recognizes that beyond the academic pursuit of protecting flora, fauna and historically/culturally significant artifacts, that there is a spiritual connection that must be recognized.

11. Ceremonies have been held at the site and others are planned for the near future. It was noted by some Nations during the consultation process that a ceremony should have been held before archaeology work began. EWSI expressed to these Nations that they hadn't considered that in the planning stages but would have. EWSI is working with Nations to maneuver protocol to correct this oversight as well as investigating internal processes to see if ceremony is something that can be included on a more regular basis where capital projects are concerned. Throughout the site visits EWSI has looked to provide prayer opportunities and observe spiritual protocol as directed and lead by Nations' Elders. EWSI continues to have open conversations with Nations and explore ideas that can be incorporated later in the project execution that would allow for a greater level of spiritual inclusion and recognition. Elders and representatives from the Kainai (Blood Tribe) Nation, Piikani Nation and Siksika Nation performed ceremony on site on April 30, 2019. A second ceremony is currently planned for May 4, 2019 and will involve Elders and participants from the Cree Nations of Maskwacis: Samson Cree Nation, Louis Bull Tribe, Montana First Nation and Erminiskine Cree Nation. Enoch Cree Nation and Paul First Nation have also expressed a desire to perform ceremony on site but no date has been selected as of yet.

12. Through site visits, active participation in archeological investigations, and presentation to Communities, EWSI continues to gather feedback from Nations. While each Nation was able

to express their own thoughts and pose questions, there were some common questions that resonated with all the Nations involved: protection of animals, protection of vegetation and acknowledgement/protection of any artifacts found. EWSI responded to these concerns by explaining the various mitigation efforts planned for the Project. For example, by detailing how changes to the Project site plan had been made to widen movement corridors for animals and minimize tree removal and vegetation disturbances, Nations learned of the care and planning that EWSI was putting into the Project and seemed to be reasonably satisfied with the efforts taken.

13. Continued conversations with some Nations revealed that there was a belief that the area could contain plant species with specific cultural and medicinal value. EWSI has begun investigating how these plant species can be harvested now and protected/replanted for potential future use. EWSI is committed to working with experts/Elders inside these Nations to develop mitigation strategies that protect and promote these culturally significant plant species. EWSI also took the opportunity to discuss with Nations that came for site visits how other ideas, such as the inclusion of native pollinator habitat, were being discussed. EWSI is looking to include Community Interpretive Elements at the proposed site (refer Historic/Cultural Site shown on pages 7 and 9 of Attachment 3 – Preliminary Concept Plan). These would include not only interpretive elements that focus on the operation and benefits of a solar farm but also the history and stories of the area’s First People. EPCOR is planning to work with indigenous groups on a process to determine an appropriate Indigenous name to highlight the historical and cultural significance of the region.

September 2020 Supplemental Report - Update

EPCOR Water Services Inc. E.L. Smith Solar Farm Project
Enoch Cree Nation Re-Engagement Summary Report

Introduction

In February 2020, EPCOR Utilities Inc. submitted a report that summarized the comprehensive re-engagement activities conducted with Enoch Cree Nation from July 2019 to February 2020. This supplemental report includes significant updates on the re-engagement since that original submission earlier this year.

Signing of Memorandum of Understanding

Following twelve months of discussions, on September 1, 2020 Enoch Cree Nation's Chief William (Billy) Morin and EPCOR's CEO Stuart Lee signed a memorandum of understanding (MOU) that creates a new relationship based on respect, communication, and reconciliation. The key elements of note in the MOU include:

- Creates clear methods of communication and a forum for continued dialogue and information sharing through the establishment of a staff-level EPCOR-Enoch Cree Nation Working Group,
- Serves as a foundation for joint work on reconnecting Enoch Cree Nation members to their former reserve lands at E.L. Smith Water Treatment Plant with initiatives that will include traditional medicine harvesting, bringing ceremony back to the land, Indigenous naming of the proposed solar farm site, and historical interpretation, and
- Establishes a path forward on projects and joint-endeavours that cause a ground disturbance at the Rossdale and E.L. Smith Water Treatment Plants.

Below is an excerpt from Chief Morin's remarks made during the MOU signing ceremony that denote the significance of this new relationship:

> *"But what's often forgotten is that just as important as that nation to nation relationship is the person to person relationship, and the EPCOR MOU today to me signifies just as important as those nation to nation relationships...*
>
> *That for over the past one hundred years we haven't been on this land conducting a ceremony such as what happened this morning, we haven't danced in regalia on this land in over a hundred years. And it didn't come at the government table[s]… it came from EPCOR, who was willing just to sit down with us consistently and over time, to make this happen because it's just the right thing to do and they honour that Treaty relationship.*
>
> *For me, EPCOR are truly stewards of the land – it truly is for as long as the grass grows, the rivers flow, and the sun shines."*

The complete text of the MOU is provided at the end of this supplemental.

Memorandum of Understanding

Between

Enoch Cree Nation

and

EPCOR Water Services Inc.

PREAMBLE:

WHEREAS Enoch Cree Nation [*Maskêkosak nehiyowak*] is a signatory to Treaty No. 6 and it is recognized that the Nation has an inherent right to self-government;

AND WHEREAS EPCOR Water Services Inc. ("EPCOR Water Services") is a North American water utility incorporated under the laws of Alberta;

AND WHEREAS EPCOR Water Services operates a portion of its business within lands claimed by Enoch Cree Nation as its traditional territory, such as the Rossdale Water Treatment Plant, and on former Enoch Cree Nation reserve lands, such as the E.L. Smith Water Treatment Plant;

AND WHEREAS the Parties have mutual respect for each other's values, policies and areas of jurisdiction;

AND WHEREAS the Parties recognize that they each have distinct authorities and responsibilities and acknowledge that the interests of all persons served by the Parties are best served by working together in the spirit of reconciliation and collaboration;

AND WHEREAS the Parties recognize the *United Nations Declaration on the Rights of Indigenous Peoples (2007)* as a framework for reconciliation;

AND WHEREAS the Parties wish to establish a robust working relationship based on mutual respect and cooperation, to deal with issues of mutual interest and benefit;

NOW THEREFORE the Chief and Council of Enoch Cree Nation, on behalf of its members and citizens, and the President of EPCOR Utilities Inc., on behalf of EPCOR Water Services hereby declare their mutual intentions to pursue a lasting relationship based upon mutual respect, honour and recognition.

PURPOSE:

The purpose of this Memorandum is:

1. To set a strong foundation for the Parties to establish and maintain a cooperative relationship in the spirit of reconciliation;

2. To establish a path forward on projects, initiatives, and joint-endeavors associated with projects causing Ground Disturbances at E.L. Smith and Rossdale Water Treatment Plants ("Water Projects") and are of mutual benefit to both Parties; and,

3. To create a platform for meaningful, effective and transparent communication on issues of mutual interest.

DEFINITIONS:

“**Area of Interest**” means the geographic area, as shown on the map, attached as Appendix A.

“**EPCOR-Enoch Cree Nation Working Group**” means the staff level working committee to be established by this Memorandum and Addendum No. 1: Engagement and Consultation Processes and Practices.

“**Ground Disturbance”** means land surface disturbance activities that require development proponents to comply with standard conditions under the *Historic Resources Act*, RSA 2000, c. H-9 and may require regulatory approvals under this act.

“**Memorandum**” means the Memorandum of Understanding between Enoch Cree Nation and EPCOR Water Services, entered into on the Effective Date indicated below.

“**Water Projects”** means development projects initiated by EPCOR Water Services that will cause or are anticipated to cause Ground Disturbances at E.L. Smith Water Treatment Plant and Rossdale Water Treatment Plant.

SHARED PRINCIPLES:

This Memorandum represents a commitment by the Parties to develop a strong, committed and fair working relationship between their respective entities, working together for the rights and benefit of all, in accordance with the following:

1. It is recognized that Enoch Cree Nation’s history, culture and peoples have made and continue to make significant contributions to the social, economic, and ceremonial growth of the Edmonton Metropolitan Region.

2. It is recognized that the Parties mutually benefit from EPCOR Water Services providing safe, clean water to customers within its service area.

3. It is recognized that the Parties mutually benefit from the continued operation of both the E.L. Smith Water Treatment Plant and Rossdale Water Treatment Plant, and the potential expansion or upgrades of the plants to meet future water needs and regulatory requirements.

4. It is acknowledged that EPCOR Water Services may have regulatory or other obligations to engage with or consult with other First Nations and Indigenous communities on matters that may overlap with interests and traditional territories claimed by Enoch Cree Nation and that this does not diminish Enoch Cree Nation’s claims, responsibilities or rights.

5. A cooperative working relationship between EPCOR Water Services and Enoch Cree Nation is built on effective communication, respect and trust.

6. This Memorandum reflects an understanding between the EPCOR Water Services and Enoch Cree Nation to work cooperatively in the best interests of both their respective entities and the region as a whole.

7. It is recognized that the parties mutually support the principles of the Edmonton Declaration, which called for immediate and urgent action to limit global warming to 1.5 degrees Celsius.

SHARED OBJECTIVES:

The Parties will collaborate on the development and implementation of Water Projects of mutual benefit and will work to develop agreements to achieve these goals.

The Chief and Council of Enoch Cree Nation and the Senior Vice President of EPCOR Water Services agree to work together, along with their respective technical teams, to address issues of mutual interest. Both Parties will strike a standing working committee to advance the collaborative dialogue and joint work, some examples of which include:

- Identifying and establishing a series of Addenda to this Memorandum that address issues of mutual interest and benefit;
- Information Sharing; and
- Cultural and historical development.

TERM:

This Memorandum will begin on the Effective Date indicated below and will continue until such time as it is terminated by the Parties.

COMMUNICATION:

1. The Chief of Enoch Cree Nation and the Senior Vice President of EPCOR Water Services shall hold meetings to discuss matters of mutual concern and/or interest on an ‘as-required’ basis, with an annual ceremony, planned jointly, to recognize the work arising from this Memorandum.

2. The Chief of Enoch Cree Nation and the Senior Vice President of EPCOR Water Services shall direct their respective technical teams to work together in establishing effective, respectful communication regarding matters mentioned in this Memorandum and its Addenda.

IMPEMENTATION:

The Parties will establish a staff level working group (“the EPCOR-Enoch Cree Nation Working Group”) to assist with implementing the Memorandum.

As soon as practicable after the signing of the Memorandum, the EPCOR-Enoch Cree Nation Working Group will be established by an exchange of letters between the Chief of Enoch Cree Nation and the Senior Vice President of EPCOR Water Services in which each Party will identify their working group representative(s) to the other Party.

Alternate members may be appointed to the EPCOR-Enoch Cree Nation Working Group as necessary to ensure that its work continues during temporary absences of any member.

The EPCOR-Enoch Cree Nation Working Group may:

a) Develop terms of reference for its activities for approval by the Parties and will report to the Parties as required in implementing and administering the Memorandum;

b) Develop procedures governing frequency, timing, location, and record-keeping of matters arising out of its meetings;

c) Meet as soon as is reasonably practicable after the signing of this Memorandum to discuss the process for implementation of matters under this Memorandum;

d) Use all reasonable efforts to meet at least [two] times each calendar year, and more frequently as it may consider necessary to carry out its responsibilities under this agreement and will communicate as required by telephone or email; and

e) Be a forum where each Party can be notified, as appropriate, of anticipated decisions of each Party respecting the Area of Interest that may affect the other.

DISPUTE RESOLUTION:

Where a dispute arises between the Parties, the Parties agree to first seek to resolution of disputes through informal communications and on a without prejudice basis.

The Parties further agree that:

a) The EPCOR-Enoch Cree Nation Working Group will endeavor to resolve disputes arising in that forum through informal communications; and the authority and/or limits of each Party's representatives in that forum will be clearly communicated to the other Party with respect to any matter under discussion or dispute;

b) At any time, either Party may request a special meeting of the Parties to discuss a dispute by providing notice in accordance with the provisions of the Memorandum. At special meetings of the Parties, Enoch Cree Nation will be represented by the Chief of the Nation or his or her designate and EPCOR Water Services will be represented by the Senior Vice President of EPCOR Water Services or his or her designate.

c) Where the Parties are unable to resolve a dispute by a special meeting, either Party may then suggest using informal dispute resolution guided by an independent third party (or third party neutral), such as a meeting facilitator or mediator. Use of a third party neutral process will be completely voluntary and without prejudice for both Parties. The Parties must agree on the selection of a third party neutral and will share the costs of such a process equally. Where both Parties agree to resort to a third party neutral, each Party will identify their own representative.

NOTICE:

The address for delivery of any notice or other written communication required or permitted to be given in accordance with this Memorandum, including any notice advising the other Party of any change of address, shall be as follows:

(a) to **EPCOR Water Services**:

Director, Edmonton Water Treatment Plants OR Manager, Government & Indigenous Relations
Suite 2000 10423 – 101 Street NW
Edmonton, Alberta T5H 0E8

(b) to **Enoch Cree Nation** [Maskêkosak nehiyowak]

Consultation Supervisor OR Council Member with Consultation Portfolio
Box 29
Enoch, Alberta T7X 3Y3

Any notice mailed shall be deemed to have been received on the fifth (5th) business day following the date of mailing. By notice faxed or e-mailed will be deemed to have been received on the first (1st) business day following the date of transmission. For the purposes of this section, the term "business day" shall mean Monday to Friday, inclusive of each week, excluding days that are statutory holidays in the Province of Alberta.

The Parties may change their address for delivery of any notice or other written communication by notifying the other party in writing.

REVIEW:

This Memorandum will be reviewed annually by the Parties. No variation or amendment of this Memorandum is effective unless it is agreed in writing between the Parties.

TERMINATION:

This Memorandum may be terminated by either Party by giving 60 days' notice in writing to the other Party.

LIMITATION:

This Memorandum is not a binding legal agreement and does not create any binding obligations on any party.

Nothing in this Memorandum is intended to be construed as modifying any Treaty, creating a new Treaty or as a Treaty-making process and any discussion that may abrogate or derogate a Treaty Right is not to be construed as consultation without free, prior and informed consent.

Agreed, this 1st day of September 2020 ("Effective Date").

Signed for and on behalf of the Enoch Cree Nation:

(*Original signed September 1, 2020*)

Signed for and on behalf of EPCOR Water Services Inc.:

(*Original signed September 1, 2020*)

ADDENDA UNDER DEVELOPMENT

Addendum No. 1: Engagement and Consultation Processes and Practices

Addendum No. 2: Communications and Information Sharing

Addendum No. 3: Historic Resources and Naming of "E.L. Smith Solar Farm"

Addendum No. 4: Plant Harvesting for Traditional Purposes

WHAT WE HEARD REPORT

River Valley Cameron Rezoning (LDA17-0283)

PROJECT ADDRESS: 16910 – 35 Avenue NW, 16850 & 16880 Anthony Henday Drive NW

PROJECT DESCRIPTION:

- Amendment to the North Saskatchewan River Valley Area Redevelopment Plan from Metropolitan Recreation and Environmental Protection to Public Utility.
- Rezoning from (A) Metropolitan Recreation Zone to (PU) Public Utility Zone to allow for the development of a solar farm (major impact utility service use).

TYPE OF ENGAGEMENT (CITY SPONSORED)	DATE	RESPONSES/ # OF ATTENDEES
Notification of Application	Mailed July 6, 2017	6 phone calls and 4 emails
Notification of Open House	Mailed January 24, 2018	0 phone call and 1 email
Open House	February 13, 2018	20 attended

ABOUT THIS REPORT

This report includes a summary of:

- Calls and emails received in response to the notification letter sent out on July 6, 2017, and
- Feedback gathered at the open house held on February 13 (written comments and feedback forms)

Who will receive this report?

- Everyone who emailed the file planner directly
- All attendees who provided their email address at the open house
- The applicant and consultants
- The Ward Councilor

Next Steps:

If/when the proposed rezoning and plan amendments advances to Public Hearing this report will be included in the information provided to City Council.

THE APPLICATION

The application consists of two components: a plan amendment to the North Saskatchewan River Valley Area Structure Plan which involves a map change that re-designates the area (currently fenced and adjacent to the water treatment plant) from Metropolitan Recreation and Environmental Protection Zone to Public Utility. The proposed rezoning is from (A) Metropolitan Recreation Zone to (PU) Public Utility Zone. The area of the proposed rezoning encompasses 40.12 ha.

An Environmental Impact Assessment is required as part of this application, and has yet to be submitted.

This file has not yet been scheduled for Public Hearing.

MEETING FORMAT

The meeting format was a station-based open house where attendees were able to view display boards with project information and ask questions of City Staff and the applicant. Participants were invited to share their feedback on poster boards by offering general feedback on what they like and do not like about the application as well as what participants would like council to know before making a decision. We also received 8 forms with written comments. The comments & questions we received are summarized by main themes below.

WHAT WE HEARD SUMMARY

The most common questions and concerns heard were:

- **Impact on trails**: There were concerns regarding the impact on trails and recreational use of the river valley.
- **Location of the Proposed Solar Farm:** Questions about allowing the solar farm within the river valley would set a precedent for future development within the river valley.

- **Environmental Impacts:** There were concerns regarding possible impacts on wildlife and the ecological integrity of the river valley.
- **Solar Farm vs. Policy Direction**: How does the solar farm align with City Policy? Specifically: The Ribbon of Green and the North Saskatchewan River Valley Area Redevelopment Plan?

The most common comments of support heard were:

- **Green Energy:** Encouragement for EPCOR providing renewable energy and moving forward with a green initiative.
- **Low Impact Development**: Some residents support of this application: citing the solar farm would have minimal impact on the environment and surrounding community.
- **Opportunity for Trail Linkages & Educational Programming:** Many of the residents support a trail connection (by way of an access easement), and solar farm educational and information signage along the path.

The following information provides answers to questions heard at the open house.

ANSWERS TO QUESTIONS

Q. What impact will the Solar Farm have on the trail system in the river valley?
Response:

- The applicant has agreed to provide the City of Edmonton access through their property (outside the solar farm fence line) for future recreational trails to ensure connectivity of the surrounding trail system.
- There will be minimal impact on the existing trail system (located south of the site and north of Anthony Henday Drive). Currently the area for the proposed solar farm is fenced off and is private property.
- There are no existing formal trails along this portion of the river.
- Pedestrians within close proximity on adjacent future trails, and possibly on trails that look down to the river valley will be able to see the panels.
- If approved, all of the proposed development, with the exception of trail development, will take place within EPCOR's existing fence. The applicant has agreed to provide a 100m setback/buffer area from their property line to the proposed solar farm.
- Trail development is independent of solar farm development and will be developed in accordance with City Standards.

Q. Why does the solar farm need to be located within the river valley?

Response:

- This proposed site is owned by EPCOR and adjacent to the existing E.L. Smith Water Treatment Plant. The solar panels can provide direct solar energy into the plant instead of using conventional outsourcing power from the City's grid network.
- The applicant has stated of possible project locations on their land holdings, this site resulted in the least disturbance to existing vegetation. Other factors the applicant evaluated include: proximity to the E.L. Smith Water Treatment Plant, land size, land orientation, land ownership, operations and maintenance, environmental impacts and cost.

Q. Will the development of the solar farm set a precedent for future industrial development in the river valley?

Response:

- Any activity in the river valley needs to be approved by Council.
- Each application is considered on its own merits and is reviewed against all City bylaw's and policies.

Q. What environmental impacts will the proposed solar farm have on the surrounding ecological network?

Response:

- The applicant has engaged an independent third-party consultant to assess the impact of the project on: wildlife, wetlands, trees / vegetation, soils, historical resources. Results from the study will be included in an Environmental Impact Assessment report and submitted to the City as part of the rezoning application process.
- All municipally, provincially and federally required environmental approvals will be obtained prior to development of the proposed solar farm. The applicant's design and construction practices will have systems, procedures and measures in place to minimize, and control, potential impacts to the environment.
- The proposed solar farm will generate renewable energy to help power the existing E.L. Smith Water Treatment Plant, while reducing EPCOR's greenhouse gas emissions.

Q. Does a solar farm align with the policies in the North Saskatchewan River Valley Area Redevelopment Plan?

Response:

- While the plans primary purpose is to minimize disruption of the natural environment, it does recognize that some development may take place. With that development , the goal of minimal adverse environmental effects is included.
- The North Saskatchewan River Valley Area Redevelopment Plan requires that the applicant complete an Environmental Impact Assessment (EIA) that evaluates the impact the development proposal will have to the ecological system. The EIA has not been submitted at this time.
- The EIA will be reviewed and will help determine the impact of the proposed development within the river valley and ultimately determine if the project aligns with the policies of the the North Saskatchewan River Valley Area Redevelopment Plan.

Q. Does a solar farm align with the policies in the Ribbon of Green?

Response:

- The Ribbon of Green directs that the majority of the River Valley will remain in a natural state, and that any new or expanded facilities be located in already disturbed areas, or areas where the environmental impact will be low.
- The City strives to minimize impact to River Valley natural areas, but recognizes that in some cases it may be appropriate to permit limited development within this corridor - provided that they are located in an already disturbed site, or an area with low environmental impact, and potential environmental impacts, including wildlife connectivity, are well understood, minimized and mitigated.
- EPCOR will address the Ribbon of Green’s Education principle and Trail principle by ensuring that recreational trail connectivity through the site is facilitated by providing an access easement, and providing educational signage.

NEXT STEPS

Based on feedback from the open house, revisions to the proposal may be forthcoming. If/when the proposed amendment advances to Public Hearing this report will be included in the information provided to City Council.

If the project is approved, the applicant will develop an environmental protection plan prior to development that includes mitigation measures and a monitoring plan for post-construction.

If you have questions about this application please contact:
Luke Cormier, Planner
780-496-7370
Luke.Cormier@edmonton.ca

WHAT WE HEARD REPORT

River Valley Cameron Rezoning (LDA17-0283)

PROJECT ADDRESS: 16910 – 35 Avenue NW, 16850 & 16880 Anthony Henday Drive NW

PROJECT DESCRIPTION:

- Amendment to the North Saskatchewan River Valley Area Redevelopment Plan from Metropolitan Recreation and Environmental Protection to Public Utility.
- Rezoning from (A) Metropolitan Recreation Zone to (DC1) Direct Development Control Provision to allow for the development of a solar power plant (major impact utility) service use).

TYPE OF ENGAGEMENT (CITY SPONSORED)	DATE	RESPONSES/ # OF ATTENDEES
2nd Notification of Application	May 1, 2018	14 phone calls, 4 emails
Notification of Information Session	Mailed April 2, 2019	3 phone calls and 1 email
Information Session	April 23, 2019	36 attended

ABOUT THIS REPORT

This report includes a summary of:

- Calls and emails received in response to the notification letter sent out on May 1, 2018, and
- Feedback gathered at the information session held on April 23, 2019 (written comments and feedback forms)

Who will receive this report?

- Everyone who emailed the file planner directly
- All attendees who provided their email address at the open house
- The applicant and consultants
- The Ward Councilor

Planning Coordination
CITY PLANNING

Edmonton

Next Steps:

If/when the proposed rezoning and plan amendments advances to Public Hearing this report will be included in the information provided to City Council.

THE APPLICATION

The application consists of two components: a plan amendment to the North Saskatchewan River Valley Area Structure Plan which involves a map change that re-designates the area (currently fenced and adjacent to the water treatment plant) from Metropolitan Recreation and Environmental Protection Zone to Direct Development Control Provision. The proposed rezoning is from (A) Metropolitan Recreation Zone to (DC1) Direct Development Control Provision. The area of the proposed rezoning encompasses 40.13ha.

This file is scheduled for the June 17, 2019 Public Hearing

MEETING FORMAT

The meeting format was a station-based information session where attendees were able to view display boards with project information and ask questions of City Staff and the applicant. Participants were invited to share their feedback on poster boards by offering general feedback on what they like and do not like about the application as well as what participants would like council to know before making a decision. We also received 19 forms with written comments. The comments & questions we received are summarized by main themes below.

WHAT WE HEARD SUMMARY

The most common questions and concerns heard were:

- **Impact on trails**: There were concerns regarding the impact on trails and recreational use of the river valley.
- **Location of the Proposed Solar Farm:** There were concerns about allowing the solar farm within the river valley would set a precedent for future development within the river valley.
- **Environmental Impacts:** There were concerns regarding possible impacts on wildlife and the ecological integrity of the river valley

The following information provides answers to questions heard at the information session.

ANSWERS TO QUESTIONS

Q. What impact will the Solar Farm have on the trail system in the river valley?
Response:

- The applicant has agreed to provide the City of Edmonton access through their property (outside the solar farm fence line) for future recreational trails to ensure connectivity to the surrounding trail system.
- There will be minimal impact on the existing trail system (located south of the site and north of Anthony Henday Drive). Currently the area for the proposed solar farm is fenced off and is private property.
- There are no existing formal trails along this portion of the river.
- Pedestrians within close proximity on adjacent future trails, and possibly on trails that look down to the river valley will be able to see the panels.
- If approved, all of the proposed development, with the exception of trail development, will take place within EPCOR's existing fence. The applicant has agreed to provide a 100m setback/buffer area from their property line to the proposed solar farm.
- Trail development is independent of solar farm development and will be developed in accordance with City Standards.
- It should be noted City administration needs to conduct wildlife monitoring and evaluate those findings before proceeding with the trail.

Q. Why does the solar farm need to be located within the river valley?
Response:

- This proposed site is owned by EPCOR and adjacent to the existing E.L. Smith Water Treatment Plant. The solar panels can provide direct solar energy into the plant instead of using conventional outsourcing power from the City's grid network.
- The applicant has stated of possible project locations on their land holdings, this site resulted in the least disturbance to existing vegetation. Other factors the applicant evaluated include: proximity to the E.L. Smith Water Treatment Plant, land size, land orientation, land ownership, operations and maintenance, environmental impacts and cost.

Q. Will the development of the solar farm set a precedent for future industrial development in the river valley?

Response:

- Any activity in the river valley needs to be approved by Council.
- Each application is considered on its own merits and is reviewed against all City bylaw's and policies.

Q. What environmental impacts will the proposed solar farm have on the surrounding ecological network?

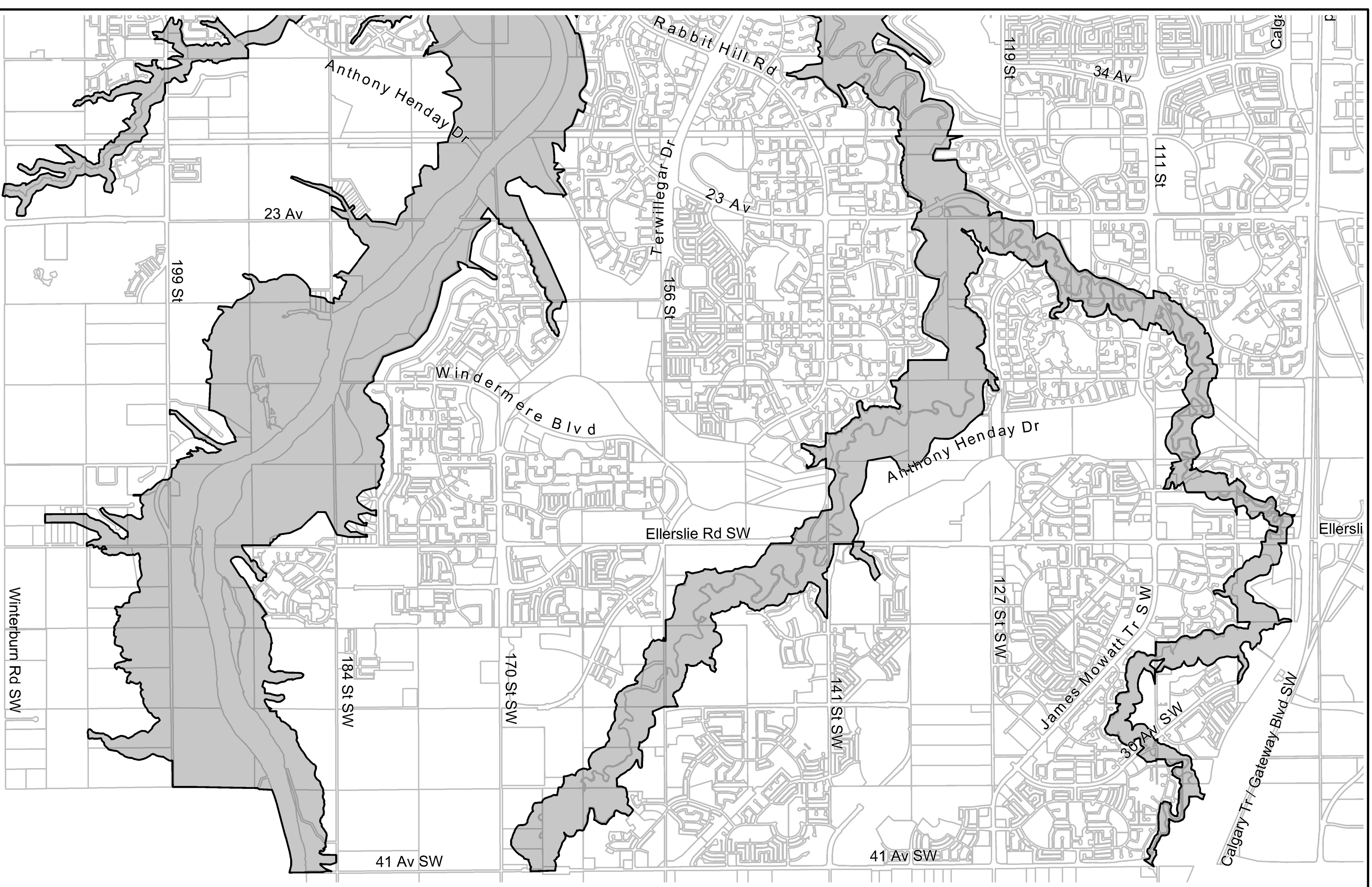
Response:

- The applicant has engaged an independent third-party consultant to assess the impact of the project on: wildlife, wetlands, trees / vegetation, soils, historical resources. Results from the study were included in an Environmental Impact Assessment report and submitted to the City as part of the rezoning application process.
- All municipally, provincially and federally required environmental approvals will be obtained prior to development of the proposed solar farm. The applicant's design and construction practices will have systems, procedures and measures in place to minimize, and control, potential impacts to the environment.
- The proposed solar farm will generate renewable energy to help power the existing E.L. Smith Water Treatment Plant, while reducing EPCOR's greenhouse gas emissions
- Recent research indicates solar energy installations pose risk to birds due to collisions with solar panels.
- If the project is approved, the applicant will develop an environmental protection plan prior to development that includes mitigation measures and a monitoring plan for post-construction.

NEXT STEPS

If/when the proposed amendment advances to Public Hearing this report will be included in the information provided to City Council

If you have questions about this application please contact:
Luke Cormier, Planner
780-496-7370
Luke.Cormier@edmonton.ca

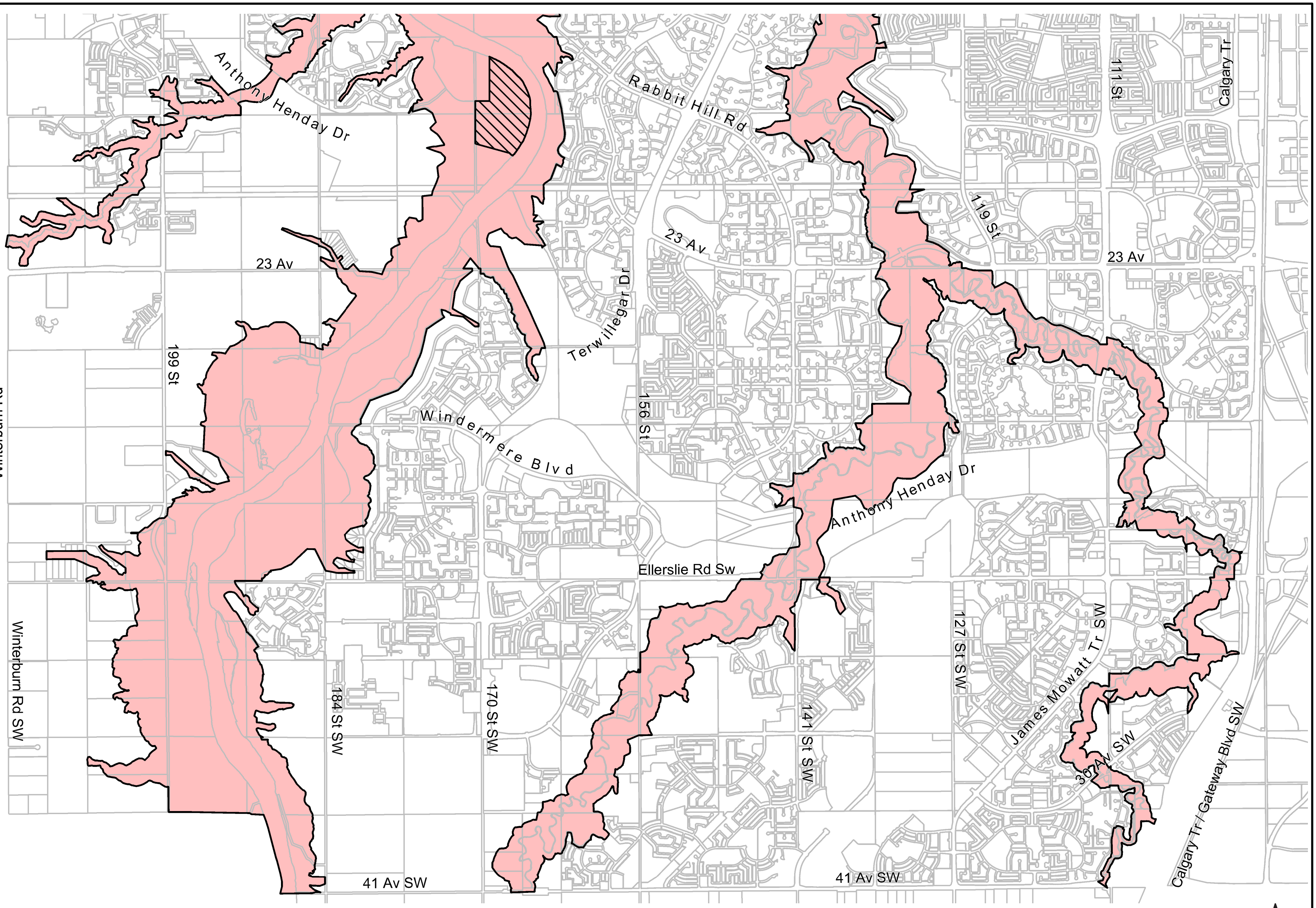


BYLAW 18569
APPROVED
NSRV
AREA REDEVELOPMENT PLAN
(as amended)

▨ North Saskatchewan River Valley Boundary

☐ Legal Block Lines

Note: In case of contradiction between the land use concept and other figures in the plan, the concept takes precedence.



BYLAW 18889
NORTH SASKATCHEWAN RIVER VALLEY

Area Redevelopment Plan
(as amended)

▨	Direct Development Control Provision
🟥	North Saskatchewan River Valley Boundary
☐	Legal Block Lines

Note: In case of contradiction between the land use concept and other figures in the plan, the concept takes precedence.

APPLICATION SUMMARY

INFORMATION

Application Type:	Plan Amendment & Rezoning
Bylaw: Charter Bylaw:	18889 18890
Date of Application Acceptance	May 17, 2017
Location:	North of Anthony Henday Drive NW, east of E.L Smith Road NW and west of North Saskatchewan River
Addresses:	16850 & 16880 - Anthony Henday Drive NW & 16910 - 35 Avenue NW
Legal Descriptions:	A portion of NW 3-52-24-4; Lot 1, Block 1, Plan 8722572 & Lot 2, Block 1, Plan 0123893
Site Area:	40.13 hectares
Neighbourhood:	River Valley Cameron
Notified Community Organizations:	Cameron Heights, Greater Windermere, Riverbend, The Lessard Edmonton, The Ridge, Wedgewood Ravine, and the Westridge / Wolf Willow / Country Club Community Leagues and the West Edmonton Communities Council Area Council, Southwest Area Council of Community Area Council, Terwillegar Riverbend Advisory Council Area Council
Applicant:	Stantec Consulting Ltd.

PLANNING FRAMEWORK

Current Zone and Overlay:	(A) Metropolitan Recreation Zone Floodplain Protection Overlay
Proposed Zone and Overlay:	(DC1) Site Specific Development Control Provision Floodplain Protection Overlay
Plan in Effect:	North Saskatchewan River Valley Area Redevelopment Plan

Written By:	Administration
Approved By:	Travis Pawlyk
Section:	Planning Coordination
Branch:	Development Services