Claresholm Solar Inc.
'Energy for a brighter future'

Claresholm Solar Inc.
260, 2323 – 32nd Ave N.E
Calgary, Alberta
T2E 6Z3

September 18, 2018

Municipal District of Willow Creek
#26, Highway 520 West
Claresholm Industrial Area
Box 550, Claresholm, AB T0L 0T0

To the Attention of: M.D. of Willow Creek Municipal Planning Commission and Planning & Development Department

Claresholm Solar Inc. (CSI) is pleased to submit this Development Permit Application for our 130MW AC solar project located in the M.D. of Willow Creek. This proposal is being submitted following the Land Use Amendment process to rezone the subject lands to Rural Industrial (RI). Solar Energy Systems are considered a discretionary use on RI lands, as per Schedule 3, section 1 of the Land Use Bylaw No. 1616, which this application is being submitted in conformance with. We are hopeful that this application highlights the merits of our project and how it can complement and provide further diversity to your M.D.'s rural and agricultural economy while contributing to the MD's objective to expand and diversify the local economy.

From the outset, our company has strived to find innovative ways to integrate solar energy into the agricultural landscapes of the Prairie Provinces. In this application, we have placed special emphasis on our development approach, which by design makes solar energy complementary to agriculture. We emphasize that the project site has been selected for its low agricultural productivity, as salinity and soil limitations make the site best suited to grazing as opposed to cash crop production. Tax revenue generated by the project to the provincial and municipal governments is estimated to be approximately 1.2million per year for the first 6 years (at which time the tax revenue will be adjusted to accommodate depreciation). Furthermore, we are offering an electricity subsidy to neighbours within 1,500m of the project, which will add to the community benefits of the project. In combination, we feel that all of these features have a net positive impact at the local, municipal, and provincial level.

Further to the MD's recommendation, we respectfully submit to you a proposal that:

(1) protects agricultural land:
   a. it can help improve on-site soil quality through preventing soil salinization;
   b. it provides an economic incentive to maintain the land for livestock production (instead of acreage development, gravel extraction or other uses that prevent agricultural activities from continuing); and

(2) maintains agricultural production at a similar extent as if no development had occurred:
   a. sheep will be grazed on the lands;
   b. an estimated 95% of the land will continue to be agriculturally productive with livestock carrying capacity anticipated to be comparable to pre-development levels;
   c. agricultural productivity of the land (and adjacent lands) could improve since re-

establishment of perennial grasses on formerly cultivated land can alleviate soil salinity issues;

d. the anticipated loss in agricultural acreage amounts to ~ 8 acres for a full quarter section

It is our understanding that the enclosed proposal meets the setback requirements as described in schedule 2, section 3.1 of the Land Use Bylaw No. 1616.

In addition, we request the final design and layout of the facility and Storm Water Management Plan be conditions of approval, as they will be finalized during detailed engineering design once all municipal setbacks have been confirmed.

In summary, we respectfully submit our proposal along with a request that the M.D. of Willow Creek consider our development proposal to be an appropriate use for the Rural Industrial zoned land.

Sincerely,

Daniel Andres
VP, Claresholm Solar Inc.

THE MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
Box 550, Claresholm, AB T0L 0T0
Phone (403) 625-3351 Fax (403) 625-3886 www.mdwillowcreek.com

FOR OFFICE USE ONLY
Application No. ____
Fees Submitted: $____
Site Inspection: ____

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Form A

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ADDRESS: [redacted] **Fax:** [redacted]

MUNICIPAL ADDRESS: N/A **Bus/Cell:**

REGISTERED OWNER: Hutterian Brethren Church of Granum **Telephone:** [redacted]

LEGAL DESCRIPTION: Lot(s) ____ Block ____ Plan ____

OR: Quarter SE Section 1 Township 13 Range 26 W 4 M

EXISTING USE: grazing and cultivation

PROPOSED USE: grazing and ground mounted solar photovoltaic facility for electricity generation

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I have read and understand the terms noted on the reverse side of this form and hereby apply for permission to carry out the development described above and/or on the attached plans and specifications. I further certify that the registered owner(s) of the land described above is aware of this application.

DATE: November 27, 2017 **SIGNED:** [redacted]
Applicant

IMPORTANT: See Over

ADDITIONAL INFORMATION: ____________________

IMPORTANT:

1. Subject to the provisions of the Land Use Bylaw of The Municipal District of Willow Creek No. 26, the term "development" includes any change in the use of buildings or land.

2. Although the Development Officer is in a position to advise on the principle or details of any proposals, such advice must not be taken in any way as an official consent, and is without prejudice to the decision in connection with the formal application. It must be clearly understood that any development by the applicant within 14 days after receipt of a Development Permit is at his own risk.

3. Please submit a plan or drawing showing locations of existing and proposed buildings, roads, services, boundaries, etc. in sufficient detail to ensure proper consideration of the application. Measurements may be metric or imperial units. It is desirable that the plans and drawings should be on scale appropriate to the development, that is:

   Site plans – ratio of 1:1000 or 1:1500
   Other drawings – ratio of 1:100 or 1:200

   or as required by the Development Officer. However, unless otherwise stipulated, it is not necessary for plans and drawings to be professionally prepared.

4. If a decision is not made within 40 days from the date of the receipt of the application in its complete and final form, the applicant may exercise his right of appeal as though he had been mailed a refusal at the end of the 40-day period unless an agreement for a time extension has been entered into with the municipality.

RIGHT OF ENTRY:

I hereby authorize representatives of The Municipal District of Willow Creek No. 26 to enter my land for the purpose of conducting a site inspection in connection with this application.

This right is granted pursuant to Section 542(1) of the *Municipal Government Act.*

DATE: November 27, 2017 **SIGNED:** ____________________

See attached Letter
Registered Landowner(s)

THE MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
Box 550, Claresholm, AB T0L 0T0
Phone (403) 625-3351 Fax (403) 625-3886 www.mdwillowcreek.com

FOR OFFICE USE ONLY
Application No. ______
Fees Submitted: $ ______
Site Inspection: ______

APPLICATION FOR A DEVELOPMENT PERMIT

IMPORTANT: *This information may also be shared with appropriate government/other agencies (e.g. Alberta Agriculture, Food and Rural Development; Alberta Environment; the regional health authority), and may also be kept on file by those agencies. This information may also be used by and for any or all municipal programs and services. The application and related file contents will become available to the public and are subject to the provisions of the Freedom of Information and Protection of Privacy Act (FOIP). If you have any questions about the collection of this information, please contact The Municipal District of Willow Creek No. 26.*

Form A

APPLICANT: Claresholm Solar Inc. C/O Scott Land & Lease Ltd. **Telephone:** [redacted]

ADDRESS: [redacted] **Fax:** [redacted]

MUNICIPAL ADDRESS: N/A **Bus/Cell:** [redacted]

REGISTERED OWNER: Hutterian Brethren Church of Granum **Telephone:** [redacted]

LEGAL DESCRIPTION: Lot(s) ______ Block ______ Plan ______

OR: Quarter SW Section 6 Township 13 Range 25 W 4 M

EXISTING USE: grazing and cultivation

PROPOSED USE: grazing and ground mounted solar photovoltaic facility for electricity generation

PARTICULARS OF PROPOSED DEVELOPMENT: Please refer to the attached submission package for details of the proposal.

Additional information or clarification can be helpful in processing the application without delay. You may wish to use the back of this form, or attach a separate sheet with such information. **Please fill out the Right of Entry authorization on reverse.**

REGISTERED OWNER OR PERSON ACTING ON BEHALF OF:

I/we agree to the collection and sharing of this information contained in this application, and any other information that may be required to verify and evaluate this application as explained above. I have submitted particulars concerning the completion of the proposed development and agree to comply in all respects with any conditions that may be attached to any development permit that is issued and with any other bylaws that are applicable. I am aware that I may be required to pay for all local improvement costs, which include drainage, sidewalks, road construction, street lighting, water and sewer main extensions, utility connection fees and installation costs at the present established rate.

I have read and understand the terms noted on the reverse side of this form and hereby apply for permission to carry out the development described above and/or on the attached plans and specifications. I further certify that the registered owner(s) of the land described above is aware of this application.

DATE: November 27, 2017 **SIGNED:** [redacted]
Applicant

IMPORTANT: See Over

ADDITIONAL INFORMATION: ______________________________

IMPORTANT:

1. Subject to the provisions of the Land Use Bylaw of The Municipal District of Willow Creek No. 26, the term "development" includes any change in the use of buildings or land.

2. Although the Development Officer is in a position to advise on the principle or details of any proposals, such advice must not be taken in any way as an official consent, and is without prejudice to the decision in connection with the formal application. It must be clearly understood that any development by the applicant within 14 days after receipt of a Development Permit is at his own risk.

3. Please submit a plan or drawing showing locations of existing and proposed buildings, roads, services, boundaries, etc. in sufficient detail to ensure proper consideration of the application. Measurements may be metric or imperial units. It is desirable that the plans and drawings should be on scale appropriate to the development, that is:

   Site plans – ratio of 1:1000 or 1:1500
   Other drawings – ratio of 1:100 or 1:200

   or as required by the Development Officer. However, unless otherwise stipulated, it is not necessary for plans and drawings to be professionally prepared.

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This right is granted pursuant to Section 542(1) of the *Municipal Government Act*.

DATE: November 27, 2017 **SIGNED:** ______________________________

See attached Letter
Registered Landowner(s)

FROM: Hutterian Brethren Church of Granum
ADDRESS [redacted]

[redacted]

TO WHOM IT MAY CONCERN:

Re: Claresholm Solar Project Letter of Authorization

We, the Hutterian Brethren Church of Granum, the owner of the lands mentioned below, hereby give Claresholm Solar Inc., and its agents permission to act as our agent to acquire the necessary permits and information from the municipality or other authorities concerned, needed to approve the construction of the Claresholm Solar Project. For clarity, permission is granted to Claresholm Solar Inc., to apply for any land rezoning and Development Permit Application as may be required for gaining approval from the municipality or other authorities for the construction of the Claresholm Solar Project.

Lands:		
SE-1-13-26-W4	NE-6-13-25-W4	NE-31-12-25-W4
NE-1-13-26-W4	SE-6-13-25-W4	SE-31-12-25-W4
NW-1-13-26-W4	SW-6-13-25-W4	

Sincerely,

Hutterian Brethren Church of Granum

Per: [redacted]
Leonard Hofer

Per: [redacted]
George Tschetter

Claresholm Solar Inc.

Addenda 2 to Development Permit Application, November 21, 2018

1. **Describe the current use of the land(s) (ie; agriculture productive land, wetlands, native grass, topography, etc.)**

1,261 acres of land located ~10km east of the town of Claresholm (legal land locations: NW, NE, SE SEC 01-13-26-W4; SW, NE, SE SEC-06-13-25-W4; NE, SE SEC 31-12-25-W4). The lands on which the project is proposed consist of lower value agricultural land. The Subdivision Application Package (Appendix "A") submitted to the Old Man River Regional Services Commission, as approved with conditions on September 19, 2018, has subdivided out wetland exclusion areas from the project lands, leading to 0% of the project lands consisting of wetlands. The total project footprint (excluding setbacks and Rural General zoned land) is approximately 956.98 acres. Approximately 58.83% of the project footprint to be zoned Rural Industrial is saline tame pasture and the balance (41.17%) is land that was recently converted (within the last 5 years) from tame pasture to cropland. A summary of the project lands, including the tentative lots to be subdivided and zoned Rural Industrial, total number of acres and land characteristics can be found in Table 1. Lot references correspond to those made in Appendix "A".

Table 1. Summary of project lands under lease option agreement.

Legal Land Description	Tame Grass (acres)	Cropland (acres)	Percent land in wetland	Total Acres	Land Characteristics
SE-1-13-26-W4 Lot 1	0	108.62	0%	108.62	Cropland, abandoned well
NE-1-13-26-W4 Lot 1	0	135.41	0%	135.41	Cropland, natural gas pipeline, abandoned well
NW-1-13-26-W4	0	149.45	0%	149.45	Cropland, natural gas pipeline, adjacent farmstead
NE-31-12-25-W4 Lot 1	122.54	0	0%	122.54	Tame pasture, natural gas pipeline
SE-31-12-25-W4 Lot 1	104.40	0	0%	104.40	Tame pasture, natural gas pipelines and pump station
SE-6-13-25-W4 Lot 1	133.87	0	0%	133.87	Tame pasture
SE-6-13-25-W4 Lot 5	0.89	0	0%	0.89	Tame pasture
NE-6-13-25-W4 Lot 1	33.60	0	0%	33.60	Tame pasture
NE-6-13-25-W4 Lot 3	75.75	0	0%	75.75	Tame pasture
SW-6-13-25-W4 Lot 2	92.45	0	0%	92.45	Tame pasture, abandoned well, natural gas pipeline, adjacent farmstead

Wetlands adjacent to the project footprint are mostly seasonal wetlands (Class I, Class II) and are vegetated in grass and currently used as pasture. The project footprint will avoid wetlands as per Alberta Environment and Parks (AEP) regulations. Further details can be found in Appendix "B" – *Environmental Evaluation.*

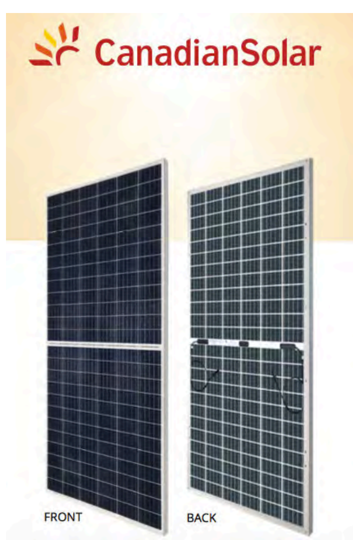
2. What is the primary purpose of the proposed development (ie: collection, inversion, storage, distribution of solar energy for electricity generation)

Ground mounted solar photovoltaic facility for electricity generation and dual use for sheep grazing. Electricity produced will be fed into the local AltaLink transmission network, where it will serve the electricity needs of Albertans.

3. Number of and size of solar panels (height and width)

CSI is currently working to further value engineer the solar project. Solar technology improvements within the last year and dynamic and favourable pricing from panel manufacturers are improving the feasibility of the project. We currently have a preliminary design involving new bi-facial solar PV technology that captures additional solar energy through ground-level reflection in winter. Supply constraints that developed with our original thin-film module supplier, First Solar, and price reductions in mono-crystalline and poly-crystalline panels (such as the bi-facial panels in our preliminary layout) have led us to switch from thin-film panels to mono- /poly-crystalline panels. Panel manufacturer and type will remain preliminary until such time as a product is secured through formal agreement with the manufacturer. CSI will supply all required project specifications at the point of applying for a construction permit. The current solar plant design calls for 477,198 Canadian Solar 355-365 W CS3U-PB-AG bifacial panels. Physical measurements on the above cited panel: 0.992 m x 2.018 m x 0.035 m. **Figure 1** below provides an image of the Canadian Solar panel. Photo renders of one of our earlier layouts and additional panel information are in Appendix "C". Note that the project footprint has been reduced compared to the layout from which the photo renders were obtained, so the actual visual impact of the project will be reduced in comparison to the cited photo renders.

Figure 1. Image of Canadian Solar 355-365 W CS3U-PB-AG bifacial panels



4. Total energy being generated by project

130 MW AC (estimated at 237 GWh/year) sufficient to power 33,000 typical Alberta homes annually.

5. Indicate all structures that will be erected or constructed in relation to the project

The following is a description of the major structures to be installed on the project site. Structures are anticipated to physically occupy/shade ~36% of the project footprint while ~95% of the project lands and 100% of the Rural General zoned lands will continue to be available for sheep grazing during the operational phase of the solar project. Note that diffuse light is still available beneath the panels for plant growth:

- aluminum/steel racking (to support the solar panels)
- Solar photovoltaic panels, ~1 m x 2 m (Canadian Solar 355-365 W CS3U-PB-AG bifacial*)
- 51* x 1500VDC/34.5KVAC* central* DC/AC inverters with step-up transformers mounted on concrete slabs
- Underground conductors from inverter stations to main substation
- 60m x 60m* 34.5KV/138KV main substation with switchgear, structures, transformers, power control equipment and electrical control building all enclosed by a chain link security fence
- O&M (Operations & Maintenance) building (22.5 ft by 30 ft*)
- Laydown area (utilized during construction for equipment and construction trailers) of approximately 5 acres (used only during construction)
- Perimeter security fence around project designed with wood post paige wire fencing (or such other fencing as required by the Electrical Safety Authority and other relevant regulations) and hedge plants to be planted near neighbouring residents to obscure views of the solar panels. On the request of Alberta Environment and Parks, project fencing will be installed to avoid wetlands where possible (see Section 34 – Site Plan for further details).
- 138 KV overhead transmission spur line (single slack span) from main substation to interconnection facility measuring <100m.
- Interconnection facility at interconnection point to the adjacent 138 KV transmission line

*Approximate. Subject to final detailed engineering design.

6. Land area being used

Please refer to legal land locations in Section 1 of this application and to the Subdivision Referral Report (Appendix "A") prepared by Mike Burla at the Old Man River Regional Planning Commission. Only the lands zoned Rural Industrial will be utilized for installation of above-ground solar PV infrastructure.

7. Indicate how power will be fed into grid (approval/confirmation from AESO or AltaLink that you will be able to tie into grid)

The power will be delivered via a short (<100m) transmission spur line (single slack span) from the main substation to the interconnection point on the adjacent 138 KV transmission line. The location of the substation and interconnection point is on the project's eastern border, located on SE-6-13-25 W4. The project has secured its position in Stage 3 of the AESO grid connection process. See project no. 1879 of the "AESO Connection Project List" (https://www.aeso.ca/grid/connecting-to-the-grid/).

8. Indicate how the facility will be operated

There will be an onsite ~22 ft. by 30 ft. Operations & Maintenance facility. The generation facility will be monitored both locally and remotely. There will be 3-4 employees onsite during regular business hours. There will be a 24 hour contact available in the event of any facility issues, which are monitored via remote monitoring equipment.

9. Describe the details of the proposed solar structures (ie: freestanding, materials, anti-reflective)

The photovoltaic solar (PV) panels will be mounted on a 25-35° angle (from horizontal) atop aluminum/steel racking. The solar panels themselves will be approximately 1 meter above ground level at their lowest point to approximately 3.45 meters above ground level on the high point. The racking will be supported on driven steel H-beam piles and/or helical steel piles depending on local geotechnical characteristics. It is planned to use Canadian Solar 355-365 W CSU-PB-AG bifacial solar panels. Photo renders (based on an earlier layout with footprint larger than the current layout) and additional panel information are in Appendix "C".

10. Estimated reflection produced from the solar panels

The reflection produced by the solar panels is analogous to reflection from a pond or lake, or windshields in a parking lot. Tree screens placed between the arrays and adjacent residences will mitigate possible reflection issues. Ground based solar reflection is limited to sunrise and sunset periods of the day.

11. Number of employees that will be onsite

During the construction phase of the project (approximately 18 months), 250-300 jobs will be created which is equivalent to 150 person-years of employment. During the operations phase, three to four employees will be present onsite during regular business hours (i.e. 7:30 a.m. - 4:30 p.m.). Claresholm Solar Inc. wishes to hire regional staff to the extent possible.

12. Hours/days of operation while under construction

Construction operations will take place through the week between sunrise and sunset. Days of the week construction activities take place will depend on weather interruptions and scheduling constraints.

13. What standards will be used to address aesthetics and/or minimize environmental impacts

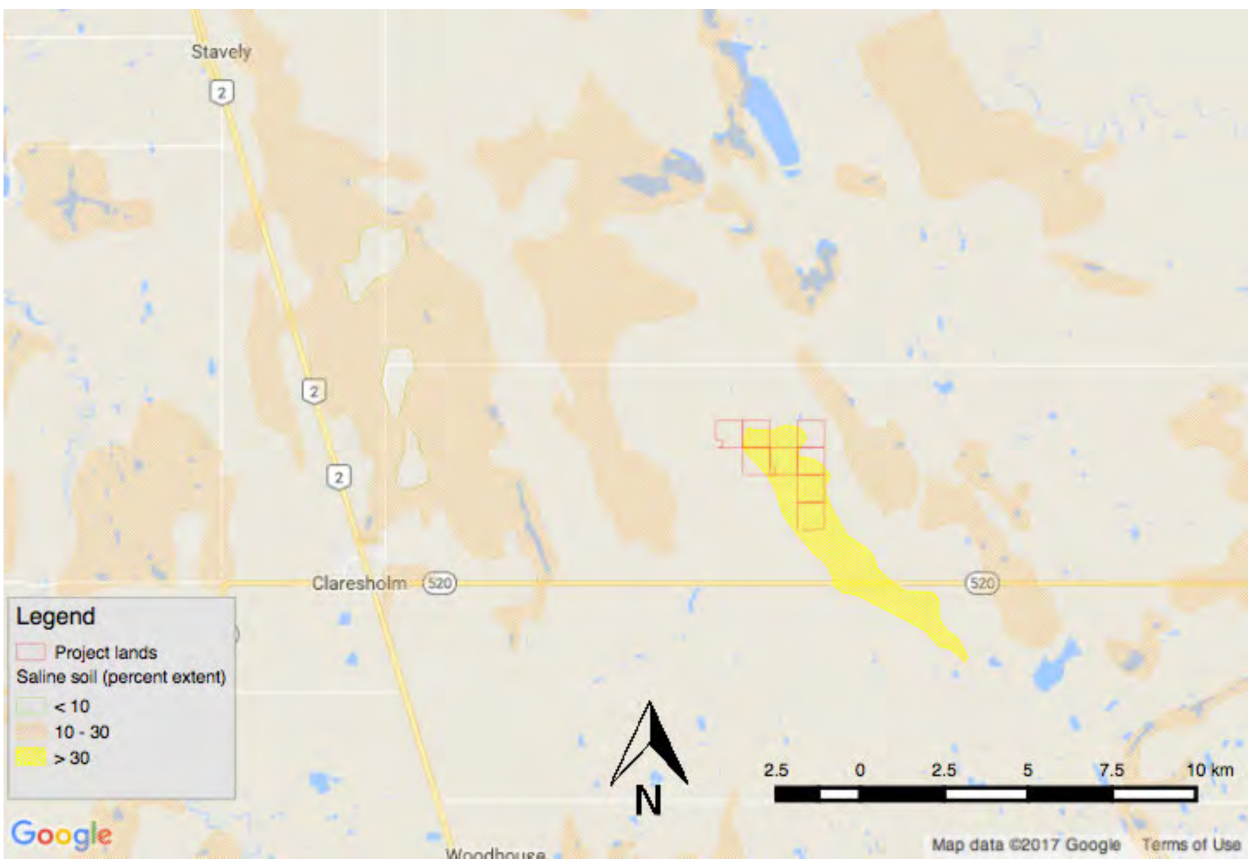
Potential Environmental Effects:

It is anticipated that the project will improve the soil conditions since marginal cropland will be restored to pasture; this will result in improved agricultural land use during and after decommissioning the project. Thus, the project is positive for soil and vegetation conditions. As a result of improving the vegetation in the area, the project will provide enhanced habitat for the local wildlife and sheep. As the landowner is a partner in the project, ensuring the environment is maintained or improved is an important factor for this project. No long-term negative environmental effects will result from the project.

The site for the Claresholm Solar project was selected on the basis of land suitability adjacent to the 138kV transmission line. More specifically, we sought land of lower agricultural value relative to the general land quality in the MD of Willow Creek; approximately 58.83% of the land area is saline tame pasture and the balance (41.17%) is land that was recently converted (within the last 5 years) from tame pasture to cropland. All parcels of land experience to a varying extent agricultural production limitations due to salinity issues. Alberta Agriculture, Food and Rural Development conducted detailed studies of soil surface salinity across the MD of Willow Creek (see Kwiatkowski et al. 1995). This report has been appended to this application as supplementary information (refer to Appendix "D"). As highlighted in the document, "Soil salinity is a major conservation issue in the Municipal District of Willow Creek. The information on salinity location, extent, type and control measures presented in this report will help Municipal District planners to target salinity control and resource management programs." As part of our initial site prospecting in the MD of Willow Creek, we utilized satellite imagery to identify surface salinity, which in turn indicates lower productive potential for agriculture. This led us to select the current 8 quarters that are part of this Development Permit Application. Our site selection is supported by the geospatial data on saline soils available through Alberta Agriculture and Forestry's 'Agricultural Land Resource Atlas of Alberta' (2017). This map indicates the percentage of land area with soil surface (top 30cm) salinity levels that significantly impede crop growth (Alberta Agriculture and Forestry 2017). A depiction of the geospatial data relative to our Project footprint can be found in **Figure 2**. As indicated by the Department of Agriculture and Forestry, our project is located in an anomalous area where greater than 30% of the land is significantly affected by soil salinity. Therefore, the proposed project *does not* occupy high value cropland.

Furthermore, locating the project at this site can improve the agricultural productivity of the local soils, since measures are being taken to mitigate pre-existing soil salinity issues on-site. We note that deep rooted perennial legumes and grasses will be planted underneath and between the solar panels, and this type of vegetation is the principal solution to reversing soil salinity issues (Kwiatkowski et al. 1995). Even areas adjacent to severely salt-affected lands can benefit from such plantings. As stated by Kwiatkowski et al. 1995, "… the effects of salinity on crop yields are not usually limited to the visible saline areas. Often the surrounding lands have weakly to very weakly saline subsoils, reducing yields of sensitive crops. Thus, salinity control practices may benefit crop yields over a much broader area than just the visible [saline] seep." Incidentally, on low and moderately salt-affected lands and over short time spans, cash crop production often yields greater financial returns for agricultural producers than hay or livestock production (the mitigation measures for salinity), but continuous cropping in these areas causes gradual increases in soil salinity over time, to the point where eventual salt-buildup significantly reduces agricultural productivity. Unfortunately, once this point is reached, salinity mitigation becomes increasingly expensive and time consuming. Therefore, an added economic incentive is often needed for agricultural producers to proactively mitigate salinity issues. In our case, the lease payments provided to the landowner and our strategy to vegetate the land in perennial forages provides exactly the kind of incentive needed to improve local soil conditions for long-term agricultural sustainability in the MD of Willow Creek. Without the economic incentive to maintain perennial vegetation, such as our project offers, salinity issues are likely to remain unresolved. Coincidentally, installation of solar panels on the site would be expected to further speed up soil recovery. This is because salinization of soil is a problem driven by evaporation (rather than transpiration through the living tissue of plants). As highlighted by Saskatchewan Agriculture (1987), "the salinization process is solar-powered. In a semi-arid climate, warm temperature, low humidity and wind evaporate water at the soil surface and cause salt accumulation." Through the partial shading and wind-reducing effects of the installed solar panels, the primary force driving salt buildup in soil would be reduced. For all these reasons, the Claresholm Solar project is ideally suited to improving soils and the agricultural capacity in the local area.

Figure 2. Soil salinity in the vicinity of Claresholm overlaid with the Project lands. To simplify the overview, both Rural General and Rural Industrial zoned lands are shown together.



In addition to the above project benefits to the local environment, the project avoids native grassland (absent on site) and as a result we avoid any impacts on this habitat type. The wetlands on site are avoided by the project footprint. Furthermore, all land under lease option that was recently converted from pasture to cropland will be re-established to perennial grass and forage. Beyond assisting with land reclamation due to salinity, seeding the site in perennial forages will also enhance habitat for wildlife in the area, as perennial ground cover is utilized by various animal species. One factor in the selection of vegetation species will be the potential use by wildlife and sheep.

One key feature of the project is that the site will continue to produce agriculturally, as in addition to generating renewable electricity, the site will also be grazed by sheep that belong to the landowners and partners to the project. Experiences with grazing sheep on solar farms indicate that stocking densities remain close to pre-construction levels (BRE 2014). Since the photovoltaic panels are mounted on frames fastened to driven or screw piles, actual loss of surface area associated with the solar panels for grazing is less than 1%, and accounting for other infrastructure needed for the solar facilities (e.g., transformers, substations), approximately 95% of the footprint area of the solar facility is still available for grazing (BRE 2014). Therefore, solar energy installations offer a multi-use option for the land while still retaining the pre-existing agricultural value and come with the added potential to improve soil conditions both on the project site and adjacent to it.

Aesthetics: We have consulted with property owners nearby the project site to develop an approach that enhances the aesthetics of the solar farm. In consultation, we have committed to select a perimeter fencing option that is most aesthetically attractive to local residents while still being acceptable to insurers of the solar facility and electrical safety regulators. The option we have selected, pending approval from an insurer and the electrical safety regulators, is wood post page wire fencing, as is typical for deer and bison ranches. Fencing would extend up to 9ft (2.7m) above ground, with a target/preferred height of 2.0m above ground, and have page wire with approximately 7 inches between wire gaps. Where visual impacts have been a concern, we will provide hedge plants to neighbouring residents that, once established, will obscure views of solar panels where they are not desired.

14. Anticipated years of operational life

The term of a government Power Purchase Agreements (PPA's) is typically 20 to 25 years. PPA's with third party off-takers can be shorter or longer depending on the contractual business arrangement between seller and purchaser of the power. By design, the Claresholm Solar project will have a 35-year life cycle. Depending on power market conditions the project could undergo a major update/replacement of solar panels in years 30-35, allowing the project to operate up to another 25 years.

15. A plan outlining how the site(s) will be decommissioned and reclaimed

Solar PV panels typically have a 30 to 35-year life cycle, so experience with decommissioning of large solar PV projects is limited worldwide. The intent is to leave behind pasture lands suitable for livestock grazing as was the case prior to the construction of the project; hence, residual environmental effects would be avoided. Furthermore, it is anticipated that the salinity of the soils will be improved by the use of deep-rooted perennial plants during the life of the project. Under the Lease Agreements with the Landowner there is a requirement for Claresholm Solar Inc. (CSI) to pay a reclamation fee into trust.

On September 14, 2018, AEP issued the, 'Conservation and Reclamation Directive for Renewable Energy Operations' which mandates the Conservation and Reclamation (C&R) Standards for renewable energy projects, and aligns the standards with other industries such as the oil & gas sector. Among other things, the Directive requires site assessments (pre-disturbance, interim monitoring, and final reclamation certification). As outlined in the cited document, "… the 2010 Reclamation Criteria for Wellsites and Associated Facilities provides the framework for how final reclamation success will be determined at the time of reclamation certification." All renewable energy operators, whether on private or public land, must adhere to these minimum standards. As noted in the AEP document, "…the criteria may evolve" and renewable energy operators will be expected to adapt accordingly. The goal of the standards is to have lands return to equivalent land capability (based on pre-construction capability) after decommissioning and reclamation has finished.

For further details on decommissioning, please refer to Appendix "B", under subsection Appendix II - *Claresholm Solar Environmental Protection Plan*, Section 9: Decommissioning Plan.

Foundations for the PV module racks will be driven steel H-beam piles or helical steel piles rather than concrete and steel rebar. The rationale is that the steel can be extracted and recycled as opposed to the industry standard whereby concrete foundations are typically cut off at 1 m below grade. The extruded aluminum racking on which the solar panels are mounted will be removed and recycled. The perimeter fencing and gates will be repurposed or recycled depending on market conditions at the time. All material (e.g., collector lines and foundations) <1m from soil surface be removed and recycled as will the substation structures.

PV modules contain substances such as glass, aluminum and semiconductor materials that can be successfully recovered and reused, either for re-use in new PV modules or other products. CSI will not landfill any of the PV module materials in the MD of Willow Creek.

The heavy industrial electrical equipment such as inverters, transformers and switchgear will be recycled and/or sold depending on market demand for used electrical gear at the time.

The concrete foundations associated with the inverter stations, transformer pads, e-houses, substation and buildings will be broken up and removed from site to a local pit whereby the concrete will be crushed for re-use as aggregate and the structural reinforcing steel (rebar) will be sold to a recycler.

All excavations and roads will be remediated to pre-construction condition to return the lands to original pasture land condition, suitable for livestock grazing. For further information on the reclamation practices (i.e. soil and vegetation) please refer to the Claresholm Solar Environmental Protection Plan prepared by McCallum Environmental dated September 22, 2017 (Appendix "B", subsection Appendix II).

We anticipate that the decommissioning and reclamation process will span 6 to 12 months.

16. Perimeter fencing details

The perimeter fence around the project area will be an up to 2.7m high (preferred target height is 2.0m) paige wire deer/bison-type fence with an electrified high-tensile top wire (i.e. electric fence meeting voltage specifications for cattle); final design pending approval from insurers and electrical safety regulators . The perimeter fence will also be equipped with video monitoring equipment if required by insurers and regulators, and in such case cameras are typically at access gates only. Further details on preliminary location of fencing is provided in Section 34 – Site Plan.

The main substation within the confines of the project perimeter fence will also have a chain link perimeter security fence per the Canadian Electric Code (CEC). Section 26 of the CEC outlines requirements for constructing fences to guard electrical equipment installed outdoors. The rules cover clearance between the fence and live electrical equipment, height of fences, use of barbed wire, setting of posts, gates and chain link materials. Fencing will be inspected by on-site staff and any issues will be dealt with expediently.

Perimeter fencing will be inspected on a regular basis by our on-site staff and any issues will be remedied promptly.

17. Proposed signage to be posted

Cautionary safety and no trespassing signs will be posted on the project perimeter fence as well as the substation chain link fence.

18. Haul routes to and from the proposed locations (for initial setup of equipment, structures, etc.)

The goal would be to minimize heavy hauls and over-dimensional loads through the geographic boundaries of the Town of Claresholm. CSI is open to discussions with the MD on proposed approach to traffic routing.

For materials and equipment deliveries from north, the proposed route would be via Highway 2, east on Township Rd 132, and then southbound via Range Road 260 to the equipment laydown area located on SE-6-13-25-W4.

For materials and equipment deliveries from west and east, the proposed route would be from Highway 520 and then northbound on Range Road 260 to the equipment laydown area located on SE-6-13-25-W4.

Haul routes are subject to approval and permits issued by Alberta Transportation and the MD of Willow Creek.

19. A description of all potential impacts on public safety and health

During the construction phase (18 months), it is anticipated that there will be no significant impacts on public health and safety. The primary public health and safety considerations will arise from the traffic impacts. These considerations will be managed using industry-standard mitigation measures.

Most freight in/out of the project area will be containerized goods, but there will be infrequent heavy loads and over-dimensional loads such as the main power transformers, pre-fabricated buildings and construction equipment that will require oversize and overweight permits. Due to the frequency and size of deliveries to the project laydown area and the dispersion of materials and equipment from the laydown area to the various construction areas within project boundaries, there will be increased risk to the safety of the public and the travelling public which will be minimized using industry-standard mitigation measures.

Bonded and insured carriers hauling in and out of the project will be responsible for pre-delivery transport surveys, dialogue and procuring the necessary oversize and overweight permitting from

Alberta Transportation, and abide by all Alberta Transportation and RCMP requirements, laws and protocols. The stated goals of Alberta Transportation is to ensure public safety as follows:

- To minimize the inconvenience to the traveling public.
- To minimize damage to the roadway infrastructure.
- To facilitate the movement of commodities which are non-divisible, deemed impractical to divide, or uneconomical to transport at legal dimensions.
- To establish and communicate to the carrier, a set of conditions for the safe movement of the load.

At times, as in the case of over-dimensional loads, shipments may be restricted to time-of-day and time-of-week use of provincial highways to avoid peak public travel periods by restricting movements to night time or weekends. Additionally, in the interest of the safety for the travelling public, some loads will be required to have professional or constabulary escorts.

In the case of overweight hauls, depending on time of year (i.e. frost restricted periods) carriers may not be allowed to haul or may be required to take the necessary actions such as additional axles to distribute weight to prevent damage to roads and infrastructure.

Additionally, safety hazard signage and flagging protocols local to the project will be followed and administered by project Health & Safety personnel.

The operations phase of the project will not have a significant impact on public health and safety. Vehicle traffic on local roads will not be significantly above baseline, as a limited number of full time employees will be on site each day. The operating solar farm will not have any harmful emissions to the public and nearby residents, and all potential hazards on-site will be mitigated according to a project-tailored health and safety protocol.

As highlighted previously, decommissioning will leave the site in a similar state to what was present prior to construction, with the exception that we anticipate improvements in local soil conditions due to the perennial vegetation cover. As described in Section 13 on decommissioning, no harmful materials will be caused to remain on the land as a result of the solar project and it's decommissioning.

20. Access and any potential impact to public roads

During the construction process, there will be need for over-dimension loads for haulage of large equipment such as pre-fabricated building structures and main power transformers. Prior to project construction, the carriers will undertake a transport surveys to identify risks with respect to public safety and provincial/municipal infrastructure assets such as road surfaces, utilities, bridges, culverts, etc.

Prior to shipping, the carrier will secure the necessary permits and arrange for escort services. Subject to transport permit requirements, the carrier will be responsible for any and all restrictions imposed by the permits such as frequency of shipments, time of day and/or day of week.

The carrier will be required to carry the necessary insurances for damaged goods, public liability and property damage. CSI will ultimately be responsible for damages and as such will hold the necessary umbrella insurances while under construction. Heavy haulers will post a bond as required with the MD of Willow Creek (Policy 320-21) to ensure road infrastructure is protected.

CSI will ensure that any effects of project construction and decommissioning on public roads are mitigated at the time of use and restored to pre-use condition following their use.

21. Management of weed control and erosion mitigation

Sheep have been demonstrated to be an excellent tool for control of herbaceous weeds (Frost & Launchbaugh 2003). Weedy forbs are generally the most problematic weeds in grasslands, and sheep are specially adapted to forage on this particular plant type; therefore, sheep are the ideal candidate for control of weeds in perennial grasslands (Frost & Launchbaugh 2003). Should weeds become problematic, adaptive management of sheep grazing can be used to target specific problem weeds; this can be accomplished through modifying stocking density and/or seasonality of grazing based on the particular features of the weedy species (Frost & Launchbaugh 2003). Our shareholders in the project company, the Hutterian Brethren of Granum, have extensive experience with such adaptive sheep grazing techniques within the MD. In the event that sheep grazing is not sufficient to manage the noxious weeds then CSI will implement further weed management actions based on the species of weeds.

For the land that was recently converted to row crops, seeding of perennial grass will be performed in the year prior to construction. The landowners, the Hutterian Brethren of Granum, have extensive experience in establishing perennial forage plantings in the local area, including during years with moisture deficits. By utilizing a no-till forage seed drill, the soil surface will be left undisturbed and soil moisture retained. This system allows forage seed to be accurately metered and placed at the appropriate shallow depth (<0.5") to promote seedling establishment. A diverse seed blend will be developed together with the landowner, seed supplier and in consultation with the municipal agricultural field-man that matches soil and site conditions to the needs of the forage species. For the site in question, soil salinity will dictate a species mix with relatively high salt tolerance. A diverse blend improves overall field performance as varying habitat tolerances of different forage species allows for production across varying field site conditions. Blends that are being considered may include, but are not limited to: AC Saltlander green wheatgrass, crested wheatgrass, intermediate wheatgrass, slender wheatgrass, and a combination of alfalfa and sainfoin varieties with different rooting characteristics and salt tolerances. Inclusion of alfalfa and sainfoin (both of which fix nitrogen in the soil) will enhance the productivity of the pasture through the life of the project. If vegetation has trouble establishing on the site then additional measures will be taken to ensure that sufficient ground cover has been established.

Perennial grasses and legumes are the best method to improve soil condition and reduce erosion. Unlike annual crop fields, which have relatively shallow root systems and no living plants for over half the year, perennial grasses and legumes maintain live plant tissues in the soil year-round and serve to anchor the soil in place. In addition, forages begin growing earlier in the year than annually seeded crops, and as a result this early top-growth on the plants helps shelter the soil from desiccation by sun and wind, reduces wind-speeds at soil level, and consequently is better suited to control erosion when compared to annual crops.

During construction and after construction, a comprehensive erosion control protocol will be followed. For full details, please refer to Appendix “B” subsection Appendix II - *Claresholm Solar Environmental Protection Plan*
Section 7: Sediment & Erosion Control. AEP’s, ‘Conservation and Reclamation Directive for Renewable Energy Operations’ also has specifications on soil conservation measures and weed control, which CSI will be required to follow.

22. Security, Emergency and Fire safety plans

Security- During the construction phase of the project, the site will be monitored during non-working hours at night, weekends, civic holiday or periods of shutdown. When the project is operational, during the normal work day, the site will be attended by a crew of 3-4 Operations and Maintenance (O&M) personnel; however, during nights, weekends and civic holidays the project will rely on the perimeter fencing and motion sensing cameras to provide security and remote monitoring. A 24 hour contact will be available to respond to any issues on-site.

Health & Safety during project construction- A qualified full time Health & Safety Officer (HSO) will be present to ensure that all workers are fully qualified to work on the site. All safety infractions including near misses and accidents will be investigated by the HSO and corrective actions will be taken. During construction activities the HSO will be responsible for the safety of unqualified visitors ensuring they receive the appropriate level of introductory training and are equipped with the necessary personal safety equipment.

Health & Safety during project operational phase- All personnel will be fully trained and adhere to Alberta Health & Safety laws as mandated by Alberta Occupational Health and Safety.

Emergency Response- Prior to construction, CSI will communicate and engage with local Emergency Response Team. The intent is to familiarize local ERT with the project, and for CSI to understand the working protocols, and for both to understand the reactive measures required during both the construction phase and the operations phase when the risk of incident is highest.

Fire Safety Plan- CSI will develop a fire management and response plan in consultation with ERT and the Fire Department in the MD of Willow Creek. As highlighted during the MD of Willow Creek, Land Use Rezoning Hearing #2, and through supplementary material supplied for the hearing, the relatively low temperatures of grassland fires do not risk combusting the PV module materials. Access roads within the project area will also act as fire-breaks that will reduce the risk of fire moving into or out of the project area. For further information, please refer to supplementary information supplied during the Public Hearing #2 for CSI's Rezoning Application.

23. List the closest residential home(s)

Listing of all residential homes and home owners within 800m is shown below. These distances are all approximate based on measurements made using GIS and are measured from project perimeter fence and closest wall of residence.

- Shirley Stange: 63m
- Dustin and Carmen Sippola: 132m
- Kelsey Miffin (residence rented from Granum Colony): 89m
- Cody and Jill Selke: 167m
- Russell and Sierra Stewart: 710m
- Reg Blenkiron (residence rented from Douglas and Olive Darch): 790m

Please refer to Appendix "E" *Residence Map.*

24. Name and brief history of Company undertaking project

CSI is a project specific company and is a subsidiary company of its parent, Perimeter Solar Inc. (PSI) with the local landowner, Hutterian Brethren of Granum, holding a 10% share in the profits of CSI. PSI was federally incorporated May 2016, and CSI was incorporated in Alberta November 2016. In June 2017, Obton A/S (Obton) became a 49% partner in PSI.

Obton is an investment company specialized in the procurement, operation and management of solar and wind energy assets (www.obton.com). As a well-established EU renewable energy company, Obton is growing its market share in this energy field; in 2016 alone, the company grew its investment in solar-photovoltaic (PV) and wind energy plants by over $360mm (million) CAD, making their total investment portfolio over $900mm CAD and achieving the status of the thirteenth largest PV solar owner/operator in the EU in terms of operational megawatts (MW). Obton has recently entered the Canadian renewable energy market through its investment in PSI and commitment to fund the company's ongoing development activities.

The founders of PSI and Obton bring extensive and complimentary expertise in the renewable energy field. Specifically, PSI leverages the extensive solar financing and operations experience of Obton with the deep development experience of PSI's founders. PSI's founders, having been pioneers in Canada's renewable energy market since the early 1990s, offer the diverse and long-term experience through its subsidiary CSI to compete in power procurement programs with the Alberta Government. PSI was founded as a utility-scale PV developer, and from the outset efforts have been focused on Western Canada. Since founding the company in May of 2016, PSI has made rapid progress in developing three southern Alberta projects totaling 280MW AC capacity. A 60 MW and a 90 MW project, located in other MD's, have been sold to third parties and PSI has retained the Claresholm Project to continue to develop it into a mature project on its own account. An additional 10MW AC project is in the early stages of development in Saskatchewan. The majority of PSI's renewable energy experience predates the formation of PSI and CSI.

Further details on the experience of CSI's core team members is located in Appendix "F"

25. Provide any supporting documentation from government, agencies other studies and reports to demonstrate site suitability and impact mitigation

Provided with this Application, please find:

- Claresholm Solar Environmental Evaluation Report prepared by McCallum Environmental dated June 12, 2018 (Appendix "B", Section 1)
- Claresholm Solar Environmental Protection Plan prepared by McCallum Environmental Ltd. dated June 12, 2018 (Appendix "B", subsection Appendix II)

- Salinity mapping for resource management within the M.D. of Willow Creek, Alberta. Report prepared by Alberta Agriculture, Food and Rural Development, 1995 (refer to Appendix "D")
- AESO Gate 2 Clearance letter dated August 2, 2017 (refer to Appendix "G")

A report published by NC State University on the Health and Safety Impacts of Solar Photovoltaics is provided in Appendix "H". This report summarizes data relating to some of the common questions about solar installations.

If required, the Preliminary Geotechnical Investigation report prepared by AECOM dated August 4, 2017 and Preliminary Hydrogeology Assessment report prepared by AECOM dated August 16, 2017 are available upon request.

26. Date(s) an Open House was held for the landowners in the MD of Willow Creek

A public open house was held August 17, 2017 at the Claresholm Community Centre from 5:00pm to 8:00pm. The open house was advertised in the Claresholm Local Press on July 26, 2017.

In accordance with the AUC's Rule 007, CSI initiated a formal consultation process in June 2017 for the Claresholm Solar Project in order to gather feedback and respond to any questions or concerns from potentially impacted stakeholders. On July 18, 2017 a project-specific information package (PSIP) (Appendix "I") was mailed to all landowners within 2km of the project boundary. Throughout the past few months, additional occupants and residents have been identified and provided the same information. The contained details about the project and company, community benefits, potential impacts, contact information and an invitation to our community open house. The community open house was held on August 17, 2017 at the Claresholm Community Centre and had approximately 40 attendees throughout the evening. Poster boards were displayed providing similar information to the previously distributed PSIP and large-scale photo renders for the public to get a feel for what the facility may look like from different vantage points. Photo renders and additional panel information are in Appendix "C".

CSI representatives have also been meeting with stakeholders within 800m of the project, or others outside of 800m that wish to meet, to personally discuss the project details and provide them with responses to any questions or concerns they may have. This process is ongoing however the project has generally garnered a lot of support in the community. As solar is new to many stakeholders, common questions were asked regarding property value impacts, human and animal health impacts, visual impacts, stormwater management, decommissioning and reclamation, construction impacts, community benefits and potential glare. Responses have been provided to these common questions which were generally accepted by stakeholders. In addition, we have offered to neighbouring landowners (within 800m of the project) free electricity for residential use during the operational lifespan of the project; this offer was welcomed by many of the immediate neighbours.

Personal consultation or in-depth discussions have occurred with over 25 stakeholders. CSI has completed all follow-up actions and all consultation commitments have been completed at this time.

CSI responded to questions raised by landowners, occupants, and residents by providing additional information throughout the PIP. The following table outlines some of the specific concerns received.

Communications
One of their primary concerns was that some project neighbours felt the solar project could depreciate the value of their home and acreage and that they would be at financial risk as a result. CSI has addressed this concern and has signed an agreement that ensures that the Stakeholder will not sustain a

financial loss on their property due to the project being constructed. In the event the Stakeholder was to sell their home and acreage and the project is constructed, CSI will guarantee the Stakeholder the appraised value of their home and acreage. This will be achieved by CSI paying any negative difference between the sale price of their home and acreage and the appraised price should the project be constructed; this agreement is stipulated in formal terms between CSI and the Stakeholder and the Stakeholder has no outstanding questions or concerns. This option has been offered to all landowners within 800 metres.
Stakeholder provided a written expression of concern about the solar project to CSI after the first public hearing for Land Use Rezoning Bylaw Amendment application with the MD of Willow Creek. We have since corresponded with the Stakeholder and have received no further indications of objection after CSI offered to extend the electricity bill compensation out from 800m to 1,500m. This subsidy will be administered as follows: - For all current neighbours within 800m of the project boundary, 100% of the cost of their residential electricity bill will be covered up to a maximum use of 9,000kWh/year; - For current residents within 1,500m but > 800m from the project boundary, the cost of the electricity bill (up to a maximum use of 9,000kWh/year) will be covered on a pro-rated basis and declining linearly from 100% at 800m to 0% at 1,500m.
CSI offered the option to backstop the appraised value of the Stakeholder's home and acreage, but they have opted to not sign this agreement and continue to be opposed to the project. The agreement offered to the Stakeholder would have required them to withdraw objection to the project in consideration for CSI guaranteeing the appraised value of their acreage and home in the event the project goes to construction. The Stakeholder expressed that they do not want to give up their options to object to the project. As explained to the council of the MD of Willow Creek during the second public hearing for our Land Use Rezoning Application in the MD, CSI has continued to be open to discussing the option of backstopping the appraised value of the Stakeholder's home and acreage in the event they sell, and the project is constructed. We have received no further communication from the Stakeholder since the last public hearing with the MD of Willow Creek and they did not attend either of the two follow up meetings with the MD council that concerns voting on and coordinating the rezoning and subdivision.

Currently, no consultation issues remain outstanding, however CSI continues to be available for consultation with Stakeholders. CSI has worked diligently with project neighbours to find solutions to concerns (in cases were concerns were present); as a result, CSI has made agreements with all but one of the 6 owners of residences within 800m of the project, and this remains the only owner of a residence within 800m of the project boundary that objects to the project. Generally, feedback from the overall community has been positive as was indicated by the many letters of support supplied in Hearing #2 of our Land Use Rezoning process. Further details on the PIP and AUC applications more generally can be obtained upon request in the form of our 'Claresholm Solar Project Participant Involvement Program (PIP) Report' and the Noise Impact Assessment (NIA), both of which were submitted concurrently to the AUC on August 21, 2018. The PIP and NIA demonstrate the project's compliance with AUC rules on public consultation procedures and on noise thresholds.

27. Provide any detailed information that you feel may assist the MPC in making an informed decision

CSI has taken a very proactive approach in site selection (avoidance of native grassland, selection of lower value cropland, integration of livestock production, proximity to interconnection which minimizes need for extensive overhead transmission lines, sparsely populated area) and is actively engaged with the local community to enhance the benefit of the project to local residents.

In particular, the landowners hosting the project (the Hutterian Brethren of Granum) hold an interest in the development company, CSI, and we work closely with them to match the development and operation of the solar farm to their agricultural way of life. The integration of livestock grazing into the project is perhaps its greatest asset. The MD of Willow Creek is primarily an agricultural community and also has seen development of various energy projects such as oil & gas and wind energy. As with these ancillary land uses, solar energy offers the MD of Willow Creek with additional diversity in its rural economy.

Moreover, given our careful site selection and combined use of land (energy and livestock production), the proposed Claresholm Solar project not only offers the ability to produce renewable energy within the MD, but it allows this energy to be produced while fostering the primary existing use of land for agricultural purposes. In addition, though a portion of the energy produced could be used in the MD of Willow Creek, much of the energy will be exported to more densely populated areas of Alberta. This effectively makes renewable energy in the MD an energy export opportunity, with revenue generated by the project through sales of electricity outside the MD return back to the MD in the form of property taxes, income for the landowners hosting the project, and benefits provided to other neighbouring landowners (e.g., we offer free electricity during the operational life of the project to residents within 800m of the project and a pro-rata electricity subsidy based on distance from the project to neighbouring residents between 800m and 1,500m). In light of the above, we consider our proposed solar project to be beneficial to the many stakeholders within the MD of Willow Creek. Indeed, we have been very encouraged by the very positive response of local residents to the project we are proposing, and we look forward to continuing our relationship with the area's residents and MD to enhance the value of the proposed development.

As you are likely aware, the Project is located within the South Saskatchewan Regional Land Use planning boundaries. "Planning on private lands is primarily governed by the Municipal Government Act (MGA) and instruments made under its authority such as the Subdivision and Development Regulation. Private landowners make decisions about how to use and manage their land consistent with existing provincial legislation and municipal bylaws. The SSRP does not change this or alter private property rights." Furthermore, "Municipal governments under Part 17, Planning and Development of the MGA, with few exceptions (such as Sections 618 and 619) are delegated with the responsibility and authority for local land-use planning and development on all lands within their boundaries. This includes the creation of municipal development plans, area structure plans and land-use bylaws. This delegated authority remains with municipalities. Municipal planning and development decisions will, however, have to be in alignment with the regional plan to achieve the regional outcomes established in the plan." (Government of Alberta, South Saskatchewan Regional Plan, 2014-2024, p.3).

With that in mind, the Project is being developed in accordance with the SSRP in that the SSRP endorses opportunities for the responsible development of the region's renewable energy industry in support of Alberta's commitment to greener energy production and economic development (the Project falls under the renewable energy category).

The project is not within a conservation area or provincial recreation area established in the applicable regional land use plan.

Finally, all impacts associated with the project, both positive and negative, are similar to those experienced on other projects previously approved not only in Alberta, but across Canada. Like other forms of renewable energy, each solar project will ineluctably have its own unique set of social, cultural, environmental, technical, and political characteristics, impacts and challenges.

As with any energy project designed and implemented anywhere, there will always be some negative impacts “on the ground” when compared against the “do nothing” option. However, there will be material social benefits in air quality. There will also be material economic benefits in job creation, payments to area landowners, payments to the MD, payments to nearby residents in the form of an electricity subsidy, and economic opportunities for contractors and suppliers in the area.

28. Soil characteristics, environmental features and issues, Stormwater management, compatibility with surrounding land uses, potential impacts to agricultural land and irrigation operations, potential visual impacts, etc.)

A geotechnical drilling campaign was performed on the projects lands July 10 -11, 2017. At the same time goundwater monitoring wells were installed. Soil and bedrock samples collected during the site investigation were tested in AECOM’s Calgary laboratory for soil classification and determination of engineering properties of soil and bedrock. The conclusion reached provided in the report from AECOM dated August 4, 2017 was "Based on the results of the preliminary geotechnical investigation and the subsurface stratigraphy, all sections of the land are considered suitable for the Project...". A copy of the report is available upon request.

Subsequent to the installation of the groundwater wells during the July 2017 geotechnical drilling campaign, groundwater field testing was completed on July 18, 2017. The study concluded that ... "As construction of the Project is predominantly understood to be above ground and not significantly below ground, groundwater is unlikely to pose significant complications with respect to development of the solar project...". A copy of the report is available upon request.

A stormwater management plan will be developed during the detailed engineering phase and will be provided prior to the application for a building permit.

The project will be compatible with surrounding land uses, as the site will continue to be used as pasture land (sheep grazing). As such, there is no undue impact on the use of agricultural land. Irrigation is not present. Section 11 of this Development Permit Application highlights topsoil characteristics of the site that are relevant to the application. To summarize, the site is located in a saline basin and its suitability for row-crop agriculture is impaired. Further details demonstrating the relatively marginal agricultural features of the site were provided as supplementary information during CSI’s Rezoning Hearing #2. As explained in Section 11, the proposed solar project is anticipated to have a positive impact on agricultural land through promoting perennial forages capable of reducing the concentration of salts in the soil surface of the project lands and surrounding area.

The visual impact of the project will be limited to local residents and passers-by. CSI has taken a proactive approach by engaging directly with residents within 800m of the project boundary, and is currently in discussion with these residents with respect to mitigative measures.

The project currently meets all environmental regulations, standards, and guidelines. For example, AEP recommended setbacks from watercourses and wetlands will be maintained. No wetland alterations are being proposed as a result of the project. Alberta Environment & Parks (AEP) recommended setbacks from wildlife features are also being maintained.

29. Environmental Assessment Report (prepared by a qualified professional)

The Claresholm Solar Environmental Protection Plan (EPP) is provided in Appendix “B” subsection Appendix II, and the Claresholm Solar Environmental Evaluation Report (EER) in Appendix “B”. Both the EPP and EER were submitted to AEP on June 12th, 2018. Following a forthcoming AEP referral report on these filings, the AUC will review the materials as part of our overall AUC project permitting application.

30. Copy of landowner permission (required to have something in writing confirming that you have permission to make application)

A letter of authorization and letter of support for the Project from Hutterian Brethren Church of Granum are provided in Appendix “J”

31. Any other relevant studies, reports, certificates and approvals from Federal/Provincial agencies

Alberta Culture & Tourism provided confirmation of Historical Resources Act approval on September 15, 2017. Refer to Appendix “K” for a copy of the letter of approval and the form of Standard Requirements provided with the letter approval.

32. Land title certificate for each of the parcels being proposed for development

Copies of recent land title certificates and a corporate search are provided in Appendix “L”.

33. Prescribed Development Permit application fee of $200.00 per application.

RBC Bank draft provided upon submission of the application as follows:
$200.00 per application x 8 applications = $1,600.00
TOTAL = $1,600.00 (Previously sent to the MD)

34. Site Plan

Proposed site plan and project fencing plan provided in Appendix “M”. Information from the Subdivision Referral Report in Appendix “A” indicating revised Project Lands designation (i.e., lands to be zoned Rural Industrial) supersede the shaded area of Project Lands indicated in the Appendix “M” site plan.

35. Alberta Energy Regulator (AER) Abandoned Well Information

Please refer to Appendix “N”- Abandoned Well Information whereby there are nine documents. The first document is the AER abandoned well map showing three abandoned wells on the subject properties. The second document outlines the details of each of these wells. The wells located on 10-01-013-26 W4 and 02-01-013-26 W4 are either Rec. Certified or Rec. Exempt. Documents 3-8 are the site survey plans prepared for Perimeter Solar Inc. (parent of CSI) by MidWest Surveys Inc. of Calgary, and the last document is a letter sent by land agency TDLC Inc. to Lexin Resources Inc. dated May 3, 2017.

As can be seen on page 5 of 8 of Appendix "N", there is one abandoned oil well on SW-6-13-25-W4. To date TDLC has received no response from Lexin Resources regarding the May 3rd letter. On May 31, 2017 TDLC reported to Perimeter Solar… "On behalf of Granum Colony as their agent, I sent a letter to Lexin Resources Ltd. with respect to wellsite location in SW 6-13-25 W4M (Caveat # 941 275 344) requesting copies of Agreement covering said caveat. As no surprise, the letter came back 'Return to Sender'. Granum had been receiving surface rental until the last few years as Lexin is now in receivership and have counter sued the government and the courts have stayed until the receivership is completed. The Surface Rights Board have been temporarily halted in their pursuit to follow up on Section 36 action."

TDLC Inc., further indicated that, "Granum Colony will be filing Section 36 Application to recover rentals not paid, but moreover to have the location cleaned up. I'm guessing, but I believe this location was a dry hole as Granum is not aware of any of this history because they bought the land after the fact. By filing a Section 36 with the SRB it will involve the government as a partner in a sense. It is likely that the Orphan Well Society will be involved to clean said site up at some point in time. This will basically entail soil mixing clean up and establishing a growth on the lands covering the lease to eventually clear the lands with a Reclamation Certificate. Upon that happening, you would be able to include those lands under your Agreement."

Literature Cited

Alberta Agriculture and Forestry. 2017. Agricultural Land Resource Atlas of Alberta – saline soils of the agricultural area of Alberta. <http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/agdex10310/$file/pg_18_saline_soils.pdf?OpenElement> Accessed October 16, 2017.

BRE. 2014. Agricultural Good Practice Guidance for Solar Farms. Ed J Scurlock. <https://www.bre.co.uk/filelibrary/nsc/Documents%20Library/NSC%20Publications/NSC_-Guid_Agricultural-good-practice-for-SFs_0914.pdf> Accessed September 18, 2017.

Frost, R.A. & K. Launchbaugh. Prescription grazing for rangeland weed management: a new look at an old tool. Rangelands, 25(6) pp. 43-47.

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Saskatchewan Agriculture, Soils and Crops Branch. 1987. Nature and management of salt-affected land in Saskatchewan. < http://publications.gov.sk.ca/documents/20/84797-salt-affected%20lands.pdf> Accessed October 16, 2017.

Appendices

Appendix “A” – Subdivision Referral Report

Appendix “B”- *Environmental Evaluation Report (Section 1) and Environmental Protection Plan (Subsection Appendix II)*

Appendix “C” - *Visualizations of Solar Project and the Physical Dimensions of Canadian Solar Panels*

Appendix “D”- *Salinity Mapping for Resource Management*

Appendix “E”- *Residence Map*

Appendix “F” – *Additional Team Member Information*

Appendix “G” - *AESO Gate 2 Clearance Letter*

Appendix “H” – *Report on Health and Safety Impacts of Solar Photovoltaics*

Appendix “I” – *Project Specific Information Package*

Appendix “J” - *Letter of support from Hutterian Brethren Church of Granum*

Appendix “K” - *Alberta Culture & Tourism Historical Resources Act letter of approval and form of Standard Requirements*

Appendix “L”- *Land Titles & Corporate Search*

Appendix “M”- *Site Plan*

Appendix “N”- *Abandoned Well Information*

APPENDIX “A”

Subdivision Referral Report

3105 - 16th Avenue North
Lethbridge, Alberta T1H 5E8

Phone: (403) 329-1344
Toll-Free: 1-844-279-8760
E-mail: subdivision@orrsc.com
Website: www.orrsc.com

OLDMAN RIVER REGIONAL SERVICES COMMISSION

NOTICE OF APPLICATION FOR SUBDIVISION OF LAND

DATE: August 14, 2018

Date of Receipt: July 23, 2018
Date of Completeness: July 30, 2018

TO: **Landowner:** Hutterian Brethren Church of Granum

Surveyor: Third Rock Geomatics – Jeff Olsen

Agent: Claresholm Solar Inc – Philipp Andres

Referral Agencies: M.D. of Willow Creek No. 26, Ian Sundquist, Livingstone Range School Division, AltaLink, FortisAlberta, TELUS, ATCO Gas, ATCO Pipelines, AB Health Services - Calgary, AB Environment & Parks - K. Murphy, AB Environment & Parks - M. Keohane, AB Environment Operations Infrastructure Branch (OIB), AB Water Boundaries, Area Wildlife Biologist - M. Didkowsky, AB Agriculture, AER, United Producing Company Inc.

Adjacent Landowners: Bar KL Farms Ltd., Douglas and Olive Darch, Dustin and Carmen Sippola, Henry and Delores Lange, Hutterian Brethren of Willow Creek, Shirley Stange

Planning Advisor: Mike Burla MB

The Oldman River Regional Services Commission (ORRSC) is in receipt of the following subdivision application which is being processed on behalf of the M.D. of Willow Creek No. 26. This letter serves as the formal notice that the submitted application has been determined to be complete for the purpose of processing.

In accordance with the Subdivision and Development Regulation, if you wish to make comments respecting the proposed subdivision, please submit them via email or mail no later than **September 4, 2018**. (Please quote our File No. **2018-0-112** in any correspondence with this office).

File No:	**2018-0-112**
Legal Description:	NE1/4 1-13-26-W4M
Municipality:	M.D. of Willow Creek No. 26
Land Designation: ***(Zoning)***	Rural General - RG / Rural Industrial - RI
Existing Use:	Agricultural
Proposed Use:	Solar Farm
# of Lots Created:	1
Certificate of Title:	041 169 977 +1

Meeting Date:	**September 19, 2018** *Note that meeting dates are subject to change. It is advisable to contact the M.D. of Willow Creek No. 26 three (3) days prior to the meeting for times and to confirm that this application is on the agenda.* *If you wish to make a presentation at the subdivision authority meeting, please notify the M.D. of Willow Creek No. 26 Municipal Administrator at your earliest convenience.*

GENERAL COMMENTS:

These subdivisions are part of the Claresholm Solar Project in the M.D. of Willow Creek No. 26. Municipal Council recently approved the designation requests to accommodate this project by rezoning lands to Rural Industrial – RI.

As most the quarter sections contain wetland areas, a request to subdivide out these areas was made to the developer. These wetland areas will remain Rural General – RG while the residual parcels will receive the Rural Industrial – RI zoning and be the subject of a following development permit for the actual solar project.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

Planner's Preliminary Comments:

This proposal would subdivide an existing 160.19 acre parcel to create two parcels of 24.78 and 135.41 acres respectively. The 24.78 acres represents the wetland and buffer areas which will remain designated Rural General – RG while the 135.41 acres will become Rural Industrial – RI and be the site for future solar panels.

As these lands have been recently redesignated to accommodate this proposal a recommendation for approval is warranted subject to standard conditions and legal access.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies
4. Provisions of easements to provide legal access to the 24.78 acres being created.

RESERVE:

Municipal Reserve is not applicable as the land is for agricultural purposes.

Submissions received become part of the subdivision file which is available to the applicant and will be considered by the subdivision authority at a public meeting.

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no.18-0008

E 1/2 SEC 31, TWP 12, RGE 25, W 4 M, E 1/2 & SW 1/4 SEC 6, TWP 13, RGE 25, W 4 M & N 1/2 & SE 1/4, SEC 1, TWP 13, RGE 26, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 31, 2018

FILE Nos: 2018-0-112 to 2018-0-119

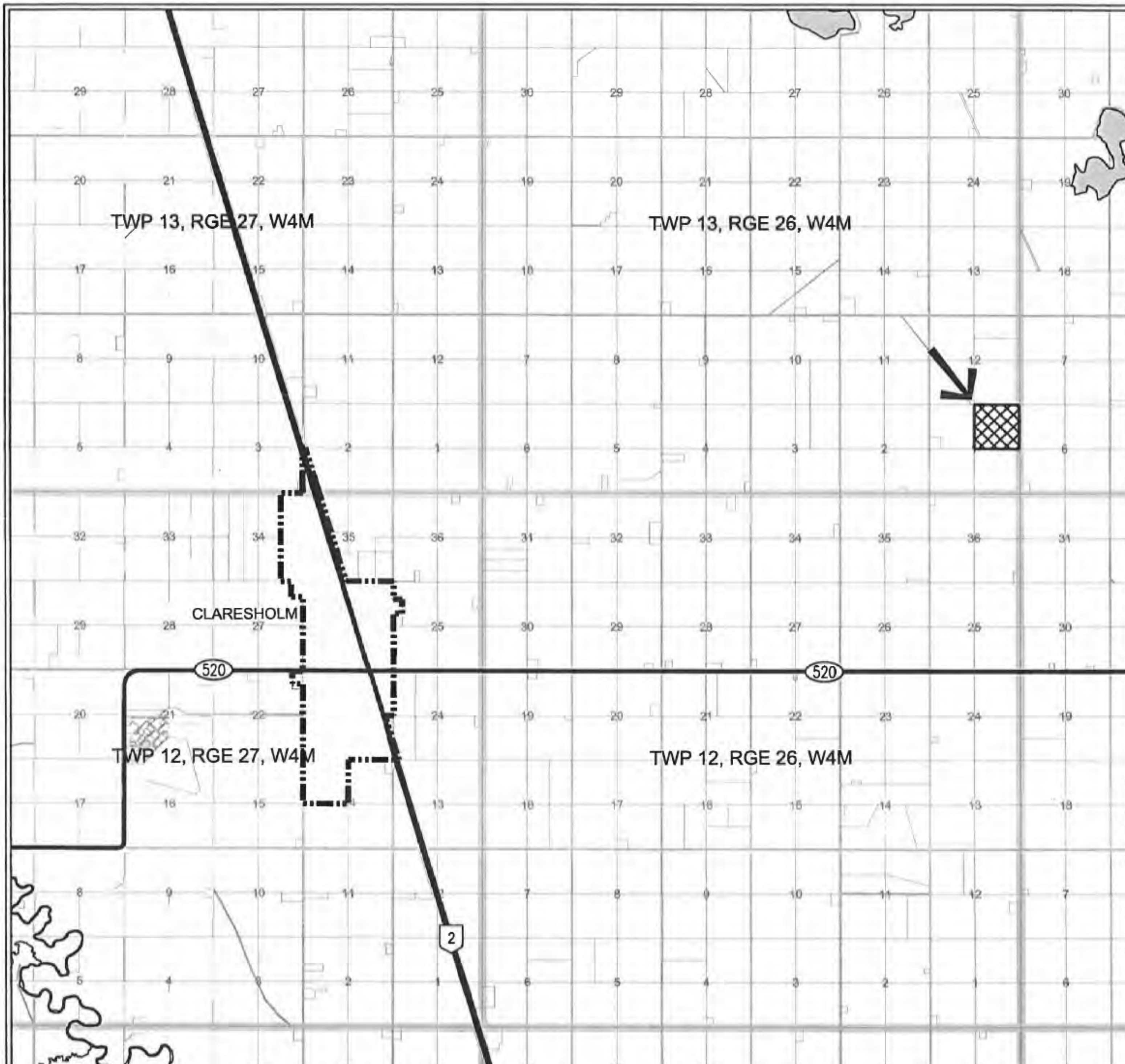
OLDMAN RIVER REGIONAL SERVICES COMMISSION

Proposed Lot Lines

Wetland Areas

Proposed Substation

August 09, 2018 N:\Subdivision\2018\2018-0-119.dwg

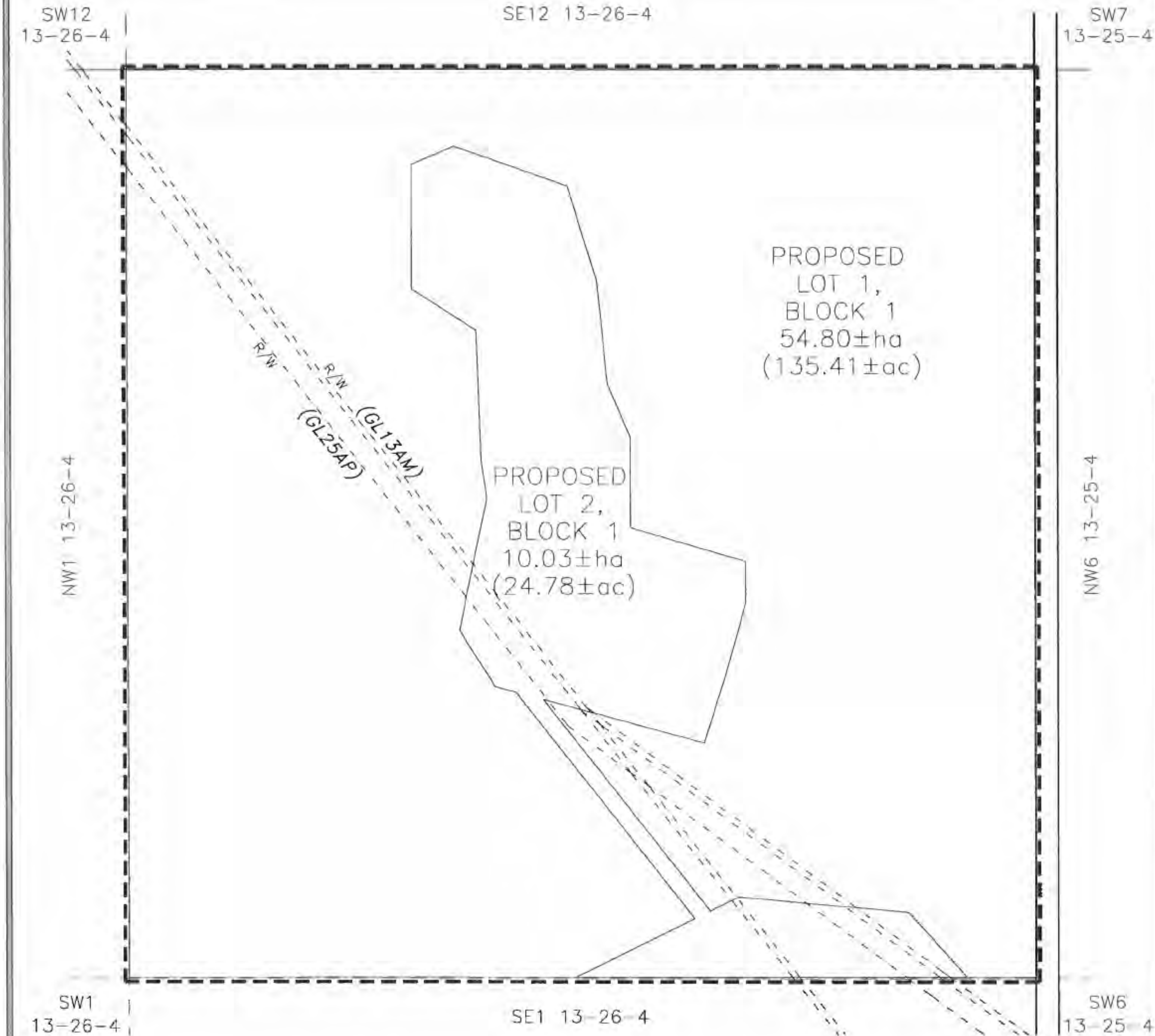


SUBDIVISION LOCATION SKETCH
NE 1/4 SEC 1, TWP 13, RGE 26, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-112

MAP PREPARED BY
OLDMAN RIVER REGIONAL SERVICES COMMISSION
3105 16th AVENUE NORTH, LETHBRIDGE, AB T1H 5E8
"NOT RESPONSIBLE FOR ERRORS OR OMISSIONS"

OLDMAN RIVER REGIONAL SERVICES COMMISSION

July 30, 2018 N:\Subdivision\2018\2018-0-112.dwg



SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no. 2018-0008

NE 1/4 SEC 1, TWP 13, RGE 26, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-112

OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 30, 2018 N:\Subdivision\2018\2018-0-112.dwg

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no. 2018-0008

NE 1/4 SEC 1, TWP 13, RGE 26, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 30, 2018

FILE No: 2018-0-112

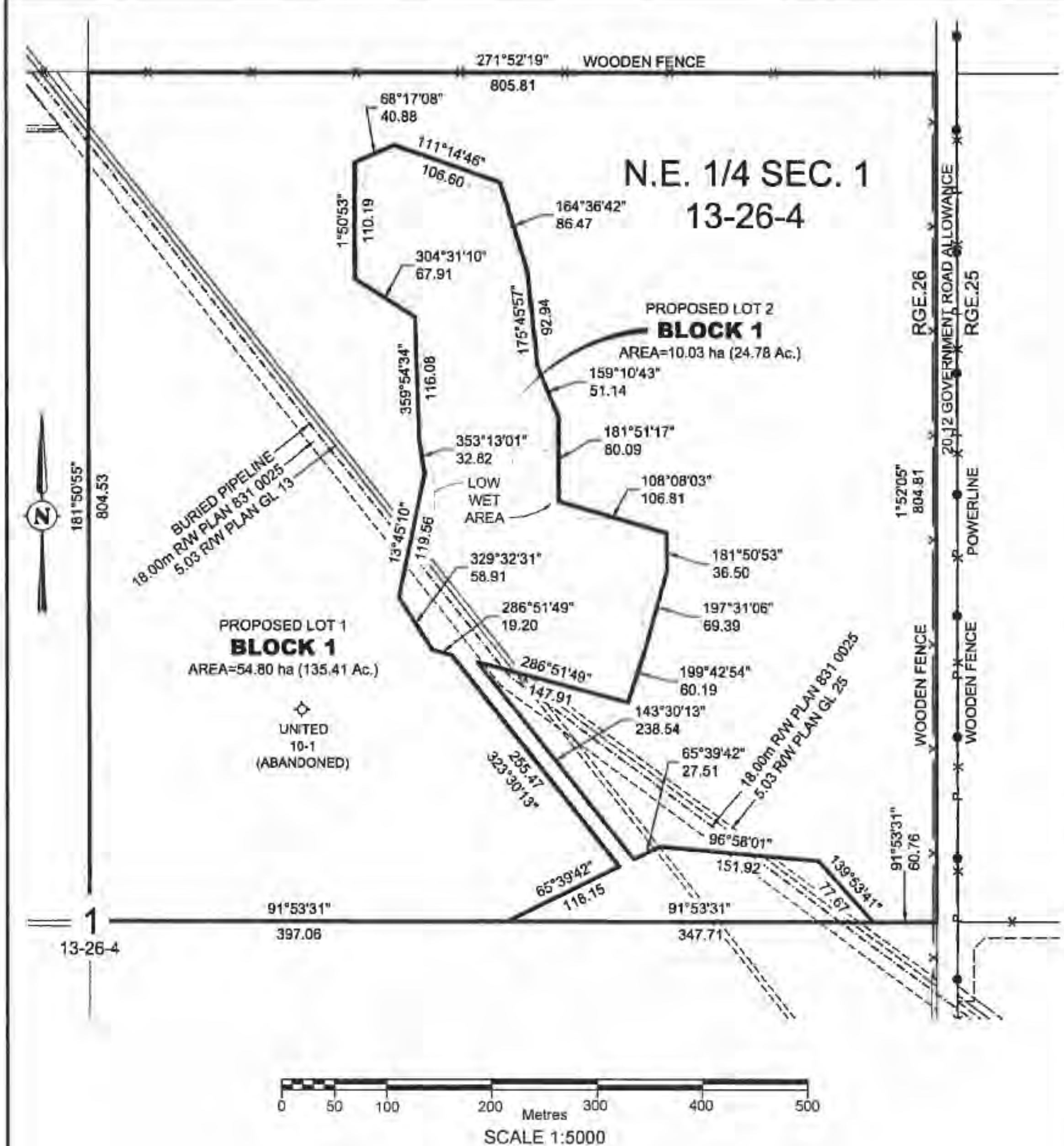
OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 30, 2018 N:\Subdivision\2018\2018-0-112.dwg

AERIAL PHOTO DATE: 2012



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

N.E. 1/4 SEC. 1

TWP. 13 - RGE. 26 - W. 4M.

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN,
ALBERTA LAND SURVEYOR

FIELD INSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
THIRD ROCK GEOMATICS LTD.

LEGEND

E. - EAST
ha - HECTARES
M. - MERIDIAN
N. - NORTH
RGE. - RANGE
R/W - RIGHT OF WAY
S. - SOUTH
SEC. - SECTION
TWP. - TOWNSHIP
W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS:
AND CONTAINS 64.83 HECTARES
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS). REFERENCE MERIDIAN 111° WEST. CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.:

REGISTERED OWNER

CERTIFICATE OF TITLE: 041 169 977 +1
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-828-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg NE1 | Plot Date: July 12, 2018

OLDMAN RIVER REGIONAL SERVICES COMMISSION

3105 - 16th Avenue North
Lethbridge, Alberta T1H 5E8

Phone: (403) 329-1344
Toll-Free: 1-844-279-760
E-mail: subdivision@orrsc.com
Website: www.orrsc.com

NOTICE OF APPLICATION FOR SUBDIVISION OF LAND

DATE: August 14, 2018

Date of Receipt: July 23, 2018
Date of Completeness: July 30, 2018

TO: **Landowner:** Hutterian Brethren Church of Granum

Surveyor: Third Rock Geomatics – Jeff Olsen

Agent: Claresholm Solar Inc – Philipp Andres

Referral Agencies: M.D. of Willow Creek No. 26, Ian Sundquist, , Livingstone Range School Division, AltaLink, FortisAlberta, TELUS, ATCO Gas, ATCO Pipelines, AB Health Services - Calgary, AB Environment & Parks - K. Murphy, AB Environment & Parks - M. Keohane, AB Environment Operations Infrastructure Branch (OIB), AB Water Boundaries, Area Wildlife Biologist - M. Didkowsky, AB Agriculture, AER, ConocoPhillips Canada Resources Corp.

Adjacent Landowners: Bar KL Farms Ltd., Douglas and Olive Darch, Dustin and Carmen Sippola, Russell and Sierra Stewart, Shirley Stange

Planning Advisor: Mike Burla MB

The Oldman River Regional Services Commission (ORRSC) is in receipt of the following subdivision application which is being processed on behalf of the M.D. of Willow Creek No. 26. This letter serves as the formal notice that the submitted application has been determined to be complete for the purpose of processing.

In accordance with the Subdivision and Development Regulation, if you wish to make comments respecting the proposed subdivision, please submit them via email or mail no later than **September 4, 2018**. (Please quote our File No. **2018-0-113** in any correspondence with this office).

File No.:	**2018-0-113**
Legal Description:	SE1/4 1-13-26-W4M
Municipality:	M.D. of Willow Creek No. 26
Land Designation: *(Zoning)*	Rural General - RG / Rural Industrial - RI
Existing Use:	Agricultural
Proposed Use:	Solar Farm
# of Lots Created:	1
Certificate of Title:	041 169 977

Meeting Date:	**September 19, 2018** *Note that meeting dates are subject to change. It is advisable to contact the M.D. of Willow Creek No. 26 three (3) days prior to the meeting for times and to confirm that this application is on the agenda.* *If you wish to make a presentation at the subdivision authority meeting, please notify the M.D. of Willow Creek No. 26 Municipal Administrator at your earliest convenience.*

GENERAL COMMENTS:

These subdivisions are part of the Claresholm Solar Project in the M.D. of Willow Creek No. 26. Municipal Council recently approved the designation requests to accommodate this project by rezoning lands to Rural Industrial – RI.

As most the quarter sections contain wetland areas, a request to subdivide out these areas was made to the developer. These wetland areas will remain Rural General – RG while the residual parcels will receive the Rural Industrial – RI zoning and be the subject of a following development permit for the actual solar project.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

Planner's Preliminary Comments:

This proposal would subdivide an existing 160.10 acre parcel to create two parcels of 51.48 and 108.62 acres respectively. The 51.48 acres contains the wetland and buffer areas on the quarter section while the 108.62 acres will be utilized for the Claresholm Solar Project.

As these lands have been recently redesignated to accommodate this proposal a recommendation for approval is warranted subject to standard planning conditions.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

RESERVE:

Municipal Reserve is not applicable as the land is for agricultural purposes.

Submissions received become part of the subdivision file which is available to the applicant and will be considered by the subdivision authority at a public meeting.

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no.18-0008

E 1/2 SEC 31, TWP 12, RGE 25, W 4 M, E 1/2 & SW 1/4 SEC 6, TWP 13, RGE 25, W 4 M & N 1/2 & SE 1/4, SEC 1, TWP 13, RGE 26, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 31, 2018

FILE Nos: 2018-0-112 to 2018-0-119

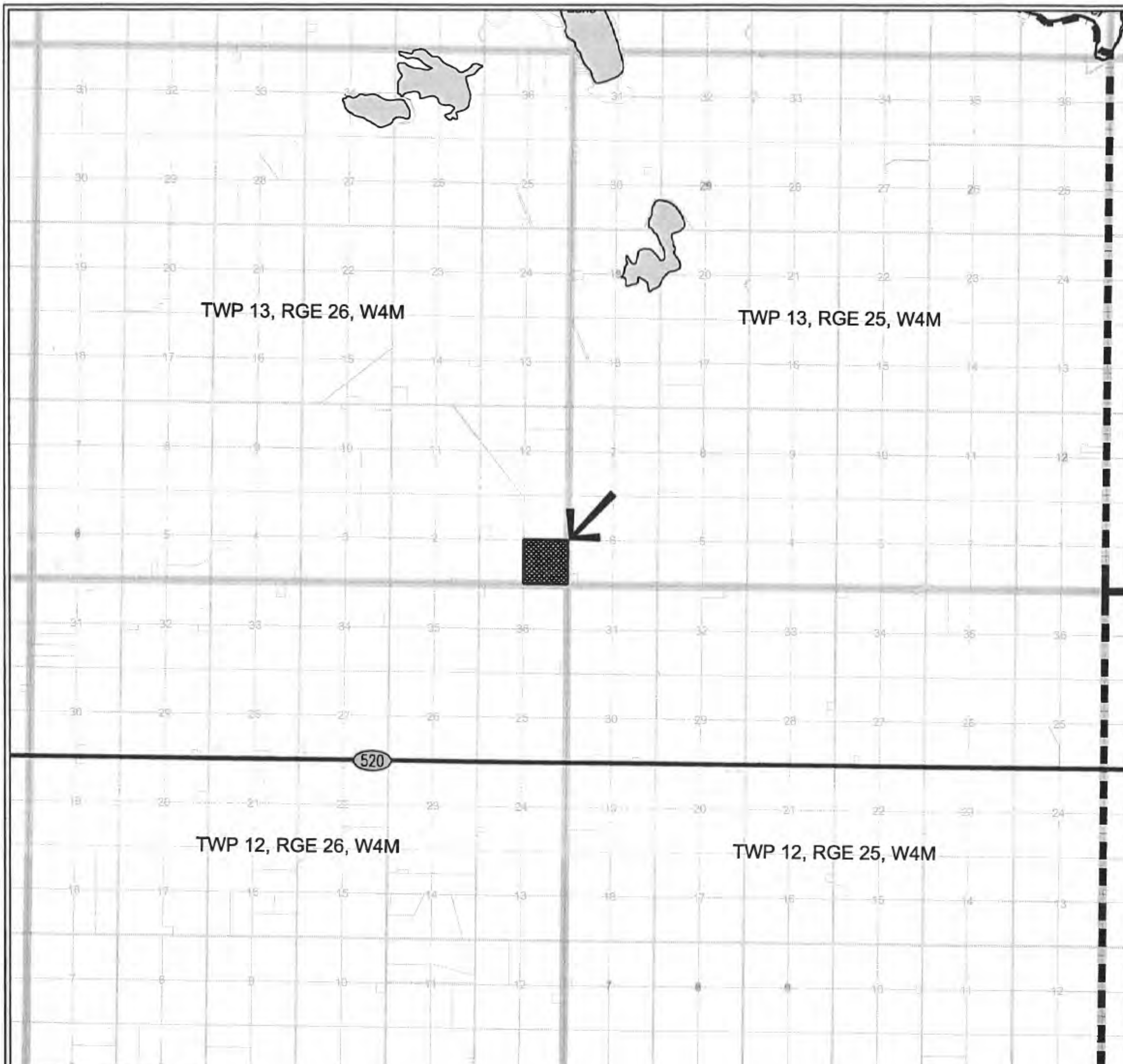
Proposed Lot Lines

Wetland Areas

Proposed Substation

OLDMAN RIVER REGIONAL SERVICES COMMISSION

N

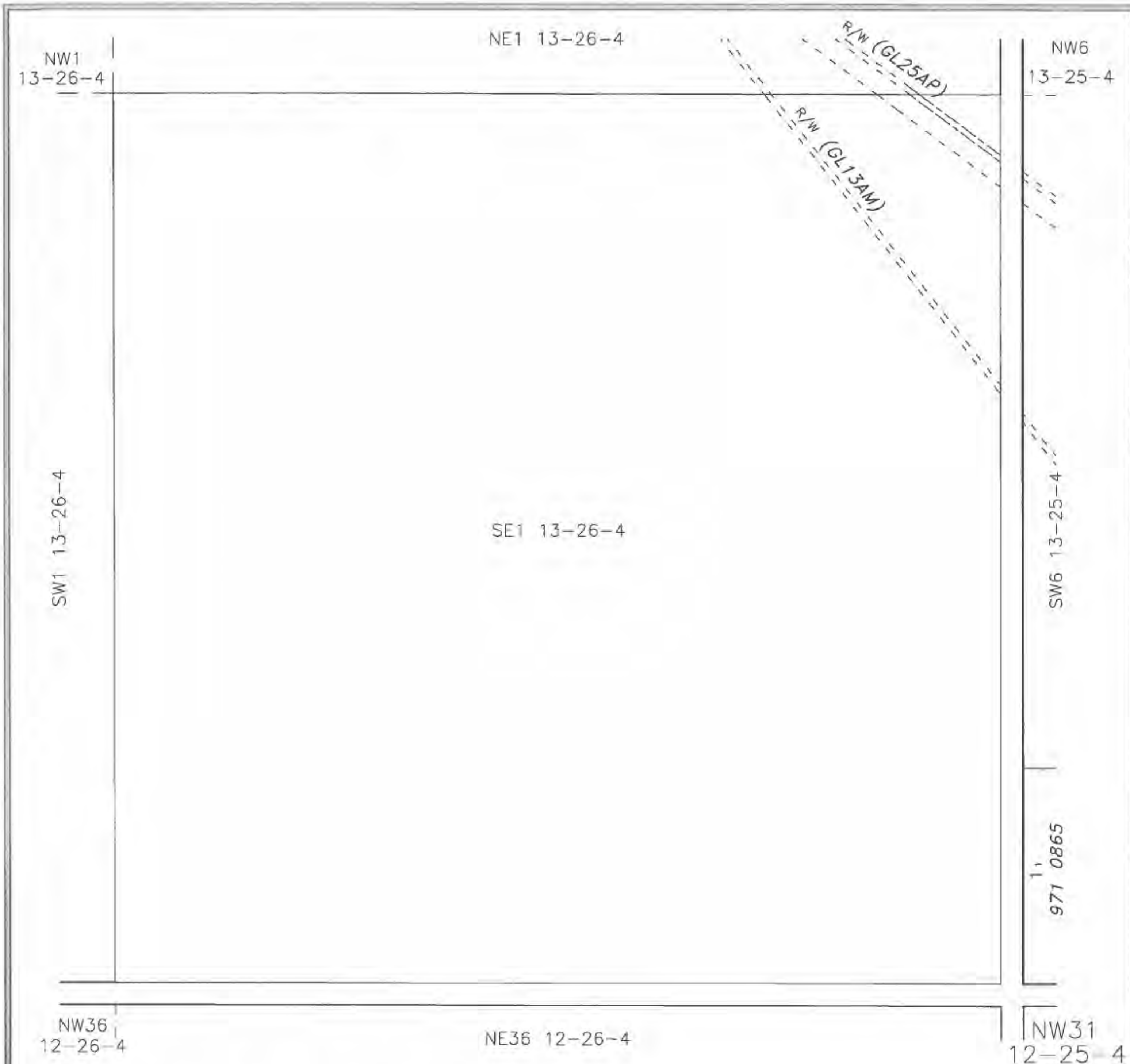


SUBDIVISION LOCATION SKETCH
WITHIN SE 1/4 SEC 1, TWP 13, RGE 26, W 4 M
MUNICIPALITY: M.D. WILLOW CREEK No. 26
DATE: July 30, 2018
FILE No: 2018-0-113

MAP PREPARED BY
OLDMAN RIVER REGIONAL SERVICES COMMISSION
3105 16th AVENUE NORTH, LETHBRIDGE, AB T1H 5E8
"NOT RESPONSIBLE FOR ERRORS OR OMISSIONS"

OLDMAN RIVER REGIONAL SERVICES COMMISSION

July 31, 2018 N:\Subdivision\2018\2018-0-113.dwg



SUBDIVISION SKETCH - **EXISTING**

WITHIN SE 1/4 SEC 1, TWP 13, RGE 26, W 4 M

MUNICIPALITY: M.D. WILLOW CREEK No. 26

DATE: July 30, 2018

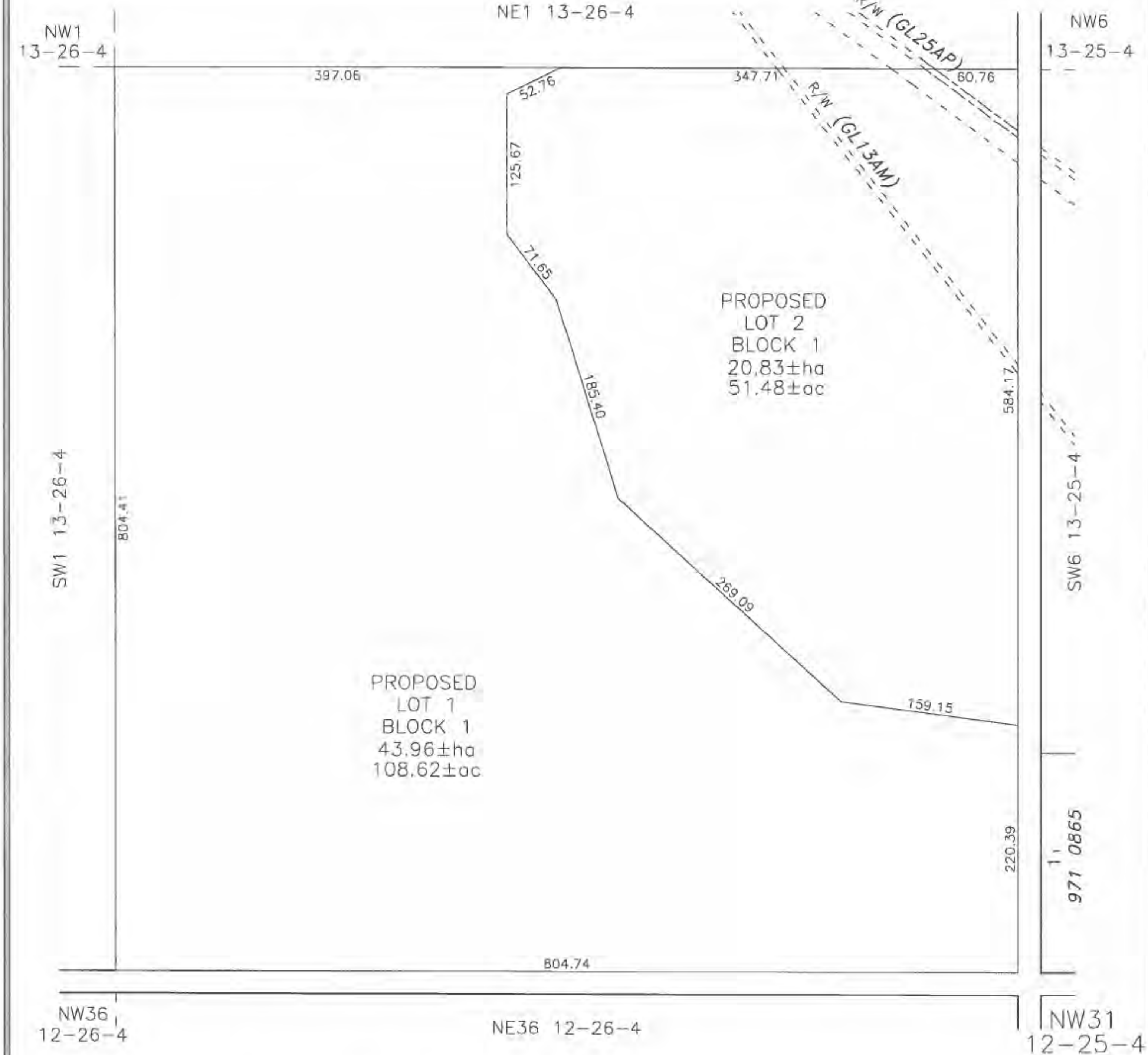
FILE No: 2018-0-113

OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 31, 2018 N:\Subdivision\2018\2018-0-113.dwg



SUBDIVISION SKETCH - **PROPOSED**

WITHIN SE 1/4 SEC 1, TWP 13, RGE 26, W 4 M

MUNICIPALITY: M.D. WILLOW CREEK No. 26

DATE: July 30, 2018

FILE No: 2018-0-113

OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 31, 2018 N:\Subdivision\2018\2018-0-113.dwg

SUBDIVISION SKETCH - **PROPOSED**
WITHIN SE 1/4 SEC 1, TWP 13, RGE 26, W 4 M
MUNICIPALITY: M.D. WILLOW CREEK No. 26
DATE: July 30, 2018
FILE No: 2018-0-113

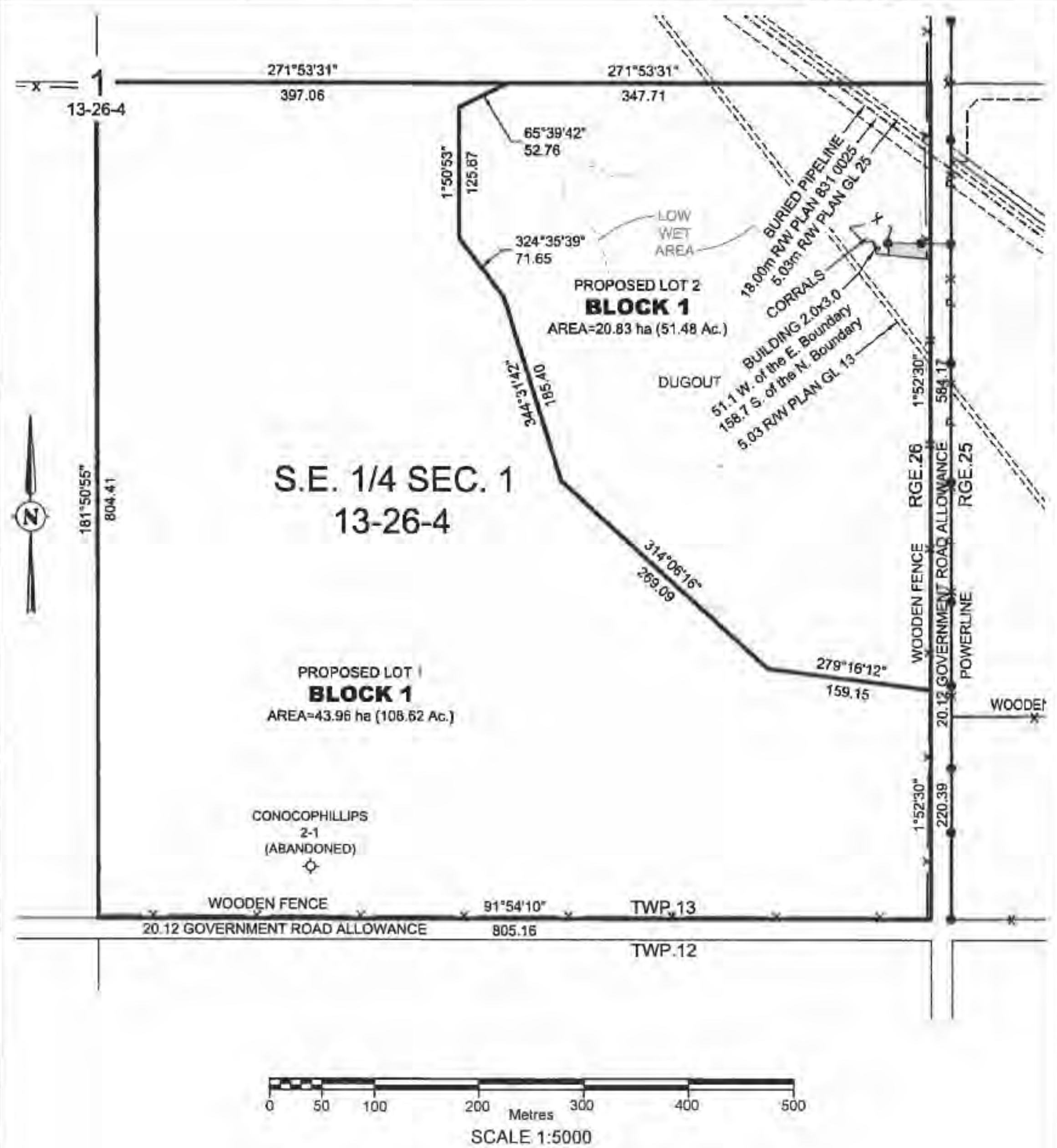
OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 31, 2018 N:\Subdivision\2018\2018-0-113.dwg

AERIAL PHOTO DATE: 2015



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

S.E. 1/4 SEC. 1

TWP. 13 - RGE. 26 - W. 4M.

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN,
ALBERTA LAND SURVEYOR

FIELD INSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
THIRD ROCK GEOMATICS LTD.

LEGEND

E. - EAST
ha - HECTARES
M. - MERIDIAN
N. - NORTH
RGE. - RANGE
R/W - RIGHT OF WAY
S. - SOUTH
SEC. - SECTION
TWP. - TOWNSHIP
W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS:
AND CONTAINS 64.79 HECTARES.
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS), REFERENCE MERIDIAN 111° WEST, CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.

REGISTERED OWNER

CERTIFICATE OF TITLE: 041 169 977
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-828-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg SE1 | Plot Date: July 12, 2018

OLDMAN RIVER REGIONAL SERVICES COMMISSION

3105 - 16th Avenue North
Lethbridge, Alberta T1H 5E8

Phone: (403) 329-1344
Toll-Free: 1-844-279-760
E-mail: subdivision@orrsc.com
Website: www.orrsc.com

NOTICE OF APPLICATION FOR SUBDIVISION OF LAND

DATE: August 15, 2018

Date of Receipt: July 23, 2018
Date of Completeness: July 30, 2018

TO: **Landowner:** Hutterian Brethren Church of Granum

Surveyor: Third Rock Geomatics – Jeff Olsen

Agent: Claresholm Solar Inc. – Philipp Andres

Referral Agencies: M.D. of Willow Creek No. 26, Ian Sundquist, Livingstone Range School Division, AltaLink, FortisAlberta, TELUS, ATCO Gas, ATCO Pipelines, AB Health Services - Calgary, AB Environment & Parks - K. Murphy, AB Environment & Parks - M. Keohane, AB Environment Operations Infrastructure Branch (OIB), AB Water Boundaries, Area Wildlife Biologist - M. Didkowsky, AB Agriculture, AER

Adjacent Landowners: Bark KL Farms Ltd., Cody and Jill Selke, Denise LeBorgne, Dustin and Carmen Sippola, Groten Hay Farms Ltd., Henry and Delores Lange

Planning Advisor: Mike Burla MB

The Oldman River Regional Services Commission (ORRSC) is in receipt of the following subdivision application which is being processed on behalf of the M.D. of Willow Creek No. 26. This letter serves as the formal notice that the submitted application has been determined to be complete for the purpose of processing.

In accordance with the Subdivision and Development Regulation, if you wish to make comments respecting the proposed subdivision, please submit them via email or mail no later than **September 4, 2018**. (Please quote our File No. **2018-0-115** in any correspondence with this office).

File No.:	**2018-0-115**
Legal Description:	NE1/4 6-13-25-W4M
Municipality:	M.D. of Willow Creek No. 26
Land Designation: *(Zoning)*	Rural General - RG / Rural Industrial - RI
Existing Use:	Agricultural
Proposed Use:	Solar Farm
# of Lots Created:	2
Certificate of Title:	001 128 204

Meeting Date:	**September 19, 2018** *Note that meeting dates are subject to change. It is advisable to contact the M.D. of Willow Creek No. 26 three (3) days prior to the meeting for times and to confirm that this application is on the agenda.* *If you wish to make a presentation at the subdivision authority meeting, please notify the M.D. of Willow Creek No. 26 Municipal Administrator at your earliest convenience.*

GENERAL COMMENTS:

These subdivisions are part of the Claresholm Solar Project in the M.D. of Willow Creek No. 26. Municipal Council recently approved the designation requests to accommodate this project by rezoning lands to Rural Industrial – RI.

As most the quarter sections contain wetland areas, a request to subdivide out these areas was made to the developer. These wetland areas will remain Rural General – RG while the residual parcels will receive the Rural Industrial – RI zoning and be the subject of a following development permit for the actual solar project.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

Planner's Preliminary Comments:

This proposal would subdivide an existing 160.29 acre parcel to create three titles of 33.60, 50.94 and 75.75 acres. The 33.60 and 75.75 acres will be used for the solar project while the 50.94 acres will encompass the wetland areas which traverse through this quarter section.

As this proposal complies with the recent resignation of this land, a planning recommendation for approval with standard planning conditions is recommended.

* Consideration should be given to a small survey change which would square off the 50.94 parcel in the northwestern portion of the proposed parcel.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

RESERVE:
Municipal Reserve is not applicable as the land is for agricultural purposes

Submissions received become part of the subdivision file which is available to the applicant and will be considered by the subdivision authority at a public meeting.

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no.18-0008

E 1/2 SEC 31, TWP 12, RGE 25, W 4 M, E 1/2 & SW 1/4 SEC 6,
TWP 13, RGE 25, W 4 M & N 1/2 & SE 1/4, SEC 1, TWP 13, RGE 26, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 31, 2018

FILE Nos: 2018-0-112 to 2018-0-119

Proposed Lot Lines

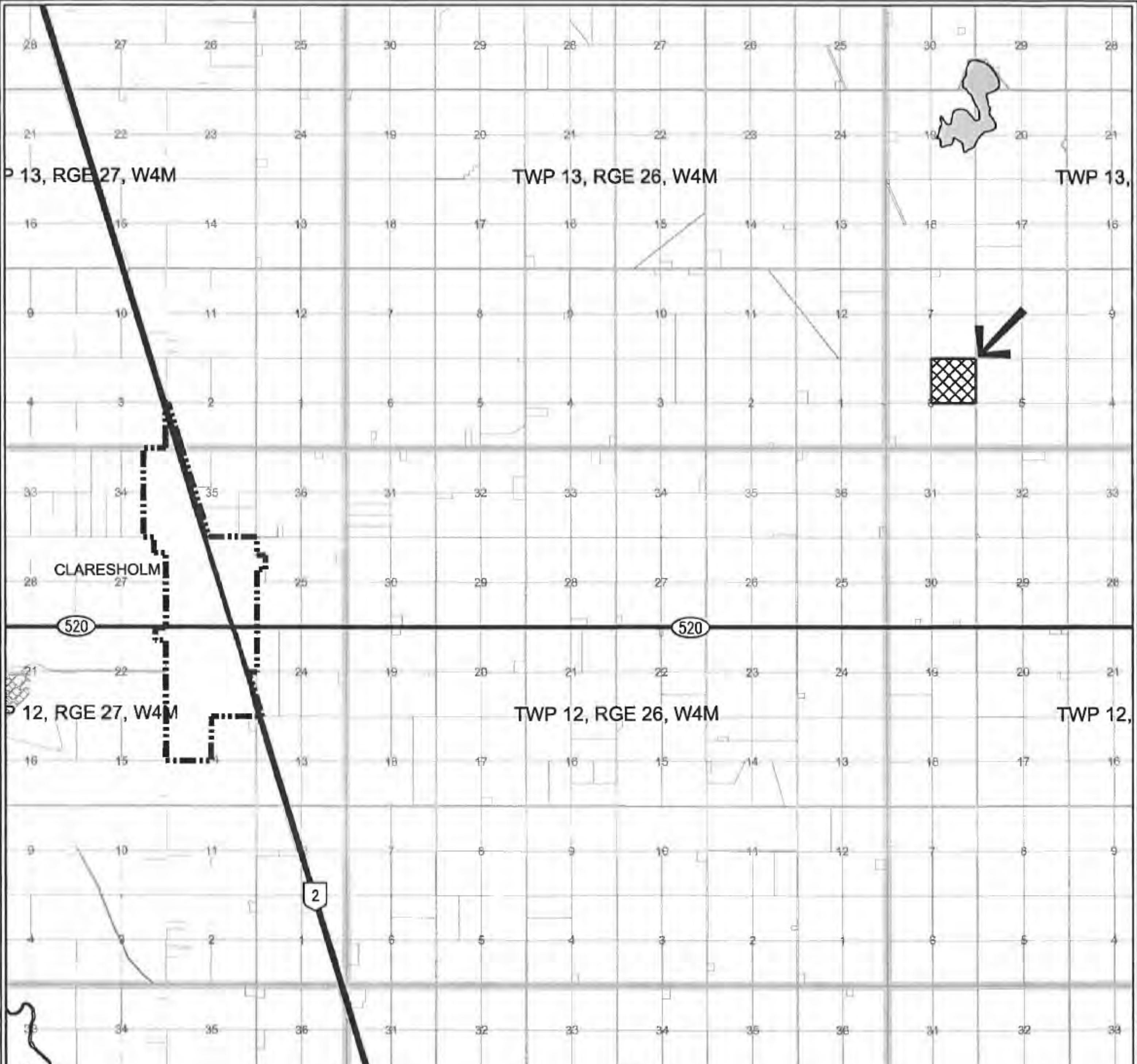
Wetland Areas

Proposed Substation

OLDMAN RIVER REGIONAL SERVICES COMMISSION

N

August 09, 2018 N:\Subdivision\2018\2018-0-119.dwg

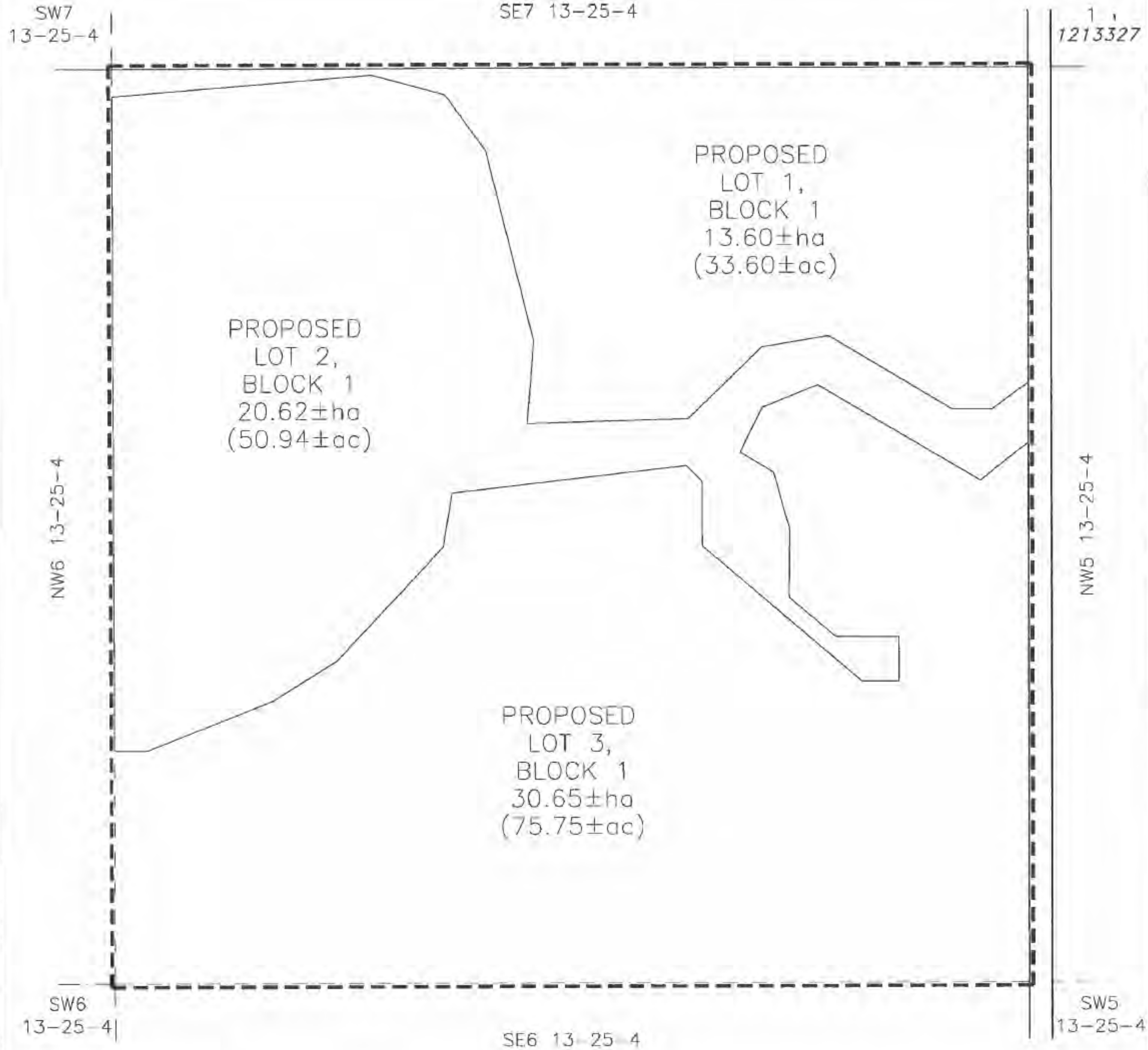


SUBDIVISION LOCATION SKETCH
NE 1/4 SEC 6, TWP 13, RGE 25, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-115

MAP PREPARED BY
OLDMAN RIVER REGIONAL SERVICES COMMISSION
3105 16th AVENUE NORTH, LETHBRIDGE, AB T1H 5E8
"NOT RESPONSIBLE FOR ERRORS OR OMISSIONS"

OLDMAN RIVER REGIONAL SERVICES COMMISSION

July 30, 2018 N:\Subdivision\2018\2018-0-115.dwg



SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics Ltd. file no. 18-0008

NE 1/4 SEC 6, TWP 13, RGE 25, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 30, 2018

FILE No: 2018-0-115

OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

July 30, 2018 N:\Subdivision\2018\2018-0-115.dwg

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics Ltd. file no. 18-0008

NE 1/4 SEC 6, TWP 13, RGE 25, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-115

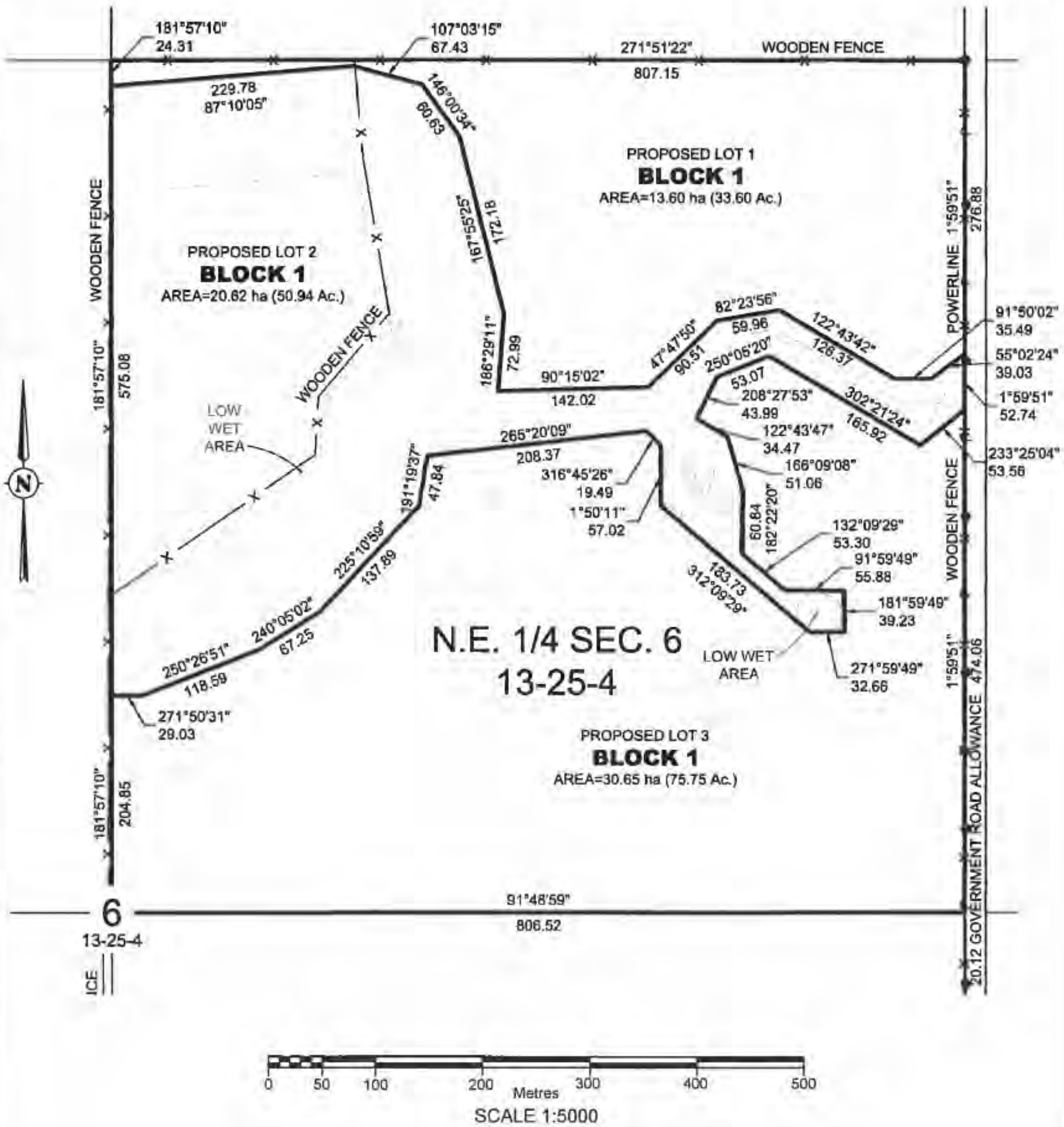
OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

July 30, 2018 N:\Subdivision\2018\2018-0-115.dwg

N

AERIAL PHOTO DATE: 2012



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

N.E. 1/4 SEC. 6

TWP. 13 - RGE. 25 - W. 4M.

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN,
ALBERTA LAND SURVEYOR

FIELD INSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT.

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
THIRD ROCK GEOMATICS LTD.

LEGEND

E. - EAST
ha - HECTARES
M. - MERIDIAN
N. - NORTH
RGE. - RANGE
R/W - RIGHT OF WAY
S. - SOUTH
SEC. - SECTION
TWP. - TOWNSHIP
W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS
AND CONTAINS 64.87 HECTARES.
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS), REFERENCE MERIDIAN 111° WEST, CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.:

REGISTERED OWNER

CERTIFICATE OF TITLE: 001 128 204
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-828-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg NE6 | Plot Date: July 12, 2018

OLDMAN RIVER REGIONAL SERVICES COMMISSION

3105 - 16th Avenue North
Lethbridge, Alberta T1H 5E8

Phone: (403) 329-1344
Toll-Free: 1-844-279-760
E-mail: subdivision@orrsc.com
Website: www.orrsc.com

NOTICE OF APPLICATION FOR SUBDIVISION OF LAND

DATE: August 15, 2018

Date of Receipt: July 23, 2018
Date of Completeness: July 30, 2018

TO: **Landowner:** Hutterian Brethren Church of Granum

Surveyor: Third Rock Geomatics – Jeff Olsen

Agent: Claresholm Solar Inc. – Philipp Andres

Referral Agencies: M.D. of Willow Creek No. 26, Ian Sundquist, , Livingstone Range School Division, AltaLink, FortisAlberta, TELUS, ATCO Gas, ATCO Pipelines, AB Health Services - Calgary, AB Environment & Parks - K. Murphy, AB Environment & Parks - M. Keohane, AB Environment Operations Infrastructure Branch (OIB), AB Water Boundaries, Area Wildlife Biologist - M. Didkowsky, AB Agriculture, AER

Adjacent Landowners: Bar KL Farms Ltd., Russell and Sierra Stewart, Dustin and Carmen Sippola, Denise LeBorgne

Planning Advisor: Mike Burla MB

The Oldman River Regional Services Commission (ORRSC) is in receipt of the following subdivision application which is being processed on behalf of the M.D. of Willow Creek No. 26. This letter serves as the formal notice that the submitted application has been determined to be complete for the purpose of processing.

In accordance with the Subdivision and Development Regulation, if you wish to make comments respecting the proposed subdivision, please submit them via email or mail no later than **September 4, 2018**. (Please quote our File No. **2018-0-116** in any correspondence with this office).

File No.:	**2018-0-116**
Legal Description:	SE1/4 6-13-25-W4M
Municipality:	M.D. of Willow Creek No. 26
Land Designation: ***(Zoning)***	Rural General - RG / Rural Industrial - RI
Existing Use:	Agricultural
Proposed Use:	Solar Farm
# of Lots Created:	4
Certificate of Title:	001 039 234

Meeting Date:	**September 19, 2018** *Note that meeting dates are subject to change. It is advisable to contact the M.D. of Willow Creek No. 26 three (3) days prior to the meeting for times and to confirm that this application is on the agenda.* *If you wish to make a presentation at the subdivision authority meeting, please notify the M.D. of Willow Creek No. 26 Municipal Administrator at your earliest convenience.*

GENERAL COMMENTS:

These subdivisions are part of the Claresholm Solar Project in the M.D. of Willow Creek No. 26. Municipal Council recently approved the designation requests to accommodate this project by rezoning lands to Rural Industrial – RI.

As most the quarter sections contain wetland areas, a request to subdivide out these areas was made to the developer. These wetland areas will remain Rural General – RG while the residual parcels will receive the Rural Industrial – RI zoning and be the subject of a following development permit for the actual solar project.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

Planner's Preliminary Comments:

This proposal would subdivide an existing 160.16 acre parcel to create five parcels of 3.60, 0.89, 11.49, 10.31 and 133.87 acres respectively. The 0.89 acre title will be used for a proposed substation associated with the solar project. The 133.87 acres will be the location of the proposed solar panels while the 3.60, 11.49 and 10.31 acres encompass the wetland areas as well as two existing dugouts.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

RESERVE:

Municipal Reserve is not applicable as the land is for agricultural purposes.

Submissions received become part of the subdivision file which is available to the applicant and will be considered by the subdivision authority at a public meeting.

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no.18-0008

E 1/2 SEC 31, TWP 12, RGE 25, W 4 M, E 1/2 & SW 1/4 SEC 6, TWP 13, RGE 25, W 4 M & N 1/2 & SE 1/4, SEC 1, TWP 13, RGE 26, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 31, 2018

FILE Nos: 2018-0-112 to 2018-0-119

Proposed Lot Lines

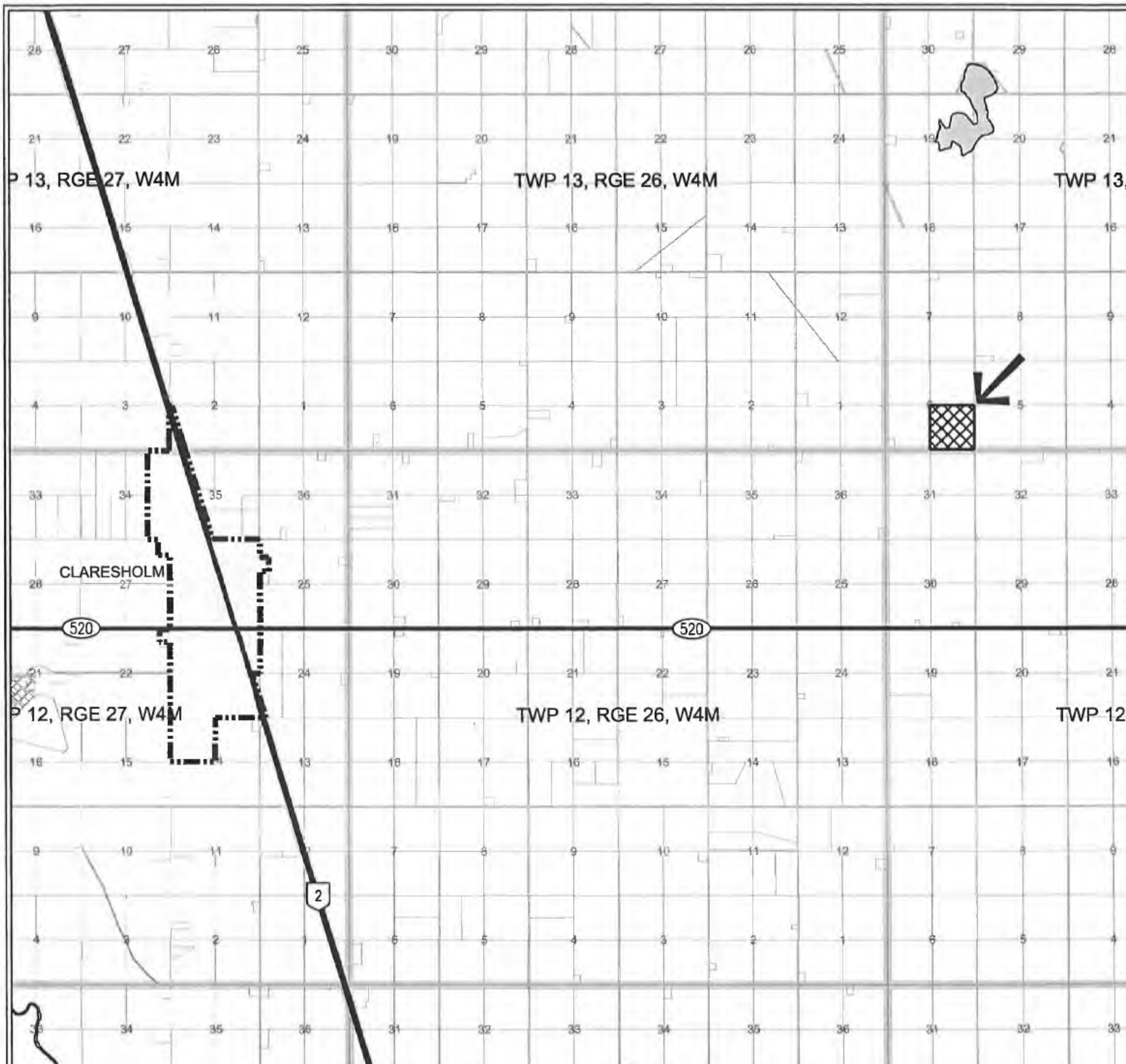
Wetland Areas

Proposed Substation

OLDMAN RIVER REGIONAL SERVICES COMMISSION

N

August 09, 2018 N:\Subdivision\2018\2018-0-119.dwg

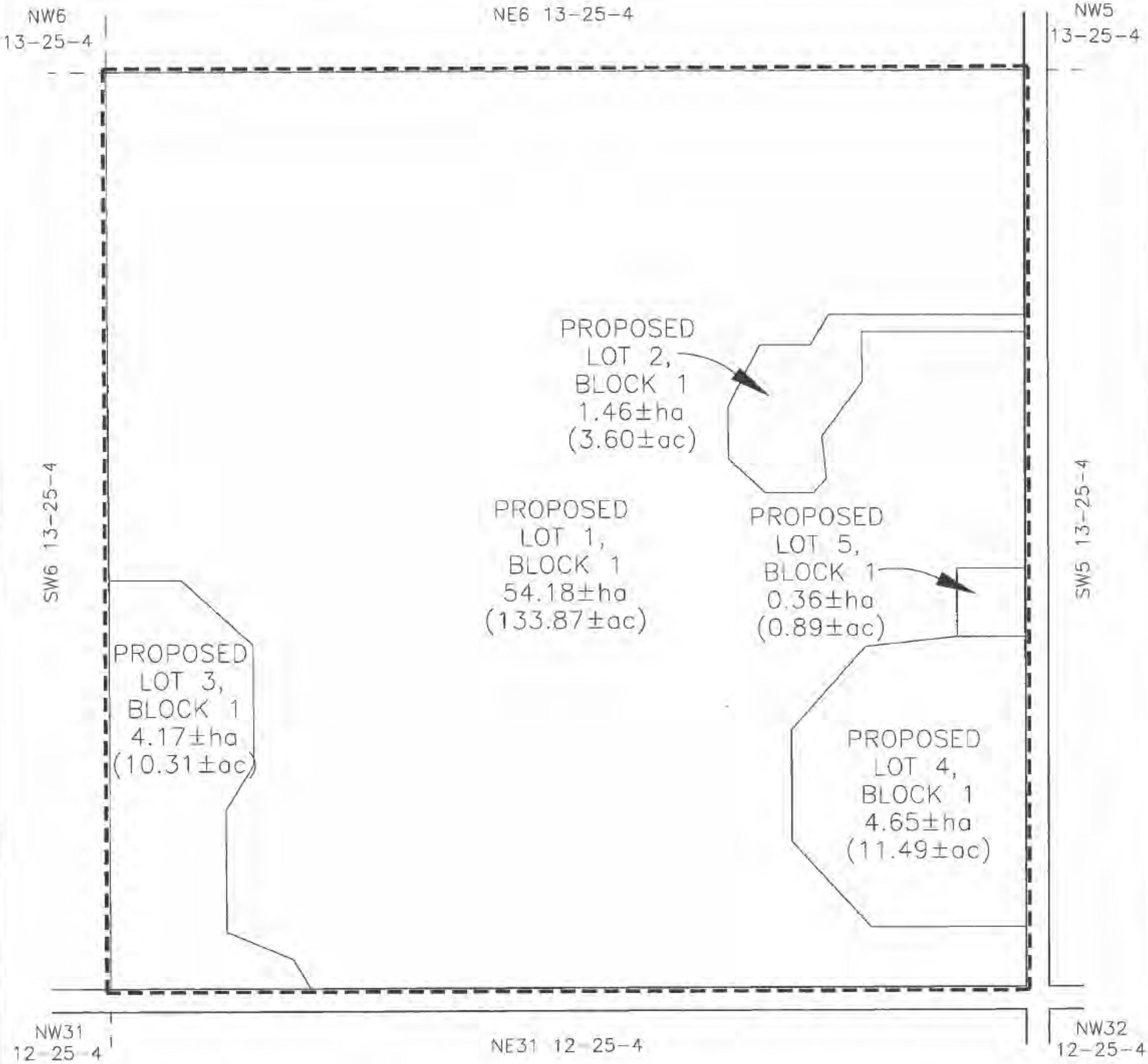


SUBDIVISION LOCATION SKETCH
SE 1/4 SEC 6, TWP 13, RGE 25, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-116

MAP PREPARED BY:
OLDMAN RIVER REGIONAL SERVICES COMMISSION
3105 16th AVENUE NORTH, LETHBRIDGE, AB T1H 5E8
"NOT RESPONSIBLE FOR ERRORS OR OMISSIONS"

OLDMAN RIVER REGIONAL SERVICES COMMISSION

July 30, 2018 N:\Subdivision\2018\2018-0-116.dwg



SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics Ltd. file no. 18-0008

SE 1/4 SEC 6, TWP 13, RGE 25, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 30, 2018

FILE No: 2018-0-116

OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 30, 2018 N:\Subdivision\2018\2018-0-116.dwg

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics Ltd. file no. 18-0008

SE 1/4 SEC 6, TWP 13, RGE 25, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 30, 2018

FILE No: 2018-0-116

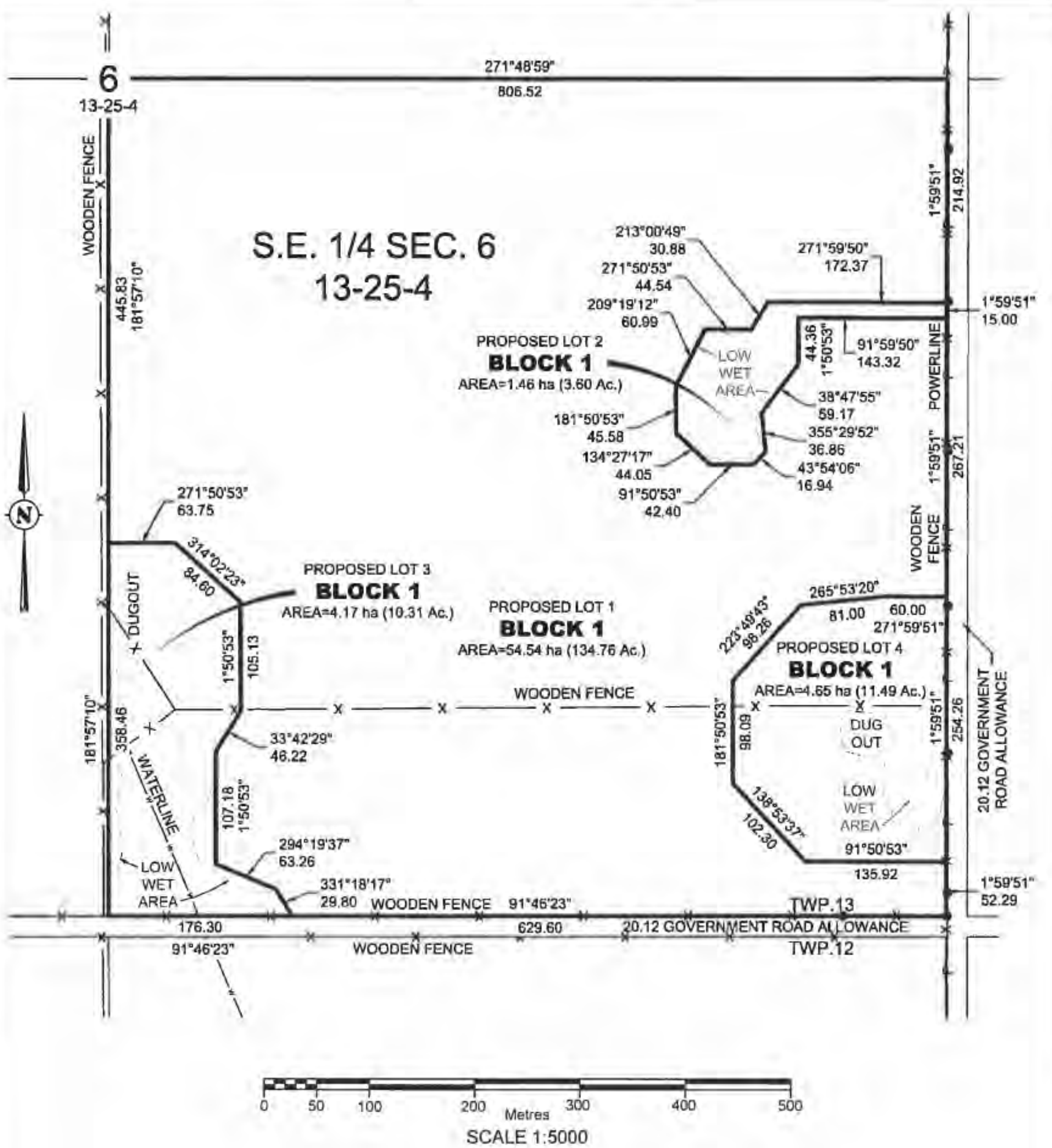
OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

July 30, 2018 N:\Subdivision\2018\2018-0-116.dwg

N

AERIAL PHOTO DATE: 2012



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

S.E. 1/4 SEC. 6

TWP. 13 - RGE. 25 - W. 4M.

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN,
ALBERTA LAND SURVEYOR

FIELD INSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
THIRD ROCK GEOMATICS LTD.

LEGEND

E. - EAST
ha - HECTARES
M. - MERIDIAN
N. - NORTH
RGE. - RANGE
R/W - RIGHT OF WAY
S. - SOUTH
SEC. - SECTION
TWP. - TOWNSHIP
W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS:
AND CONTAINS 64.82 HECTARES.
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS), REFERENCE MERIDIAN 111° WEST, CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.:

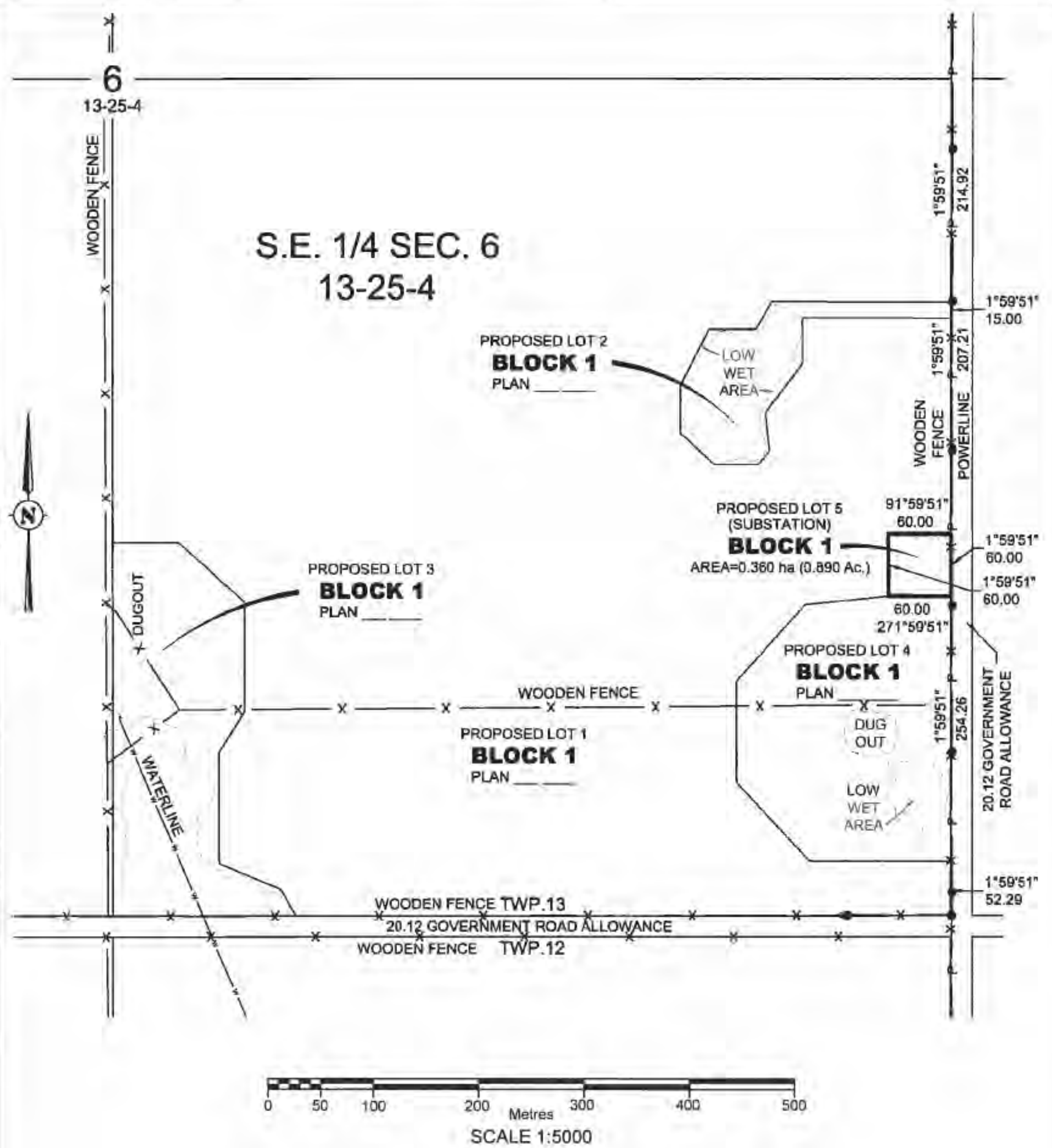
REGISTERED OWNER

CERTIFICATE OF TITLE: 001 039 234
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-628-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg SE6 | Plot Date: July 12, 2018



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

LOT 1, BLOCK 1, PLAN ___ ___

(S.E. 1/4 SEC. 6 - TWP. 13 - RGE. 25 - W. 4M.)

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN,
ALBERTA LAND SURVEYOR

FIELD INSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
THIRD ROCK GEOMATICS LTD.

LEGEND

E. - EAST
ha - HECTARES
M. - MERIDIAN
N. - NORTH
RGE. - RANGE
R/W - RIGHT OF WAY
S. - SOUTH
SEC. - SECTION
TWP. - TOWNSHIP
W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS:
AND CONTAINS: 0.360 HECTARES
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS), REFERENCE MERIDIAN 111° WEST, CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.:

REGISTERED OWNER

CERTIFICATE OF TITLE: 001 039 234
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-828-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg SE6 (Substation) | Plot Date: July 12, 2018

OLDMAN RIVER REGIONAL SERVICES COMMISSION

3105 - 16th Avenue North
Lethbridge, Alberta T1H 5E8

Phone: (403) 329-1344
Toll-Free: 1-844-279-760
E-mail: subdivision@orrsc.com
Website: www.orrsc.com

NOTICE OF APPLICATION FOR SUBDIVISION OF LAND

DATE: August 15, 2018

Date of Receipt: July 23, 2018
Date of Completeness: July 30, 2018

TO: **Landowner:** Hutterian Brethren Church of Granum

Surveyor: Third Rock Geomatics – Jeff Olsen

Agent: Claresholm Solar Inc. – Philipp Andres

Referral Agencies: M.D. of Willow Creek No. 26, Ian Sundquist, , Livingstone Range School Division, AltaLink, FortisAlberta, TELUS, ATCO Gas, ATCO Pipelines, AB Health Services - Calgary, AB Environment & Parks - K. Murphy, AB Environment & Parks - M. Keohane, AB Environment Operations Infrastructure Branch (OIB), AB Water Boundaries, Area Wildlife Biologist - M. Didkowsky, AB Agriculture, AER, Lexin Resources

Adjacent Landowners: Bar KL Farms Ltd., Douglas and Olive Darch, Dustin and Carmen Sippola, Hutterian Brethren of Granum, Russell and Sierra Stewart

Planning Advisor: Mike Burla MB

The Oldman River Regional Services Commission (ORRSC) is in receipt of the following subdivision application which is being processed on behalf of the M.D. of Willow Creek No. 26. This letter serves as the formal notice that the submitted application has been determined to be complete for the purpose of processing.

In accordance with the Subdivision and Development Regulation, if you wish to make comments respecting the proposed subdivision, please submit them via email or mail no later than **September 4, 2018**. (Please quote our File No. **2018-0-117** in any correspondence with this office).

File No.:	**2018-0-117**
Legal Description:	SW1/4 6-13-25-W4M
Municipality:	M.D. of Willow Creek No. 26
Land Designation: *(Zoning)*	Rural General - RG / Rural Industrial - RI
Existing Use:	Agricultural
Proposed Use:	Solar Farm
# of Lots Created:	3
Certificate of Title:	001 039 215

Meeting Date:	**September 19, 2018** *Note that meeting dates are subject to change. It is advisable to contact the M.D. of Willow Creek No. 26 three (3) days prior to the meeting for times and to confirm that this application is on the agenda.* *If you wish to make a presentation at the subdivision authority meeting, please notify the M.D. of Willow Creek No. 26 Municipal Administrator at your earliest convenience.*

GENERAL COMMENTS:

These subdivisions are part of the Claresholm Solar Project in the M.D. of Willow Creek No. 26. Municipal Council recently approved the designation requests to accommodate this project by rezoning lands to Rural Industrial – RI.

As most the quarter sections contain wetland areas, a request to subdivide out these areas was made to the developer. These wetland areas will remain Rural General – RG while the residual parcels will receive the Rural Industrial – RI zoning and be the subject of a following development permit for the actual solar project.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

Planner's Preliminary Comments:

The subdivision application would create 4 parcels of 4.02, 43.02, 12.63 and 92.45 acres respectively from a titled area comprising 152.12 acres. This quarter section has been previously subdivided in 1997 to create a 7.98 acre country residential parcel in the southwest portion of the quarter section.

The 12.63 and 43.02 acre parcels will be used for the solar project while the 92.45 and 4.02 acres encompass the wetland and buffer areas. A planning recommendation for approval is suggested subject to condition and legal access.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies
4. Provision of legal access via an easement for the proposed 4.02 acre parcel.

RESERVE:

Municipal Reserve is not applicable as the land is for agricultural purposes.

Submissions received become part of the subdivision file which is available to the applicant and will be considered by the subdivision authority at a public meeting.

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no.18-0008

E 1/2 SEC 31, TWP 12, RGE 25, W 4 M, E 1/2 & SW 1/4 SEC 6,
TWP 13, RGE 25, W 4 M & N 1/2 & SE 1/4, SEC 1, TWP 13, RGE 26, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 31, 2018
FILE Nos: 2018-0-112 to 2018-0-119

Proposed Lot Lines

Wetland Areas

Proposed Substation

OLDMAN RIVER REGIONAL SERVICES COMMISSION

N

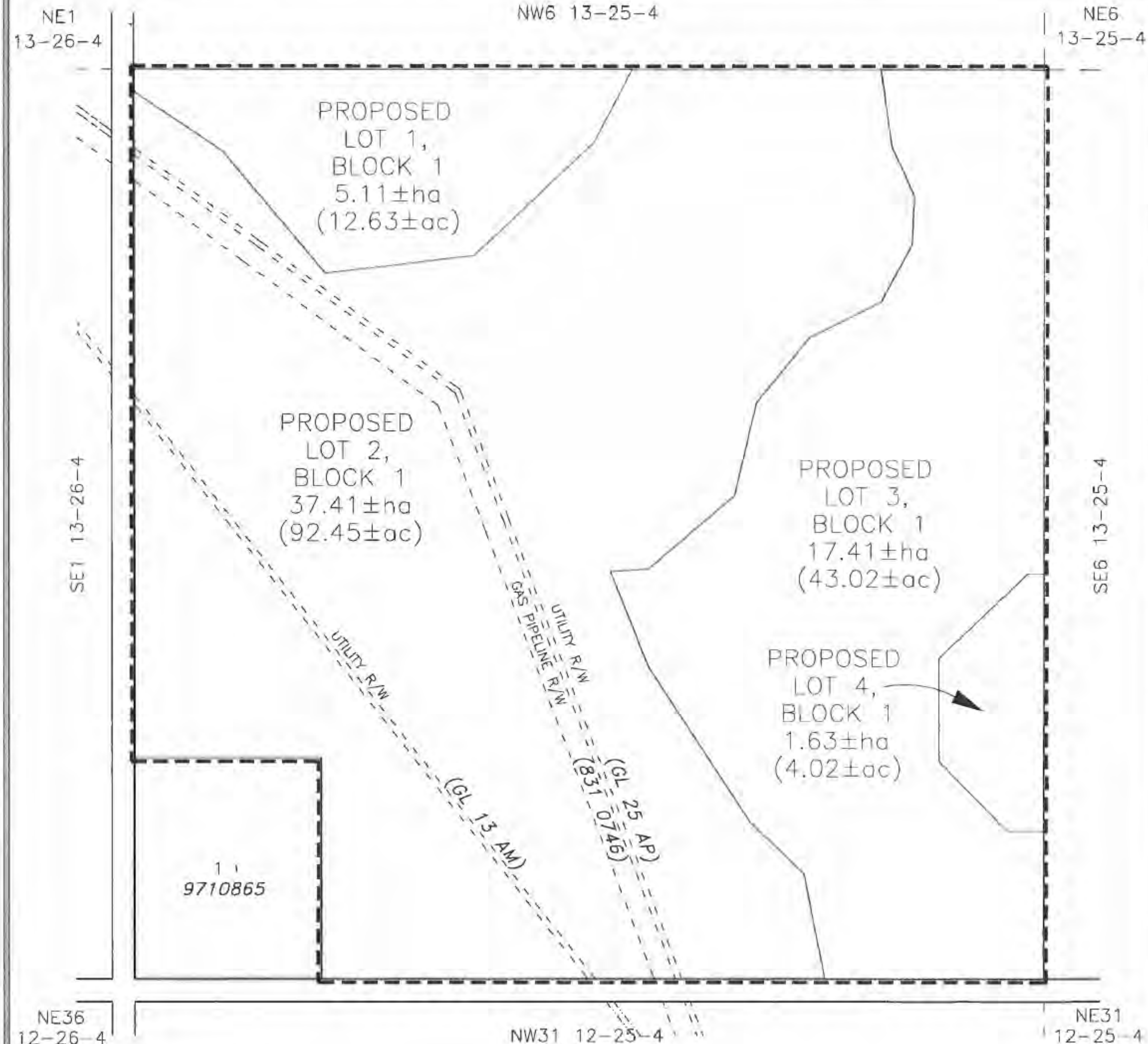
August 09, 2018 N:\Subdivision\2018\2018-0-119.dwg

SUBDIVISION LOCATION SKETCH
SW 1/4 SEC 6, TWP 13, RGE 25, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-117

MAP PREPARED BY
OLDMAN RIVER REGIONAL SERVICES COMMISSION
3105 16th AVENUE NORTH, LETHBRIDGE, AB T1H 5E8
"NOT RESPONSIBLE FOR ERRORS OR OMISSIONS"

OLDMAN RIVER REGIONAL SERVICES COMMISSION

July 30, 2018 N:\Subdivision\2018\2018-0-117.dwg



SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no. 18-0008

SW 1/4 SEC 6, TWP 13, RGE 25, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 30, 2018

FILE No: 2018-0-117

OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 30, 2018 N:\Subdivision\2018\2018-0-117.dwg

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no. 18-0008

SW 1/4 SEC 6, TWP 13, RGE 25, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 30, 2018

FILE No: 2018-0-117

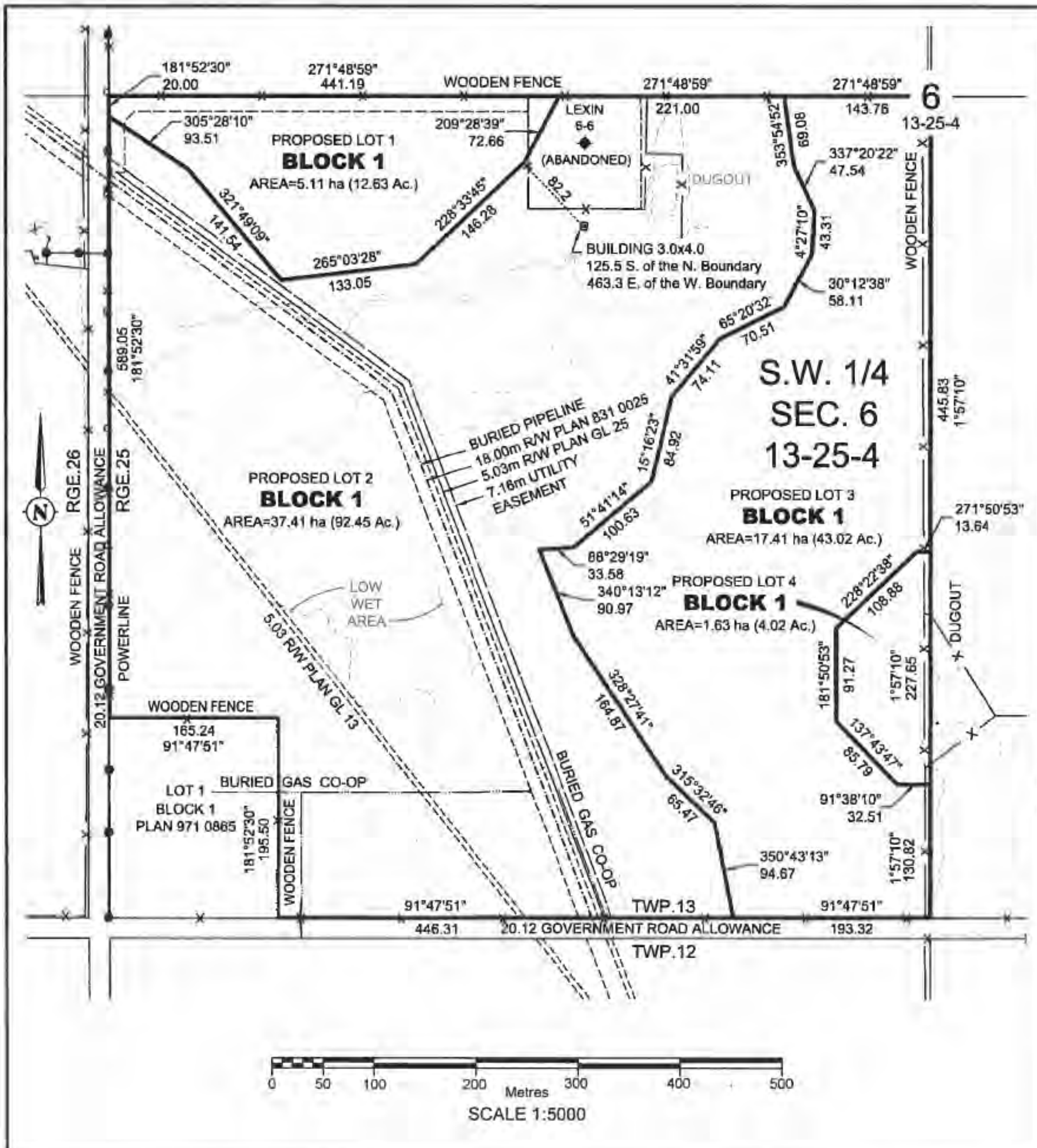
OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 30, 2018 N:\Subdivision\2018\2018-0-117.dwg

AERIAL PHOTO DATE: 2012



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

S.W. 1/4 SEC. 6

TWP. 13 - RGE. 25 - W. 4M.

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN, ALBERTA LAND SURVEYOR

FIELD INSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT.

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
THIRD ROCK GEOMATICS LTD.

LEGEND

E. - EAST
ha - HECTARES
M. - MERIDIAN
N. - NORTH
RGE. - RANGE
R/W - RIGHT OF WAY
S. - SOUTH
SEC. - SECTION
TWP. - TOWNSHIP
W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS: ————
AND CONTAINS 61.56 HECTARES.
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS), REFERENCE MERIDIAN 111° WEST, CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.:

REGISTERED OWNER

CERTIFICATE OF TITLE: 001 039 215
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-828-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg SW6 | Plot Date: July 12, 2018

OLDMAN RIVER REGIONAL SERVICES COMMISSION

3105 - 16th Avenue North
Lethbridge, Alberta T1H 5E8

Phone: (403) 329-1344
Toll-Free: 1-844-279-760
E-mail: subdivision@orrsc.com
Website: www.orrsc.com

NOTICE OF APPLICATION FOR SUBDIVISION OF LAND

DATE: August 16, 2018

Date of Receipt: July 23, 2018
Date of Completeness: July 30, 2018

TO: **Landowner:** Hutterian Brethren Church of Granum

Surveyor: Third Rock Geomatics – Jeff Olsen

Agent: Claresholm Solar Inc. – Philipp Andres

Referral Agencies: M.D. of Willow Creek No. 26, Ian Sundquist, Livingstone Range School Division, AltaLink, FortisAlberta, TELUS, ATCO Gas, ATCO Pipelines, AB Health Services - Calgary, AB Environment & Parks - K. Murphy, AB Environment & Parks - M. Keohane, AB Environment Operations Infrastructure Branch (OIB), AB Water Boundaries, Area Wildlife Biologist - M. Didkowsky, AB Agriculture, AER

Adjacent Landowners: Dustin and Carmen Sippola, Russell and Sierra Stewart, Stanley and Phyllis Kruszewski

Planning Advisor: Mike Burla MB

The Oldman River Regional Services Commission (ORRSC) is in receipt of the following subdivision application which is being processed on behalf of the M.D. of Willow Creek No. 26. This letter serves as the formal notice that the submitted application has been determined to be complete for the purpose of processing.

In accordance with the Subdivision and Development Regulation, if you wish to make comments respecting the proposed subdivision, please submit them via email or mail no later than **September 4, 2018**. (Please quote our File No. **2018-0-118** in any correspondence with this office).

File No.:	**2018-0-118**
Legal Description:	NE1/4 31-12-25-W4M
Municipality:	M.D. of Willow Creek No. 26
Land Designation: *(Zoning)*	Rural General - RG / Rural Industrial - RI
Existing Use:	Agricultural
Proposed Use:	Solar Farm
# of Lots Created:	2
Certificate of Title:	001 038 799

Meeting Date:	**September 19, 2018** *Note that meeting dates are subject to change. It is advisable to contact the M.D. of Willow Creek No. 26 three (3) days prior to the meeting for times and to confirm that this application is on the agenda.* *If you wish to make a presentation at the subdivision authority meeting, please notify the M.D. of Willow Creek No. 26 Municipal Administrator at your earliest convenience.*

GENERAL COMMENTS:

These subdivisions are part of the Claresholm Solar Project in the M.D. of Willow Creek No. 26. Municipal Council recently approved the designation requests to accommodate this project by rezoning lands to Rural Industrial – RI.

As most the quarter sections contain wetland areas, a request to subdivide out these areas was made to the developer. These wetland areas will remain Rural General – RG while the residual parcels will receive the Rural Industrial – RI zoning and be the subject of a following development permit for the actual solar project.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

1. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
2. Provision of a development agreement with the M.D. of Willow Creek No. 26.
3. Pertinent comments and information provided by adjacent landowners and by referral agencies

Planner's Preliminary Comments:

This proposal would subdivide an existing 160.21 acre parcel to create three parcels of 3.04, 34.63 and 122.54 acres. The 3.04 and 34.63 acres encompass the wetland/buffer areas while the 122.54 acres will be utilized for the solar project. A dugout is also located on the 34.63 acres as shown on the proposed plan of survey.

The Subdivision Authority is requested to consider the following when rendering decision on this application:

4. Payment of any outstanding property taxes to the M.D. of Willow Creek No. 26.
5. Provision of a development agreement with the M.D. of Willow Creek No. 26.
6. Pertinent comments and information provided by adjacent landowners and by referral agencies

RESERVE:

Municipal Reserve is not applicable as the land is for agricultural purposes.

Submissions received become part of the subdivision file which is available to the applicant and will be considered by the subdivision authority at a public meeting.

SUBDIVISION SKETCH

See tentative plan of subdivision by Third Rock Geomatics file no.18-0008

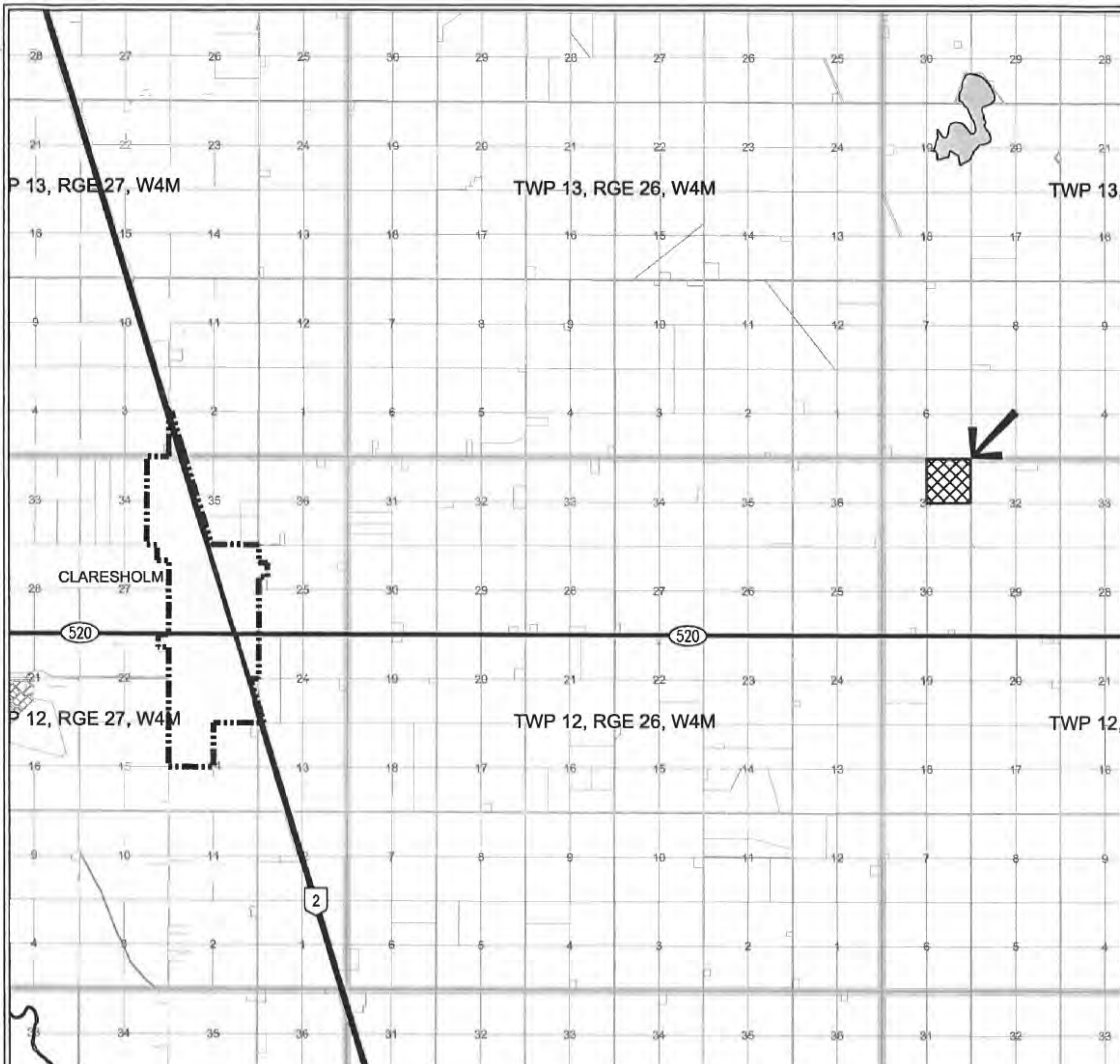
E 1/2 SEC 31, TWP 12, RGE 25, W 4 M, E 1/2 & SW 1/4 SEC 6,
TWP 13, RGE 25, W 4 M & N 1/2 & SE 1/4, SEC 1, TWP 13, RGE 26, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 31, 2018
FILE Nos: 2018-0-112 to 2018-0-119

OLDMAN RIVER REGIONAL SERVICES COMMISSION

N

Proposed Lot Lines
Wetland Areas
Proposed Substation

August 09, 2018 N:\Subdivision\2018\2018-0-119.dwg

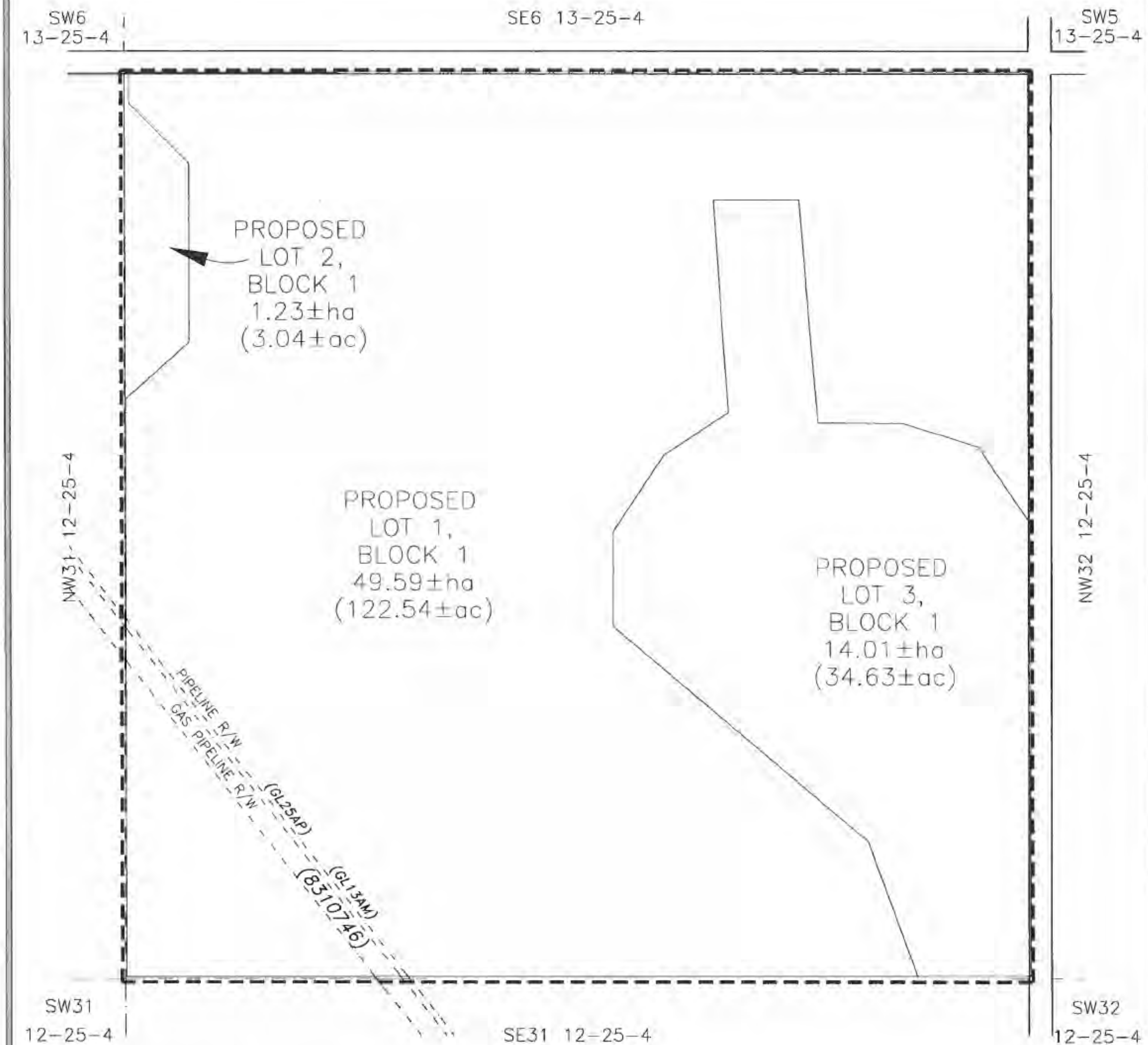


SUBDIVISION LOCATION SKETCH
NE 1/4 SEC 31, TWP 12, RGE 25, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-118

MAP PREPARED BY
OLDMAN RIVER REGIONAL SERVICES COMMISSION
3105 16th AVENUE NORTH, LETHBRIDGE, AB T1H 5E8
"NOT RESPONSIBLE FOR ERRORS OR OMISSIONS"

OLDMAN RIVER REGIONAL SERVICES COMMISSION

July 30, 2018 N:\Subdivision\2018\2018-0-118.dwg



SUBDIVISION SKETCH
NE 1/4 SEC 31, TWP 12, RGE 25, W 4 M
MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26
DATE: JULY 30, 2018
FILE No: 2018-0-118

July 30, 2018 N:\Subdivision\2018\2018-0-118.dwg

SUBDIVISION SKETCH

NE 1/4 SEC 31, TWP 12, RGE 25, W 4 M

MUNICIPALITY: MUNICIPAL DISTRICT OF WILLOW CREEK NO. 26

DATE: JULY 30, 2018

FILE No: 2018-0-118

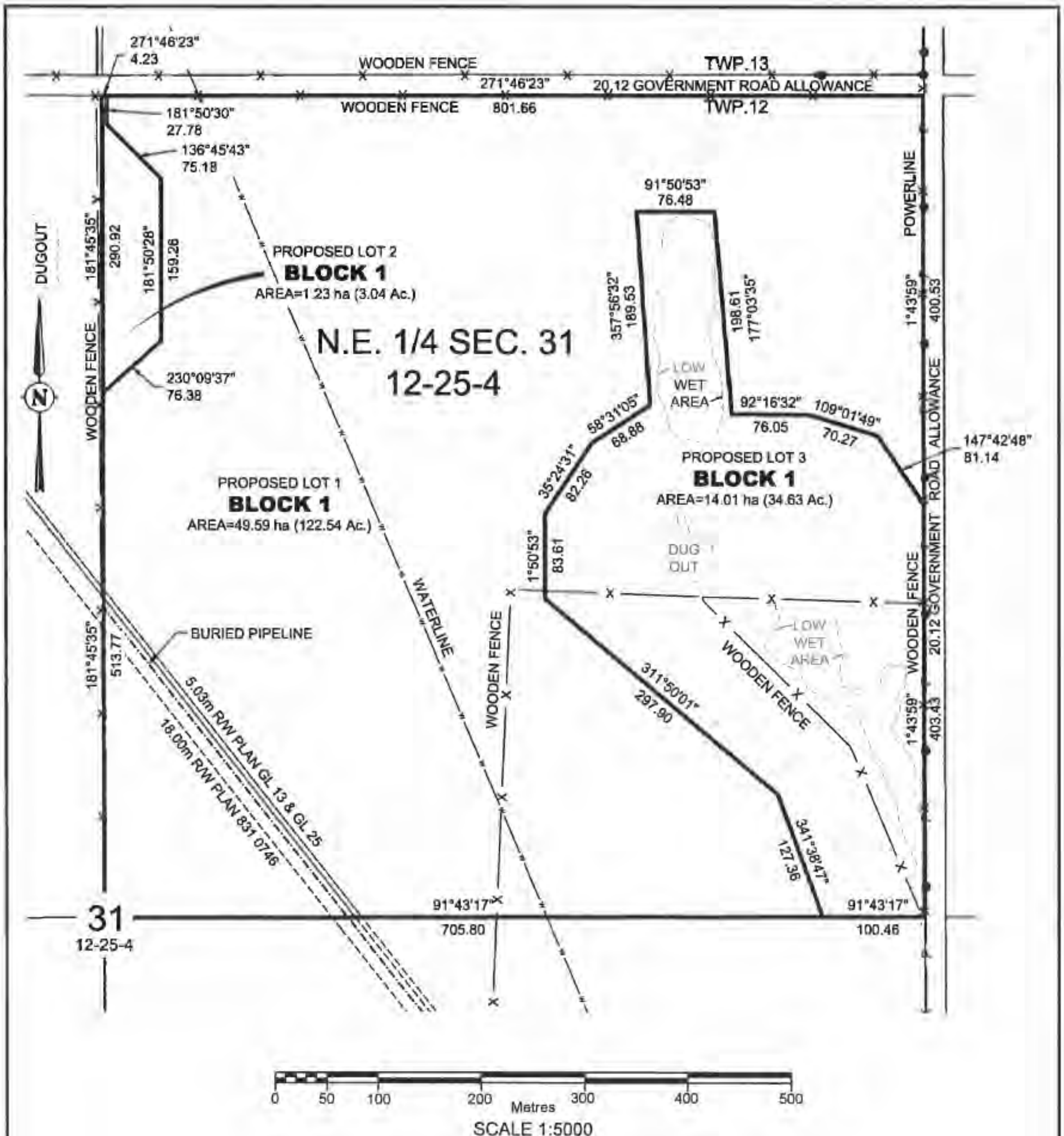
OLDMAN RIVER REGIONAL SERVICES COMMISSION

0 Metres 100 200 300 400

N

July 30, 2018 N:\Subdivision\2018\2018-0-118.dwg

AERIAL PHOTO DATE: 2012



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

N.E. 1/4 SEC. 31

TWP. 12 - RGE. 25 - W. 4M.

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN,
ALBERTA LAND SURVEYOR

FIELD INSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
THIRD ROCK
GEOMATICS LTD

LEGEND

E. - EAST	R/W - RIGHT OF WAY
ha - HECTARES	S. - SOUTH
M. - MERIDIAN	SEC. - SECTION
N. - NORTH	TWP. - TOWNSHIP
RGE. - RANGE	W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS:
AND CONTAINS: 64.83 HECTARES.
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS), REFERENCE MERIDIAN 111° WEST, CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.:

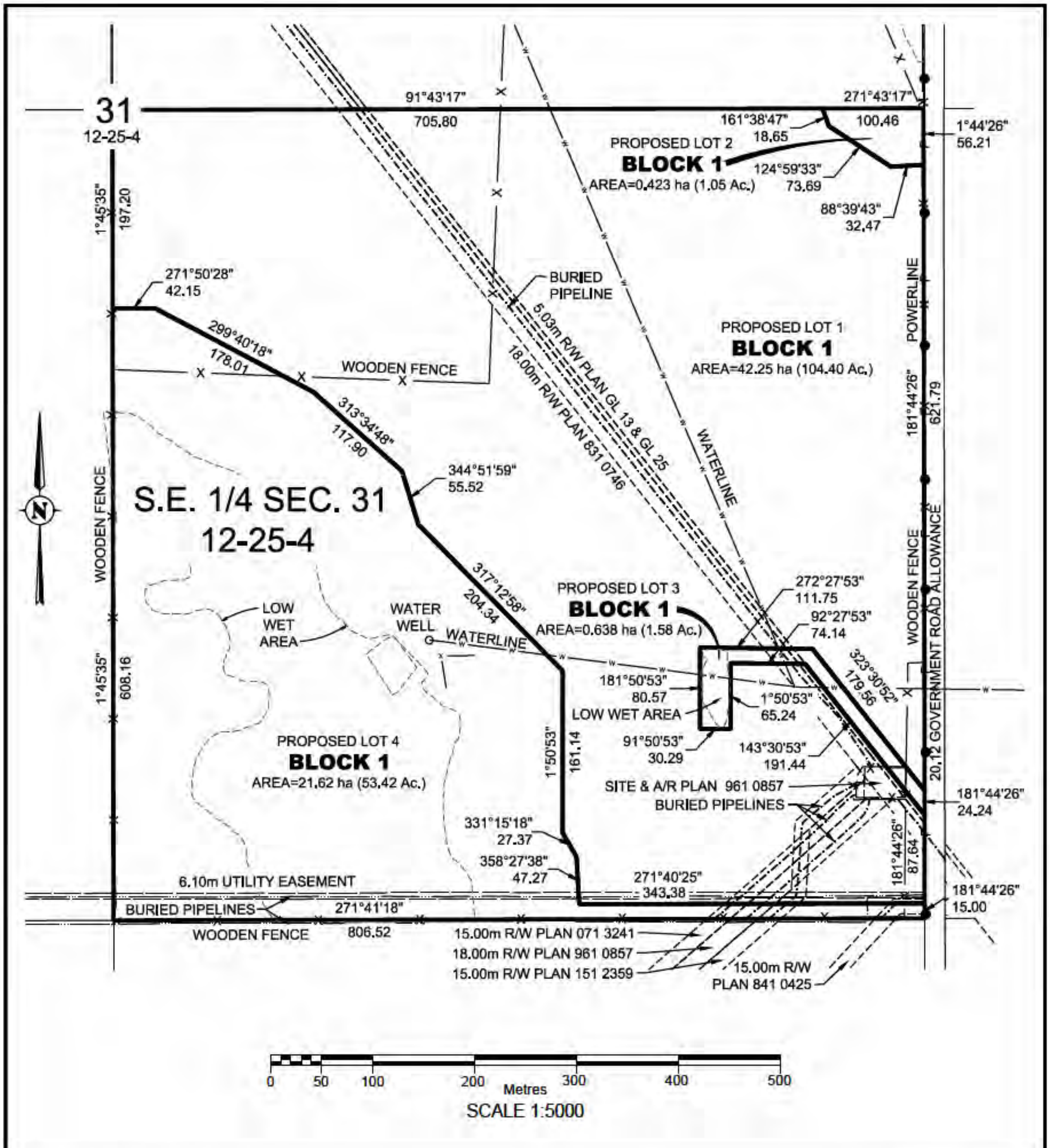
REGISTERED OWNER

CERTIFICATE OF TITLE: 001 038 799
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-828-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg NE31 | Plot Date: July 12, 2018



SKETCH SHOWING

TENTATIVE SUBDIVISION

OF

S.E. 1/4 SEC. 31

TWP. 12 - RGE. 25 - W. 4M.

M.D. OF WILLOW CREEK NO.26 - ALBERTA

SURVEYOR

NAME: JEFFREY A. OLSEN,
ALBERTA LAND SURVEYOR

FIELD NSPECTION: JUNE 26, 2018

IN ACCORDANCE WITH THE PROVISIONS OF THE SURVEYS ACT.

ALBERTA LAND SURVEYORS' ASSOCIATION
PERMIT NUMBER
P306
TH RD ROCK GEOMATICS LTD.

LEGEND

E. - EAST	R/W - RIGHT OF WAY
ha - HECTARES	S. - SOUTH
M. - MERIDIAN	SEC. - SECTION
N. - NORTH	TWP. - TOWNSHIP
RGE. - RANGE	W. - WEST

LANDS DEALT WITH BY THIS PLAN BOUNDED THUS:
AND CONTAINS 64.93 HECTARES.
DISTANCES SHOWN ARE IN METRES AND DECIMALS THEREOF.
BEARINGS ARE GRID AND DERIVED FROM GNSS OBSERVATIONS.
UTM NAD 83 (CSRS), REFERENCE MER DIAN 111° WEST, CSF=0.999813

SUBDIVISION AUTHORITY

NAME: M.D. OF WILLOW CREEK NO. 26
FILE NO.:

REGISTERED OWNER

CERTIFICATE OF TITLE: 001 038 798
OWNER(S): HUTTERIAN BRETHREN CHURCH OF GRANUM

THIRD ROCK GEOMATICS

PO Box 216, Suite 104, 1240 Kensington Road N.W. Calgary, AB T2N 3P7 403-828-8804

File: 18-0008 Perimeter Solar | Drawing Name: 2018-0008-TentSub.dwg SE31 | Plot Date: July 12, 2018

AER Abandoned Well Map

Base Data provided by: Government of Alberta

Author XXX

Printing Date 7/12/2018

Date Date (if applicable)

Legend

- Abandoned Wells (Large Scale)
- Revised Well Location (Large Scale)
- Revised Location Pointer
- Railways
  - Mutiple Track Rail Line
  - DoubleTrack Rail Line
  - Single Track Rail Line
  - Rail Line Spur
  - Abandoned Rail Line
  - Former Rail Line
- Detailed Roads

Scale 8,361.31

0.13 Kilometers 0

Projection and Datum

10TM AEP Forest, NAD83

Alberta Energy Regulator

APPENDIX “B”

Environmental Evaluation Report (Section 1)

Environmental Protection Plan (subsection Appendix II)

ENVIRONMENTAL EFFECTS ASSESSMENT
REVISION 1

For the
CLARESHOLM SOLAR PROJECT
ALBERTA

To satisfy the requirements of
ALBERTA UTILITIES COMMISSION

RULE 007

To be Submitted to
Alberta Environment and Parks

<u>Proponent</u>

CLARESHOLM SOLAR INC.

DOCUMENT COMPLETED BY

McCallum Environmental Ltd.

BearTracks Environmental Services

June 12, 2018

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1 Executive Summary

On April 20, 2018, an Environmental Effects Assessment (EEA) for the Claresholm Solar Project was submitted to Ms. Kristin Cline, Wildlife Biologist, Renewable Energy Projects, Alberta Environment & Parks. As a result of changes in the proposed project layout compared to the original submission, this revised EEA is being submitted to both AEP and the AUC. At the time of this submission, we have assumed that the original EEA has not been reviewed by AEP, nor submitted to the AUC, and we are therefore submitting this revised EEA in its entirety.

Claresholm Solar Inc. ('CSI') intends to develop a photovoltaic (PV) solar power electrical generation project and a substation on privately owned lands located 10km east of the town of Claresholm, Alberta. This solar power project is referred to herein as the Claresholm Solar Project ('CSP'). The CSP includes approximately 407,000 solar panels, each with a nameplate capacity of 430 W/panel. The total energy output will be approximately 130 MW AC (estimated at 237 GWh/year).

The CSP boundary is located approximately 10.1 km NE of the town of Claresholm. (Figure 1) The CSP development will be located in Townships 12 and 13, Range 25 and Range 26, west of the fourth Meridian in southwest Alberta (Figure 2). The CSP lands encompass approximately 579 hectares (~9 quarter sections) and dominant land use is agriculture, which accounts for approximately 90% of the total land use within the CSP boundaries. The site for the Project was selected based on land suitability adjacent to the 138kV transmission line. Furthermore, the land is of lower agricultural value relative to the general land quality in the MD of Willow Creek; 51% of the land area is saline tame pasture and 39% is land that was recently converted (within the last 5 years) from tame pasture to cropland.

The CSP will include panel areas, access roads, collector lines, a perimeter fence, inverters, step-up power transformers substation containing main power transformers, electrical gear and electrical control transformer, and an Operations & Maintenance (O&M) building and an operations building.

This Environmental Effects Assessment (EEA) has been developed in response to the requirements outlined in the AUC Rule 007, dated February 1, 2016, and more specifically PP16 and PP17.

No approval, registration or notification requirements exist for solar power projects under the Alberta *Environmental Protection and Enhancement Act*, *Environmental Assessment (Mandatory and Exempted Activities) Regulation, Alberta Regulation 111/1993, with amendments up to and including Alberta Regulation 62/2008.* Therefore, no Alberta Provincial Environmental Assessment is required for this project. Project infrastructure (i.e. panels; roads) are setback from wetlands. In the event underground collection crosses a watercourse or wetland, notification under the *Water Act* will be required.

The following document summarizes the CSP development activities and the results of wildlife monitoring surveys and habitat evaluations that have been conducted within and surrounding the proposed CSP. The development of the CSP, and the methodologies used for environmental assessment were, and continue to be based upon the requirements of Alberta Environment & Parks (AEP), and standard and acceptable practices for environmental assessments.

The specific objective of these environmental assessments was to identify potentially affected Ecosystem Components (ECs), determine what effects the CSP may have on each EC, and develop mitigation techniques that will eliminate, reduce, or control any adverse environmental effects.

The environmental assessment area encompassed the lands within and approximately 1000m outside of the Project boundary. Assessment of wildlife, including vegetation, and habitat was completed based on the requirements outlined in the Government of Alberta, *Wildlife Guidelines for Alberta Solar Energy Projects*, 2016 and the Alberta Government, *Sensitive Species Inventory Guidelines* 2013. The following lists the environmental assessment work that has been completed for the CSP in 2017:

1. Spring Migration Surveys – mid-March to mid-May 2017.
2. Breeding Bird Surveys – early June to mid-July 2017.
3. Fall Migration Surveys – mid-August to mid-October 2017.
4. Bird Species Specific Surveys:
    a. Sharp-tailed Grouse Lek Survey (April 29th and May 3rd, 2017)
    b. Raptor Nest Survey (May 2nd, 2017)
5. Wetland / Watercourse Surveys

The CSP impacts are summarized as follows:

1. All solar panels, access roads, collector lines and substation are located on cultivated land and tame pasture. No native prairie is present or affected.
2. All collector lines will be located underground.
3. All setbacks from wildlife features are being met.
    a. No known Sharp-tailed Grouse leks have been previously identified within the CSP area, and no new leks or individual sightings were recorded.
    b. No burrowing owls were located during other surveys and the project is located outside burrowing owl habitat ranges so burrowing owl surveys were not required.

   c. No nests are present within the Project boundaries and setback from a nest located off the NE corner of the Project boundary is being maintained.

4. At the time of this application, no wetland disturbance is expected as a result of the CSP. Collector lines that are required to cross wetlands will be trenched and notifications will be completed under the *Water Act* notification process.

5. An intermittent watercourse is present in the northern part of the CSP. The watercourse is currently heavily impacted by livestock. There are hoof prints, manure and weeds throughout the watercourse.

6. Bird activity levels and movement patterns in spring and fall migration study periods did not reveal the presence of clearly identifieable migratory pathways. There are also no topographical features that appear to funnel or constrain bird movement.

   a. 2818 birds were counted during spring migration surveys. The most abundant species group identified during spring migration were passerines, which accounted for 53% of all birds counted.

   b. 3302 birds were counted during fall migration surveys. The most abundant species group identified during fall migration were passerines, which accounted for 67% of all birds counted .

7. Due to the CSP being located entirely on cultivated and pasture land there is limited affects to breeding birds and bird habitat.

8. Due to the CSP being located entirely on cultivated and pasture land there is limited affects to wildlife habitat more generally.

9. The CSP is not situated in defined *Critical Habitat*[1] for any wildlife species.

10. There are no unique or regionally or locally important habitats affected.

11. In a single year, the CSP will reduce overall provincial Greenhouse Gas Emissions (‘GHG’) as very small emissions are created by the CSP. Based on quantification protocols for renewable generation, the CSP could produce 0.59 tonnes CO_2e GHG offsets for every megawatt hour of electricity produced (Government of Alberta, 2015). Given the CSP produces measurable electricity, the GHG offsets are measurable. Using the total energy output of approximately 130 MW AC (estimated at 237 GWh/year) equates to approximately 135,700 tonnes[2] of CO_2e GHG offset in a single year.

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[1] As defined by Canada's *Species at Risk Act*; **critical habitat** is the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species critical habitat in the recovery strategy or in an action plan for the species.

[2] = 230,000 MW/Year x 0.59 tonnes CO_2e GHG Offsets/MWhr = 135,700 tonnes

The results of this environmental assessment suggest that there are no significant impacts on ECs that cannot be effectively mitigated during construction, operation and decommissioning of the CSP. Based on the assessment of land use conditions in proximity to the Project site, it can be reasonably concluded that the Project site (as currently proposed) meets the expectations of AEP with respect to Project siting and avoidance of important wildlife habitat features.

As with any energy project designed and implemented anywhere, there will always be some negative impacts when compared against the "do nothing" option. However, there will be material social benefits in air quality. There will also be material economic benefits in job creation, payments to area landowners, payments to the MD, payments to a community fund, and economic opportunities for contractors and suppliers in the area.

The effects that this project has on physical, biological, and cultural components varies in magnitude and scale. For example, the reduction of GHG emissions has a large magnitude of effect on biological and cultural components, at the local, regional, provincial, and international scale. Furthermore, the significant magnitude of positive effects from such reductions likely negates the less significant, negative effects, which tend to be confined to a small scale (i.e. the project area). The GHG reductions inherent in renewable energy projects potentially provide the single most important environmental and socially positive impact that is recognized by many governments and agencies in Alberta, Canada and the world. This example shows the importance of considering magnitude and scale of effects when determining their significance.

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2 List of Acronyms

AB	Alberta
AC	Alternating Current
AEP	Alberta Environment & Parks (formerly ESRD)
ASRD	Alberta Sustainable Resource Development*
AUC	Alberta Utilities Commission
AUS	Avian Use Study
AWCS	Alberta Wetland Classification System
BBS	Breeding Bird Survey
BOP	Balance of Plant
BTES	Bear Tracks Environmental Services (2015) Ltd.
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
CSI	Claresholm Solar Inc.
CSP	Claresholm Solar Project
EC	Ecosystem Components
EEA	Environmental Effects Assessment
EPP	Environmental Protection Plan
ESA	Environmentally Significant Area
ESRD	Alberta Environment & Sustainable Resource Development*
FWMIS	Fisheries and Wildlife Management Information System
FWMIT	Fisheries and Wildlife Internet Mapping Tool
GHG	Greenhouse Gas
GIS	Geographic Information System
GOA	Government of Alberta
GPS	Global Positioning System
IBA	Important Bird Area
km	kilometers
kV	kilovolt
m^3	meter cubed
MEL	McCallum Environmental Ltd.
MV	Medium Voltage
MW	Megawatt
NAD83	North American Datum of 1983
SAR	Species at Risk
SARA	Species at Risk Act
UTM	Universal Transverse Mercator

*These acronyms were changed by Alberta Environment & Sustainable Resource Development over time and are provided in this document as the acronym appeared in referenced material.

3 Project Information

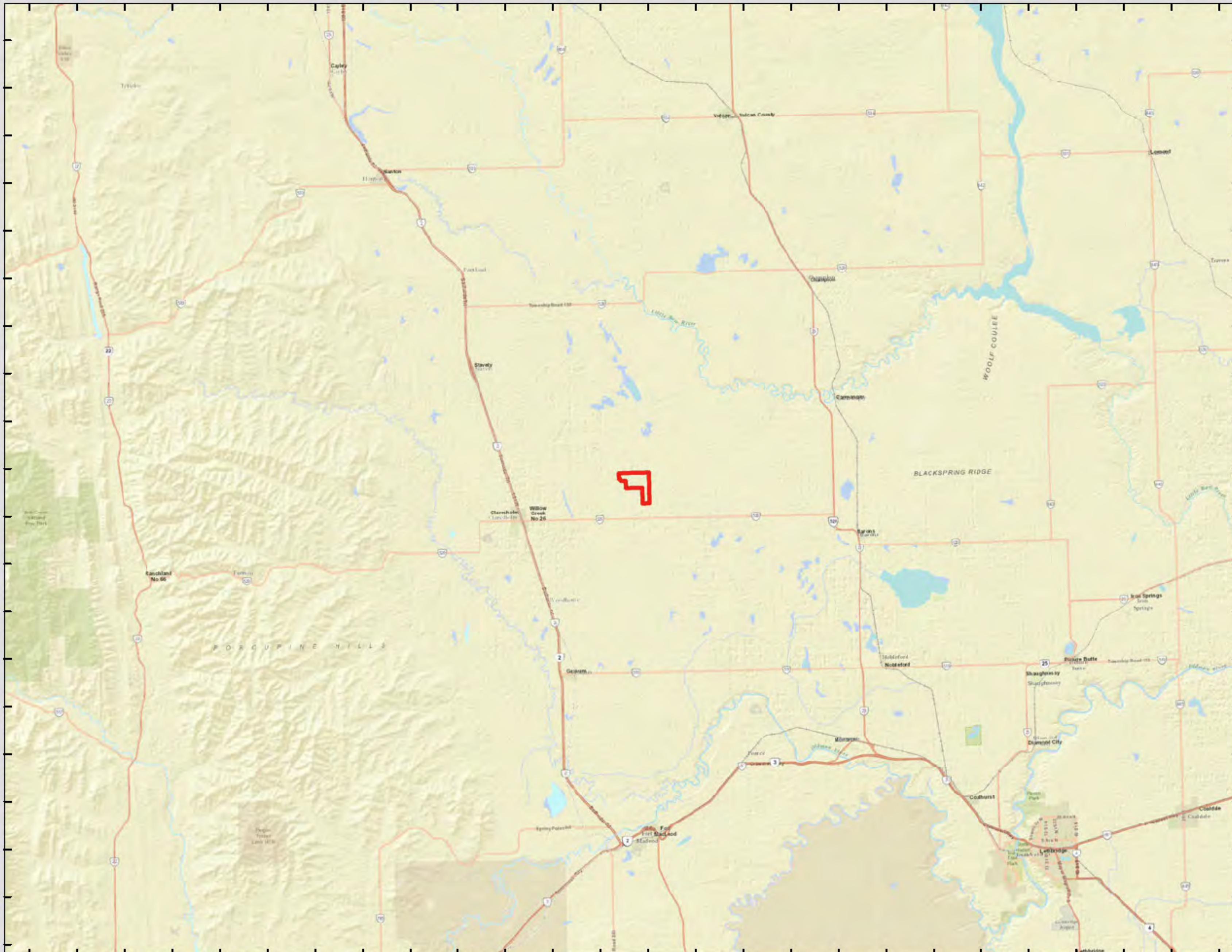
Claresholm Solar Inc. ('CSI') intends to develop a solar power electrical generation project and a substation on privately owned lands located 10km east of the town of Claresholm, Alberta. This solar power project is referred to herein as the Claresholm Solar Project ('CSP'). The CSP includes approximately 407,000 solar panels, each with a nameplate capacity of 430 W/panel. The total energy output will be approximately 130 MW AC (estimated at 237 GWh/year).

The CSP is a proposed solar energy development to be located in Townships 12 and 13, Range 25 and Range 26, west of the fourth Meridian in sourthwest Alberta. The CSP boundary is located approximately 10.1 km NE of the town of Claresholm. The CSP lands encompass approximately 579 hectares and dominant land use is agriculture, which accounts for approximately 90% of the total land use within the CSP boundaries.

Table 1. Project Summary

Project Name	Claresholm Solar Project (CSP)
Proponent Name	Claresholm Solar Inc. (CSI)
Solar Panels	Up to 407,000
Nameplate Capacity	Up to 130MW AC
Total Energy Output	237 GWh/yr
CSP location	E ½ - 31- Twp-12, Rge 25 W4M NW; NE; SE; SW – 6- Twp 013, Rge 25 W4M NW; NE; SE – 1 – Twp 013, Rge 26 W4M
CSP approximate boundary area	~579 hectares
Landowner(s)	The CSP lands are private land. Refer to the AUC PIP for further information.
Required Federal Environmental	None

Permits & Authorizations	
Municipality	Municipal District of Willow Creek No. 26
Primary Environmental Consultant	Robert McCallum, P.Biol McCallum Environmental Ltd.
Environmental Studies completed by	McCallum Environmental Ltd. Bear Tracks Environmental Services Ltd.



Prepared For:

Claresholm Solar Inc.

Figure 1: Project Location

Claresholm Solar Project
Claresolm, Alberta

Claresholm Project Area

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

0 3,600 7,200 14,400 m

1:375,000 Scale when printed @ 11" x 17"

Drawn By: EP

Date: 2018-04-13

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3.1 Activity Phases

The following outlines general order of activities associated with a solar power project development.

Table 2. Activity Phases

Phase	Details
Pre-Construction	
	• Notification of residents/landowners of construction commencement • Survey access roads on CSP lands • Trucking & set up of temporary facilities – construction offices, workers trailers, temporary washroom facilities, etc. • Construction equipment delivery
Construction	
General	• Clearing of soils on construction/post construction roads; O&M building; substation • Construction of storage yards • Construction of temporary work space • Construction of perimeter security fence
Civil	• Stripping of surface soils along access roads, at solar panel locations, at substation, at other required work areas • Construction of access roads, water crossings • Construction of temporary work space(s) • Construction of solar panel locations • Installation of erosion and sediment control structures • Site grading on those areas stripped of soils only (see "General" above) • Excavation of foundations • Installation of base pads for solar panels or other infrastructure • Pouring of concrete for foundations • Testing of concrete foundations • Backfilling of foundations with previously excavated soils • Reclamation of surplus soils • Grading of site
Solar panels	• Solar panel component and racking delivery • Pile driving and solar racking

Phase	Details
	• Racking erection • Install solar panel on racking
Collection System	• Trenching for underground Medium Voltage ('MV') electrical collector system • Installation of underground MV collector lines • Concrete pads for central inverter stations, MV power transformers and associated switch gear • Delivery and handling of MV electrical components
Sub-Station	• Delivery of equipment • Installation of equipment foundations and station ground grid • Installation of equipment support structures • Installation of transformer, switch gear, protection and control systems, control building, conduits, wiring, and terminations • System commissioning and testing • Installation of perimeter security fence
Operations & Maintenance	
	• Weed control • Re-seeding of disturbed soils • Grading of roads • Road maintenance • Culvert maintenance • Solar panel maintenance • Sub-station maintenance • Equipment repair and testing
Decommissioning	
	• De-energize facility • Removal and recycling of above ground and below ground infrastructure • Recontouring • Reclamation of surface soils • Re-seeding or re-planting • Reclamation monitoring

4 Constraints

A key aspect of planning the CSP was the determination of suitable lands for development.

This section details how the CSP lands and siting for the solar panels and infrastructure was rationalized:

A. Site Optimization: determination of the most appropriate location for the CSP to maximize power yields and to minimize overall impact on the landscape.

B. Constraints Analysis: analysis used to determine appropriate lands for the CSP.

4.1 Site Optimization

This section describes how multiple factors were considered in order to determine the area and footprint for the CSP. These factors include technical (i.e. solar resource), financial, construction, socio-economic, landowner, biophysical, as well as community and stakeholder feedback.

The determination of the most appropriate location for the CSP helps to minimize the overall impact on the landscape. Detailed planning and analysis was completed to determine available lands and to ensure that the solar panels can be placed within the area. Minimization of the CSP footprint allows CSI to reduce the impact on the environment and reduce construction and development costs.

The CSP was chosen for the following reasons:

1. Appropriate solar regime to make the CSP economically viable;
2. Presence of adequate land base for placement of solar panels and Balance of Plant;
3. Private v Public land: No solar panels are going to be placed on public lands;
4. Presence of agricultural land (cultivated; tame pasture);
5. Relatively level topography and the characteristics to allow placement of solar panels as close together as practical to minimize land disturbance and CSP footprint;
6. Ability to place solar panels to meet regulatory setbacks;
7. Ability to place solar panels to meet municipal setbacks from residences; and,
8. Proximity to the transmission system to connect the CSP to the grid with a short single-slack-span connection.

4.2 Environmental Setbacks for Final Layout

The following environmental setbacks were used[3] and the table provides setbacks from only those features identified in and around the CSP.

Table 3. Setbacks for features identified at CSP

Environmental Feature[4]	Setback Definition	Setback (m)	Applied as setback?
Nests of Species: Ferruginous Hawk	1000 m	1000	Yes
Nests of Species: Swainson's Hawk	100 m	100	Not applicable - no relevant features in area
Watercourse	45 m	15	15 metre setback applied.
Wetland - Class 1[5]	Avoid development on Class 1 wetland; no additional setback applied	All infrastructure: 0	No impact to wetland as wetland will be avoided but no setback applied
Wetland - Class 2 (Temporary marsh)	Avoid development on Class 2 wetland; no additional setback applied	0	No impact to wetland as wetland will be avoided but no setback applied

[3] All setbacks as outlined in the *Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta* (AEP, 2011) were used, in addition to those provided in *Wildlife Directive for Alberta Solar Energy Projects, October 4, 2017*. However, of the species listed in those documents, only the species in the table were identified within the SSP and constraints are summarized accordingly.

[4] During micro-siting, all setbacks as outlined in the *Recommended Land Use Guidelines for Protection of Selected Wildlife Species and Habitat within Grassland and Parkland Natural Regions of Alberta* (AEP, 2011) were used. However, of the species listed in that document, only the species in the table were identified within the CSP and constraints are summarized accordingly.

[5] Classes as described in Stewart & Kantrud (1971) Classification System as AEP had recommended setbacks based on that classification. The author is aware this system is not in use (but referenced) in the new Alberta Wetland Policy (2016).

Environmental Feature[4]	Setback Definition	Setback (m)	Applied as setback?
Wetland - Class 3, 4 & 5 (seasonal marsh, semi-permanent marsh, permanent shallow open water, or intermittent shallow open water)	100m from boundary	Solar panels: 100 Other infrastructure: 100	Yes

5 Consultation with AEP

Ms. Brandy Downey, Senior Species at Risk Biologist, AEP, was consulted on environmental assessment methodologies only, in the spring of 2017.

Ms. Kristin Cline, Wildlife Biologist, Renewable Energy Projects, AEP was consulted on the project and assessments in June 2017.

6 Assessments Completed

The following lists the environmental assessment work that has been completed on the CSP during 2017:

1. Spring Migration Surveys – mid-March to mid-May 2017.
2. Breeding Bird Surveys – early June to mid-July 2017.
3. Fall Migration Surveys – mid-August to mid/end-October 2017.
4. Bird Species Specific Surveys:
    a. Sharp-tailed Grouse Lek Survey (April 29th and May 3rd, 2017)
    b. Raptor Nest Survey (May 2nd, 2017)
5. Wetland Surveys – completed in June and July 2017.

7 Environmental Assessment Methodologies

Assessment of wildlife, including vegetation, and habitat was completed based on the requirements outlined in the Government of Alberta, *Wildlife Guidelines for Alberta Solar Energy Projects*, 2016 and the Alberta Government, *Sensitive Species Inventory Guidelines* 2013.

The purpose of the surveys was to document wildlife use and environmental characteristics within the CSP area to eliminate or minimize impacts to local wildlife from the proposed development, and to aid in the planning process for solar panel placement. Species specific surveys targeted sharp-tailed grouse and raptors.

7.1 Desktop Review

A desktop review was conducted to determine historic and potential wildlife species of concern occurrences in the CSP area. The Alberta Environment and Parks (AEP) Habitat Suitability Index (HSI) Model Search Tool (version 2.2) was used to identify wildlife species at risk with likelihood of occurrence in the CSP area. The HSI tool has habitat suitability indices generated for 11 sensitive species. Species predicted to have 'highly suitable' or 'suitable' habitat were identified as potential species of concern for the CSP. In addition, the Fish and Wildlife Internet Mapping Tool (FWIMT) was used to identify wildlife of concern that have been previously observed within 6 km radius of CSP centroid (ASRD, 2016). Finally, a more detailed search of the Fish and Wildlife Management Information System (FWMIS) was conducted to determine actual locations of all fish and wildlife observed historically within the CSP townships (ASRD, 2016).

In addition to the above research, the following were reviewed prior to the wildlife assessment in order to determine potential sensitive species in the area and to develop proposed mitigation measures when warranted by the confirmed presence of species of management concern.

1. *Sensitive Species Inventory Guidelines* (Government of Alberta, 2013)
2. *Wildlife Guidelines for Alberta Solar Energy Projects*, 2016 (Alberta Environment and Parks, 2017)
3. *Master Schedule of Standards and Conditions* (Government of Alberta, 2017)
4. *Alberta Wild Species General Status Listing 2015* (Alberta Environment and Parks, 2015)
5. *Species at Risk Act (SARA)* (Government of Canada, 2002)
6. *Committee on the Status of Endangered Wildlife in Canada (COSEWIC)* (Government of Canada, 2017)
7. Provincial Wildlife Sensitive feature spatial data layers in GIS-usable format that require GIS software such as ESRI® ArcGIS and are provided in the following WinZip files for each sensitivity layer from AEP (Alberta Environment & Parks, 2016)

The following lists the environmental assessment work that has been completed on the CSP to date.

7.2 Spring Migration Surveys - 2017

The methods were as follows:

1. Surveys would be completed between mid-March and mid-May, with a total of five rounds of surveys.
2. Pre-determined survey locations were chosen throughout the CSP.
3. Each location was surveyed twice during each visit (once in early morning and once in mid-day) for a minimum of 20 minutes.
4. All observed avifauna within 800 m of the location were documented.
5. The surveyor would stop periodically throughout the CSP area and document flocks of migrating or staging birds, at which point a GPS location would be taken.
6. The surveyor would also stop at observed high value habitat areas (shrub rows, coulees, native pasture, etc.) to thoroughly investigate these areas for avian use.

The migration survey was designed to assess spring avifauna use within the various habitat types present within the CSP area. The primary objective is to identify areas of high (abundance) flight activity.

Five rounds of surveys were conducted to increase the probability of capturing the various stages of migration (i.e., early, mid, late). Surveys were conducted on:

1. March 24th,
2. April 7th,
3. April 18th,
4. April 26th, and,
5. May 13th.

Timing of migrations varies year to year and species to species, and can also be influenced by environmental conditions (i.e., warm and cold fronts) in wintering habitats and along migration routes. Surveys were only suspended if poor visibility or audible perception was impeded. The minimum number of survey rounds required by AEP is three, however this may potentially lend to a higher probability of one (or more) of the migratory stages being missed. This would lead to potentially inaccurate data; therefore, four site visits were completed.

Five survey locations were plotted throughout the CSP (Figure 2 and Table 4).

Plot locations were chosen to provide appropriate coverage of the CSP area, and to accurately represent dominant habitat types. Plots consisted of the area encompassing survey points with an 800 m radius (approximately 200 ha of coverage) and the entire column of airspace above it. At each location, a minimum of 20 minutes per survey was conducted where the surveyor would scan out to 800 m and record information with respect to avifauna seen or heard. This included:

1. Species;
2. Direction/ distance of observation from plot center;
3. Direction of travel; and,
4. Number of individuals observed.
5. Incidental observations of flocks of staging or migrating birds were also recorded (those outside of the dedicated survey time, or greater than 800 m in distance to the plot center).

The timing of the surveys (early morning and mid-day) allowed surveyors to capture both nocturnal migrants (e.g., songbirds) and afternoon migrant species (e.g., raptors). Efforts were made to avoid double counting individual birds.

Table 4. Avian Use Study (AUS) plot descriptions

Plot Number	GPS Location NAD 83, 12U		Habitat	Topography
	Easting	Northing		
CLM1	325687	5549267	Cultivation	Flat to gently rolling.
CLM 2	327241	5547277	Tame Pasture	Flat to gently rolling.
CLM 3	328926	5548646	Cultivation	Flat to gently rolling.
CLM 4	325562	5545823	Cultivation	Flat to gently rolling.
CLM 5	328815	5545540	Cultivation, near wetland	Flat to gently rolling.

Prepared For:

Claresholm Solar Inc.

Figure 2: Avian Use Survey Locations

Claresholm Solar Project
Claresolm, Alberta

Migration Survey Locations
Claresholm Project Area
Migration Survey Area (800m)

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

0 250 500 1,000 m

1:25,000 Scale when printed @ 11" x 17"

Drawn By: EP

Date: 2018-04-17

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Each AUS plot was surveyed once in the morning and once mid-day for a minimum of 20 minutes for each of the five rounds of surveys. This resulted in a total of 50 site visits and accounted for approximately 16.7 hours of survey time logged.

If accurate counts of individual birds could not be made due to the presence of large groups of birds, a block counting method was utilized to estimate bird numbers in these instances. The block counting method involves counting individuals within a subset (block) of the group and then estimating the size of the flock by extrapolating the known number of individuals within the 'block' to the remainder of the group (Urfi, 2004). This method is considered valid for estimating large groups of birds within an acceptable margin of error.

7.3 **Breeding Bird Surveys – 2017**

Surveys were completed by Bear Tracks Environmental Services Ltd. The maximum provincially or federally recommended setback distance for a species at risk likely to occur in the regional vicinity of the Project is 1000 m. Lands within 1000 m of the Project were therefore selected as the study area for the Project. Field surveys for this project generally followed the survey protocols for breeding birds and sensitive species, as specified in the Alberta Environment and Sustainable Resource Development *Sensitive Species Inventory Guidelines* (ESRD 2013) and the Alberta Environment and Parks *Wildlife Guidelines for Alberta Solar Energy Projects* (AEP 2016). Survey protocol was modified in instances where adjacent lands were not accessible due to land ownership, or where adjacent land use was generally expected to preclude use by sensitive species (i.e. cultivated lands). In these situations, an assessment of land use to determine wildlife habitat suitability, as well as a thorough visual scan was used in the place of a ground search.

Two rounds of Breeding Bird Surveys (BBS) were conducted under survey appropriate weather conditions on May 31st and June 16th, 2017. During the survey, temperatures ranged from 10°C to 25°C and winds ranged from 3 to 18 km/hr.

Eleven (11) breeding bird survey points (CLBBS1 through CLBBS11) were established throughout the Project, which were spaced approximately 800 m apart (Figure 14). Surveys followed the *Sensitive Species Inventory Guidelines* (Government of Alberta, 2013) and included a five-minute point count at each location (beginning at sunrise and ending before 9:00 am), during which all wildlife species occurrences (visual and auditory identification) within 200 m of the surveyor's location were recorded. In addition to the breeding bird point count locations, a meander search was conducted on foot within the Project boundary, wherein wildlife species detected through visual or auditory cues were recorded. Observations of potential high-value wildlife habitat features (eg. dens, leks, wetlands, and nesting sites) were also documented.

Adjacent properties were visually inspected (up to 1000 m from the Project boundary using binoculars or a spotting scope) for the presence of raptor stick nests or other sensitive wildlife habitat features. This distance corresponds to the maximum provincially or federally recommended setback distance for species of management concern likely to occur in the regional vicinity of the Project. All GPS locations of wildlife features and concerns were recorded in NAD 83.

7.4 Fall Migration Surveys – 2017

Migration surveys conducted were intended to characterize fall bird use within the various habitat types present within the Project area and vicinity. The primary objective was to identify areas of high flight or staging activity, as well as presence of sensitive species, to ascertain high risk sites to wildlife. Migration surveys were conducted as per Alberta Environment and Parks (AEP) *Wildlife Guidelines for Alberta Solar Energy Projects* (*2016*). Ms. Brandy Downey (Senior Species at Risk Biologist – AEP, Lethbridge) was consulted prior to the survey to review and approve the proposed survey methodology. The survey methods included:

1. Spring migration survey locations were used for the fall migration survey locations throughout the Project.
2. Each location was surveyed twice during each visit (once in early morning and once in mid-day) for a minimum of 20 minutes.
3. All observed avifauna within 800 m of pre-determined survey locations were documented.
4. The surveyor would stop periodically throughout the Project area and document flocks of migrating or staging birds, at which point a GPS location would be recorded. These locations were recorded as incidental sightings.
5. The surveyor would also stop at observed high value habitat areas (shrub rows, coulees, native pasture, etc.) to further investigate these areas for avian use.
6. The information collected included:
    a. Species;
    b. Direction/ distance of observation from plot center;
    c. Direction of travel; and,
    d. Number of individuals observed.

Timing of migrations generally varies year to year and species to species, and can also be influenced by environmental conditions (i.e. warm and cold fronts) in summer habitats and along migration routes. Surveys were only suspended if poor visibility or audible perception was impeded. Based on discussion with AEP, five survey rounds were selected to provide greater accuracy in the data sets collected, as well as to better account for the seasonal variability of migrations. Surveys were conducted on:

1. August 23rd;
2. September 12th;
3. September 27th;
4. October 23rd; and
5. November 17th.

Incidental observations of flocks of staging or migrating birds were also recorded (those outside of the dedicated survey time, or greater than 800 m from plot center). The timing of the surveys (early morning and mid-day) allowed surveyors to capture both nocturnal migrants (e.g. songbirds) as well as afternoon migrants (e.g. raptors).

If accurate counts of individual birds could not be made due to the presence of large groups of birds, a block counting method was utilized to estimate bird numbers in these instances. The block counting method involves counting individuals within a subset (block) of the group and then estimating the size of the flock by extrapolating the known number of individuals within the 'block' to the remainder of the group (Urfi, 2004). This method is considered valid for estimating large groups of birds within an acceptable margin of error.

7.5 Species Specific Surveys – 2017

7.5.1 Sharp Tailed Grouse Surveys

Sharp-tailed surveys were completed on March 24, April 7th and April 26th to document the presence and relative abundance of this species in and around the CSP, and were recommended by AEP and followed the methodology used by AEP. Surveys targeted areas within 500 m of the proposed solar power CSP (the year-round setback distance for Sharp-tailed Grouse). Surveyor travelled through the CSP area by ATV and on foot, focusing on areas within or adjacent to native prairie. The survey was conducted between sunrise and 11:30 am to comply with appropriate survey protocols. A 5-minute scan was performed at approximately 800 m intervals along all roads within and adjacent to the CSP. On calm mornings, activity at the lek (calling, strutting, etc.) can be heard up to a kilometer away. If any birds were seen or heard, the area was further investigated for evidence of a lek. Leks can still be identified in the absence of birds as they often contain feathers and scat, and the vegetation is trampled down.

Surveys were completed in the early mornings, starting at sunrise and continuing for approximately 5 hours. Surveys were conducted in suitable survey conditions when temperatures were above 0°C, winds were below 4 on the Beaufort Scale (20-28 km/hr), and there was no precipitation falling or fog present. The environmental conditions were recorded at the beginning of each survey and included temperature, wind speed, and cloud cover.

7.5.2 Raptor Nest Surveys

Raptor nest surveys (two rounds) were conducted in conjunction with the breeding bird surveys on May 31, 2017 and June 16, 2017. The raptor nest surveys included the inspection of habitat features (e.g. trees) considered suitable for raptor nesting activity within a 1000 m radius of the proposed project. Nest sites (typically stick nests) were identified using binoculars or a spotting scope and nesting activity was confirmed by observing raptors on the nest and/or by observing displays of defensive behaviour in direct proximity to a suspected nesting location. In instances where nesting activity could not be confirmed, the location was recorded as a 'probable' raptor nesting location.

7.5.3 Burrowing Owl Surveys

Burrowing Owl (*Athene cunicularia*) call playback surveys were not conducted as no suitable habitat is present.

7.6 Amphibian Surveys

Two rounds of auditory amphibian surveys were conducted on the evenings of June 1, 2017 and June 8, 2017 in accordance with applicable *Sensitive Species Inventory Guidelines* (Government of Alberta, 2013). Nine (9) amphibian survey points were plotted within the general Project area (Figure 16. *Amphibian Survey locations*). During the survey, amphibians calling during the 3-minute survey interval were recorded. Open water wetlands/waterbodies within the Project area were also visited during the breeding bird surveys (May 31, 2017 and June 16, 2017) to search for evidence of adult frogs or egg masses/tadpoles.

7.7 Wetlands

Desktop evaluation and field assessments completed by McCallum Environmental Ltd.

Under the Wetland and Delineation directive, the wetlands have been delineated according to Pathway 3 – simple desktop delineation and verification. **"**Pathway 3 is followed when the wetland boundary is obvious and simple to delineate AND imagery is available. In pathway 3, the desktop delineation is completed by a desktop assessment, but the wetland boundary is subsequently verified in the field at a representative number of points using a GPS unit."

Using the desktop results for wetlands, anticipated wetland locations were known. During the field assessment, GPS tracks were taken once the wetland boundaries were determined. Wetland boundary determination was based upon clear changes in surface vegetation or underlying soil structure if no surface vegetation was present. Wetland delineation was completed by Robert McCallum, P.Biol. Boundary determination was based on micro-topography, and observed surface hydrology and vegetation. If wetland boundaries were unclear, soil pits were taken to determine if mottling or gleying was evident and boundaries were then documented using a hand held GPS unit to ensure that minimum setbacks, based on wetland type, were maintained.

Because the intent of the delineations was to determine location and extent only so the wetlands could be avoided no functions assessments were completed.

7.8 Vegetation/Rare Plant Surveys

The CSP area is wholly situated on cultivated/agricultural pasture land and therefore vegetation surveys were not completed.

7.9 Assumptions & Limitations in Methods and Reporting

7.9.1 Constraints Analysis

- On some maps, land use or land cover is defined everywhere to form a complete mosaic of polygons. On topographic maps land use/land cover is depicted only in certain areas. The source data in some cases may need to be conditioned to allow the second type of depiction if it is a mosaic, and certain constraints will operate differently in each case.
- Conflicts that might exist between objects in a database are typically of a logical nature, such as topological inconsistencies or duplicate identifiers. We attempted to ensure that our database has addressed any potential inconsistencies, however inconsistencies may still occur. In map generalization, the vast majority of conflicts are physical, spatial consequences of reducing map scale. The greater the degree of scale change, the more cluttered a map will be, and this signals the extents of potential conflicts in presentation of the data.

7.9.2 Limitations incurred at the time of the assessments

- There are a potentially infinite number of methods in which human activity can influence wildlife behaviors and populations and merely demonstrating that one factor is not operative does not negate the influence of the remainder of possible factors.

- The environmental assessment provides an inventory based on acceptable industry methodologies. A single assessment may not define the absolute status of site conditions and site conditions can and will change over time.
- Effects of impacts associated with oil and gas, electrical infrastructure, power generation, agriculture, and other power plant projects, separated in time and space that may affect the areas in question, have not been included in this assessment.
- The aerial photos used in the mapping may not represent actual on the ground conditions due to the age of the aerial photo and changes in land use.

7.9.3 General Limitations

- Classification and identification of soils, vegetation, wildlife, and general environmental characteristics have been based upon commonly accepted practices in environmental consulting. Classification and identification of these factors are judgmental and even comprehensive sampling and testing programs, implemented with the appropriate equipment by experienced personnel, may not identify all factors.
- Different assessors may in fact come to different results and conclusions and analysis based upon the collected information.
- All reasonable assessment programs will involve an inherent risk that some conditions will not be detected and all reports summarizing such investigations will be based on assumptions of what characteristics may exist between the sample points.

7.9.4 Discussion of Effects

The environmental assessment is being completed with specific CSP infrastructure, the analysis of effects is based upon the assessor's, the CSP developer's and the undersigned's experience with similar projects. That experience includes not only environmental assessment work, but completion of environmental permitting and compliance monitoring during construction for projects across Canada.

7.9.5 Assessment of Significance of Effects

In order to identify if residual effects are significant or not, consideration of the magnitude, geographical extent, duration, frequency, and reversibility is required. Table 5. *Characterization Criteria for Residual Environmental Effects*, (below) provides a description of these effects characteristics and the varying degrees in which they can contribute to the significance of an effect. Where possible, criteria will be described quantitatively. When residual effects cannot be characterized quantitatively, they will be characterized qualitatively.

The following criteria were defined in relation to assessing the significance of the residual adverse effects for all Valued Components:

Table 5. Characterization Criteria for Residual Environmental Effects

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
Magnitude	*Refers to the expected size and/or severity of an adverse effect relative to existing conditions on a valued component from Project activities after mitigation*	***Insignificant (I)*** *– Differing from the average value for the existing environment/baseline conditions to a small degree, but within the range of natural variation and below a threshold value* ***Minor*** *– Differing from the average value for the existing environment/baseline conditions, outside the range of natural variation, and less than or equal to appropriate guideline or threshold value* ***Moderate*** *– Differing from the existing environment/ baseline conditions and natural variation, and marginally exceeding a guideline or threshold value* ***Major*** *– Differing from the existing environment/ baseline conditions and natural variation, and exceeding a guideline or threshold value*
Likelihood	*The qualitative assessment of the probability of the impact occurring.*	***Almost Certain-*** *expected to occur with a high degree of certainty.* ***Likely*** *- expected to occur with a medium to high degree of certainty.* ***Possible*** *- expected to occur with a low to medium degree of certainty.* ***Unlikely*** *– expected to occur with a low degree of certainty* ***Unknown*** *– likelihood unknown*
Geographic Extent	*Refers to the spatial extent of an adverse effect on a valued component from Project activities after mitigation*	***Project Area (PA)*** *– the residual environmental effect from Project activities are restricted to the Project area* ***Local Assessment Area (LAA)*** *– Exceedance of relevant guideline or threshold occurs beyond the PA and within the LAA.*
Duration	*Refers to the period an adverse effect on a valued component from Project activities will persist after mitigation*	***Short-Term (ST)*** *– effects are limited to occur from as little as 1 month to 12 months* ***Medium-Term (MT)*** *– effects can occur beyond 12 months and up to 3 years* ***Long-Term (LT)*** *– effects extend beyond 3 years*

Characterization	Description	Quantitative Measure or Definition of Qualitative Categories
		Permanent (P) *– valued component unlikely to recover to baseline conditions*
Frequency	*Refers to the number of times an adverse effect on a valued component from Project activities will occur after mitigation*	***Once (O)*** *– effects occur once* ***Sporadic (S)*** *– effects occur at irregular intervals throughout the Project* ***Regular (R)*** *– effects occur at regular intervals throughout the Project* ***Continuous (C)*** *– effects occur continuously throughout the Project*
Reversibility	*Refers to the potential that a valued component will recover to baseline conditions once reclamation, restoration, compensation, and offset programs are considered*	***Reversible (R)*** *– VCs will recover to baseline conditions before or after Project activities have been completed.* ***Irreversible (IR)*** *– effects to VCs are permanent and will not recover to baseline conditions*

7.9.5.1 Risk

Depending on the information available, there are several approaches used to characterize risk. The classical quantitative approach is based on frequency information for effects and exposure, and uses null hypothesis testing and likelihood estimation (Australian Government, Dept. of Environment, 2016). Where frequency data are not available an approach which involves assessing degrees of 'belief' using qualitative or semi-quantitative reasoning is often used. In practice, a combination of techniques is used, where qualitative assessments tend to be precursors to quantitative assessment (Australian Government, Dept. of Environment, 2016). Conceptualizing risk pathways to identify how and what risks may arise and to plan targeted monitoring is an important qualitative step from which quantitative data can then be acquired (Burgman, 2001).

In this report, we have used a structured approach to ranking risks (Table 6), which considers uncertainties, particularly when assessing risks from multiple stressors.

Table 6. Risk matrix of consequences vs likelihood

Likelihood	**Magnitude**				
	Insignificant	**Minor**	**Moderate**	**Major**	**Unknown**
Almost Certain	High	High	Very High	Very High	Unknown (H)
Likely	Medium	High	High	Very High	Unknown (M)
Possible	Low	Medium	High	Very High	Unknown (L)
Unlikely	Low	Low	Medium	High	Unknown (L)
Unknown	Unknown	Unknown	Unknown	Unknown	Unknown

VH= Very High; H-High; M=Medium; L=Low; U=Unknown

8 REGIONAL CHARACTERISTICS

8.1 Topography

The topography of the CSP area ranges from level to gently rolling. The Project lands slope from west to east, with western boundary elevations approximately 34 metres higher than elevations along the eastern boundary of the Project.

8.2 Ecoregion

The CSP is found in the Grassland Natural Region, within the Dry Mixedgrass Natural Sub-Region.

8.2.1 Mixedgrass Subregion[6]

The Mixedgrass Subregion is generally characterized by level to gently undulating semiarid prairie, broken in places by coulees, valleys, badlands and dune fields. The warm, dry climate supports grasses, shrubs and herbs that are adapted to summer droughts.

This subregion has the warmest summers, longest growing season and lowest precipitation of all the subregions in Alberta.

Soils in the subregion are dominated by Brown Chernozems.

Vegetation communities are typified by species that favour warmer and dry sites and species include blue grama and needle-and-thread grass, with sand grass and June grass on sand dunes. Extensive low shrublands with silver sagebrush, silverberry, buckbrush and prickly rose occupy low-lying areas and northerly or easterly aspects. Tall shrub and tree stands are found in coulee or valley bottoms or on sandy soils with perched water tables, where the moisture supply is sufficient to support growth during the summer drought period. Generally, the subregion is dominated by low-growing, drought tolerant communities.

8.3 Bird Areas

No Regionally Significant Bird Areas (BA) occur within 20 km of the CSP area.

[6] Natural Regions and Subregions of Alberta, Natural Regions Committee. 2006.

8.4 Protected Areas / Natural Areas

No federal or provincially protected areas, provincially designated Natural areas, or provincial recreational areas are located within or adjacent to the CSP boundaries.

8.5 Environmentally Significant Areas (ESA)

ESAs are (Government of Alberta, 2016):

- Important to the long-term maintenance of biological diversity, soil, water, or other natural processes, at multiple spatial scales.
- Areas that contain rare or unique elements or that include elements that may require special management consideration due to their conservation needs.

It is important to note that ESAs do not (Government of Alberta, 2016):

- Consider how these areas are being, or how they should be, managed or conserved.
- Represent natural resource policy, areas requiring specific management objectives, or comprehensive status reporting.
- Represent government policy, and do not necessarily require or confer legal protection.
- Replace other indicator-specific mapping and planning tools, such as wetland inventories, caribou range maps, and species at risk recovery plans.

ESAs are intended as an information tool – not as a regulatory tool. (Government of Alberta, 2016)

ESA mapped areas "are available for use by provincial and municipal land-use planners, industry, consultants, environmental organizations, academic institutions, and others, as an information tool to support municipal, regional, and provincial scale planning initiatives. The identification of significant areas does not consider how these areas are being, or how they should be, managed or conserved. As such, ESAs do not represent natural resource policy, areas requiring specific management objectives, or comprehensive status reporting. Further, ESAs do not represent government policy and do not necessarily require legal protection. They are intended to be an information tool that complements other information sources to inform land-use planning and policy at local, regional, and provincial scales," (FIERA Biological Consulting, 2014).

A comprehensive list of criteria, sub-criteria, and indicators were selected to identify ESAs in Alberta. Given that a single criteria is unlikely to be representative of all desired components of an ESA, multiple criteria, sub-criteria, and indicators were incorporated into the ESA framework (FIERA Biological Consulting, 2014).

Once final ESA values were calculated, and a continuous ESA value surface was produced the distribution of ESA scores was examined and a variety of methods were explored to objectively assign an ESA cut-off value, including Jenks and percentile ranks. Ultimately, professional judgement was used to determine a cutoff value of >0.189 for designating quarter sections as Environmentally Significant Areas in the province (FIERA Biological Consulting, 2014).

Results of the ESA mapping completed by Fiera Biological Consulting (2014) are provided in Figure 11.

The NE-6-13-25W4 has the highest value in the ESA scoring system. This appears to be a result of the wetland, watercourse scoring under Criterion 4.0 – Areas that contribute to water quality and quantity. All other criterion indicators (1.0 – Areas that contain focal species, species groups, or their habitats; 2.0 – Areas that contain rare, unique, or focal habitat; 3.0 – Areas with ecological integrity) are scored lower and that is supported by the information collected in the field during the assessment process.

8.6 <u>Sensitive Species Ranges</u>[7]

The CSP Area falls into the expected distribution ranges of four sensitive species/groups in Alberta: Ferruginous hawk (*Buteo regalis*), Golden eagle (*Aquila chrysaetos*), Prairie falcon (*Falco mexicanus*) and Sharp-tailed grouse (*Tympanuchus phasianellus*) (Alberta Environment & Parks, 2016). The expected distribution ranges for these species cover the entire CSP Area.

There is a known (or at least previously identified), nesting colony of Great Blue Heron (*Ardea herodias*) on Clear Lake, and it is located approximately 14 km north of the CSP area boundary.

9 PROJECT AREA ECOSYSTEM COMPONENTS

Each Ecosystem Component (EC), including the baseline environmental work that has been completed to evaluate each EC, is described in the following sections. EC selection was based upon desktop findings, consultation with AEP, standard practices in environmental assessments in Alberta, and as per the guidelines and documents previously mentioned.

Each EC section provided below identifies the results of the baseline conditions, potential effects as a result of the CSP, mitigation measures to reduce potential effect, and identifies the significance of potential effects.

[7] AEP Website. Wildlife Sensitivity Maps – May 11, 2017. http://aep.alberta.ca/forms-maps-services/maps/wildlife-sensitivity-maps/default.aspx

9.1 Habitat Types / Land Use

The CSP area is occupied by agricultural land, homesteads/farms, oil and gas infrastructure and all weather and seasonal roads (Figure 12). No Critical Habitat (as defined by Canada's *Species at Risk Act*; **critical habitat** is the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species critical habitat in the recovery strategy or in an action plan for the species), is present within or adjacent to the Project.

The CSP area encompasses approximately 579 hectares, within which is a land use mixture as follows:

Table 7. Land Use/Habitat within CSP

Land Use	Total Area (hectares)	Percent of Total
Cultivated	224	39%
Tame pasture	295	51%
Native Prairie	0	0
Wetlands/Watercourses	59	10%
Oil & Gas/Farmyards/Roads	1	0.001%
TOTAL	**579**	**100%**

Cultivated lands, including tame pasture, contained the lowest species diversity and density in the CSP. Cultivated lands provide very little structure for local bird species, and are primarily used for foraging or waterfowl nesting. These areas are under constant pressure from farming activities, which disrupts the birds during breeding, nesting, and brood rearing.

The lands were selected as they are of lower agricultural value relative to the general land quality in the MD of Willow Creek; 51% of the land area is saline tame pasture and 39% is land that was recently converted (within the last 5 years) from tame pasture to cropland. Wetlands and watercourses make up 10% of the landscape within the CSP.

Photo 1. Overview of landscape near CLBBS5.

Photo 2. Cultivated fields were prevalent throughout the Project area - overview of landscape near CLBBS3.

9.1.1 Effects of the CSP

The effects of the CSP on land use will be directly correlated to change of land use due to the presence of CSP infrastructure. This would include change in agricultural activity (i.e. due to the presence of a solar panel in a cultivated field = loss of commercial agricultural crop (i.e. canola), but change to pasture), loss of use by residents, and/or loss of use by other industrial activities (i.e. oil and gas; gravel pit) due to setback requirements.

The CSP activities identified as having the greatest potential impact upon habitat would be associated with the construction phase and the final BOP operational footprint. The construction phase typically results in a larger overall impact footprint, due to use of staging areas, work sites, borrow pits, or equipment storage. In contrast the permanent infrastructure (lasting the life of the CSP) such as road surfaces, solar panel and substation foundations results in a long-term habitat loss, but have a smaller footprint than the construction phase. There would be some expectation that small mammals and different ground dwelling bird species may continue to use the CSP lands.

CSP activities that have been identified as resulting in impacts on habitat include:

- Top soil stripping (which will be limited to roads, substation, and the O&M building)
- Construction of infrastructure including new access roads, crane pads, solar panel foundations and substation;
- Upgrade of existing roads;
- Installation of solar panels and electrical infrastructure;
- Installation of perimeter fence resulting in isolation of habitat; and,
- Transportation of crews and equipment.

During the operations phase, CSP activities will include the periodic transportation of work crews and equipment for routine infrastructure maintenance and operations.

Some of the original impacts resulting from the construction activities will be reduced during the operations phase through the localized regeneration of systems that were subject to temporary disturbances during the construction phase.

Environmental co-benefits can occur when existing agricultural land is co-located with solar. The co- existence of grazing habitat for livestock, such as sheep, may curtail the need for vegetation removal and maintenance, or both, and limit erosion, while supporting both energy and food/ fiber production (Dahlin, et al., 2011).

9.1.2 <u>Mitigation</u>

The use of existing roads and agricultural lands reduces the amount of fragmentation of wildlife habitat as a result of the CSP.

CSP intends to manage weeds and maintain livestock production of sheep during project operations.

9.1.3 Significance

9.1.3.1 Magnitude

The potential effects of clearing on habitat are anticipated to be of insignificant magnitude due to use of agricultural lands as the primary CSP footprint. Overall, the construction duration for the solar CSP will have a neutral effect on agricultural land due to only a change of agricultural land use.

The operation duration for the CSP will have a borderline neutral effect on agricultural land. The lands will no longer be available for commercial agricultural crop but sheep livestock production will be in place. In addition, weed control and re-seeding of disturbed sites will have a positive impact on agricultural land.

The CSP would be expected to have a positive effect on soil conditions and health as annually cultivated lands will be converted to perennial vegetation. This vegetation would further increase carbon stores, support erosion control and loss of topsoil due to wind/water, and ultimately maintain long term soil health and characteristics.

Table 8 provides a summary of whether proposed mitigation achieves Wildlife Outcomes as it relates to wildlife habitats.

Table 8. Habitat Mitigation and Resulting Wildlife Outcomes

Wildlife Outcome	Does Mitigation Achieve Wildlife Outcome (Y/N)	Notes
Reduce human caused wildlife mortality	Yes	CSP infrastructure has been located on cultivated and pasture land and appropriate setbacks have been applied to sensitive wildlife habitat.
Reduce increased predation associated with anthropogenic features	Yes	Anthropogenic features are not planned within, or in close proximity to sensitive wildlife habitat, therefore increased predation not expected. Additionally, fencing of the project will limit predatory access.

Wildlife Outcome	Does Mitigation Achieve Wildlife Outcome (Y/N)	Notes
Conserve and protect Critical Habitat	N/A	No Critical Habitat for wildlife is present within the CSP area.
Maintain the ecological conditions necessary for naturally sustainable wildlife populations to exist throughout Alberta, and conserve the habitat they require.		
a) Maintain unique and/or important habitat sites.	Yes	No unique or locally or regionally important habitat sites are present.
b) Avoid or minimize development within key habitats.	Yes	The recommended restricted activity dates and setback distances to sensitive wildlife will be applied.
c) Maintain habitat intactness, connectivity, and allow for wildlife use, breeding and passage throughout areas by minimizing habitat loss and fragmentation.	No	No habitat loss due to siting of CSP infrastructure on agricultural lands. However, the presence of perimeter fencing will limit larger wildlife from utilizing the CSP lands.

9.1.3.2 Likelihood

The likelihood of effects on habitat is almost certain for those species using pasture and cultivated lands. However, once construction is complete, and pasture is restored, the overall effect on continuous habitat throughout the area will be possible.

9.1.3.3 Geographic Extent

The residual effects from the project will be limited to the project area as surrounding land use and infrastructure and lands can be used and will maintain habitat in current forms. This includes surrounding land use of cultivation, pasture, highways, farmsteads, and oil and gas.

9.1.3.4 Duration

The duration of the effect on habitat would be short term during construction.

9.1.3.5 Frequency

The frequency of the effect on habitat would be once during the life of the project as existing pasture will be restored following construction of the project.

9.1.3.6 Reversibility

The reversibility of the effect on habitat would be reversible as existing pasture will be restored following Project reclamation.

9.2 Soils

During micro-siting surveys completed in October 2016, 12 shallow soil pits were excavated throughout the CSP to examine surface soil depths and characteristics in cultivated lands affected by the CSP.

In addition, the Agricultural Region of Alberta Soil Inventory Database was consulted to provide data on soils in the CSP (Alberta Agriculture and Forestry, 2017)(Figure 13). Soils identified in the database to exist at CSP are listed in Table 9.

Table 9. List of soil series found at CSP[8]

Unit Name	LLD4/U1L	LEWN4/U1h	WNY4/U1h
Landform	Undulating – low relief with a limiting slope of 2%	Undulating – high relief with limiting slope of 4%	Undulating – high relief with limiting slope of 4%
LSRS Rating (spring grains)	5NM(10)	3M(10)	3M(10)
General Description	Orthic Brown Chernozem on medium textured (L, SiL)	Orthic Dark Brown Chernozem on medium textured (L, SiL)	Orthic Dark Brown Chernozem on medium textured (L, SiCL, CL) materials over medium (L, CL) or fine (C) textured till (WNY).
Horizon Depth (cm)	10	15	15
Master Horizon	A	A	A
% Sand	18	40	40

[8] Alberta Soil Information Viewer; Revised July 30, 2015; http://www1.agric.gov.ab.ca/$Department/deptdocs.nsf/all/sag10372

% Silt	58	35	35
% Clay	24	25	25

All parcels of land experience to a varying extent agricultural production limitations due to salinity issues. Alberta Agriculture, Food and Rural Development conducted detailed studies of soil surface salinity across the MD of Willow Creek (Kwiatkowski, Marciak, Wentz, & King, 1995). As highlighted in that document, "soil salinity is a major conservation issue in the Municipal District of Willow Creek. The information on salinity location, extent, type and control measures presented in this report will help Municipal District planners to target salinity control and resource management programs."

As part of the Project initial site prospecting in the MD of Willow Creek, the Project utilized satellite imagery to identify surface salinity, which in turn indicates lower productive potential for agriculture. This led CSI to select the current 9 quarters that are part of the Project lands. CSI site selection was supported by the geospatial data on saline soils available through the Alberta Agriculture and Forestry's 'Agricultural Land Resource Atlas of Alberta' (2017).

This map indicates the percentage of land area with soil surface (top 30cm) salinity levels that significantly impede crop growth (Alberta Agriculture and Forestry, 2017). As indicated by the Department of Agriculture and Forestry, the Project is in an anomalous area where greater than 30% of the land is significantly affected by soil salinity.

9.2.1 Effects of the CSP

Site-specific soil surveys indicated that there are clear soil horizon layers throughout the cultivated lands impacted by development. In most soil pits there were no B-horizons present but that is expected as a result of cultivation. Some admixing is already present however the soils represent no limitations to construction. None of the soils present at the CSP require special management practices during the implementation of the CSP.

The proposed Project *does not* occupy high value cropland. Furthermore, locating the project at this site can help mitigate soil salinity issues both on the project footprint and on neighbouring lands, improving the agricultural value of land in the local area. This is because the principal method of reversing soil salinity is the establishment of deep-rooted perennial grasses and legumes. (Kwiatkowski, Marciak, Wentz, & King, 1995) Even areas adjacent to severely salt-affected lands can benefit from such plantings. As stated by Kwiatkowski et al. 1995, "… the effects of salinity on crop yields are not usually limited to the visible saline areas. Often the surrounding lands have weakly to very weakly saline subsoils, reducing yields of sensitive crops. Thus, salinity control practices may benefit crop yields over a much broader area than just the visible [saline] seep."

Incidentally, on low and moderately salt-affected lands and over short time spans, cash crop production often yields greater financial returns for agricultural producers than hay or livestock production (the mitigation measures for salinity), but continuous cropping in these areas causes gradual increases in soil salinity over time, to the point where eventual salt-buildup significantly reduces agricultural productivity. Unfortunately, once this point is reached, salinity mitigation becomes increasingly expensive and the time required for soil conditions to improve increases as well. Therefore, an added economic incentive is often needed for agricultural producers to proactively mitigate salinity issues. In the case of the Project, the lease payments provided to the landowners in conjunction with the plan to vegetate the land in perennial forages provides exactly the kind of incentive needed to improve local soil conditions for long-term agricultural sustainability in the MD of Willow Creek. Coincidentally, installation of solar panels on the site would be expected to further speed up soil recovery. This is because salinization of soil is a problem driven by evaporation (rather than transpiration through the living tissue of plants). As highlighted by Saskatchewan Agriculture (Saskatchewan Agriculture, 2008), “the salinization process is solar-powered. In a semi-arid climate, warm temperature, low humidity and wind evaporate water at the soil surface and cause salt accumulation.” Through the partial shading and wind-reducing effects of panels, the primary force driving salt buildup in soil is reduced. For all these reasons, the Claresholm Solar project is ideally suited to improving soils in the local area.

The CSP activities identified as having the greatest potential impact upon soils are predominantly associated with the construction phase, where the permanent infrastructure (lasting the life of the CSP) such as road surfaces, solar panel and substation foundations results in a long-term use. CSP activities that have been identified as resulting in impacts on soils include:

- Stripping of surface soils along access roads, at solar panel locations, at substation, at other required work areas
- Upgrade of existing roads;
- Installation of solar panels and electrical infrastructure; and,
- Transportation of crews and equipment.

Four actions were identified, which may contribute to effects on soils. These actions are closely tied to those acting on vegetation. The 4 actions affecting soils may include:

1. Admixing – As soils are removed during construction soil layers will become mixed. This has the effect of reducing soil quality as organic matter layers are mixed with underlying clay horizons. This can result in limitations to vegetation growth in the mixed soils.

2. Wind erosion - Risk relates to the potential for the soil to be mobilized by wind, particularly when disturbed through construction activities or a high degree of traffic. Loss of (or reduced) vegetative cover during activity can increase the risk for wind erosion. The highest risk for wind erosion tends to occur in areas with coarse-textured soils and sparse vegetative cover.

3. Water erosion - Risk relates to the potential for the soil to be mobilized by water, particularly when disturbed through construction activities or a high degree of traffic. The highest risk for water erosion tends to be associated with long or steep slopes (particularly those that are channeled or dissected), higher clay content and low vegetative cover. A combination of these factors tends to produce an extreme risk for water erosion. Compaction caused by excess traffic can increase overland flow, which can promote water erosion in channels or gullies.

4. Compaction along trails – caused by the continued use of equipment on designated minimal disturbance working areas. Although dry sandy soils have limited compaction characteristics, long term use will result in compaction. Compaction due to traffic will cause soil compaction on lease sites and along trails. Maintenance and operations traffic will contribute to this compaction over the life spans of the CSP. Unless traffic is eliminated, good timing of operations is the most effective way to preserve soil structural quality. There are a variety of methods available for compaction relief post operations which include aeration and subsoiling. Ultimately, reclamation and remediation following abandonment will minimize the long-term effects, but some areas will ultimately receive irreversible compaction beyond repair in a reasonable timeframe.

9.2.2 Mitigation

Soil stripping and leveling will be completed using a two-lift soil stripping method:

1. The first lift will remove the A-horizon to the colour change (B-horizon);
2. The second lift will remove the B-horizon. Both A and B-horizons will be stockpiled on the edges of the lease with a 1m separation. Care will be taken to avoid admixing while handling and stockpiling soils. The soils will be preserved and used for production and final reclamation. The remaining C-horizon will be used as cut and fill to level each lease to accommodate the necessary equipment.
    i. If new accesses require upgrading, they will be upgraded to medium grade roads and graveled to allow culvert installation as required, assistance to drying of the road bed, and safe travel conditions;

ii. Gravel will be used on the accesses on an as-needed basis during the production life;
iii. Hill cuts required will be contoured with a 3:1 slope for production access. In areas where a significant hill cut is made, an additional 5m may be required to properly back slope the hill cut, to avoid any erosion issues while maintaining a 3:1 slope;
iv. Borrow areas may also be proposed in areas where there is insufficient material to construct an access road capable of hauling equipment to and from the sites;
v. Culverts will be installed as required to maintain natural drainage; and,
vi. All final access road construction and design will be completed in accordance with both landowner and solar panel manufacturer requirements.

Some of the original impacts resulting from the construction activities will be reduced during the operations phase through the localized regeneration of systems that were subject to temporary disturbances during the construction phase.

Mitigation for soils has been further outlined in the Environmental Protection Plan (‘EPP’). (Appendix II)

9.2.3 Significance

9.2.3.1 Magnitude

The magnitude of effects to soils will be limited to the actual areas of disturbance and therefore considered insignificant. Implementation of the soils handling procedures, interim reclamation, and revegetation techniques outlined in the EPP will reduce the magnitude of any localized effects.

9.2.3.2 Likelihood

The likelihood of effects on soils is almost certain, but only on soils affected by construction and operations. Surrounding soils are not anticipated to be affected.

9.2.3.3 Geographic Extent

The extent of impact to soils is isolated to the infrastructure in question and would have no geographical extent.

9.2.3.4 Duration

The duration of the effect on soils would be short term during construction.

9.2.3.5 Frequency

The frequency of effects would be once during construction. Following construction, restoration of soils and revegetation will prevent further effects.

9.2.3.6 Reversibility

Effects from the Project are reversible following Project reclamation.

9.3 Wildlife

Wildlife surveys were limited to assessments for bird use and migration. Incidental sightings of mammals were noted but so infrequent as to not warrant discussion. This is due to the agricultural nature of the lands in question providing little to no habitat is larger species such as deer, coyote, or others.

9.3.1 Spring Migration Surveys – 2017

The survey was undertaken to assess avian spring migration activity in proximity to the CSP.

The primary purpose of the survey was to:

1. Assess avian spring migration flight activity within the CSP area to potentially characterize major flyways or staging areas;
2. Determine species within the CSP area (either staging or migrating);
3. Identify the timing of migration/staging periods throughout the spring; and,
4. Discern key areas that potentially attract higher proportions of individuals.

Differences in the potential for solar panel collisions exist for the various bird groups – i.e. raptors, songbirds, waterfowl, etc., therefore flight data are summarized to species group. During the spring migration surveys, a total of 2818 individuals were observed, within 66 avian species classifications. Those individuals observed that could not be classified to unique species (n=520) are still included in the species group summaries, but removed from the species individual calculations. Of the 2818 individuals observed during spring migration, all but 24 were observed at the dedicated survey points.

9.3.1.1 Total Number of Individuals Observed

During spring migration surveys, a total of 2818 individuals were observed. Observed individuals that could not be identified to the species level are included in the species group summaries, but have been removed from the individual species calculations.

9.3.1.2 Sensitive Species

Of the 63 species observed during the 2017 spring migration period, 1 was identified as an "At-Risk" species, and 8 were identified as "Sensitive" under the Alberta General Status.

Table 10 provides a complete list of all species observed and their subsequent designations provincially and federally.

Table 10. Species observed during spring migration and their regulated status.

Common Name	Latin Name	# observed	AB General Status[1]	COSEWIC[2]	SARA[3]
American Avocet	*Recurvirostra americana*	2	Secure		
American Coot	*Fulica americana*	2	Secure	Not at Risk	
American Crow	*Corvus brachyrhynchos*	15	Secure	-	
American Kestrel	*Falco sparverius*	1	Sensitive		
American Pipit	*Anthus rubescens*	13	Secure		
American Robin	*Turdus migratorius*	14	Secure	-	-
American Widgeon	*Anas americana*	62	Secure	-	-
Barn Swallow	*Hirundo rustica*	10	Sensitive	Threatened	-
Black-billed Magpie	*Pica hudsonia*	119	Secure	-	-
Blue-winged Teal	*Anas discors*	4	Secure		
Brewer's Blackbird	*Euphagus cyanocephalus*	7	Secure	-	-
Brown-headed Cowbird	*Molothrus ater*	21	Secure	-	-
Canada Goose	*Branta canadensis*	86	Secure	-	-
Chipping Sparrow	*Spizella passerina*	25	Secure		
Cinnamon Teal	*Anas cyanoptera*	4	Secure		
Clay-colored Sparrow	*Spizella pallida*	5	Secure		
Common Goldeneye	*Bucephala clangula*	10	Secure		
Common Grackle	*Quiscalus quiscula*	1	Secure		
Common Raven	*Corvus corax*	8	Secure		
Cooper's Hawk	*Accipiter cooperii*	2	Secure		
Eurasion-collared Dove	*Streptopelia decaocto*	2	Exotic		
European Starling	*Sturnus vulgaris*	174	Exotic	-	-
Ferruginous Hawk	*Buteo regalis*	1	At Risk	Threatened	Threatened
Franklin's Gul	*Larus pipixcan*	14	Secure	-	-

Common Name	Latin Name	# observed	AB General Status[1]	COSEWIC[2]	SARA[3]
Gadwall	*Anas strepera*	2	Secure	-	-
Gray Partridge	*Perdix perdix*	10	Exotic	-	-
Great-horned Owl	*Bubo virginianus*	2	Secure	-	-
Greater Yellowlegs	*Tringa melanoleuca*	52	Secure	-	-
Green-winged Teal	*Anas carolinensis*	10		-	-
Horned Lark	*Eremophila alpestris*	25	Secure	-	-
House Sparrow	*Passer domesticus*	72	Exotic	-	-
Killdeer	*Charadrius vociferus*	41	Secure	-	-
Lapland Longspur	*Calcarius lapponicus*	667	Secure	-	-
Lesser Yellowlegs	*Tringa flavipes*	36	Secure	-	-
Lincoln's Sparrow	*Melospiza lincolnii*	1	Secure	-	-
Long-billed Curlew	*Numenius americanus*	11	Sensitive	Special Concern	Special Concern
Mallard	*Anas platyrhynchos*	155	Secure	-	-
Marbled Godwit	*Limosa fedoa*	6	Secure	-	-
Merlin	*Falco columbarius*	5	Secure	Not at Risk	-
Northern Harrier	*Circus cyaneus*	10	Sensitive	Not at Risk	-
Northern Pintail	*Anas acuta*	133	Sensitive	-	-
Northern Shoveler	*Anas clypeata*	39	Secure	-	-
Red-tailed Hawk	*Buteo jamaicensis*	4	Secure	Not at Risk	-
Red-winged Blackbird	*Agelaius phoeniceus*	75	Secure	-	-
Ring-billed Gull	*Larus delawarensis*	5	Secure	-	-
Rock Pigeon	*Columba livia*	49	Exotic	-	-
Sandhill Crane	*Grus canadensis*	1	Sensitive	-	-
Savannah Sparrow	*Passerculus sandwichensis*	24	Secure	-	-
Swainson's Hawk	*Buteo swainsoni*	7	Sensitive	-	-
Tree Swallow	*Tachycineta bicolor*	25	Secure	-	-
Tundra Swan	*Cygnus columbianus*	33	Secure	-	-
Upland Sandpiper	*Bartramia longicauda*	3	Sensitive	-	-
Vesper Sparrow	*Pooecetes gramineus*	25	Secure	-	-
Western Meadowlark	*Sturnella neglecta*	127	Secure	-	-
Willet	*Catoptrophorus semipalmatus*	2	Secure	-	-
Wilson's Phalarope	*Phalaropus tricolor*	16	Secure	-	-
Wilson's Snipe	*Gallinago delicata*	22	Secure	-	-

Common Name	Latin Name	# observed	AB General Status[1]	COSEWIC[2]	SARA[3]
Yellow-rumped Warbler	*Setophaga coronata*	1	Secure	-	-

1- Government of Alberta. 2015. General Status of Alberta Wild Species. http://aep.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx. Updated April 24, 2017.
2- Government of Canada. Committee on the Status of Endangered Wildlife in Canada. http://www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm Accessed September 2017.
3- SARA – *Species at Risk Act* - Government of Canada. Committee on the Status of Endangered Wildlife in Canada. http://www.registrelep-sararegistry.gc.ca/sar/index/default_e.cfm Accessed September 2017.
4- - = indicates no listing

9.3.1.3 Species Abundance and Richness

During spring migration, the number of avian sightings and species observed trended down from the beginning to the end of the surveys. Due to a number of large incidental flocks observed (large flocks of passerines in round 3), the number of individuals recorded during subsequent rounds did not progressively increase. However, the species richness and abundance generally rose as migrants returned to the CSP area.

Table 11 details overall number of species, sightings (the number of observations, at different times, of an individual or group during the 20-minute survey), and individual migration data per survey round.

Table 11. Migration data summary for each survey round

Survey Round	Number of Species	Number of Sightings	Number of Individuals*
Round 1	22	70	1032
Round 2	19	80	256
Round 3	39	144	712
Round 4	32	58	542
Round 5	39	93	276
Totals		**445**	**2818**

*This includes the incidentals observed outside of the designated survey points/times.

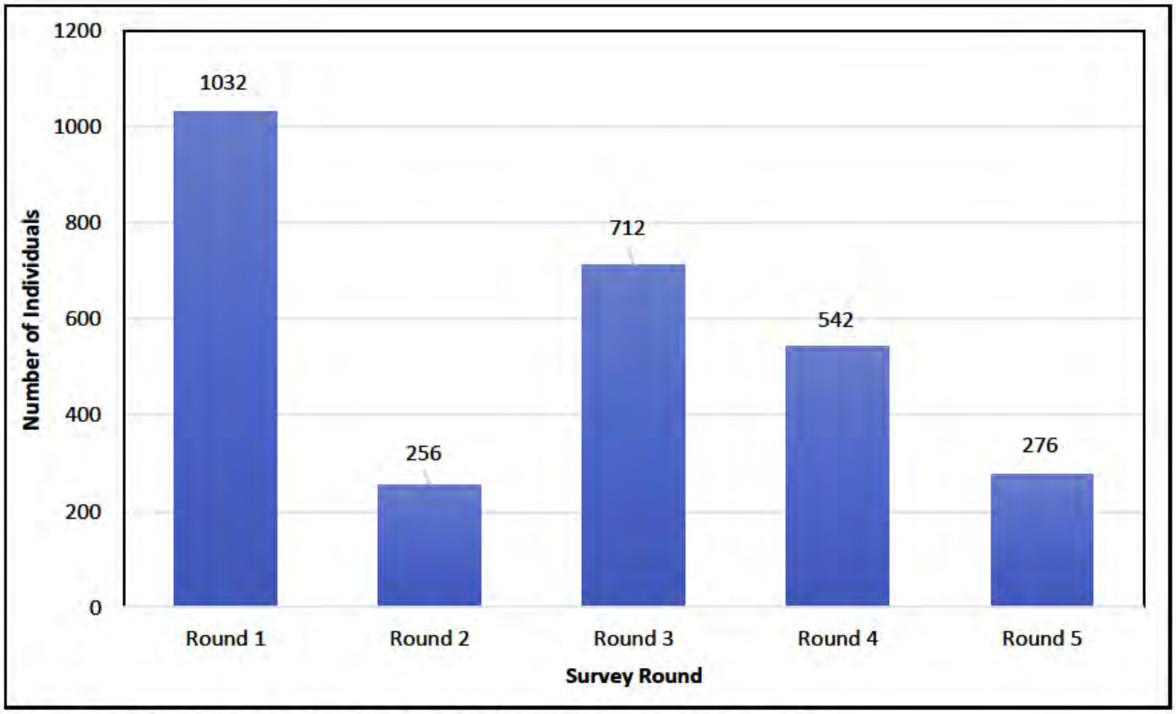

Figure 3. Number of individual birds observed by survey round

Table 12 outlines the prevalence of each species group, indicating the total number of species within each group, number of individuals identified to species group, and observations/hour for each group. Individuals not identified at the species level, or recorded as incidentals (i.e. greater than 800 m from the plot center, outside of the 20 min survey), were excluded from this abundance analysis.

Table 12. Abundance characteristics by species group

Species	Number of Species	% of Total Species	Number of Individuals*	% of Total Individuals
Grouse and Allies	0	0%	0	0%
Corvids and Others	3	5%	142	5%
Raptors	9	14%	33	1%
Shorebirds & Gulls	14	22%	215	8%
Passerines	26	41%	1493	53%
Waterfowl	11	17%	935	33%
Combined Total	**63**		**2818**	

*Does not include incidentals observed outside of the designated survey points/times.

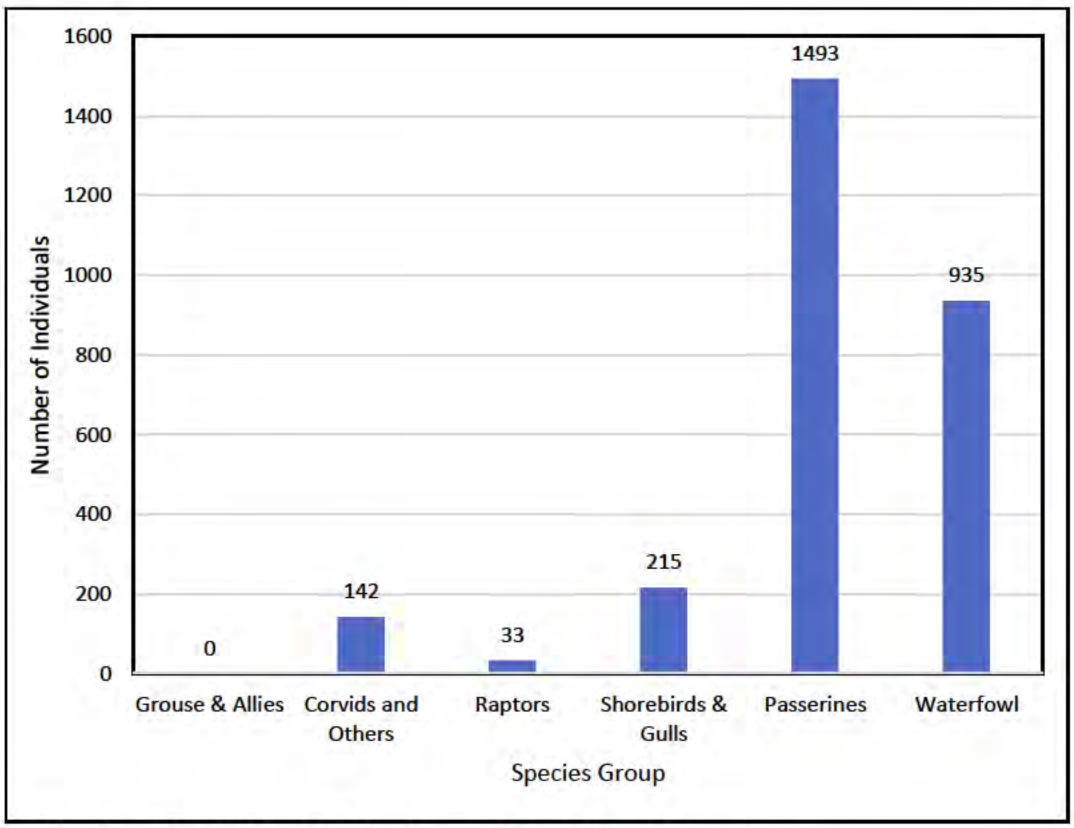

Figure 4. Number of individual birds observed in each species group

Table 13. Number of individual birds observed at each AUS plot.

AUS Plot Number	Round 1	Round 2	Round 3	Round 4	Round 5	Total
CLM1	130	38	412	149	56	785
CLM2	104	34	51	58	81	328
CLM3	151	58	58	32	22	321
CLM4	272	49	38	220	19	598
CLM5	354	76	153	83	98	764

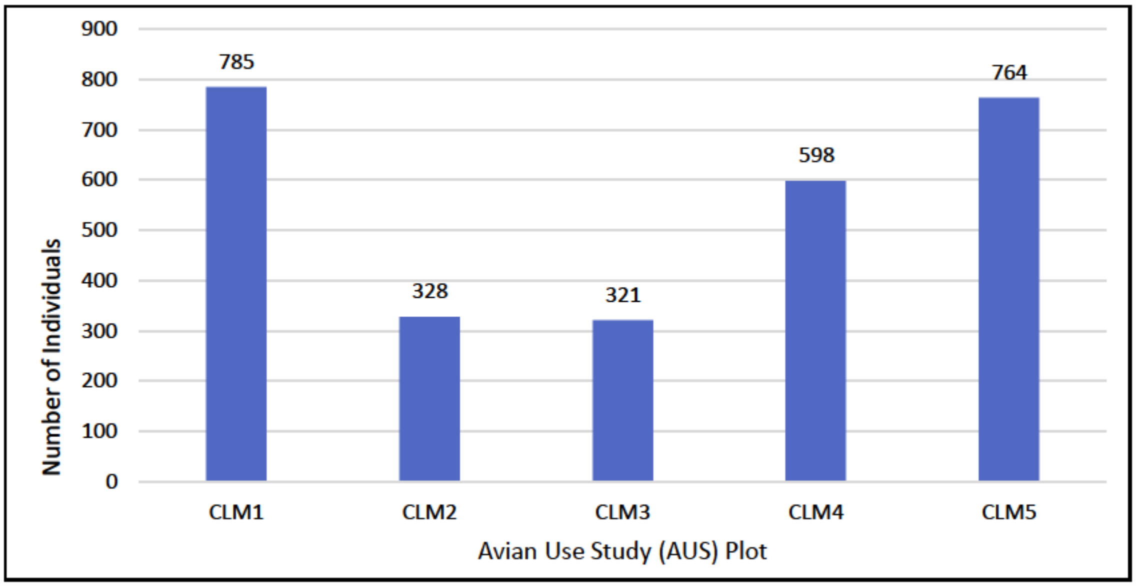

Figure 5. Number of individual birds observed at each sample plot – All survey rounds

9.3.1.4 Passerines

The passerine group had the highest species richness observed, with 26 distinct songbird species recorded (41% of all species). Passerines were also the most prevalent species group recorded in the CSP area during spring migration; they represented 53% of all individuals observed during spring migration.

Laplund Longspur were observed in the highest densities within the passerine group, with 667 individuals recorded. European Starling were the second most abundant (n=174).

9.3.1.5 Waterfowl

A total of 11 distinct species of waterfowl were documented within the CSP area during spring migration surveys. Waterfowl accounted for 17 % of the total species detected, and 33% of the observed individuals (n=935) in the surveys. Overall, waterfowl were observed consistently throughout the migration period.

The most prevalent waterfowl species observed during the surveys, and observed during all four survey rounds, was the Mallard, totaling 155 individuals. Northern Pintail was the second most abundant (n=133).

9.3.1.6 Raptors

Nine (9) distinct raptor species were detected during the migration surveys. This avian group number accounted for 1% (n=33) of all individuals recorded during spring migration surveys. Of the 33 individuals recorded, 1 was unable to be classified to species and recorded as ‘unknown raptor’.

Northern Harriers were the most abundant raptor (by a factor of 2 over all other raptor species) and were frequently documented raptor during spring migration (n=10). They were observed during all survey rounds, and at all survey point locations.

9.3.1.7 Shorebirds and Gulls

Fourteen (14) species of shorebirds were observed during spring migration surveys. While shorebirds accounted for 22% of species observations, they only represented approximately 8% (n=215) of the total number of individuals observed.

As spring migration progressed, an upward trend in species richness was observed, from two species detected in the first round, to five in the last survey round. Greater Yellowlegs (n=52), Killdeer (n=41), and Lesser Yellowlegs (n=36) were the most commonly observed species of this group.

9.3.1.8 Corvids and Others

Three (3) corvid species were detected during the migration surveys, with 142 individuals recorded, of which 119 were Black-billed Magpies. Together, this avian group accounted for 5%

of total individuals recorded during spring migration. Overall, these species were observed consistently during the spring migration survey periods, with no obvious trends in timing and abundance.

It is important to note that Black-billed Magpies are year-round residents that may not necessarily migrate south, or will migrate into southern Alberta from northern areas of the province.

9.3.1.9 Grouse and Allies

No Grouse and Allies were observed.

No known Sharp-tailed Grouse (*Tympanuchus phasianellus*) leks (dancing grounds) have been previously identified within the CSP area, and no new leks or individual sightings were recorded.

9.3.1 Fall Migration – 2017

9.3.1.1 Total Number of Individuals Observed

During fall migration surveys, a total of 3302 individuals were observed (29 avian species, incidental species included). Observed individuals that could not be identified to the species level (n=427) are included in the species group summaries, but have been removed from the individual species calculations. Of the 3302 individuals observed during fall migration, 2875 (87%) were observed at the dedicated survey points (incidental observations removed).

9.3.1.2 Sensitive Species

Of the species observed during the 2017 fall migration surveys, four were identified as species of management concern under the *Alberta Wild Species General Status Listing – 2015* (Government of Alberta 2017):

1. American Kestrel (*Falco sparverius*) – “Sensitive”;
2. Barn Swallow (*Hirundo rustica*) – “Sensitive”;
3. Great Blue Heron (*Ardea herodias*) – “Sensitive”; and
4. Prairie Falcon (*Falco mexicanus*) – “Sensitive”.

A complete list of all species observed during the survey, including applicable provincial and federal designations for each species is presented Table 14 (below).

Table 14. Species observed during fall migration and their regulated status.

Common Name	Latin Name	Number Observed *	Species Status: AB General Status	AWA	COSEWIC	SARA
American Crow	*Corvus brachyrhynchos*	21	Secure	-	-	-
American Kestrel	*Falco sparverius*	1	Sensitive	-	-	-
Barn Swallow	*Hirundo rustica*	4	Sensitive	-	Threatened	No Status
Black-billed Magpie	*Pica hudsonia*	111	Secure	-	-	-
Brewer's Blackbird	*Euphagus cyanocephalus*	10	Secure	-	-	-
Canada Goose	*Branta canadensis*	99	Secure	-	-	-
Clay-colored Sparrow	*Spizella pallida*	6	Secure	-	-	-
European Starling	*Sturnus vulgaris*	244	Exotic	-	-	-
Gray Partridge	*Perdix perdix*	27	Exotic	-	-	-
Great Blue Heron	*Ardea herodias*	1	Sensitive	-	-	-
Horned Lark	*Eremophila alpestris*	36	Secure	-	-	-
House Sparrow	*Passer domesticus*	32	Exotic	-	-	-
Killdeer	*Charadrius vociferus*	3	Secure	-	-	-
Mallard	*Anas platyrhynchos*	1	Secure	-	-	-
Merlin	*Falco columbarius*	3	Secure	-	Not at Risk	-
Mourning Dove	*Zenaida macroura*	22	Secure	-	-	-
Northern Harrier	*Circus cyaneus*	13	Secure	-	Not at Risk	-
Prairie Falcon	*Falco mexicanus*	1	Sensitive	-	Not at Risk	-
Red-tailed Hawk	*Buteo jamaicensis*	7	Secure	-	Not at Risk	-
Red-winged Blackbird	*Agelaius phoeniceus*	4	Secure	-	-	-
Rock Pigeon	*Columba livia*	139	Exotic	-	-	-
Rough-legged Hawk	*Buteo lagopus*	4	Secure	-	Not at Risk	-
Savannah Sparrow	*Passerculus sandwichensis*	3	Secure	-	-	-
Snow Bunting	*Plectrophenax nivalis*	1180	Secure	-	-	-

Common Name	Latin Name	Number Observed *	Species Status			
			AB General Status	AWA	COSEWIC	SARA
Swainson's Hawk	*Buteo swainsoni*	20	Secure	-	-	-
Tundra Swan	*Cygnus columbianus*	45	Secure	-	-	-
Vesper Sparrow	*Pooecetes gramineus*	19	Secure	-	-	-
Western Meadowlark	*Sturnella neglecta*	128	Secure	-	-	-
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	2	Secure	-	-	-

Thirteen of the detected avian species (45%) are protected under the Federal *Migratory Birds Convention Act*, ('MBCA') 1994 (excludes raptors, corvids, Galliformes [grouse, quail, pheasants, ptarmigan], cormorants, pelicans, and kingfishers). This federal act affords protection to native migrant bird species and their nests across Canada during nesting and migration periods.

9.3.1.3 Species Abundance and Richness

Based on the fall migration results, the number of individuals generally trended upwards as fall migration rounds progressed. The greatest number of individuals observed was during the fifth round of surveys. The number of sightings (number of observations of distinct groups or individuals recorded) were greatest in the last two survey rounds (Table 19, Figure 6).

Species richness (number of observed species) generally decreased throughout the fall migration, from 17 species in the first survey round, to 10 in the last (Table 19). Survey point CLM2 was observed to have the greatest species richness with 15 distinct species observed within the survey area.

Table 15. Migration summary data for each survey round.

Survey Round	Number of Species*	Number of Sightings*	Number of Individuals*
Round 1	17	52	160
Round 2	15	89	370
Round 3	15	75	324
Round 4	11	69	918
Round 5	10	34	1530
Total for All Rounds	**29**	**319**	**3302**

*Includes incidental observations outside of the designated survey points/times.

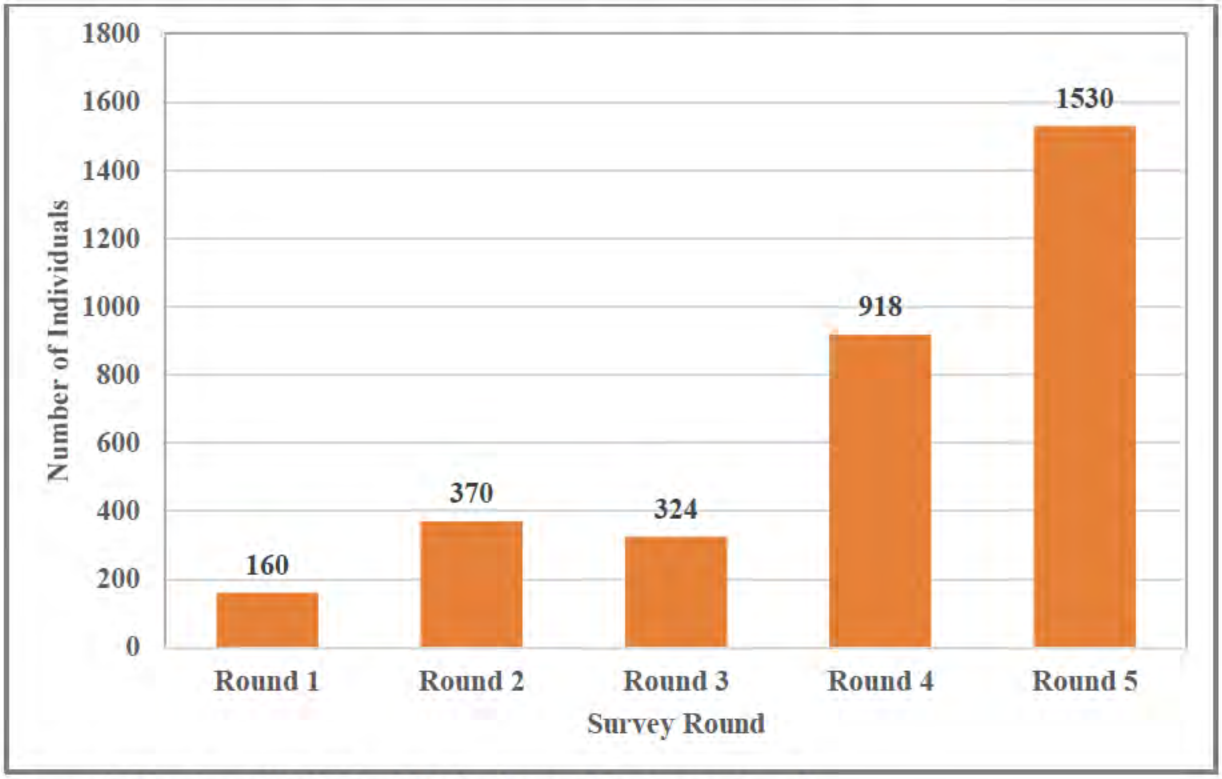

Figure 6. Number of individual birds observed by survey round.

The greatest number of birds were observed at survey point CLM1 (n=956) – this survey point had a value greater than the mean (n=575). The number of observed individuals recorded at CLM5 was also greater than the mean (n=580) (Table 18, Figure 7).

Table 16. Number of individuals observed at Avian Use Study (AUS) plots by survey round.

AUS Plot Number	Number of Individuals*					
	Round 1	Round 2	Round 3	Round 4	Round 5	Total
CLM1	24	94	63	233	542	**956**
CLM2	24	18	102	75	293	**512**
CLM3	33	40	30	50	246	**399**
CLM4	29	21	14	212	152	**428**
CLM5	22	84	114	133	227	**580**

*Does not include incidental observations outside of the designated survey points/times.

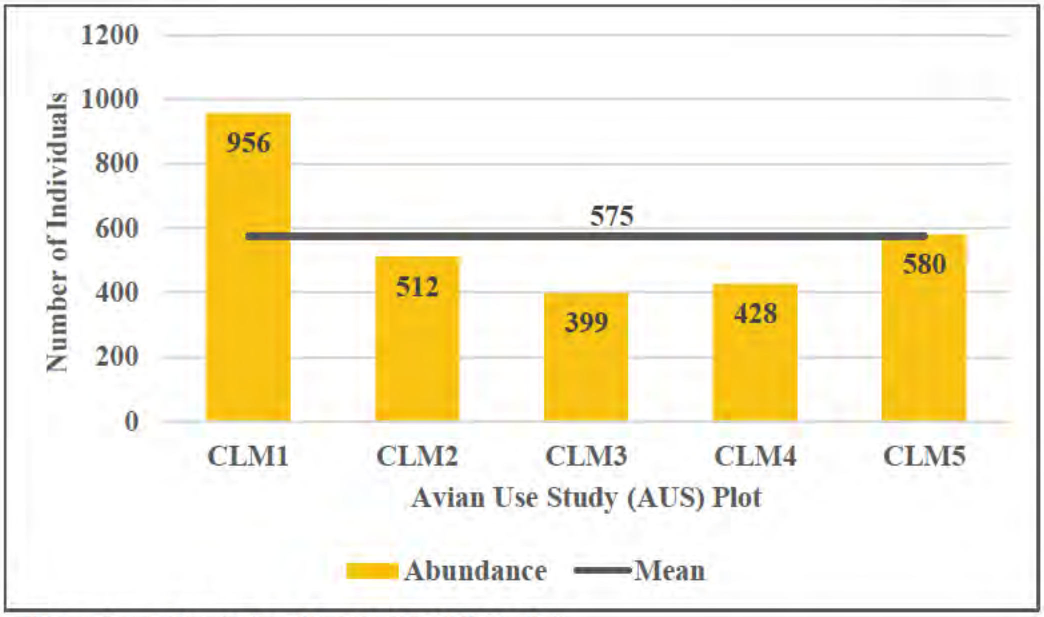

Figure 7. Abundance by Avian Use Study (AUS) plot.

Passerines were the most dominant species group, accounting for approximately 76% of individuals observed. The second most observed group was waterfowl, with 11% of the total individuals observed (Table 20, Figure 8). Individuals not identified at the species group level, or recorded as incidentals (i.e. greater than 800 m from the plot center, and/or outside of the dedicated survey time), were excluded from this abundance analysis. Details of each species groups is discussed below.

Table 17. Abundance characteristics by species group

Species Group	Number of Identified Species*	Per cent of Total Species	Number of Individuals*	Per cent of Total Individuals	Observations per Hour**
Grouse and Allies	1	3.7	27	0.7	1.26
Others	4	14.8	277	9.6	16.62
Raptors	6	22.2	54	1.9	3.24
Shorebirds	2	7.4	4	0.1	0.24
Passerines	12	44.4	2197	76.4	131.79
Waterfowl	2	7.4	322	11.2	19.32
Combined Total	**27**	**100**	**2875**	**100**	**172.47**

*Does not include incidentals observed outside of the designated survey points/times.

**Observations/hr equals the number of individuals divided by the total survey time (16.67 hrs) at this project site.

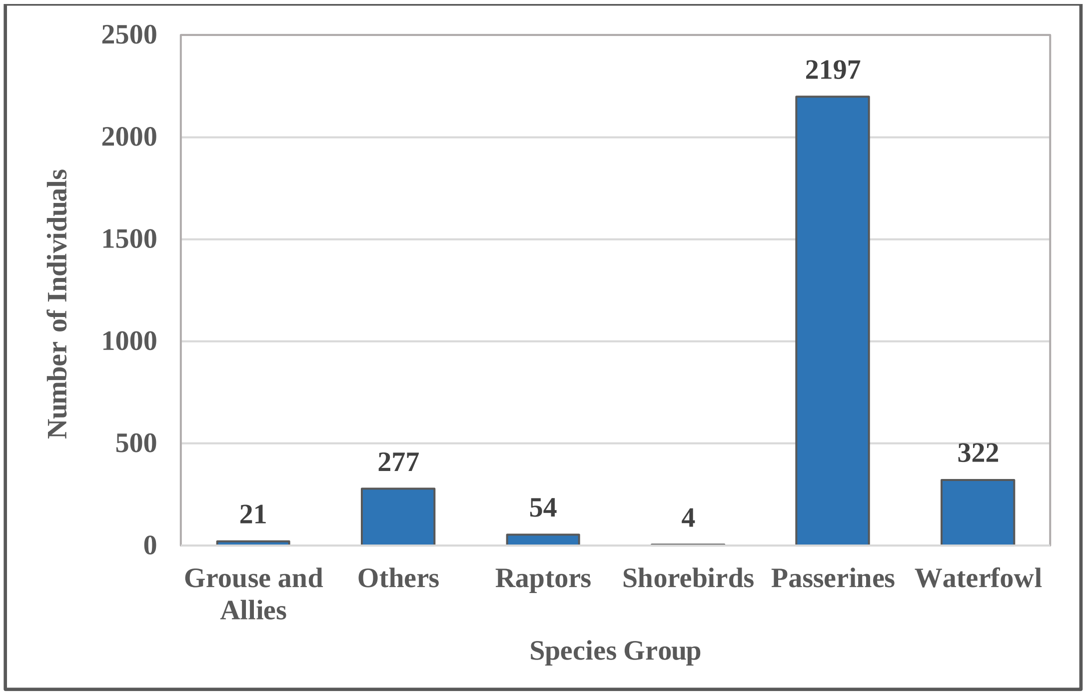

Figure 8. Abundance by species group.

9.3.1.4 Waterfowl

Three species of waterfowl were identified within the Project study area during designated fall migration surveys, with the majority of the observations being Canada Geese (*Branta canadensis*) (n=99). With 99 individuals documented, this accounted for approximately 68% of all waterfowl observed during dedicated surveys. An additional 448 individuals in this group were observed, but could not be identified to species and were recorded as unknown waterfowl. Waterfowl were observed at a rate of approximately 19 observations/hour during the fall migration survey.

Of the waterfowl identified during fall migration surveys, no species were identified as obligatory waterbirds. This classification includes diving ducks, grebes, and loons – those species that require sufficient area to run across the water for take-off, and cannot take off from solid ground (Kaiser 2010).

The greatest number of waterfowl observations were recorded late October (Round 4). Approximately 69% of observations were recorded during this time period. Survey point CLM1 had the greatest recorded number of waterfowl, with 128 individuals recorded in-flight throughout fall migration.

9.3.1.5 Passerines (songbirds)

Approximately 76% of all species identified were passerines, with 2197 individuals documented. Approximately 131 individuals per survey hour were recorded during the fall migration survey; the greatest observation rate for all species groups. This avian group also had the greatest number of species observed (n=12).

Snow Bunting (*Plectrophenax nivalis*) (n=1180) were the most abundant songbird species observed during the fall migration surveys. Due to the difficulty of identifying individuals to species of this size at great distances or heights, 649 unknown passerines were recorded during fall migration surveys – these were included in the abundance analysis of species groups.

The number of passerine observations increased as fall migration progressed. The greatest number of passerine individuals were observed during Round 5 in early November; 59% of passerines were observed during this round. The survey point with the greatest number of passerine individuals was CLM1 (775 passerines were recorded). CLM4 had the lowest number of passerines recorded, with 289 individuals noted.

9.3.1.6 Raptors

A total of seven raptor species (22.2% of total species observations) were detected during the migration surveys, totaling 54 individuals. Raptor observations were recorded at all survey points; generally, observations consisted of one or two individuals per sighting. Additionally, fourteen incidental observations of raptors were recorded within the Project area.

Swainson's Hawks (*Buteo swainsoni*) were the most frequently observed raptor species during the fall migration survey (n=20). A species list detailing raptor species observed during the survey, including associated provincial and federal statuses is presented in Appendix A.

The greatest number of individuals recorded during the surveys was 15 individuals in the first two survey rounds in late August and early September, respectively. In total, raptors were observed at a rate of approximately three individuals per survey hour. No discernible trend with respect to spatial abundance of raptor observations was noted during the survey.

9.3.1.7 Corvids and Others

Four species (14.8% of total species observations) were detected for this species group during the migration surveys, totaling 277 individuals. Included in this group was the corvid family and doves and pigeons. The species most commonly observed were those in the corvid family such as the American Crow (*Corvus brachyrrhynchos*) and Black-billed Magpie (*Pica hudsonia*). Species richness as well as the number of individuals observed throughout the survey rounds remained relatively consistent, with no obvious trends in relation to seasonal abundance. Individuals in this species group were observed at a rate of approximately 17 individuals per surveyed hour.

It is important to note that the Black-billed Magpie are year-round residents that may not necessarily migrate south, or will migrate into southern Alberta from northern areas of the province.

9.3.1.8 Shorebirds

Two shorebird species were observed during fall migration surveys, accounting for approximately 0.1% of species observations. Four individuals were observed during surveys; Killdeer (*Charadrius vociferus*) were the most commonly observed species (n=3). One Great Blue Heron (*Ardea herodias*) was observed within a wetland in the vicinity of the Project area. Shorebirds were observed at a rate of 0.24 individuals per surveyed hour. No data trends can be summarized for this species group.

9.3.1.9 Grouse and Allies

Gray Partridge (*Perdix perdix*) was the only species recorded from this species group during fall migration surveys, with 21 individuals documented near survey point CLM3.

This species group had an observation rate of approximately one individual per surveyed hour, with the majority of observations associated with survey point CLM3; north of the proposed project boundary.

9.3.2 Breeding Bird Surveys – 2017

A total of 47 wildlife species were detected during the wildlife assessment within 1000 m of the Project. Species of management concern have bolded statuses in Table 18. Eight species detected at the time of survey are of management concern in the province of Alberta; ferruginous hawk is considered ‘At Risk’, Canadian toad (*Bufo hemiophrys*) and plains spadefoot (*Spea bombifrons*) are considered “May Be At Risk”, and eastern kingbird (*Tyrannus tyrannus*), loggerhead shrike (*Lanius ludovicianus*), long-billed curlew (*Numenius americanus*), and sora (*Porzana carolina*) are considered “Sensitive”. The remaining species detected during the wildlife assessment are considered ‘Secure’ in the province of Alberta.

Avian species detected during the assessment were primarily associated with grassland habitat; examples include the clay-colored sparrow (*Spizella pallida*), western meadowlark (*Sturnella* *neglecta*), and savannah sparrow (*Passerculus sandwichensis*). Many species were documented actively displaying and calling, indicative of breeding in the immediate area.

Table 18. Wildlife Species Observed During Field Reconnaissance and Status Ranks

Common Name	Latin Name	Species Status		
		AB General Status[1]	COSEWIC[2]	SARA[3]
American Robin	*Turdus migratorius*	Secure	-	-
American Wigeon	*Anas americana*	Secure	-	-
Barn Swallow	***Hirundo rustica***	**Sensitive**	**Threatened**	**No Status**
Black-billed Magpie	*Pica hudsonia*	Secure	-	-
Blue-winged Teal	*Anas discors*	Secure	-	-
Brewer's Blackbird	*Euphagus cyanocephalus*	Secure	-	-
Brown-headed Cowbird	*Molothrus ater*	Secure	-	-
Canada Goose	*Branta canadensis*	Secure	-	-
Clay-colored Sparrow	*Spizella pallida*	Secure	-	-
Common Snipe	*Gallinago delicata*	Secure	-	-
Eastern Kingbird	***Tyrannus tyrannus***	**Sensitive**	-	-
European Starling	*Sturnus vulgaris*	Exotic	-	-
Ferruginous Hawk	***Buteo regalis***	**At Risk**	**Threatened**	**Threatened**
Franklin's Gull	*Leucophaeus pipixcan*	Secure	-	-
Gadwall	*Anas strepera*	Secure	-	-
Gray Partridge	*Perdix perdix*	Exotic	-	-
Horned Lark	*Eremophila alpestris*	Secure	-	-
House Sparrow	*Passer domesticus*	Exotic	-	-
House Wren	*Troglodytes aedon*	Secure	-	-
Killdeer	*Charadrius vociferus*	Secure	-	-
Loggerhead Shrike	***Lanius ludovicianus***	**Sensitive**	**Threatened**	**Threatened**
Long-billed Curlew	***Numenius americanus***	**Sensitive**	**Special Concern**	**Special Concern**
Mallard	*Anas platyrhynchos*	Secure	-	-
Marbled Godwit	*Limosa fedoa*	Secure	-	-
Merlin	*Falco columbarius*	Secure	Not at Risk	-
Mourning Dove	*Zenaida macroura*	Secure	-	-
Nelson's Sparrow	*Ammodramus nelsoni*	Secure	Not at Risk	-
Northern Shoveler	*Anas clypeata*	Secure	-	-
Red-tailed Hawk	*Buteo jamaicensis*	Secure	Not at Risk	-
Red-winged Blackbird	*Agelaius phoeniceus*	Secure	-	-
Ring-billed Gull	*Larus delawarensis*	Secure	-	-
Rock Dove	*Columba livia*	Exotic	-	-

Common Name	**Latin Name**	**Species Status**		
		AB General Status[1]	**COSEWIC[2]**	**SARA[3]**
Savannah Sparrow	*Passerculus sandwichensis*	Secure	-	-
Sora	***Porzana carolina***	**Sensitive**	-	-
Spotted Sandpiper	*Actitis macularius*	Secure	-	-
Swainson's Hawk	*Buteo swainsoni*	Secure	-	-
Vesper Sparrow	*Pooecetes gramineus*	Secure	-	-
Western Meadowlark	*Sturnella neglecta*	Secure	-	-
Willet	*Tringa semipalmata*	Secure	-	-
Wilson's Phalarope	*Phalaropus tricolor*	Secure	-	-
Yellow-headed Blackbird	*Xanthocephalus xanthocephalus*	Secure	-	-

1 - Government of Alberta. 2017. Alberta Wild Species General Status Listing - 2015. Available at: http://aep.alberta.ca/fish-wildlife/species-at-risk/albertas-species-at-risk-strategy/general-status-of-alberta-wild-species/documents/SAR-2015WildSpeciesGeneralStatusList-Mar2017.pdf

2 - Government of Canada. 2017. Committee on the Status of Endangered Wildlife in Canada. Available at: http://www.cosewic.gc.ca/default.asp?lang=en&n=A9DD45B7-1

3 - Government of Canada. 2002. *Species at Risk Act*. S.C. 2002., c. 29. Published by the Minister of Justice at: http://www.sararegistry.gc.ca/

9.3.2.1 Raptors

Several raptor species were observed during the wildlife assessment at, or in proximity to the Project, including: four ferruginous hawks, two red-tailed hawks (*Buteo jamaicensis*), and nine Swainson's hawks (*Buteo swainsoni*). An active ferruginous hawk nest was identified at 12U 330495E 5546672N; approximately 1600 m east of the Project boundary, near the intersection of Range Rd 254 and Township Rd 130 (FEHA1). Two adult hawks were present displaying defensive behaviour, and young were visible in the nest. Four Swainson's hawk nests were observed approximately 900 m southwest (SWHA1), 1300 m east (SWHA2), 2000 m east (SWHA3), and 2000 m northeast (SWHA4) of the Project boundary (Figure 15). One stick nest was also recorded approximately 29 m west of the northeast project boundary (Nest5). The nest was recorded as 'probable' as one adult Swainson's hawk was displaying aggressive behavior near a tree stand located on a homestead, though a nest could not be confirmed due to land ownership constraints. The nest is in the yard of a homestead across a high-grade gravel road.

No other raptor stick nests were observed during the assessment. Table 19 (below) summarizes habitat features identified during the assessment, as well as their location.

Table 19. Sensitive wildlife features documented in proximity to the Project area

Species	Feature	Feature ID	UTM Coordinates (12 N)		Distance from Project boundary (m)
			Easting	Northing	
Swainson's Hawk	Nest	SWHA1	327177	5544855	900
Ferruginous Hawk	Nest	FEHA1	330495	5546672	1600
Swainson's Hawk	Nest	SWHA2	330154	5546714	1300
Swainson's Hawk	Nest	SWHA3	330863	5546676	2000
Swainson's Hawk	Nest	SWHA4	330614	5549940	2000
Swainson's Hawk	Nest	SWHA5	328929	5548372	29

Photo 3. Ferruginous hawk nest with young identified at 12U 330495E 5546672N.

9.3.2.2 Discussion

An active ferruginous hawk nest is located approximately 1600 m east of the Project; as the recommended setback distance for ferruginous hawk nests is 1000 m year-round (Government of Alberta, 2011), no further mitigation is recommended in this instance. Four active Swainson's hawk nests were also documented during the surveys; located 900 m or greater from the Project boundary. The Government of Alberta (2011) generally recommends a 100 m buffer from active raptor nests (excluding those species with specified nest setbacks). As such, no specific mitigation measures are recommended in this instance.

However, a probable raptor nesting location was identified in proximity to the project area (29 m west). Should construction be required between mid-March and mid-August, it is recommended that a pre-construction nest sweep be conducted for confirmation of nest location. It is also recommended that this site be visited by a qualified biologist during the breeding and/or nesting season to determine if this location is actively used by raptor species and (if applicable) if additional mitigation to address this location is warranted.

9.3.3 Effects of the CSP

9.3.3.1 Habitat

AEP recommends siting solar energy projects on cultivated or previously disturbed lands in order to reduce high-quality habitat loss (Alberta Environment and Parks, 2017). Based on the assessment of land use and wildlife use, it can be reasonably concluded that the Project site (as currently proposed) meets the expectations of AEP (2017) with respect to Project siting and avoidance of important wildlife habitat features.

Due to increased human activity, species of birds, and wildlife generally may avoid foraging, nesting, and roosting habitats near solar farms during construction activities and operation, thus effectively decreasing habitat quality beyond the immediate footprint of the infrastructure. The effect is expected to vary among species depending on their thermal, security and foraging requirements.

Habitat fragmentation, degradation, and loss are recognized as leading threats to wildlife and biological diversity (Fahrig, 2003). Solar facility development has the potential to impact wildlife communities due to site abandonment, loss of movement corridors, loss of foraging, breeding, and brood rearing habitat, and direct fatality (Alberta Environment and Parks, 2017). Project related effects vary between solar development due to project size, location, and equipment and technology utilized.

One of the key challenges to developing alternative energy projects is balancing competition for land resources with other land users (Dahlin et al., 2011). Siting solar developments on agricultural lands can help to balance land use requirements of alternative energy projects with other land uses related to energy, food, and fiber production (Dale, Efroymson, & Kline, 2011). By managing siting of solar development in this way, valuable wildlife habitat and key environmental areas can be preserved, while improving efficiency of use of currently disturbed lands. For example, one would expect that smaller birds such as passerines would nest throughout the CSP lands, using infrastructure as nesting support and for cover during project operations.

9.3.3.2 Mortality

Mortality effects from the CSP are unknown. Due to avian mortality documented at a number of utility-scale solar facilities in North America, avian fatalities are becoming a primary concern associated with solar developments. Death occurs primarily as a result of impact trauma, but also due to predation and starvation, when birds land within the project site and either sustain direct impact injuries and/or are stranded and unable to escape predators (Alberta Environment and Parks, 2017). Diving waterbirds (i.e. grebes, loons, diving ducks) make up the majority of mortalities at photovoltaic (PV) sites (Kagan, Viner, Trail, & Espinoza, 2014), potentially mistaking the panels for water (Grippo, Hayse, & O'Connor, 2015); most succumbed to starvation or predation after impact. As many animals use polarized light for orientation and navigation, polarized light pollution can disrupt this innate tool when searching for waterbodies; Lovich and Ennen (2011) deem this “lake effect” linked to continuous rows of solar panels. Also, noted in their study was the concept of solar panels creating an “ecological trap”, wherein the lake effect attracts insects, and in turn, (Lovich & Ennen, 2011) avian species. Utility-scale solar energy (USSE) developments may also fragment habitat and create linear barriers to movement of wild species.

A recent study found no correlation between specific avian species groups and mortality hazards associated with solar facilities, except in instances where open water sources were present – such as wetlands or man-made evaporation pools (Kagan, Viner, Trail, & Espinoza, 2014). However, a recent study by the U.S. Department of Energy’s Argonne National Laboratory (Walston *et al.*, 2015) found passerines to be the most frequently killed or injured taxonomic group at all six California solar energy facilities studied. Risk to waterfowl was also high, due to the supposed confusion of solar arrays with waterbodies.

In a 2015 review of avian monitoring and mitigation information at existing utility-scale solar facilities, the U.S. Department of Energy identified the majority of birds found killed or injured at solar facilities in southern California were passerines. “The cause of death could not be determined for the majority of bird deaths, and many detections consisted only of feather spots. It has been hypothesized that feather spots found near perching/roosting structures may be incorrectly classified as fatalities when in fact they are the result of preening. Feather spots may also represent predation events and not reflect direct solar- related fatality. At sites where a large proportion of the fatalities detected are identified on the basis of feather spots, assigning fatalities to a known cause of death such as predation is difficult. Further work is needed to develop standardized protocols for evaluating feather spot detections and assigning carcasses to causes of death at solar energy facilities" (Walston, et al., 2015).

Water-dependent species (loons, grebes, rails, coots, shorebirds, waterbirds, and waterfowl) have been postulated to be vulnerable to fatality at PV facilities because of the potential for them to confuse arrays for bodies of water (the lake effect hypothesis). However, there was no consistent pattern of fatality by taxonomic groups among the solar energy facilities evaluated in this report to support or refute the lake effect hypothesis within the southern California region. Water-dependent species represented 11.3% of all recorded fatalities (as of December 2014), but there was high variability among PV facilities, with mortality ranging from 0.27% to 46.3%. Due to the limited and inconsistent dataset (i.e., six studies of incidental and systematic observations), it is too speculative to make any conclusions about the influence of the lake effect fatality of water-dependent birds. The activity and abundance of water-dependent species near solar facilities may depend on other site-specific and regional factors (such as the surrounding landscape) that have not yet been investigated (Walston, et al., 2015).

Notwithstanding the above, direct impacts to avian mortality rates have been found to be low for USSE systems in comparison to other anthropogenic impacts on birds (McCrary et al., 1986). While solar panels can cumulatively kill large numbers of birds, it is not known whether fatalities are high enough to cause population-level impacts (Grippo et al., 2015). It is recognized that regional and site-specific preconstruction surveys to estimate the number of resident and migratory birds are important to further characterize the significance of bird mortality related to solar developments (Grippo et al., 2015).

9.3.4 ***Mitigation***

The primary mitigation will be to maintain all required setbacks from nests, or mating and roosting habitat. Adherence to guidelines for setback distances on key wildlife areas/sites (e.g., sharp-tailed grouse leks, ferruginous hawk nests) found within the CSP area will be followed, and development within areas of native prairie has been avoided.

Although monitoring is not considered mitigation, it can frame future mitigation associated with the CSP. Therefore, a follow-up monitoring program will be implemented after construction and will be designed in accordance with AEP requirements. The purposes of the follow-up monitoring are:

- to determine rates of mortalities occurring and, if so, to identify any possible mitigation measures; and,
- to inform future decisions about any future development or placement of further solar panels for additional phases of the CSP.

If it appears that a high number of direct fatalities are occurring, attempts will be made to determine the nature of the fatalities, specific timing or seasonality, weather related effects at the time, so that mitigation may be designed.

9.3.5 Significance

9.3.5.1 Magnitude

The potential effect of the loss of breeding bird habitat from clearing for the CSP would be of insignificant magnitude. The potential effect of sensory disturbance from construction activities may result in nest abandonment however the effect would be of short in duration.

The largest species group of birds identified were passerines. The potential effect birds from clearing and operations for the CSP would therefore be expected to be moderate. Although the presence of solar panels and infrastructure will reduce habitat, upon restoration of vegetation, some passerine use will be expected. No guidelines or threshold values currently exist for bird use at a solar project so no exceedance of a guideline/threshold value will occur.

Waterfowl use may or may not change however 100 metre setbacks from marsh wetlands and dugouts is being maintained by infrastructure. This would be expected to mitigate effects on wildlife use and meets the AEP guideline for setbacks from a wetland.

Table 20 provides a summary of whether proposed mitigation achieves Wildlife Outcomes as it relates to birds.

Table 20. Bird Mitigation and Resulting Wildlife Outcomes

Wildlife Outcome	Does Mitigation Achieve Wildlife Outcome (Y/N)	Notes
Reduce human caused wildlife mortality	Yes	The recommended restricted activity dates and setback distances for birds will be applied. Post Construction Monitoring will be completed to evaluate potential effects on migratory birds. Additional mitigation will be applied should it be required.
Reduce increased predation associated with anthropogenic features	Yes	Anthropogenic features (i.e. solar panels, access roads, substation) have been sited to avoid bird habitat. Therefore, increased predation is not anticipated.
Conserve and protect Critical Habitat	N/A	No Critical Habitat for birds is present within the CSP area.
Maintain the ecological conditions necessary for naturally sustainable wildlife populations to exist throughout Alberta, and conserve the habitat they require. a) Maintain unique and/or important habitat sites. b) Avoid or minimize development within key habitats. c) Maintain habitat intactness, connectivity, and allow for wildlife use, breeding and passage throughout areas by	Yes	CSP infrastructure has been located on agricultural / cultivated land.

Wildlife Outcome	Does Mitigation Achieve Wildlife Outcome (Y/N)	Notes
minimizing habitat loss and fragmentation.		

9.3.5.2 Likelihood

The likelihood of mortality effect is unknown as no literature could be found that indicated that an operating solar project resulted in significant bird mortality. At this point in time, the likelihood of effect on populations of birds is unlikely. Of course, individual birds that experience mortality will be affected, but the extent of that impact is unknown.

9.3.5.3 Geographic Extent

The extent of the potential effect on migrating birds from the CSP would be limited to the Project area, depending on the species of migrating bird and where the populations are based.

9.3.5.4 Duration

The potential effect will be long-term for the life of the project.

9.3.5.5 Frequency

The potential effect would be sporadic during the operation of the CSP.

9.3.5.6 Reversibility

The potential effect would be reversible following Project reclamation.

9.4 Amphibian

No evidence of sensitive amphibian use was observed at the Project site; however, two amphibian species of management concern (Canadian toad and plains spadefoot toad) were recorded approximately 3 km north of the proposed Project.

A large dugout with standing water was recorded in the southernmost area of the Project at the time of the assessment. Several Class I and II wetlands were also observed within the Project area. A large Class III wetland was observed immediately east of the Project boundary.

The presence of natural and man-made waterbodies in the Project area could provide suitable habitat for sensitive amphibians historically recorded in the area; however, only boreal chorus frog

(*Pseudacris maculate*) was detected within the Project boundaries during the wildlife assessment. Plains spadefoot (*Spea bombifrons*) were heard calling approximately 3 km north of the Project area during amphibian surveys on the evening of June 8, 2017 at 12U 328759E 5551833N.

9.4.1 Effects of the CSP

9.4.1.1 Habitat

The CSP will utilize existing pasture land and be setback from open water wetlands as indicated in this document.

The setback distances apply to any wetland class identified in Table 1 in the *Alberta Wetland Classification System* except for wetland classes with Water Permanence listed as temporary.

9.4.1.2 Mortality

Mortality effects from the SSP are unknown but not expected.

9.4.2 Mitigation

The primary mitigation will be to maintain all required setbacks. Adherence to guidelines for setback distances will be followed as indicated. At Class I and II wetlands, silt fencing will be installed around the perimeter of wetlands during construction to prevent any movement out of wetlands of amphibians that may have gone undetected.

9.4.3 Significance

9.4.3.1 Magnitude

The potential effects on amphibians, which of course rely on wetlands and watercourses, are anticipated to be insignificant as effects to amphibian habitat is also insignificant.

Table 21 provides a summary of whether proposed mitigation achieves Wildlife Outcomes as it relates to amphibians.

Table 21. Amphibian Mitigation and Resulting Outcomes

Wildlife Outcome	Does Mitigation Achieve Wildlife Outcome (Y/N)	Notes
Reduce human caused wildlife mortality	Yes	CSP infrastructure has been located on cultivated land, and setback a minimum of 100m from Class III/IV/V wetland habitat.
Reduce increased predation associated with anthropogenic features	Yes	Anthropogenic features are not planned within, or in close proximity to wetland habitat, therefore increased predation not expected.
Conserve and protect Critical Habitat	N/A	No Critical Habitat for wildlife is present within the CSP area and wetland habitat avoided.
Maintain the ecological conditions necessary for naturally sustainable wildlife populations to exist throughout Alberta, and conserve the habitat they require.		
a) Maintain unique and/or important habitat sites.	Yes	CSP infrastructure has been located on cultivated/pasture land, and setback from wetland habitat.
b) Avoid or minimize development within key habitats.	Yes	
c) Maintain habitat intactness, connectivity, and allow for wildlife use, breeding and passage throughout areas by minimizing habitat loss and fragmentation.	Yes	

9.4.3.2 Likelihood

The likelihood of effects on amphibians is unlikely as wetlands with amphibian species are being avoided as per the setback guidelines.

9.4.3.3 Geographical Extent

The extent of the potential effect on amphibians would be within the project area only, but as avoidance is being used as mitigation, the extent would be less than the project area.

9.4.3.4 Duration

The duration of the effect on amphibians would be short term. Any effects would be limited to impacted wetlands only.

9.4.3.5 Frequency

Any effects would be limited to impacted wetlands only. As no impacts are expected, frequency does not apply.

9.4.3.6 Reversibility

Any effects would be limited to impacted wetlands only. As no impacts are expected, reversibility does not apply.

9.5 Watercourses

Within the CSP lands, there are no mapped watercourses that are identified on the *Code of Practice for Pipelines & Telecommunication Lines Crossing a Water Body/Watercourse Crossings Detailed Area Maps; Pincher Creek Management Area Map, November 2012*.

No watercourses with permanent water regimes were encountered within the CSP boundaries. All watercourses are intermittent and seasonal and are dependent upon precipitation events as the primary input. The following photo (Photo 4) shows the watercourse in the NE-6-13-25W4, in the NE ¼ section of the CSP.

Photo 4. Watercourse in NE-6-13-25W4

The watercourse is heavily impacted by livestock. There are hoof prints and manure throughout the watercourse. As evident in the photo, weeds are also present within the watercourse. There is no defined bed but a bank is evident along the north boundary.

There are no fisheries concerns requiring Fisheries and Oceans Canada approvals. Furthermore, no navigable waters are encountered and no applications to the Coast Guard for crossing approvals are associated with the proposed CSP.

Alberta Environment will subsequently be notified of all applicable crossings in accordance with Alberta Environment requirements in *Guide to the Code of Practice for Watercourse Crossings, Including Guidelines for Complying with the Codes of Practice, Alberta Environment, April 2001*. All watercourse crossings by will be constructed in accordance with the same document.

9.5.1 Effects of the CSP

As discussed, no infilling of the watercourses are expected as part of the CSP. The watercourse is clearly seasonal and receives a great deal of surface impacts as a result of livestock grazing. As a result of the solar project, livestock grazing by cattle in the watercourse will be eliminated. There will be sheep grazing the lands during operations, but the expectation is that due to the smaller weight, impacts to the watercourse would be reduced. As such, the expectation is that the watercourse will trend back towards a more natural state. Therefore the CSP is proposing to reduce the setback to the watercourse to 15m as following construction, the watercourse would be expected to be in better ecological condition (related to function) than in its present state.

As per the layout design, no crossing of the watercourse will occur (by roads). All standard watercourse mitigation strategies will be integrated into adjacent road design (see below) and thus effects resulting from CSP development should be expected to be limited in duration and scope.

Clearing soils for the solar panel pads, roads and underground electrical collector network may potentially impact surface water flow by increasing the potential for surface erosion and runoff and changing drainage patterns, which may direct flows toward or away from natural drainage channels.

A measurable change in the rate of runoff into watercourses is not expected from the proposed CSP; therefore, no measurable increase in peak flows downstream is anticipated.

9.5.2 Mitigation

- A stormwater management plan will be developed to adequately manage surface runoff associated with the project to ensure that existing drainage patterns within the project boundaries are not overwhelmed;
- Pre-construction drainage patterns will be matched post-construction wherever possible to reduce potential changes in downstream flows; and,
- Water used for dust suppression will be acquired from approved sources, including municipal water supplies and/or provincially approved water withdrawal locations under provincially approved licences.
- Erosion control will be placed between construction areas and the watercourse during construction (and during operations as required), and may include silt fencing or other methods, to prevent the movement of surface material into the watercourse.

9.5.3 Significance

9.5.3.1 Magnitude

The Stormwater Management Plan is expected to limit the magnitude of effects on surface water as a function of the design. Therefore, the magnitude of effects would be insignificant.

Similarly, potential magnitude of effects on fish and fish habitat through erosion during construction and decommissioning would be insignificant as there are no permanent watercourses within the CSP lands, and the distance from the CSP to offsite watercourses is far enough that siltation would not be expected.

Potential magnitude of effects on water quality would be insignificant. Sedimentation generated from erosion may degrade down-gradient watercourses, however if constructed according the Stormwater Management Plan, the magnitude of effects is low.

9.5.3.2 Likelihood

Effects to water resources from sedimentation associated with soil clearing during construction and decommissioning activities are possible, but unlikely. Soil types in the region, combined with major rainfall events, create vulnerability to erosion and sedimentation when soil is disturbed, but there are limited slopes and lack of permanent watercourses.

9.5.3.3 Geographical Extent

The extent of the potential effects to water resources from sedimentation would be local and effects would not be transported downstream far enough to have an effect that could not be mitigated.

9.5.3.4 Duration

Related effects on water resources are expected to be short term and somewhat infrequent and are most likely to occur during construction only. Impacts from erosion and sedimentation would be reduced as the proposed SSP footprint is reclaimed (interim or final).

9.5.3.5 Frequency

Operations-related effects from site maintenance are anticipated to be sporadic.

9.6 Wetlands

9.6.1 Types within the CSP

Desktop and field assessments provided a base layer used for constraints analysis for the CSP layout. At the time of this application, no wetland disturbance that requires application under the *Water Act* will be occurring as a result of the CSP. All solar panels and additional infrastructure meet the setback requirements.

Within the boundaries of the CSP, only one type of wetland class is found – Marshes. (Figure 17) There are approximately 59 hectares of wetlands within the CSP boundaries.

Table 22. Wetland Types and Areas

Alberta Classification	Wetland Class*	Area (hectares)
Ephemeral waterbody	I	1.73
Ephemeral waterbody	II	10.2
Temporary / Seasonal marsh	III (including dugouts)	47.85
	TOTAL	**59.78**

* (Stewart & Kantrud, 1971)

The reader should note that the wetlands and ephemeral water bodies were not classified at the CSP to a level of detail commensurate with a functions assessment. They were only generally classified based upon cursory observations during field delineation. The field and desktop delineation was used to build a base layer and to establish constraints. As no wetlands will be impacted the following information only describes generally what is present within the CSP.

9.6.1.1 Ephemeral Waterbodies

Ephemeral water bodies are classified using the Alberta Wetland Classification System (AWCS) Classification key (AWCS, page 11), which states "terrain is not affected by the water table near, at or above the ground surface for more than a short period of days after spring snowmelt or a heavy rainfall, or is affected by deepwater habitat with water levels that are greater than two metres deep at midsummer". These areas are defined as having "evidence of water altered soils found deeper than 30 cm below the ground surface or may not be present at all. Surface water is present in most years, but only for a brief period of days after snowmelt or a heavy rainfall. Although some water tolerant vegetation may be present, they are not dominant and are intermixed with a majority of upland species." Under AWCS these are not considered wetlands.

9.6.1.2 Marshes

Marshes have one form – graminoid (meaning grass like vegetation). "Marshes and shallow open waters are mineral wetlands characterized by mineral soil (which can include non-peat accumulating organic soil), fluctuating water levels, and a wide range of chemical gradients. Some marshes and shallow open waters may be isolated from surface water connections (e.g. some prairie potholes), while others may have a variety of water sources that exhibit complex groundwater-surface water interactions. Examples of marshes and shallow open waters with hydrologic connections include recharge, discharge and flow-through wetlands, and wetlands bordering lotic (e.g. streams) and lentic (e.g. lakes) water bodies." (Alberta Environment and Sustainable Resource Development (ESRD), 2015).

Marshes are mineral wetlands that are periodically inundated by standing or slow flowing water. Surface water levels generally fluctuate seasonally, they have water levels near, at or above the ground surface for variable periods during the growing season. They can be identified by the dominance of water tolerant graminoids in the deepest wetland zone covering more than 25% of the total area in the majority of years (Alberta Environment and Sustainable Resource Development (ESRD), 2015). The surface waters are typically rich in nutrients. The substrate is usually mineral material although well-decomposed peat may occasionally be present. Marshes typically display zones or surface patterns consisting of pools or channels interspersed with patches of emergent vegetation, bordering wet meadows and peripheral bands of shrubs or trees.

Marshes may experience water level drawdown's which will result in portions drying up and exposing the sediments. Marshes receive their water from the surrounding catchment as surface runoff, stream inflow, precipitation, storm surges, or groundwater discharge. Marshes dependent upon surface runoff usually retain less permanent water than sites supplied by groundwater. The water table usually remains at or below the soil surface, but soil water remains within the rooting zone for most of the growing season, except in years of extreme drought.

The following marsh types are present within the CSP boundaries:

1. Temporary Marshes;
2. Seasonal Marshes;
3. Semi-permanent;

The six (6) classes of wetlands as defined by Stewart & Kantrud (Stewart & Kantrud, 1971) that are found within the CSP lands were used.

<u>Class I - Ephemeral Wetlands</u>: typically have free surface water for only a short period of time after snowmelt or storm events in early spring. Because of the porous condition of the soils, the rate of water seepage from ephemeral wetlands is very rapid after thawing of the underlying frost seal. They may be periodically covered by standing or slow moving water. Water is retained long enough to establish some wetland or aquatic processes. They are typically dominated by Kentucky bluegrass, goldenrod and other wetland or low prairie species.

<u>Class II Wetlands</u>: occur in depressions where the water remains for a few weeks during the spring for a few days after large precipitation events. Topography surrounding these wetlands consists of shallow undulations exposing depressions to wind and sun. This allows them to experience increased desiccation, which does not permit the colonization by hydrophilic species.

<u>Class III Wetlands</u>: maintain surface water for an extended period of time during the spring and early summer. Vegetation within these wetland types include those found in Class II wetlands, but also contain submerged species. These wetlands can be divided into a shallow marsh zone, which allows for emergent hydrophytes, and a low prairie zone, which has more forbs and is transitional to drier grassland.

Class IV Wetlands: semi-permanent features that maintain water for only portions of the season, but may be saturated throughout fall and winter.

Class V Wetlands: permanently wet with very little vegetation cover and may have a deep marsh zone.

Photo 5. Seasonal marsh located in NE-6-13-25W5. There was no standing surface water however underlying soils were saturated and surface salinity is clearly evident. There was extensive rutting from cattle throughout this area. Additionally, there are agronomic species within this wetland, either as a result of former tillage and/or a result of seed dispersal from neighbouring pasture.

9.6.2 Effects of the CSP

At the time of this application, no wetland disturbance that requires application under the *Water Act* will be occurring. Therefore, the CSP is not expected to have any measurable effects on wetlands.

For intermittent wetlands (Class I and II) setbacks will be set to the boundary of the wetland. Because no wetland disturbance will occur, even with the reduced setback, no change to form or function is expected to result from reduced setbacks. Because of the characteristics of these wetland types in the CSP area, they receive a great deal of surface impacts as a result of livestock grazing. As a result of the solar project, livestock grazing will change from cattle grazing to sheep grazing, which is expected to reduce soil disturbance within the wetlands. As such, the expectation is that the wetlands will trend back towards a more natural state. Therefore the CSP is proposing to locate the setback to the boundary of the watercourse as following construction, the wetlands would be expected to be in better ecological condition (related to function) than in their present states and because there is no expectation of a negative project impact on wetland function.

Additionally, the Stormwater Management Plan may incorporate wetland areas to assist in management of stormwater flow.

9.6.3 Mitigation

As a function of the CSP layout planning process, the primary mitigation planning sequence of avoidance was used. This achieves wetland conservation through avoidance of impacts.

For intermittent wetlands (Class I and II) during construction silt fencing will be placed around the boundary of the wetlands. This will ensure the boundaries are clearly visible during construction. Furthermore, silt fencing would reduce the potential for soils to be transported into the wetlands during construction. Silt fencing will remain in place until surrounding soils are stabilized and erosion is controlled.

For marsh wetlands (Class III, IV, V) setbacks of 100 m will be used. Wetlands are sensitive to disturbance and the setback distance will reduce the potential for soil erosion/sedimentation, protect nesting habitat for waterfowl, and protect breeding habitat for amphibians.

9.6.4 Significance

9.6.4.1 Magnitude

The potential effects on wetland systems[9] are anticipated to be insignificant.

Table 23 provides a summary of whether proposed mitigation achieves Wildlife Outcomes as it relates to wildlife habitats.

Table 23. Wetland Mitigation and Resulting Wildlife Outcomes

Wildlife Outcome	Does Mitigation Achieve Wildlife Outcome (Y/N)	Notes
Reduce human caused wildlife mortality	Yes	CSP infrastructure has been located on cultivated land, and setback a minimum

[9] Includes both as a functioning complex, or individual wetlands.

Wildlife Outcome	Does Mitigation Achieve Wildlife Outcome (Y/N)	Notes
		of 100m from Class III/IV/V wetland habitat.
Reduce increased predation associated with anthropogenic features	Yes	Anthropogenic features are not planned within, or in close proximity to wetland habitat, therefore increased predation not expected.
Conserve and protect Critical Habitat	N/A	No Critical Habitat for wildlife is present within the CSP area and wetland habitat avoided.
Maintain the ecological conditions necessary for naturally sustainable wildlife populations to exist throughout Alberta, and conserve the habitat they require.		CSP infrastructure has been located on cultivated land, and setback from wetland habitat.
a) Maintain unique and/or important habitat sites.	Yes	
b) Avoid or minimize development within key habitats.	Yes	
c) Maintain habitat intactness, connectivity, and allow for wildlife use, breeding and passage throughout areas by minimizing habitat loss and fragmentation.	Yes	

9.6.4.2 Likelihood

The likelihood of effects on wetland ecosystems is unlikely as wetlands will be completely avoided. No alteration applications are being submitted as a result of the Project.

9.6.4.3 Geographical Extent

The extent of the potential effect on wetlands would be within the proposed footprint, specifically, the area to be cleared for the proposed infrastructure.

9.6.4.4 Duration

The duration of the effect on wetland ecosystems would be short term. Any effects would be limited to impacted wetlands only.

9.6.4.5 Frequency

As no impacts are expected, frequency does not apply.

9.6.4.6 Reversibility

As no impacts are expected, reversibility does not apply.

10 CONSTRUCTION FOLLOW-UP COMMITMENTS

Post-construction wildlife monitoring and adaptive management will be incorporated into the Project. Commitments have been included as part of this submission to align with the expectations cited in the recently released *Wildlife Directive for Alberta Solar Energy Projects*, AEP, October 4, 2017. These include mortality surveys for 3 years and will include the standards as outlined in *Section 100.4 – Standards* of the above referenced document.

10.1 Post Construction Surveys

Surveys will:

1. Document wildlife mortalities within specific solar arrays
2. Determine carcass removal rates
3. Determine searcher efficiency
4. Monitor impact of the SSP on species at risk, sensitive species or other wildlife.

The seasonality and frequency of surveys will be as follows:

1. Seasonality: Between March 1st and November 15th
2. Frequency: Weekly during migratory periods (March 1st - May 15th and August 15th – November 15th) and once every 2 weeks during the summer

10.2 Annual Reporting

An annual report will be submitted to Alberta Environment and Parks (AEP) outlining the results of the mortality surveys. Information will include raw data, results of mortality trials, fatality rates for birds, and mortalities found during the year being studied. Based on study findings, should it be deemed necessary by AEP, operational mitigation methods to reduce the risk of fatalities will be discussed.

The post-construction annual report will include the following:

1. a detailed description of the survey methods;
2. the raw data, using the appropriate FWMIS datasheet for each solar collector/reflector;
3. results of searcher efficiency trials and scavenger removal trials;
4. the uncorrected fatality rate for birds expressed as the number of mortalities/megawatt/year;
5. the corrected rates of mortalities/megawatt/year as per Huso (2011) or acceptable alternatives;
6. a summary of species affected;

7. results of the pre-construction wildlife surveys;
8. a comparison of the pre- and post-construction survey results if required; and,
9. a statement of compliance with the Directives and the signature of the lead biologist.

10.3 Adaptive Management

As per Standard 100.4.9, in the event that post-construction surveys reveal wildlife mortalities exceed acceptable levels (as determined by AEP), adaptive management may be implemented in consultation with AEP. Adaptive management may include, but may not be limited to:

1. Determination of reason for mortality (i.e. electrocution, impacts)
2. Once mortality is determined, where possible, mitigation may include:
    a. Installation of bird deterrents or markers;
    b. Addition of white edges to solar reflectors;
    c. Installation of nest spikes on areas to prevent raptor nesting; and/or;
    d. Other methods appropriate at the time.

10.4 Injured Wildlife

In the event that injured wildlife is found within the Project boundaries during operations, AEP will be notified and injured wildlife will be handled in accordance with regulatory direction and requirements.

11 Discussion of Effects

The scope, methodology and baseline environmental conditions for the CSP have been described in detail in this document. Each Ecosystem Component as identified and defined, has been described and baseline environmental work has been completed to evaluate each EC based on the site-specific conditions relating to the CSP.

Based on the environmental baseline work completed for each EC over the course of one year, and the expertise of the various members of the EA CSP Team, evaluation of each EC has been completed to determine which EC could have potential residual effects once planned mitigation has been completed. This evaluation is described in Table 24. A project EPP has been completed, and will support the mitigation strategies required for the CSP.

Table 24. Ecosystem Component Evaluation

Ecosystem Components (EC)	Sub-Component	Life Cycle Stage Effector	Description of Impacts	Mitigation	Magnitude of Effect	Likelihood of Effect	Risk	Residual Effects assuming Mitigation Effective
Habitat		Construction Operations	Changes in land surface temperature and microclimates. Loss of use of pasture lands due to infrastructure and perimeter fencing	• Avoidance of wetlands and watercourses.	Insignificant	Almost Certain	High	Avoidance of cultivated lands by wildlife during operations.
Wildlife	**Large mammals**	Construction Operations	Barriers to movement within CSP lands due to fencing	• Location situated on agricultural land, thus reducing potential habitat fragmentation.	Insignificant	Unlikely	Low	Barriers to movement through the lands will remain for life of project for species unable to move through perimeter fencing (i.e. deer)
Soils	**All soil types**	Construction Operations	Impacts associated with construction	Mitigation for soils has been outlined in the	Insignificant	Likely	Medium	Following interim reclamation

Ecosystem Components (EC)	Sub-Component	Life Cycle Stage Effector	Description of Impacts	Mitigation	Magnitude of Effect	Likelihood of Effect	Risk	Residual Effects assuming Mitigation Effective
			include potential reduction in soil characteristics (quality and quantity) due to handling, admixing and losses due to erosion.	Environmental Protection Plan.				replacement and revegetation of soils following construction (outside operational areas), residual effects are short term and not expected to extend beyond construction.
Vegetation	**Rare Plants**	Construction Operations	Impacts to rare plants not expected as none identified within footprint of solar panels, access roads, or collector lines during	Avoidance through use of cultivated land	None	None	None	None

Ecosystem Components (EC)	**Sub-Component**	**Life Cycle Stage Effector**	**Description of Impacts**	**Mitigation**	**Magnitude of Effect**	**Likelihood of Effect**	**Risk**	**Residual Effects assuming Mitigation Effective**
			assessments and all infrastructure on agricultural land.					
Watercourses	**Class A, B, C or D**	Construction Operations	No mapped watercourses. All watercourses intermittent and/or ephemeral and Class D.	Install culverts and crossings as per *Guide to the Code of Practice for Watercourse Crossings, Including Guidelines for Complying with the Codes of Practice, Alberta Environment, April 2001.* Refer to EPP for additional information.	Insignificant	Possible	Low	None
Water	**Use and Consumption**	Construction Operations	• Use of localized water sources for dust suppression during construction.	Use of water from approved water withdrawal locations, municipal water supplies, or under provincial permit.	Insignificant	Unlikely	Low	None

Ecosystem Components (EC)	Sub-Component	Life Cycle Stage Effector	Description of Impacts	Mitigation	Magnitude of Effect	Likelihood of Effect	Risk	Residual Effects assuming Mitigation Effective
			• Water use for dust suppression during operations.					
Wetlands	**All Classes, All Types**	Construction Operations	Initial desktop and field assessments provided a base layer used for constraints analysis for the CSP layout. At the time of this application, no wetland disturbance that requires application under the *Water Act* will be occurring as a result of the CSP. Potential concerns associated with	As a function of the CSP layout planning process, the primary mitigation planning sequence of avoidance was used. Wetland habitat has been delineated and setbacks have been identified across the CSP area. Solar panel locations and related infrastructure avoids wetland habitat. This achieves wetland conservation through avoidance of impacts.	Insignificant	Possible	Low	None

Ecosystem Components (EC)	Sub-Component	Life Cycle Stage Effector	Description of Impacts	Mitigation	Magnitude of Effect	Likelihood of Effect	Risk	Residual Effects assuming Mitigation Effective
			wetlands include: • Indirect impact of wetland habitat through construction in upland buffer areas; • Impacts to surface water systems that could indirectly affect wetland habitat; • Changes to surface hydrology • Alteration of nutrient cycles	Stormwater management plan will incorporate and determine surface volumes to be directed to wetland and drainage systems.				

Ecosystem Components (EC)	Sub-Component	Life Cycle Stage Effector	Description of Impacts	Mitigation	Magnitude of Effect	Likelihood of Effect	Risk	Residual Effects assuming Mitigation Effective
			• Water stress due to volume changes (too high or too low)					
Birds	**Waterfowl** **Passerines** **Raptors** **Corvids/Others** **Shorebirds** **Grouse/Allies**	Construction Operations Decommissioning	Potential concerns associated with birds include: • Displacement of nesting birds in pasture lands (limited) • Mortality resulting from direct collision with solar panels; • Habitat alteration; and, • Sensory disturbance.	Due to the potential residual effects of solar panels on birds once mitigation efforts are employed, this EC has been considered for further assessment in post construction/operations, using mortality monitoring, and potentially adaptive management, following consultation with AEP as required.	Moderate	Unlikely (population level)	Medium (population level)	Extent to be determined through post construction mortality monitoring.

Ecosystem Components (EC)	Sub-Component	Life Cycle Stage Effector	Description of Impacts	Mitigation	Magnitude of Effect	Likelihood of Effect	Risk	Residual Effects assuming Mitigation Effective
Amphibians	**Great Plains Toad** **Boreal Chorus Frog**	Construction Operations Decommissioning	Habitat loss and fragmentation from proposed activities such as clearing for roads, solar panel, the substation, could cause displacement of species from their habitats, degrade breeding habitats. Attractants may include the creation of ruts on roads, caused by equipment and vehicles, which may fill with water in the spring and attract breeding species of amphibians.	• Maintain setbacks from wetlands as per the layout and use existing disturbance and access as much as possible. This was incorporated into the layout. • Conduct regular road maintenance in the form of grading to prevent water pooling and to minimize deep ruts and/or water ponding; • Ensure erosion and sedimentation controls are in place to reduce soil erosion and water quality degradation and to prevent movement of amphibians out of wetlands during construction.	Insignificant	Unlikely	Low	None

Ecosystem Components (EC)	**Sub-Component**	**Life Cycle Stage Effector**	**Description of Impacts**	**Mitigation**	**Magnitude of Effect**	**Likelihood of Effect**	**Risk**	**Residual Effects assuming Mitigation Effective**
			Since these ruts would likely dry up in the summer, this presents a potential risk to species that hatch and reproductive failure could occur. Creation of low spots following construction that may collect water may also result in attractants to species.	• Avoid impacts to ephemeral wetlands wherever possible; and. • Avoid wetlands and watercourses to the greatest extent possible and ensure stormwater management structures are constructed properly.				

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13 Environmental Assessment Project Team

Name	Designation	Years of Experience	Project Team Tasks
Robert McCallum	P.Biol	20	Project manager; Field assessments; Micro-siting; Wetlands; Reporting, Regulatory consultation.
Darryl Jarina	P.Biol	11	Project manager; Field assessments; Birding; Reporting; Regulatory consultation.
Chris Pepper	Tech.	12	Spring migration; spring wildlife surveys; Lek surveys.
Mike Kelly	P.Biol (pending)	4	Field assessments; Birding; Vegetation; Wetlands; amphibians
Michelle Fournier	P.Biol (pending)	4	Field technician; Field assessments
Emma Posluns	MSc.	3	GIS Analyst; Reporting

14 Certification

The undersigned has personally inspected the subject property and considered relevant factors and influences pertinent within the scope of the assessment.

The undersigned has no past, present, or contemplated interest in the assessed underlying property or investments in the proponent.

I have reviewed the information as submitted and completed this report in conformity with the Code of Ethics and the Duties of Professional Biologists.

Respectfully Submitted,

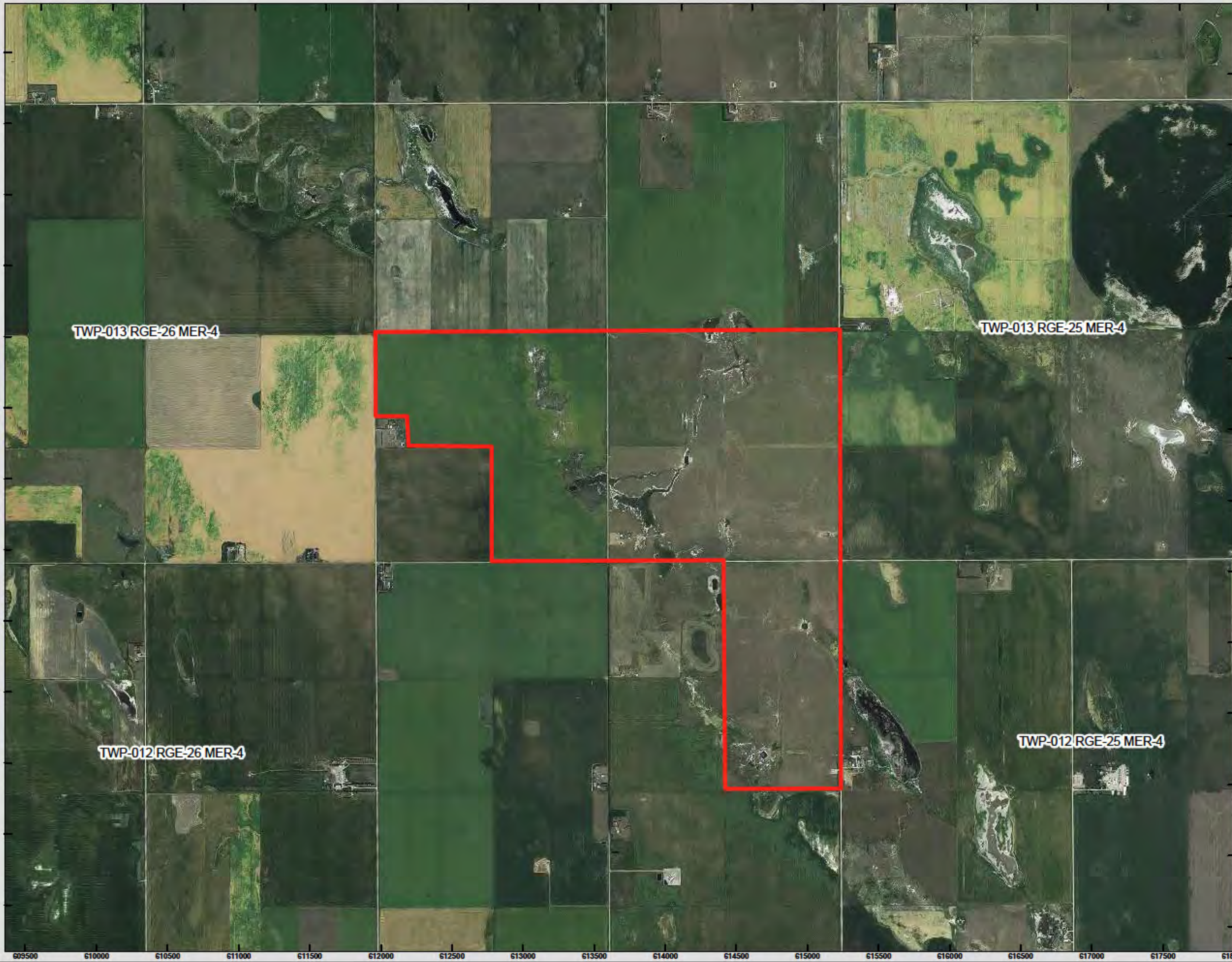
Robert McCallum, P.Biol
President
McCallum Environmental Ltd.

Darryl Jarina, B.Sc., P.Biol
President
Bear Tracks Environmental Services (2015) Ltd.

The undersigned has no past, present, or contemplated interest in the assessed property.

Emma Posluns, M.Sc.
McCallum Environmental Ltd.

Appendix I – Figures



Prepared For:

Claresholm Solar Inc.

Figure 9: Aerial Imagery

Claresholm Solar Project
Claresolm, Alberta

Claresholm Project Area

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

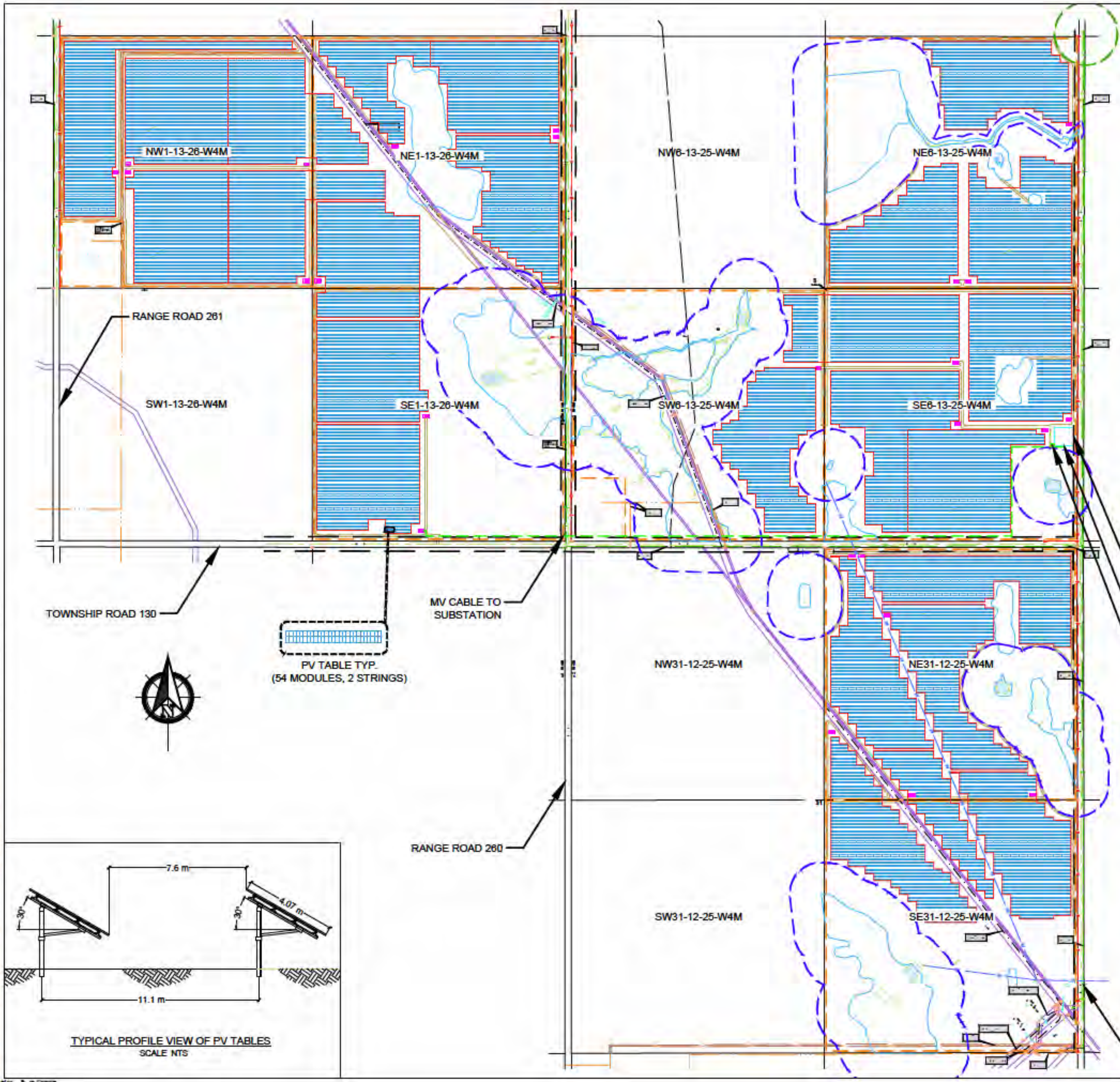
0 250 500 1,000 m

1:25,000 Scale when printed @ 11" x 17"

Drawn By: EP

Date: 2018-04-17

McCallum Environmental Ltd.



TYPICAL PROFILE VIEW OF PV TABLES
SCALE NTS

TOTAL FIXED TILT SYSTEM DESCRIPTION	
NUMBER OF PV MODULES	477,198
NUMBER OF STRINGS	17,674 (27 MODULES PER STRING)
SYSTEM SIZE(DC)	172.97 MW
NAMEPLATE CAPACITY (AC)	132 MW
NAMEPLATE CAPACITY (AC) TOTAL INTERCONNECTED CAPACITY	130 MW
DC/AC RATIO	1.31

GENERAL NOTES:
THIS IS A PRELIMINARY DESIGN.

SUBSTATION DETAILS:
TOTAL INTERCONNECTED CAPACITY 130 MW-AC

LEGEND:
- PV TABLES
- INVERTER MV TRANSFORMER STATION
- SUBARRAY BOUNDARY
- ACCESS ROADS
- YARD SETBACK
- ROAD SETBACK
- WETLAND
- WETLAND BUFFER
- BIRD OBSERVATION BUFFER
- EXISTING 138 kV 180 L POWER LINE
- BURIED WATERLINE
- BURIED PIPELINE

AECOM

PROJECT
CLARESHOLM SOLAR
TOWNSHIP RD 130
CLARESHOLM, AB CANADA

CLIENT
Claresholm Solar Inc.
260, 2323 - 32 Ave NE
Calgary, Alberta
T2E 6ZE

DESIGNER
AECOM CANADA LTD
48 Quarry Park Blvd SE, Suite 300
Calgary, AB T2C 5P2, Canada
1.403.254.3301 tel
www.aecom.com

NOT FOR CONSTRUCTION

REGISTRATION

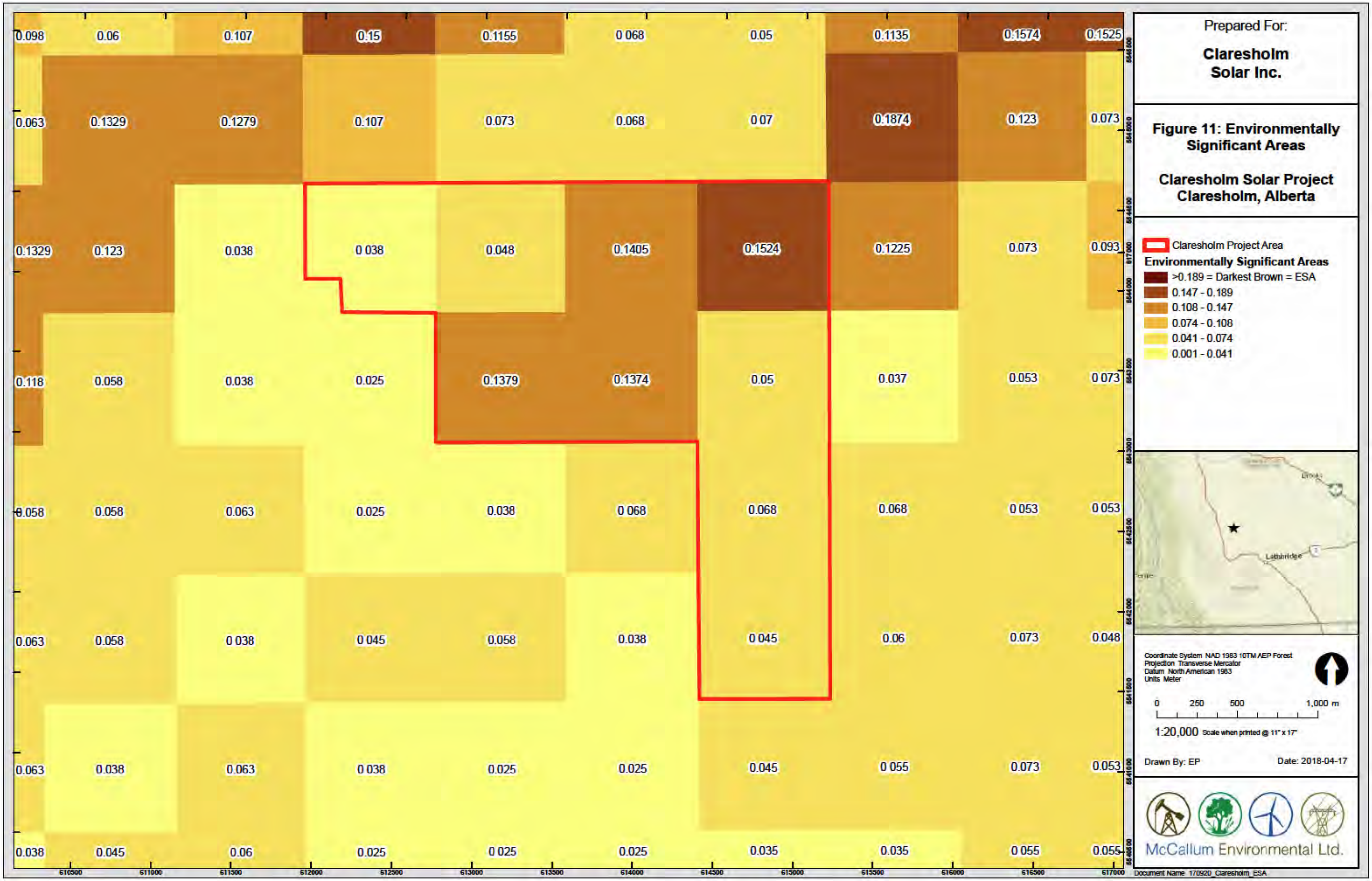
ISSUE/REVISION

I/R	DATE	DESCRIPTION
C	2018-06-XX	CANADIAN SOLAR UPDATE
C	2018-05-25	WETLAND SETBACK UPDATE
B	2018-01-26	SUBSTATION UPDATE
A	2017-11-30	PRELIMINARY LAYOUT

KEY PLAN

SHEET TITLE
CLARESHOLM SOLAR
PRELIMINARY SOLAR LAYOUT

E1.1
SHEET X OF X



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610500 611000 611500 612000 612500 613000 613500 614000 614500 615000 615500 616000 616500 617000
Prepared For:
Claresholm Solar Inc.
Figure 11: Environmentally Significant Areas
Claresholm Solar Project
Claresholm, Alberta
Claresholm Project Area
Environmentally Significant Areas
>0.189 = Darkest Brown = ESA
0.147 - 0.189
0.108 - 0.147
0.074 - 0.108
0.041 - 0.074
0.001 - 0.041
Brooks
Lethbridge
Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter
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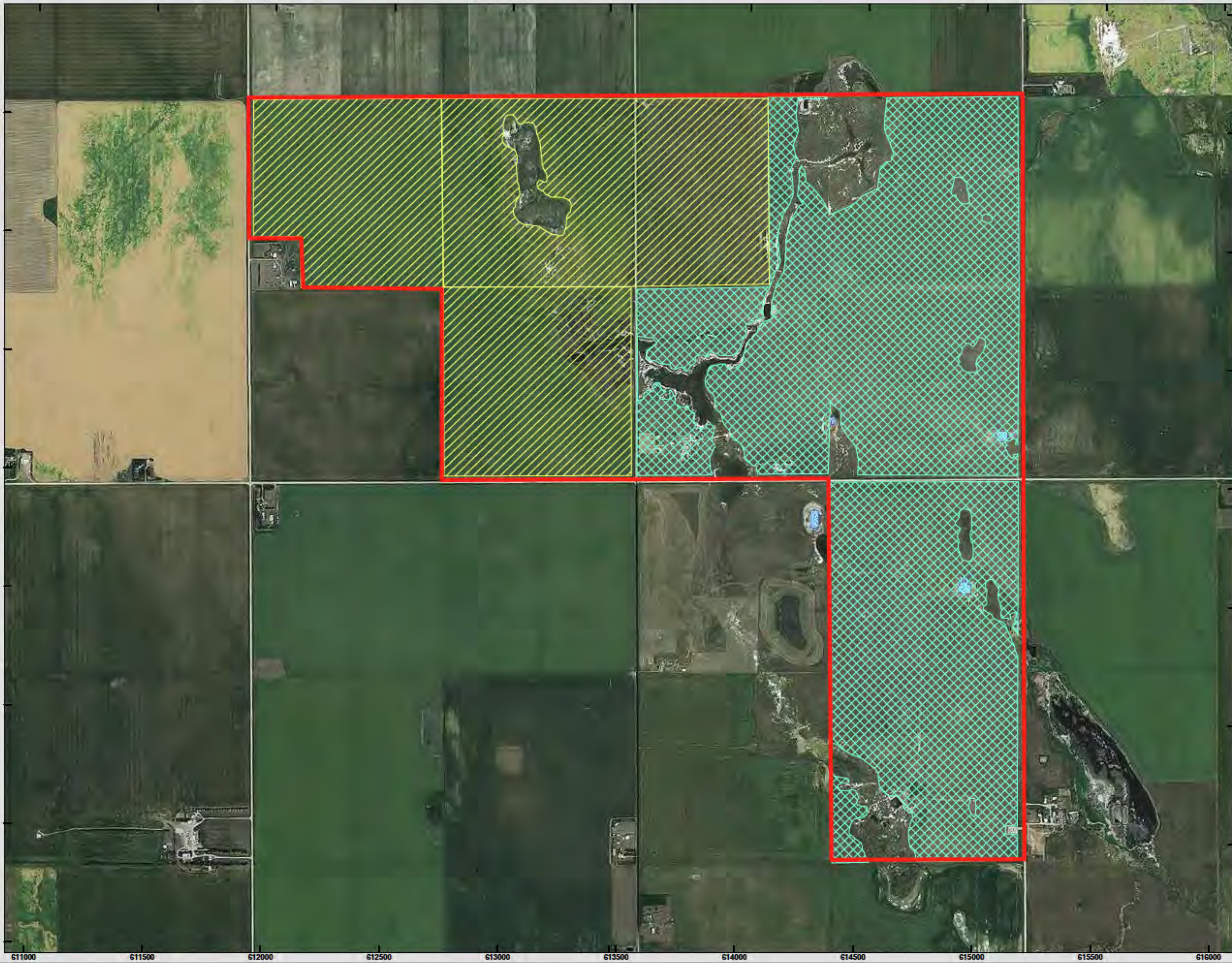
1:20,000 Scale when printed @ 11" x 17"
Drawn By: EP
Date: 2018-04-17
McCallum Environmental Ltd.
Document Name 170920_Claresholm_ESA

Prepared For:

Claresholm Solar Inc.

Figure 12: Land Use

Claresholm Solar Project
Claresolm, Alberta



Claresholm Project Area
Cultivated
Pasture/Hay

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

0 200 400 800 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP

Date: 2018-04-17

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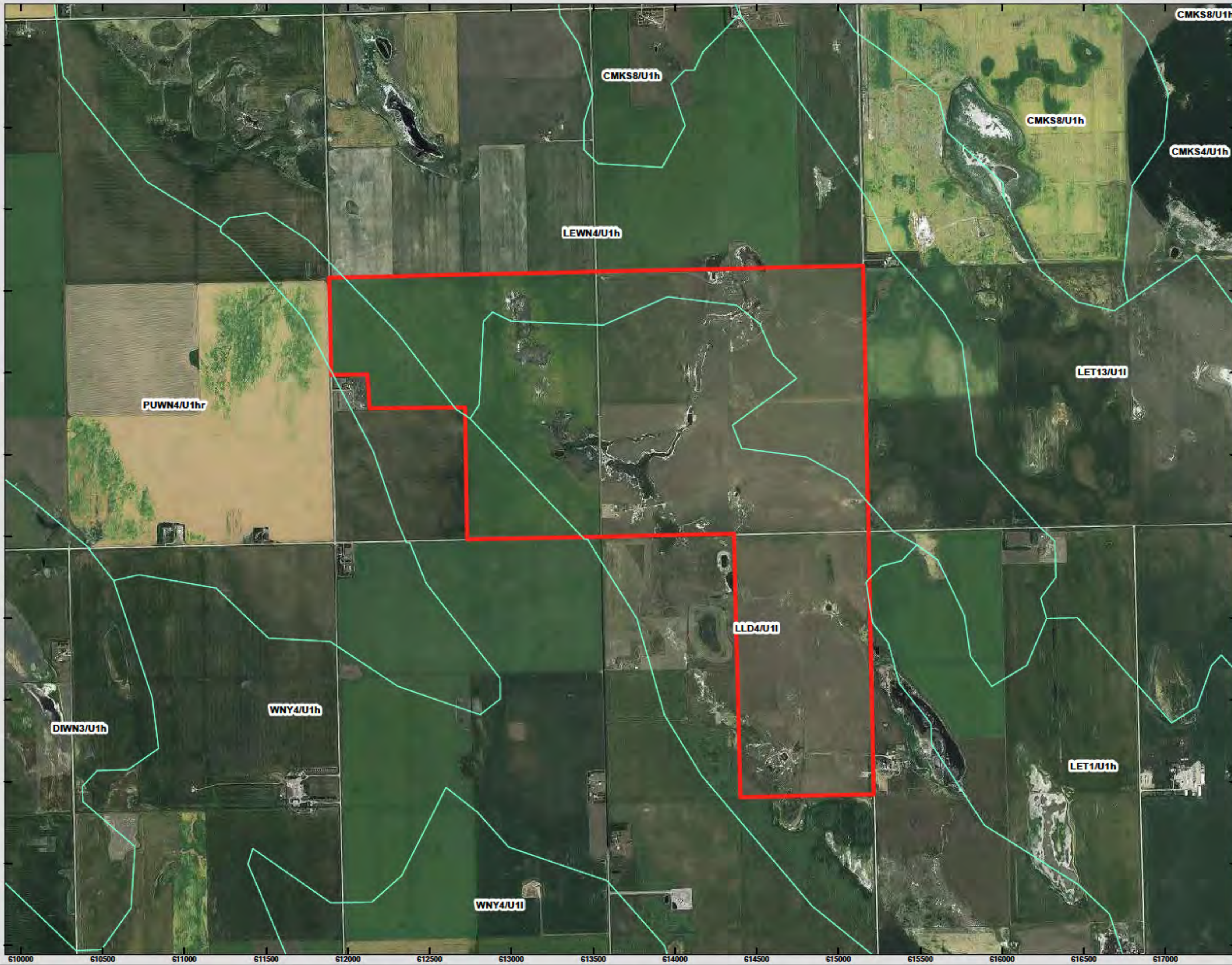
Document Name 180416 Claresholm Landuse



Prepared For:

Claresholm Solar Inc.

Figure 13: AGRISID Soils

Claresholm Solar Project
Claresolm, Alberta

SoilLandscapePolygons
Claresholm Project Area

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

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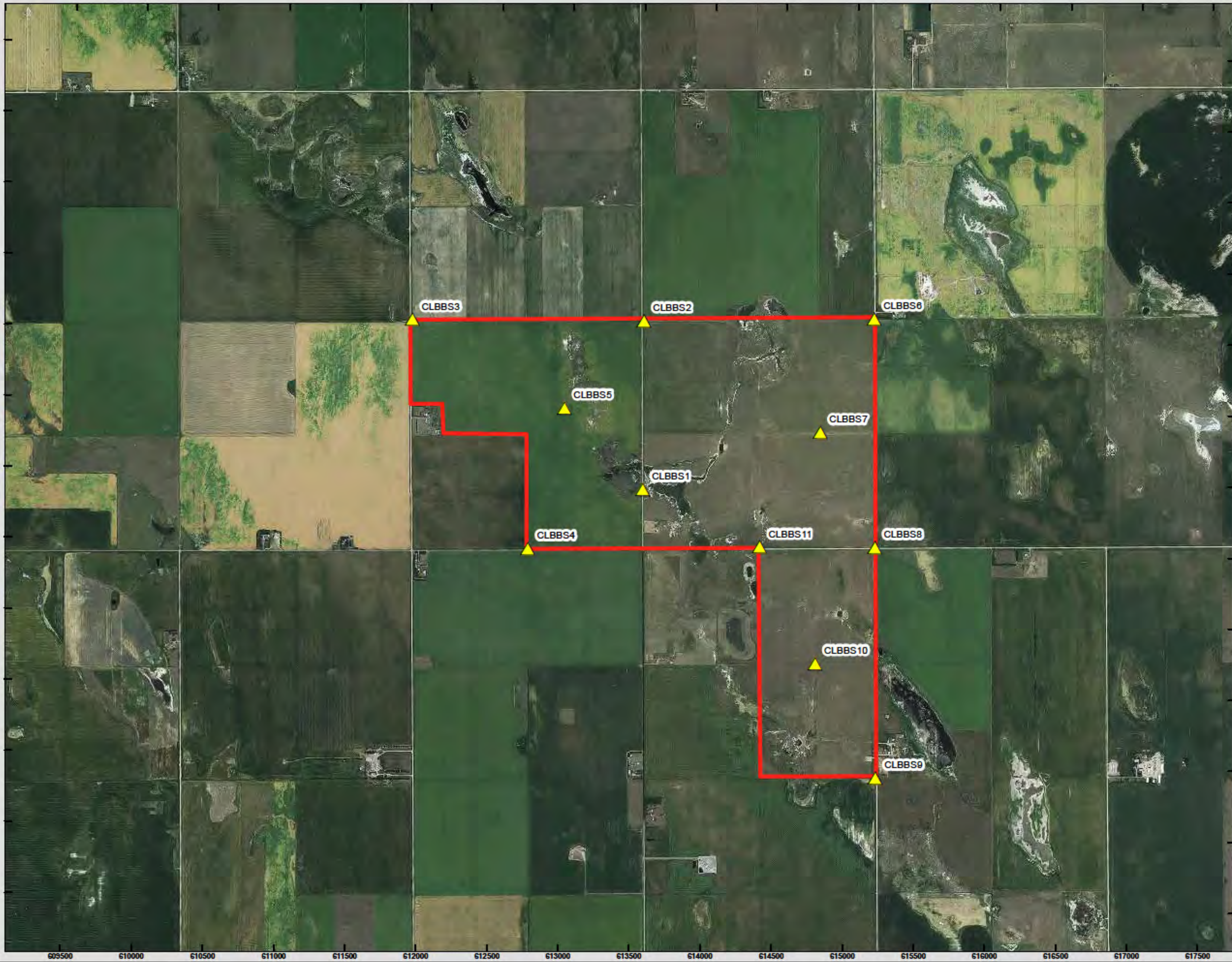

Prepared For:

Claresholm Solar Inc.

Figure 14: Breeding Bird Survey Locations

Claresholm Solar Project
Claresolm, Alberta

Breeding Bird Survey Locations
Claresholm Project Area

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

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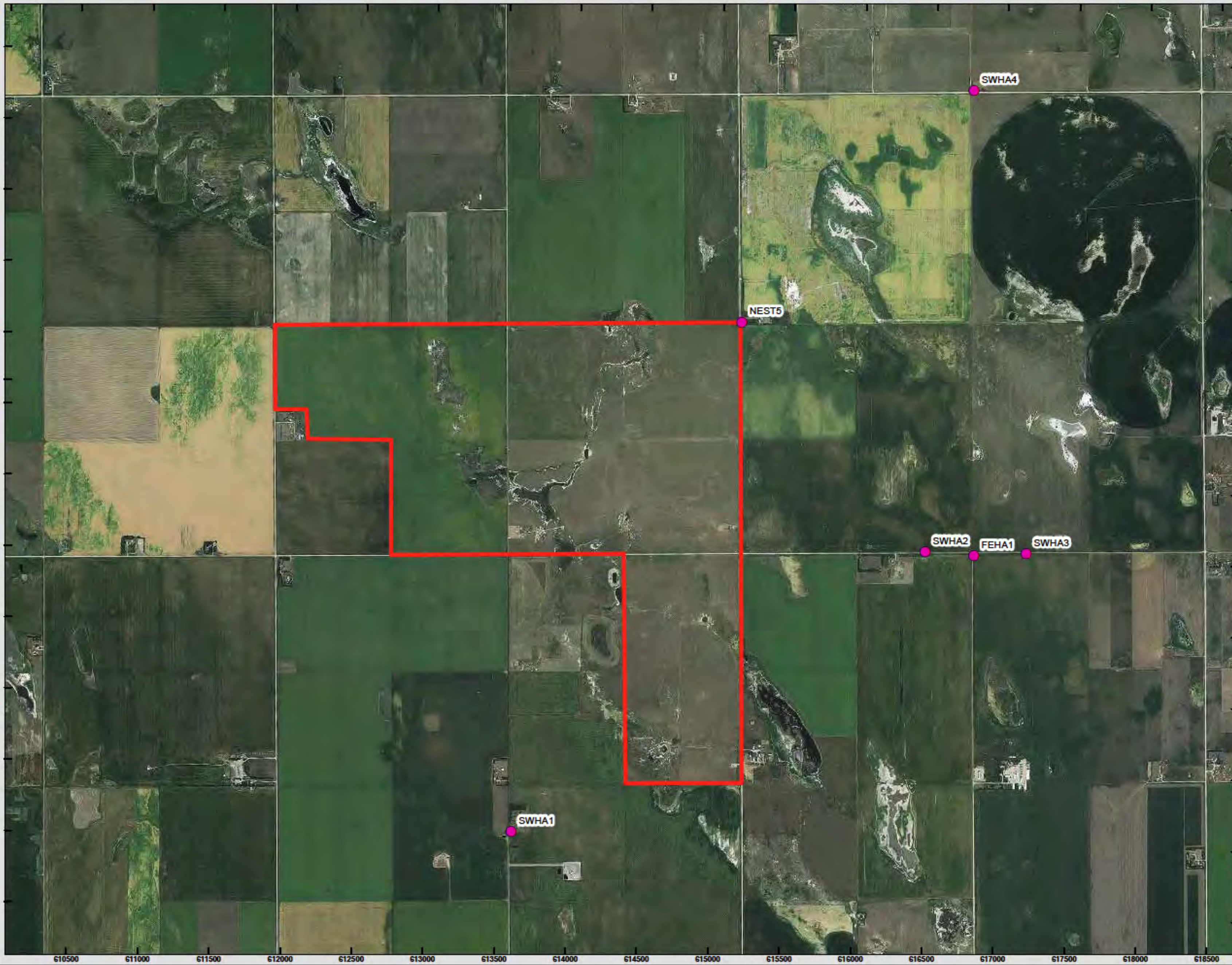
1:25,000 Scale when printed @ 11" x 17"

Drawn By: EP

Date: 2018-04-17

McCallum Environmental Ltd.



Prepared For:

Claresholm Solar Inc.

Figure 15: Nests

Claresholm Solar Project
Claresolm, Alberta

Claresholm Wildlife Concerns
Claresholm Project Area

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

0 250 500 1,000 m

1:25,000 Scale when printed @ 11" x 17"

Drawn By: EP

Date: 2018-04-17

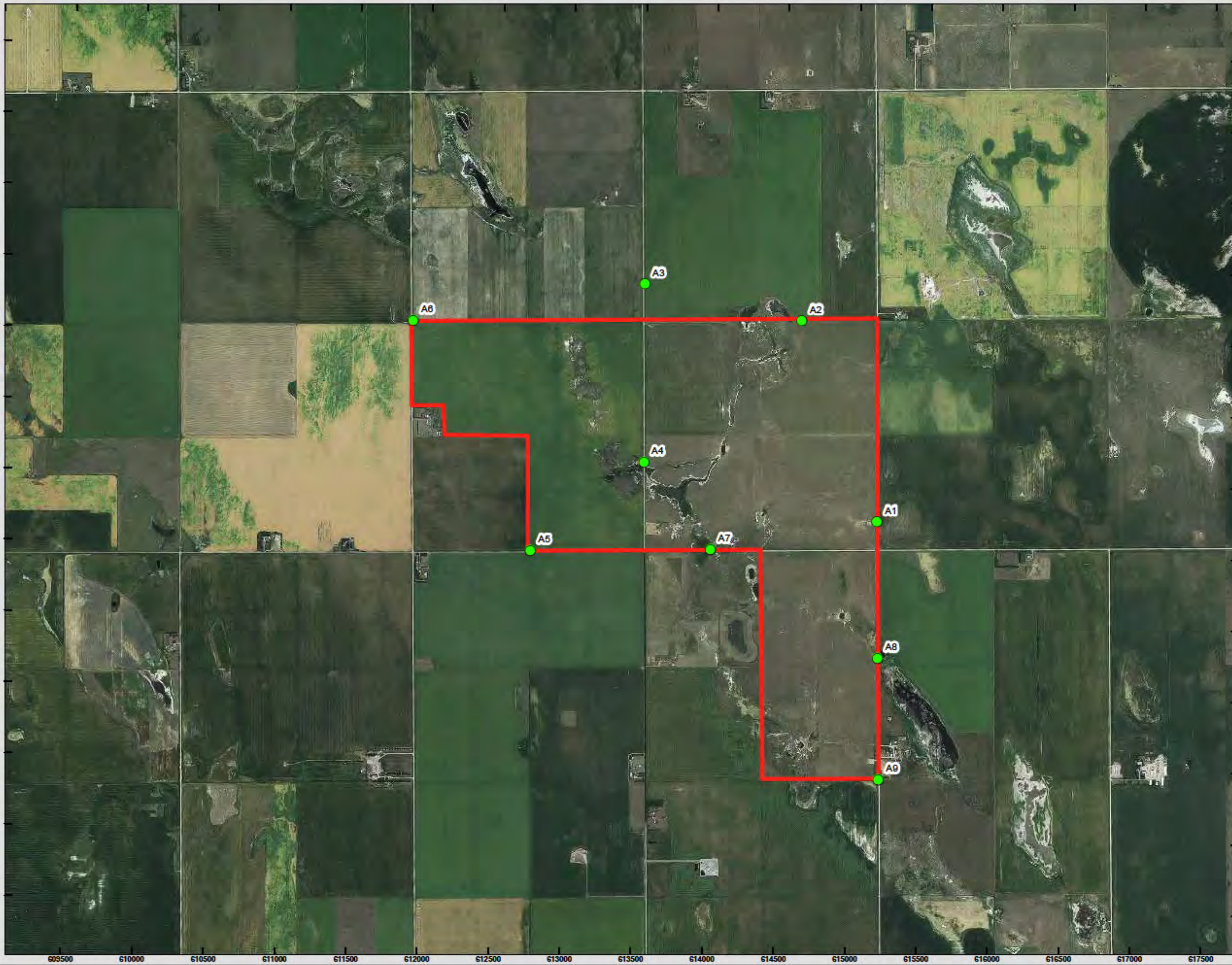
McCallum Environmental Ltd.

Prepared For:

Claresholm Solar Inc.

Figure 16: Amphibian Survey Locations

Claresholm Solar Project
Claresolm, Alberta



Claresholm Amphibian Points
Claresholm Project Area

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

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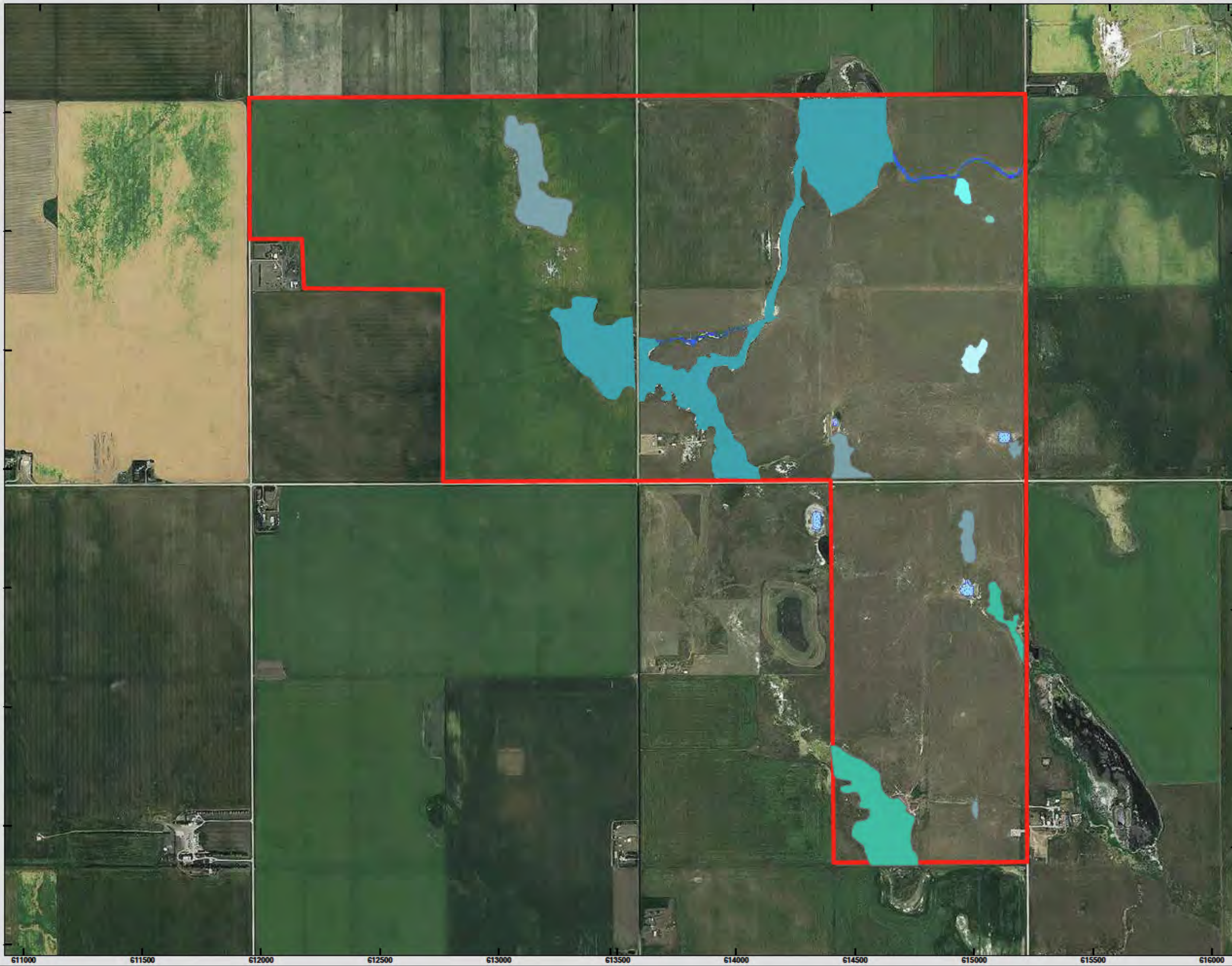
Drawn By: EP

Date: 2018-04-17

McCallum Environmental Ltd.



Prepared For:

Claresholm Solar Inc.

Figure 17: Wetlands and Watercourses

Claresholm Solar Project
Claresolm, Alberta

- Class I
- Class I or II
- Class I surrounding Class II
- Class II
- Class II/III
- Class III
- Claresholm Project Area
- Dugouts
- Watercourses

Coordinate System NAD 1983 10TM AEP Forest
Projection Transverse Mercator
Datum North American 1983
Units Meter

0 200 400 800 m

1:15,000 Scale when printed @ 11" x 17"

Drawn By: EP

Date: 2018-04-17

McCallum Environmental Ltd.

Document Name 170921_Claresholm_Wetlands

Appendix II - Environmental Protection Plan

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CLARESHOLM SOLAR PROJECT
(‘CSP’)

ENVIRONMENTAL PROTECTION PLAN
(EPP)

Operated by:

CLARESHOLM SOLAR INC.
(‘CSI’)

2018

1 INTRODUCTION

The purpose of this Environmental Protection Plan ('EPP') is to provide regulatory bodies and landowner(s) and/or occupants with a commitment to reduce, mitigate, and where possible eliminate the environmental impacts of operations on the natural systems encountered. The EPP will serve as a field guide to ensure successful conservation and reclamation of valued ecosystem components in the area and ensure regulatory compliance during construction, operations, and reclamation at the Claresholm Solar Project ('CSP'; also, referred herein to as the "Project").

The operating procedures contained in this document are intended as a guide in conducting operations with consideration for environmental protection. The procedures are partially based on regulatory requirements but are not intended to be used in substitution to regulations, nor are they intended to be an exhaustive review or interpretation of applicable legislation. When used in conjunction with other manuals, such as those which may be provided by EPC contractors or specific emergency response plans, the procedures contained herein are a valuable tool in guiding operations.

Environmental legislation is designed to protect the environment. All employees and contractors at the CSP work sites must comply with applicable regulatory requirements. These requirements include acts, regulations, policies, practices and procedures that are administered by governments and their agencies.

In general, the proposed development will not significantly alter the existing grades. The panels will be aligned in table rows between 8 to 12 m apart, and will be mounted on racking structures. It is expected that the use of a racking system with helical ground screws will have little effect on the imperviousness of the Project location, both above and below ground, as the area of the ground screws compared to the area of the Project location is small. Re-vegetated ground cover will be located in and around the base of the solar panel racking.

The lands proposed for development include the solar panels, gravel access roads, substation and fenced area. Although the solar panels themselves are impervious, rain water will land on the solar collector panels and runoff directly onto the ground below the individual panels. Minimal erosion is anticipated beneath each solar panel, once the ground cover vegetation is re-established after construction. The overall effects of the runoff generated from the solar panels will be minimal, as the majority of the anticipated ground cover during the operations phase (i.e., a low-growing native grassland species) will improve hydrologic conditions relative to existing conditions (i.e. longer duration flow paths and reduced runoff potential).

The facility will include panel areas, access roads, collector lines, a perimeter fence, inverters, step-up power tranformers substation containing main power transformers, electrical gear and electrical control transformer, and an O&M building and an operations building. Foundations for infrastructure are anticipated to be helical ground screws and concrete pads. Permanent gravel access roadways will be constructed using a suitable depth of granular material. Once completed, any foundation excavations will be backfilled and leveled to match the proposed grading. The entire Project, with the exception of new access roads is anticipated to be covered with low growing perennial vegetation.

2 General Operational Guidelines

CSP is committed to operating in the following manner:

- Ensure approvals are in place prior to beginning operations;
- Follow approval conditions;
- Conduct reporting as required by approval conditions;
- Practice good housekeeping;
- Understand the emergency response plans in place;
- Conduct inspections as required;
- Clean up drips, leaks and spills;
- Maintain equipment;
- Report incidents;
- Participate in inspections whether internal, external or regulatory;
- Report spills;
- Be a good neighbour;
- Keep abreast of changing regulations;
- Manage waste appropriately;
- Maintain vegetative cover and control weeds;
- Foster continued agricultural production from the project lands;
- Prevent erosion;
- Control surface water releases;
- Communicate and share knowledge; and,
- Maintain records.

3 ACCOUNTABILITY

The Construction Foreman will be accountable for ensuring environmental compliance during the construction of the Project. All incidents that qualify as being in non-compliance of applicable laws, commitments made by CSP and/or specific approval conditions by regulators, shall be reported to the Foreman and Environmental Monitors. The Foreman and Environmental Monitors shall take necessary steps to rectify the situation through appropriate notification of regulators, implementation of suitable mitigation measures and record keeping of the circumstances that resulted in the non-compliance, any remedial measures taken and any recommendations for future monitoring.

The Foreman and Environmental Monitors will monitor construction activities and, if applicable, will implement suitable measures to prevent non-compliance with laws, commitments and/or specific approval conditions by regulators.

4 CONSTRUCTION/OPERATIONS MANAGEMENT

To ensure that procedures are followed to reduce environmental impacts, reduce liability and promote compliance with applicable regulatory requirements, the following may be implemented:

4.1 Material Handling & Storage

The following material handling and storage procedures or other measures as authorized by the Construction Manager should be followed:

1. Potentially hazardous materials will be stored and handled at dedicated areas in accordance with all regulatory requirements;
2. All fuel storage and equipment-servicing areas will be located a minimum of 100 m away from any wetland/ waterbody;
3. All handling and storage of materials will conform to safety guidelines and regulatory requirements;
4. All hazardous materials will be labeled in accordance with applicable regulatory requirements;
5. Hazardous materials will be stored in appropriate containment in accordance with applicable regulations;
6. Inspect storage areas regularly; and,
7. Hazardous materials will be transported in accordance with the *Dangerous Goods Handling and Transportation Act.*

4.2 Spill Response

CSP recognizes its responsibility for its operations and the effects that these operations have on employees, landowners, the public and the environment. Although facilities and operating procedures are designed to prevent upsets that could result in a spill, spills may occur.

Effective spill response is dependent on the amount of planning that is undertaken before a spill occurs. Sound planning will help reduce the number of spills, improve the success of response activities, reduce environmental impact, decrease conflict with regulatory agencies, the public, and lower spill response costs. Spill planning is a continuous process that requires commitment, cooperation and input. Components of planning include:

- Company policy;
- Spill prevention and Best Management Practices (BMPs);
- Contingency plans (or specific ERPs);
- Equipment readiness (know local contractors); and,
- Training.

CSP's policy regarding spill planning and control operations involves:

- Authority to initiate emergency actions;
- Reporting structures for notification and approvals;
- Authority for expenditures related to spill activities;
- Authority to activate additional resources as needed;
- Authority to respond to public and media inquiries; and
- Authority to respond to unidentified spills.

If a spill occurs, a single authority will immediately assume overall responsibility for coordination of response actions. For small spills one individual can oversee the entire operation, especially if that individual can obtain advice and support from internal resources, spill specialists, regulatory staff and others.

4.2.1 Basic Procedure

1. Assess for safety hazards.
2. Eliminate the spill source and contain if possible.
3. Notify the appropriate CSP personnel. CSP will contact the Environmental Coordinator. Regulatory Agencies will be notified if required.
4. Recover any spill material.
5. Initiate waste management procedure if necessary.
6. File an incident report as per regulatory requirements.
7. Identify remediation options and requirements and implement as approved.
8. Waste materials that are generated from a spill will be minimized and managed so that there are no concerns with disposal.

4.2.2 Spill Containment

The successful containment of a spill on land or water depends upon ground cover and topography, hydrogeology, solubility of the material, viscosity of the liquid, water currents, flow rates, soil permeability and climatic conditions. A timely response to any spill will help maintain the integrity of the land and water while reducing the costs associated with the cleanup and restoration.

The following general guidelines are necessary for containment of most materials:

- Overfill shut-off systems on production/storage tanks will be in good working order;
- An impervious tarp shall be in place during equipment servicing activities with the potential for accidental spills (e.g., oil changes, servicing of hydraulic systems, etc.).
- Spent oils, lubricants and filters, etc., shall be collected and disposed of at an approved location.
- Spill kits will be provided, per regulatory requirements, with each piece of equipment.
- Where immobile equipment is required to operate within 100 meters of a water body:
    - containers, nozzles and hoses will be inspected to ensure they are free of leaks;
    - fuel nozzles are to be equipped with automatic shut-off;
    - No fuel, oil or hazardous material storage will be allowed within 100 meters of any water body or intermittent creek;

  - No equipment or machinery is to be washed within 100 meters of any water body or intermittent creek;

- The contractor shall ensure that during operations, no fuel, lubricating fluids, hydraulic fluids, methanol, antifreeze, herbicides, biocides, or other chemicals are dumped on the ground.

Sources of contaminants at solar projects are few and generally limited to:

1. Transformers: Routine maintenance helps avoid transformer leakage. A transformer leak can cause land contamination and other safety risks. Knowing if a leak is present and planning for maintenance to repair or replace it can be key in keeping energy generation at a maximum. There are several ways to carry out preventive maintenance in transformers; however, monitoring transformer oil temperature, pressure and level to prevent a transformer from leaking are part of the routine maintenance schedule. To prevent fatal errors, a parameter range is set and automatic alarms can be issued to check on site before problems develop

2. Solar panel leakage: There is little written on this subject and the reason appears to be that because solar pv panels are solid state, there is limited risk from such an event. The following summary of potential affects is provided from a 2012 report issued by Environment Canada, titled "*Assessment of the Environmental Performance of Solar Photovoltaic Technologies. A report funded under the Clean Energy Fund (*Environment Canada, in partnership with Natural Resources Canada's CanmetENERGY; Cat. No.: En84-88/2012E-PDF ISBN 978-1-100-21269-2, page 45).

   There are no emissions associated with the operational or use phase of PV modules. The modules are enclosed and sealed within two glass modules, and therefore there are no expected emissions while the modules are in use.

   The cadmium found in a CdTe PV module poses no threat during the normal use of the PV module since cadmium is present as CdTe and CdS, which are chemically stable compounds. The vapour pressure and water solubility of CdTe is essentially zero and therefore there is essentially no potential for human exposure to CdTe during the normal use and lifetime of a CdTe solar module.

   There is a possibility that a CdTe PV module could break during operation and maintenance, exposing CdTe to the environment. In the case of such a limited release, CdTe would be dispersed in ambient air at concentrations well below acute exposure guidelines and subsequently diluted. This scenario is unlikely because of the laminate bonding with the semiconductor material. In addition to limited atmospheric releases, potential exposure to Cd from rainwater leaching of broken modules is highly unlikely to pose a potential health risk. Studies have shown that limited cadmium releases (0.04% under American Society for Testing and Materials/Underwriters Laboratories protocols) could occur during fire.

3. Oil spills associated with maintenance vehicles: Routine maintenance and travel associated with normal vehicle operation can result in incidental surface soil contamination from leaking service vehicles. Unless a vehicle has a catastrophic failure resulting in release of motor oil or hydraulic fluid, incidental spills associated with normal equipment operations are not expected to be significant. In the event of catastrophic failure, spill response as outlined in Section 4.2.1 would be initiated.

4.3 Waste Management

All domestic and construction waste will be disposed of at an approved landfill. All hazardous waste will be disposed of to an approved hazardous waste disposal facility.

5 SOILS HANDLING

All soil stripping and leveling using a two-lift soil stripping method:

1. Ensure all erosion control measures are in place prior to moving any soils.
2. The first lift will remove the A-horizon to the color change (B-horizon);
3. The second lift will remove the B-horizon. Both A and B-horizons will be stockpiled on the edges of the lease with a 1m separation between horizons. Care will be taken to avoid mixing while handling and stockpiling soils. The soils will be preserved and used for production and final reclamation. The remaining C-horizon will be used as cut and fill to level each lease to accommodate the necessary equipment.
4. All stripped soils will be stored separately.
5. Erosion control for wind and water erosion will be implemented as required.

5.1 Time of Construction

Construction procedures which involve surface disturbance such as stripping, grading or travelling on un-stripped sod will be conducted under suitably dry and/or frozen ground conditions as much as possible. This allows installation to take place unimpeded by most adverse weather.

Additionally, the completion of all stripping, grading and specific soil mitigation will occur at one time if possible and will be followed by restoration and reseeding.

5.2 General Soils Management

Activity / Concern	Mitigation
Wet/Thawed Conditions	1. Comply with municipal and provincial road bans. 2. Minimize use of heavy machinery in the event of wet or thawed soil conditions to reduce terrain disturbance and soil structure damage. 3. Initiate contingency measures once one of the following indicators occurs: • Excessive rutting; wheel slip, build-up of mud on tires and cleats, formation of puddles, and/or tracking of mud down the road as vehicles leave the site. 4. Employ the following contingency measures progressively or individually as warranted if the above indicators occur: • limit equipment traffic to the late afternoon or early morning when ground conditions are frozen or delay construction until soils dry out or freeze; • prevent rubber-tired traffic from driving on the right-of-way;

Activity / Concern	Mitigation
	• salvage excess snow from the right-of-way and spread, as well as pack, the snow on the travel lane to avoid premature thawing of the upper soils; • restrict construction vehicle traffic to equipment with low-ground-pressure tires or wide pad tracks.
Sod Conservation	Retain well developed sod during dormant conditions (*i.e.*, late summer/fall) if a competent sod layer exists. Grade only where environmental considerations dictate to reduce disturbance to the sod.
Topsoil Handling Contingency Measures	Implement the Soil Handling Contingency Measures during topsoil salvage if any of the following are encountered: little or no topsoil; uneven boundary between topsoil and subsoil; poor colour separation between topsoil and subsoils; stony soils; wetlands; high winds; or requests for alternate topsoil handling methods by a landowner and/or occupant.
Topsoil Salvage Schedule	• For construction scheduled to occur during frozen conditions, attempt to pre-strip topsoil prior to freeze-up, if feasible. Attempt to have all topsoil salvage completed prior to October 31. • Postpone topsoil salvage until after spring break-up when ground conditions are not excessively wet for construction scheduled to occur during non-frozen conditions.
Topsoil Salvage-Non-Frozen Conditions	Full Topsoil Stripping Scenario • Salvage topsoil on all lands from the travel lane and all areas that will be subject to grading; • Restrict the extent of topsoil salvage wherever possible; • Store excavated subsoil on unstripped topsoil (*i.e.*, the sod layer) adjacent to the excavation. Ensure sufficient space (approximately 0.5 m) is left between the edge of the storage pile and the excavation to ensure material does not slough back into the excavation. • If topsoil is being degraded, consider installing matting (or equivalent) to protect topsoil degradation.
Topsoil Salvage - Frozen Conditions	• Reduce the area of land subject to topsoil salvage during frozen conditions to areas that will be subject to grading. • Limit topsoil stripping activities to specialized equipment capable of accurately separating variable depths of topsoil from subsoil (*e.g.*, frozen topsoil cutter, if available). If a frozen topsoil cutter/mulcher is not available, rip frozen topsoil to the same depth as the salvage requirements. • Do not salvage topsoil from the travel lane during frozen conditions unless the right-of-way will be graded. Implement the Wet/Thawed Soils Contingency Plan if thawed conditions are encountered during winter construction.
Stripping Depth	• Salvage all available soils to color change.
Wind Erosion of Topsoil Windrow	• Drought erosion-prone soils require wind erosion protection. Tackify or apply water or pack the topsoil windrow with approved equipment.

Activity / Concern	Mitigation
	Application of a tackifier following topsoil removal is more cost effective than repeated watering of topsoil windrows and piles. • If blade width or double blade width stripping has been implemented, other options include: flattening the windrows to reduce the erosion-prone surface and reducing the time between stripping and replacement.
Grading	• Salvage topsoil from areas to be graded and store in a location that will not allow for mixing of topsoil with excavated subsoil and graded material. • The area stripped is to correspond to the area to be graded. • Conduct grading adjacent to wetlands away from the wetland to reduce the risk of sediment and other material entering the wetland.
Spoil Storage	• During non-frozen conditions on cultivated lands, place excavated spoil material on the stripped area adjacent to the excavation. Ensure enough workspace is available to allow for a sufficient distance to be left in place between the spoil and the excavation to reduce the risk of spoil material sloughing into the excavation. • During non-frozen conditions on cultivated lands used for hay production (where a vegetation layer is relatively constant), place excavated spoil material directly on the unstripped topsoil (*i.e.*, the sod layer) adjacent to the excavation. Ensure enough workspace is available to allow for a sufficient distance (approximately 0.5 m) to be left in place between the spoil and excavation to reduce the risk of spoil material sloughing into the excavation. • During frozen conditions, place excavated spoil material on a buffer of snow, if available. Otherwise place excavated material on the unstripped topsoil adjacent to the excavation. Ensure enough workspace is available to allow for a sufficient distance to be left in place between the spoil and the excavation to reduce the risk of spoil material sloughing into the excavation.
Dewatering	• Pump water onto stable and well-vegetated areas, tarpaulins or sheeting in a manner that does not cause erosion or any unfiltered or silted water to directly re-enter a watercourse. Place pumps on polyethylene sheeting above the high-water mark of the watercourse or wetland. • Ensure all erosion control measures are in place to direct run off and reduce the potential for erosion.
Backfilling	• Ensure sources of imported backfill have been approved by landowners/occupants and/or applicable authorities prior to the removal of material from the site and hauling. • To the extent feasible, attempt to schedule delivery of imported fill so it can be installed directly into the excavation upon arrival at the tower assembly site rather than being temporarily stored prior to being backfilled. • Avoid mixing snow into backfill material.

Activity / Concern	Mitigation
	• Feather out excess spoil material across the area that has been stripped of topsoil. Avoid mixing topsoil and feathered subsoil material. Blend feathered material into the natural grade of the area to not change local surface drainage patterns.
Excess Spoil	Dispose of excess spoil material at locations approved by the landowner and/or occupant and/or applicable government agency.

6 WEED MANAGEMENT

CSP recognizes that each operational region is unique and that weed management that is effective in one area, may not be effective in another. However, CSP's policy to control vegetation on private lands will be based upon the species identified, and discussions with landowners.

CSP will take the following approach to vegetation management:

1. Identification
2. Prevention
3. Chain of Custody
4. Procedures for Vegetation Control
5. Monitoring

6.1 Identification

Species identified during site assessments will be compared with those listed in the *Weed Act*.

6.2 Prevention

Prevention is paramount to an effective weed management program.

CSP will attempt to minimize the potential for weed introduction/invasion by seeding all disturbed areas with landowner approved seed mixes unless the landowner/occupant chooses to do so independently.

6.3 Operational Considerations

- Avoid driving vehicles across weeded areas. Fence off areas of weeds if necessary;
- Ensure imported materials (gravel, clay) are free of vegetative matter and soil. Avoid importing straw because it is very difficult to assess for weeds;
- Ensure equipment used during treatment programs is clean and free of any weed debris before entering the area that has been treated.

6.4 Chain of Custody

Successful implementation of the weed management program is dependent on awareness and participation by all parties active in the pasture and immediate surrounding area. It requires commitment from management, planning, communication, training, reporting and follow-up.

CSP's Vegetation Management Policy guidelines will include:

- If landowners manage or implement a vegetation control program on surrounding lands, during the planning process CSP will solicit their participation in a cooperative weed management program; and,
- Only licensed applicators or landowners may enter upon and treat vegetation on a CSP site.

6.5 Procedures for Vegetation Control

CSP will use information collected in prior seasons to evaluate the infestation of noxious and invasive species over time and prepare a weed treatment plan for operations in the upcoming year.

As no one method of vegetation control may be effective, the following procedures will be implemented in a synergistic manner for all CSI operations on Project lands:

- The most effective method of weed control is to prevent their establishment.
- Integrated weed management may combine chemical, mechanical and natural controls with each measure implemented as needed. Treatments should not be employed on a scheduled basis but used in response to a situation identified during past monitoring;
- Preventative control must be incorporated for all operations.

6.5.1 Sheep

Sheep will be allowed to graze the lands during operations. Sheep are considered to be an excellent means for control of herbaceous weeds (Frost & Launchbaugh, 2003). Weedy forbs are generally the most problematic weeds in grasslands, and sheep are specially adapted to forage on this particular plant type; therefore, sheep are the ideal candidate for control of weeds in perennial grasslands (Frost & Launchbaugh, 2003). Should weeds become problematic, adaptive management of sheep grazing can be used to target specific problem weeds; this can be accomplished through modifying stocking density and/or seasonality of grazing based on the particular features of the weedy species (Frost & Launchbaugh, 2003).

6.5.2 Chemical Controls

If required permits will be obtained from regulatory bodies for the application of herbicides on the Project lands. All applicable regulations and requirements will be adhered to.

6.5.3 Monitoring

- Monitoring of locations is required to alleviate problems as they occur or until weeds are controlled and vegetation established as appropriate;

- Information regarding the vegetation control program shall be documented for each site treated.

7 SEDIMENT & EROSION CONTROL

Guidelines, measures and best management practices for erosion and sediment control include, but are not limited to:

- Stabilize all disturbed areas, by:
    - immediately installing temporary erosion control measures;
    - allow measures to remain in place until vegetation or other long-term erosion control methods are fully established and functioning; and,
- Place any excavated material in a location where erosion into the water body will be minimized;
- Runoff or water from a work site or area disturbed by construction that contains sediment, may be diverted to a settling pond, sediment trap or through a vegetated area to minimize the addition of sediment to a water body;
- Construction may be halted when adverse conditions caused by heavy rains or other weather exist;
- CSP will install temporary erosion controls prior to any disturbance in an erosion prone area. Erosion controls must be properly maintained and reinstalled as necessary until replaced by permanent erosion controls or restoration is complete.

This is not limited to the duration of the Project, but to return to pre-disturbance conditions. The Construction Consultant/Environmental Monitor will consult with construction personnel on the appropriate measures to be taken. They may include:

7.1 Mulch application

- Mulch is intended to stabilize the soil surface. Mulch can consist of woodchips, straw, hay, erosion control fabric, or some functional equivalent;
- 2:1 slopes or steeper should be re-contoured with hand tools only (if possible) to at least a 3:1 ratio slope and a Straw/Coconut Blanket or High Velocity Wood Blanket be installed. Some slopes resulting from propagated blowouts from this Project may not be re-contoured due to location or preventing further disturbance to vegetated layer;
- 3:1 slopes or steeper - Wood or Straw Blanket with net on both sides;
- 4:1 slopes or flatter - Wood or Straw Mulch blanket with net on one side flat areas Straw Mulch with anchoring;
- Apply mulch in accordance with the specifications outlined in this section except, if mulching before seeding.

Mulch before seeding if:

- Final cleanup and installation of permanent erosion control measures, is not completed or activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions;
- Ensure that mulch is anchored to minimize loss by wind and water;
- When anchoring with liquid mulch binders, use rates recommended by the manufacturer.
- Do not use liquid mulch binders within 25m of wetlands or waterbodies;
- Install erosion control fabric, such as bonded fibre blankets, at a minimum, on waterbody banks at the time of final bank re-contouring. Anchor the erosion control fabric with staples or other appropriate devices;

7.2 Sediment Barriers Application

- Sediment barriers are intended to stop the flow of sediment. They may be constructed of materials such as silt fence or silt bags;
- Install temporary sediment barriers at the base of slopes adjacent to road crossings until disturbed vegetation has been re-established;
- Install temporary sediment barriers at appropriate locations to prevent siltation into waterbodies or wetlands crossed by or near the construction work area;
- Maintain all temporary sediment barriers in place until permanent re-vegetation measures are successful;
- Remove temporary sediment barriers from an area when that area has been successfully restored.

7.3 Seeding

For the land that was recently converted to row crops, seeding of perennial grass will be performed in the year prior to construction. The landowners hosting the project have extensive experience in establishing perennial forage plantings in the local area, including during years with moisture deficits. By utilizing a no-till forage seed drill, the soil surface will be left undisturbed and soil moisture retained. This system allows forage seed to be accurately metered and placed at the appropriate depth to promote seedling establishment. A diverse seed blend will be developed together with the seed supplier that matches soil and site conditions to the needs of the forage species. For the site in question, soil salinity will dictate a species mix with relatively high salt tolerance. A diverse blend improves overall field performance as varying habitat tolerances of different forage species allows for production across varying field site conditions. Blends that are being considered may include, but are not limited to: crested wheatgrass, intermediate wheatgrass, slender wheatgrass, and a combination of alfalfa and sainfoind varieties with different rooting characteristics and salt tolerances. Inclusion of alfalfa and sainfoind (both of which fix nitrogen in the soil) will enhance the productivity of the pasture through the life of the project.

Maintenance of the site in perennial grass is the best method to improve soil condition and reduce erosion. Unlike annual crop fields, which have relatively shallow root systems and no living plants for over half the year, grasslands maintain live plant tissues in the soil year-round and serve to anchor the soil in place. In addition, forages begin growing earlier in the year than annually seeded crops, and as a result this early top-growth on the plants helps shelter the soil from desiccation by sun and wind, reduces wind-speeds at soil level, and consequently is better suited to control erosion when compared to annual crops.

8 WATERCOURSE PROTECTION

No infilling of the watercourses are expected as part of the CSP. The watercourse in NE-6-13-25W4 is clearly seasonal and receives a great deal of surface impacts as a result of livestock grazing. As a result of the solar project, livestock grazing by cattle in the watercourse will be eliminated. There will be sheep grazing the lands during operations, but the expectation is that due to the smaller weight, impacts to the watercourse would be reduced. As such, the expectation is that the watercourse will trend back towards a more natural state.

As per the layout design, no crossing of the watercourse will occur (by roads). All standard watercourse mitigation strategies will be integrated into adjacent road design (see below) and thus effects resulting from CSP development should be expected to be limited in duration and scope.

Erosion control will be placed between construction areas and the watercourse during construction (and during operations as required), and may include silt fencing or other methods, to prevent the movement of surface material into the watercourse.

A stormwater management plan will be developed to adequately manage surface runoff associated with the project to ensure that existing drainage patterns within the project boundaries are not overwhelmed.

9 WETLAND PROTECTION

At the time of this application, no wetland disturbance that requires application under the *Water Act* will be occurring. Therefore, the CSP is not expected to have any measurable effects on wetlands.

For intermittent wetlands (Class I and II) setbacks will be set to the boundary of the wetland. Because no wetland disturbance will occur, even with the reduced setback, no change to form or function is expected to result from reduced setbacks. Because of the characteristics of these wetland types in the CSP area, they receive a great deal of surface impacts as a result of livestock grazing. As a result of the solar project, livestock grazing will change from cattle grazing to sheep grazing, which is expected to reduce soil disturbance within the wetlands. As such, the expectation is that the wetlands will trend back towards a more natural state.

Additionally, the Stormwater Management Plan may incorporate wetland areas to assist in management of stormwater flow.

For intermittent wetlands (Class I and II) during construction silt fencing will be placed around the boundary of the wetlands. This will ensure the boundaries are clearly visible during construction. Furthermore, silt fencing would reduce the potential for soils to be transported into the wetlands during construction. Silt fencing will remain in place until surrounding soils are stabilized and erosion is controlled.

For marsh wetlands (Class III, IV, V) setbacks of 100 m will be used. Wetlands are sensitive to disturbance and the setback distance will reduce the potential for soil erosion/sedimentation, protect nesting habitat for waterfowl, and protect breeding habitat for amphibians.

10 STORMWATER MANAGEMENT PLAN

Stormwater management will be achieved during the operational phase of the Project following an approach of source control and conveyance control. The engineered components of the Stormwater Management System are being designed and will be appended to this document when available. Proposed source control is provided by dense-growing vegetative surface cover, which will be determined during detailed design. Conveyance control is to be provided by enhanced grass swales with rock check dams. The vegetative cover in both source and conveyance will allow for removal of suspended solids during overland flow through the grassed areas.

The following are proposed stormwater management practices:

1. <u>Site Grading:</u> Re-grading of the site will be used to direct drainage from solar panel array blocks and internal access roads to on-site ditches, for direction of waterflow to existing wetlands or ditches,

2. <u>Grass-swales:</u> The use of grass-swales to reduce the runoff of Total Suspended Solids ('TSS') and other pollutants from site to surrounding areas. Grass-swales are vegetated drainages typically consisting of a sandy loam, sand, peat moss and compost (termed ESM layer) which assist in filtering out sediment from stormwater. The locations of swales are generally established along the access roads and the following preliminary design criteria and assumptions include:

    - Constant longitudinal slopes of 1%;
    - 3:1 side slopes;
    - Minimum bottom of 0.75 m
    - Freeboard of 0.30 m
    - Check dam heights of 0.30 m

    It is anticipated that the areas draining to each grass-swale will be small however geometry and hydraulics of the grass-swales will be confirmed and finalized in detailed design.

3. <u>Absorbent Landscaping:</u> The use of Absorbent Landscaping (consisting of an ESM layer) may be used as a riparian buffer on the wetlands within the Project site. This layer will mitigate the increased stormwater discharge that may result from the development of the CSP.

4. <u>Road-side ditches:</u> V-shaped, road-side ditches are proposed where applicable to receive runoff from access roads and surrounding areas.

Once the Project location has been restored and the ground cover re-established, it is anticipated that the total runoff from the Project location will decrease. With the reduction in peak flow to the outlets, it is not expected that lands downstream of the Project will suffer a loss from the change in flow. No impacts to flooding and erosion are expected for watercourses downstream of the Project. It is expected that peak flows from the Project location will be diverted around neighboring properties via the use of existing ditch systems and as yet designed stormwater conveyance controls, such as enhanced grass swales, in order to prevent alterations to existing drainage characteristics.

Stormwater quality control is proposed following a treatment train approach with source and conveyance measures. The proposed source control system is a dense-growing vegetative surface cover and transformer spill containment system. The vegetative cover will allow for removal of suspended solids during overland flow through the grassed areas. Conveyance control is to be provided by enhanced grass swales with rock check dams.

Pre-construction drainage patterns will be matched post-construction wherever possible to reduce potential changes in downstream flows.

11 DECOMMISSIONING PLAN

The Project would have an estimated operational lifespan of 35 years or more. Proper maintenance, components replacement and repowering will extend the Project lifespan. However, for planning and commitment purposes, if the Project is decommissioned, the following would represent the expected decommissioning requirements.

11.1 Excess Materials & Waste

Prior to decommissioning of the Project, the Proponent would complete a waste audit and prepare a waste reduction work plan in accordance with any applicable guidance or requirements, or relevant regulations in effect at time of decommissioning.

Major pieces of equipment will be recycled or reused wherever possible. Components such as the cabling would have a high resale value due to copper and aluminum content and recycling through sale of the material can be used to offset decommissioning costs. As much of the facility would consist of reusable or recyclable materials, there would be minimal residual waste for disposal resulting from decommissioning the Project. Small amounts of registerable waste materials would be managed in accordance with applicable legislation. Residual non-hazardous wastes would be disposed of at a licensed landfill in operation at the time of decommissioning.

Typical components and methods of disposal are expected as follows:

Project Component	Method of Disposal
Solar Panels	Refurbish, reuse and/or recycle
Steel and aluminum support racks	Refurbish, reuse and/or recycle as scrap
Collector lines	Recycle
Inverters, transformers, circuit breakers	Refurbish, reuse and/or recycle as scrap
Concrete (foundations)	Crush and recycle
Hazardous materials	Dispose as per applicable regulations in place
Non-hazardous materials (i.e. wood waste; geotextiles)	Recycle or Dispose in approved landfill facility

11.2 Environmental Protection

The requirements for environmental protection outlined in this document would be maintained and followed during decommissioning activities. Most, if not all, activities during decommissioning would be comparable to the construction phase.

All decommissioning and reclamation activities will be completed as per the regulatory requirements in place at the time.

11.3 Pre-Dismantling Activities

At the end of the Project, the Project will be de-energized and isolated from external electrical lines and interconnection points.

Staging areas for equipment placement prior to final removal from the Project lands will be determined and constructed as per this document or construction requirements in place at the time.

11.4 Equipment Dismantling and Removal

11.4.1 Solar Panels and Rack Supports

The exact make and model of the solar panels will be determined later, but are anticipated to be monocrystalline/polycrystalline silicon technology measure approximately 2 m long by 1 m wide.

Each solar panel will be mounted on a galvanized steel and/or aluminum rack system. Each panel will be disconnected from the electrical system and disconnected from the mounting rack. Following removal, the panels will be removed to the staging area, and loaded for transport to either and approved recycling and/or disposal facility.

All rack system surface components and subsurface components, including those related to foundations, will be removed to a minimum of 1 m depth below ground surface. This may involve either complete removal of support posts, or cutting posts/foundations to the 1m depth. 1 metre has been chosen as it a standard burial depth for oil and gas pipelines; telecommunications lines, etc., and once removed, allows for future land use without risk of striking infrastructure below this depth.

11.4.2 Panel Recycling

The preferred supplier of solar PV panels for the project is First Solar.

First Solar's recycling process begins with the modules being reduced in a twostep process. In a first step, a shredder breaks the module into pieces, while step two uses a hammer mill to crush the glass further into pieces of about 4 mm and 5 mm size- small enough to ensure the lamination bond is broken. In step two, the module fragments are then leached with an acidic oxidizing solution to solubilize the Cd and Te.

The remaining fragments of the encapsulation foil are physically separated from the glass by a vibrating screen, and the recovered for re-use in commercial uses. At the same time, the Cd and Te are precipitated into "filter cake", which is sent to a partner company where it is reprocessed into semiconductor-grade CdTe for use in new PV modules.

According to First Solar's recycling technology information, approximately 90% of the module weight is recovered most of it being glass that can be used in new glass products. The achieved recovery of the semiconductor material is over 90%[79,80]. The remaining 10% is treated as hazardous waste and is disposed in accordance with local laws.

According to First Solar's documentation, the recycling technology has evolved since 2006 and the company has several on-going projects to further improve the recycling technology aiming to develop a mobile recycling plant by 2027.

First Solar has operational recycling facilities in Perrysburg (OH, USA), Kulim (Malaysia) and Frankfurt-Oder (Germany) with a total annual recycling capacity of approximately 2 million modules.

11.4.3 Electrical Equipment and Collsdector Lines

Inverters, inverter step-up transformer skids, including the associated pilings or supports, will be removed from location, sent to the staging area and loaded for transport to an approved recycling and/or disposal facility.

Underground lines that are buried less than 1m below grade, and above ground collector lines will be removed.

All work to decommission the overhead / underground connection lines would be conducted within the boundaries of the Project to the Point of Common Coupling, after which point the infrastructure is owned by Altalink.

11.4.4 Access Roads

All access roads will be removed unless they are requested by the landowner to remain in place. The exception to removal of the access roads and associated culverts or their related material would be upon written request from the landowner to leave all or a portion of these facilities in place for future use by the landowner.

Road restoration includes removal of any geotextile material beneath the roads and granular material. All granular and geotextile materials would be removed from the site by dump truck. Topsoil will be redistributed to provide substantially similar ground cover as was present within the areas prior to site disturbance.

11.4.5 Storage Areas and Perimeter Fence

Storage areas will be restored unless they are requested by the landowner to remain in place. The exception to removal of the storage areas or their related material would be upon written request from the landowner to leave all or a portion of these facilities in place for future use by the landowner.

Storage area restoration includes removal of any geotextile material beneath the area and granular material. All granular and geotextile materials would be removed from the site by dump truck. Topsoil will be redistributed to provide substantially similar ground cover as was present within the areas prior to site disturbance.

Any foundations associated with these facilities would be removed to a depth of at least 1 m below original grade or to the depth originally installed if less than 1 m below original grade.

Perimeter fencing would be removed and recycled or re-used. Where the landowner prefers to retain the fencing, these portions of fence would be left in place.

12 RECLAMATION PLAN

The objective of the reclamation plan is to remove all garbage from site, control erosion as necessary, restore soil capability, and reclaim the disturbed areas to pre-disturbance characteristics.

Reclamation will take place once construction equipment has left the location or as soon as soil and weather conditions permit. The landowner will be notified prior to the initiation of the reclamation activities and again upon completion. Reclamation success is dependent upon landowner communication and favourable conditions in the root zone for optimum crop growth. The key soil factors that determine root zone quality include the water holding capacity, organic content, structure and consistency, salinity, nutrient balance and soil regime.

12.1 Interim Reclamation

CSP shall attempt to reclaim all disturbed land surfaces within two growing seasons. Interim reclamation will include:

- site debris clean-up;
- slope stabilizations;
- re-contouring with subsoil;
- spreading of topsoil;
- determination of suitable vegetation species (i.e. hay mixture) for revegetation between solar array rows and under solar panels and around other infrastructure locations; and,
- Development and implementation of a co-operative weed control plan with the landowner(s).
- Allowing sheep to graze the revegetated lands.

12.2 Final Project Reclamation

Reclamation of the CSP will be completed to typical reclamation practice at the time. As no reclamation standards for solar power are currently in place in Alberta, other provincial practices, guidelines, best industry practice, or regulations will be followed. The following would be considered a generic plan in line with current practice.

12.2.1 Typical Timing

Decommissioning	Activity	Typical Timeline	Off Site Land Use Requirements
Solar Site/ Access Roads	Removal of panels and infrastructure	May – August	• Use provincial, municipal or private roads for access to water or soils;
	Removal of transformers	May – August	
	Partial excavation and removal of concrete base	June – August	

Decommissioning	Activity	Typical Timeline	Off Site Land Use Requirements
	to approximate depth of 1.0 meters		• May require temporary work space for equipment storage prior to removal from Project lands; • Use of water from local sources for reclamation purposes; • Reclamation of borrow pits at pre-approved locations; • Use of landfill or recycling activities for equipment/waste disposal.
	Removal of gravel pads and gravel from access	July – August	
	Recontouring of pad and access roads	July – August	
	Reclamation of surface soils	August – September	
	Re-seeding	September - October	
Power Lines/ Transformer Station	Removal of above ground poles and lines	May – July	
	Below ground collector lines will remain in place if depth greater than 1 metre	N/A	
	Removal of transformer station and associated infrastructure	May – July	
	Removal of gravel pads	June – July	
	Removal of access roads	July – August	
	Recontouring of pad and access roads	August – September	
	Reclamation of surface soils	September - October	

12.3 Soils

1. Upon abandonment of the locations, all disturbed areas are to be re-contoured to pre-construction conditions. Loading of slopes with unconsolidated material will be avoided during slope re-contouring;
2. All grades and drainages will be restored by removing any culverts and fills;
3. Topsoil replacement should not be started until all subsoil levelling, decompaction and cleanup has been completed, to prevent mixing by levelling after topsoil replacement;
4. Surface diversion berms will be installed, as required. Run-off will be diverted to stable and vegetated off-right-of-way areas;
5. Remove all foreign materials including geotextile;
6. Fences and culverts are to be restored to meet or exceed pre-construction conditions;
7. Rocks/stones exposed on the surface due to construction activity will be removed prior to and after topsoil/surface material replacement. The concentration of surface and profile rocks will be equivalent to, or better than the surrounding fields. Rocks/stones will be disposed of at a site approved by the landowner;

8. Any areas with rutting or erosion gullies will be re-contoured and all strippings will be replaced evenly over all portions of disturbed areas. Replacement of soils during wet weather or high winds will be avoided. This will prevent damage to soil structure and reduce the potential for erosion of topsoil;
9. Once sub-soil has been adequately reclaimed, topsoil will be replaced. Replaced topsoil will be disced to alleviate compaction and break up aggregates then harrowed to create an adequate seed bed;
10. Complete re-contouring and stabilization of disturbed areas. Smooth water channelling ruts and outside berms. Ensure that all erosion control and water management measures (e.g. water bars, drainage dips, culverts and ditches) are functioning per design.
11. If grading or other earthwork is required to facilitate vehicle/equipment on areas, strip and salvage topsoil and organic material for replacement during clean-up procedures.
12. Where soils have been disturbed, implement appropriate reclamation procedures (i.e. seeding, erosion blankets, slash rollback, straw crimping, etc.) to promote stability of the site, soil preservation, and plant re-establishment. Ensure the natural drainage is restored.
13. Spread mulch, wood chips, straw/hay, or other organic material over areas where the soil is susceptible to erosion, pulverization, or compaction.

12.4 Vegetation – Cultivated

1. Seeding will be completed by landowners as part of normal farming operations.
2. Fertilizer may be needed in some cases but will not be applied unless approved by landowners.
3. If cattle may be frequently grazing through the area, reclaimed areas will require access restrictions (fencing) to ensure newly seeded/fertilized areas are not disturbed. Fencing may be electrical, temporary and/or permanent depending upon the requirements and grazing practices of landowners.
4. Locations should be monitored monthly during growing seasons. Typical monitoring should occur in June, July and August. Monitoring will consist of visually inspecting the areas to ensure vegetation has been established and is healthy, erosion has been mitigated, and landowner concerns have been addressed.

13 MORTALITY MONITORING

Post-construction wildlife monitoring and adaptive management will be incorporated into the Project. Commitments have been included as part of this submission to align with the expectations cited in the recently released *Wildlife Directive for Alberta Solar Energy Projects*, AEP, October 4, 2017. These include mortality surveys for 3 years and will include the standards as outlined in *Section 100.4 – Standards* of the above referenced document.

13.1 Post Construction Surveys

Surveys will:

1. Document wildlife mortalities within specific solar arrays
2. Determine carcass removal rates
3. Determine searcher efficiency
4. Monitor impact of the SSP on species at risk, sensitive species or other wildlife.

The seasonality and frequency of surveys will be as follows:

1. Seasonality: Between March 1st and November 15th
2. Frequency: Weekly during migratory periods (March 1st - May 15th and August 15th – November 15th) and once every 2 weeks during the summer

13.2 Annual Reporting

An annual report will be submitted to Alberta Environment and Parks (AEP) outlining the results of the mortality surveys. Information will include raw data, results of mortality trials, fatality rates for birds, and mortalities found during the year being studied. Based on study findings, should it be deemed necessary by AEP, operational mitigation methods to reduce the risk of fatalities will be discussed.

The post-construction annual report will include the following:

1. a detailed description of the survey methods;
2. the raw data, using the appropriate FWMIS datasheet for each solar collector/reflector;
3. results of searcher efficiency trials and scavenger removal trials;
4. the uncorrected fatality rate for birds expressed as the number of mortalities/megawatt/year;
5. the corrected rates of mortalities/megawatt/year as per Huso (2011) or acceptable alternatives;
6. a summary of species affected;
7. results of the pre-construction wildlife surveys;
8. a comparison of the pre- and post-construction survey results if required; and,
9. a statement of compliance with the Directives and the signature of the lead biologist.

13.3 Adaptive Management

As per Standard 100.4.9, in the event that post-construction surveys reveal wildlife mortalities exceed acceptable levels (as determined by AEP), adaptive management may be implemented in consultation with AEP. Adaptive management may include, but may not be limited to:

1. Determination of reason for mortality (i.e. electrocution, impacts)
2. Once mortality is determined, where possible, mitigation may include:
    a. Installation of bird deterrents or markers;
    b. Addition of white edges to solar reflectors;

c. Installation of nest spikes on areas to prevent raptor nesting; and/or;
d. Other methods appropriate at the time.

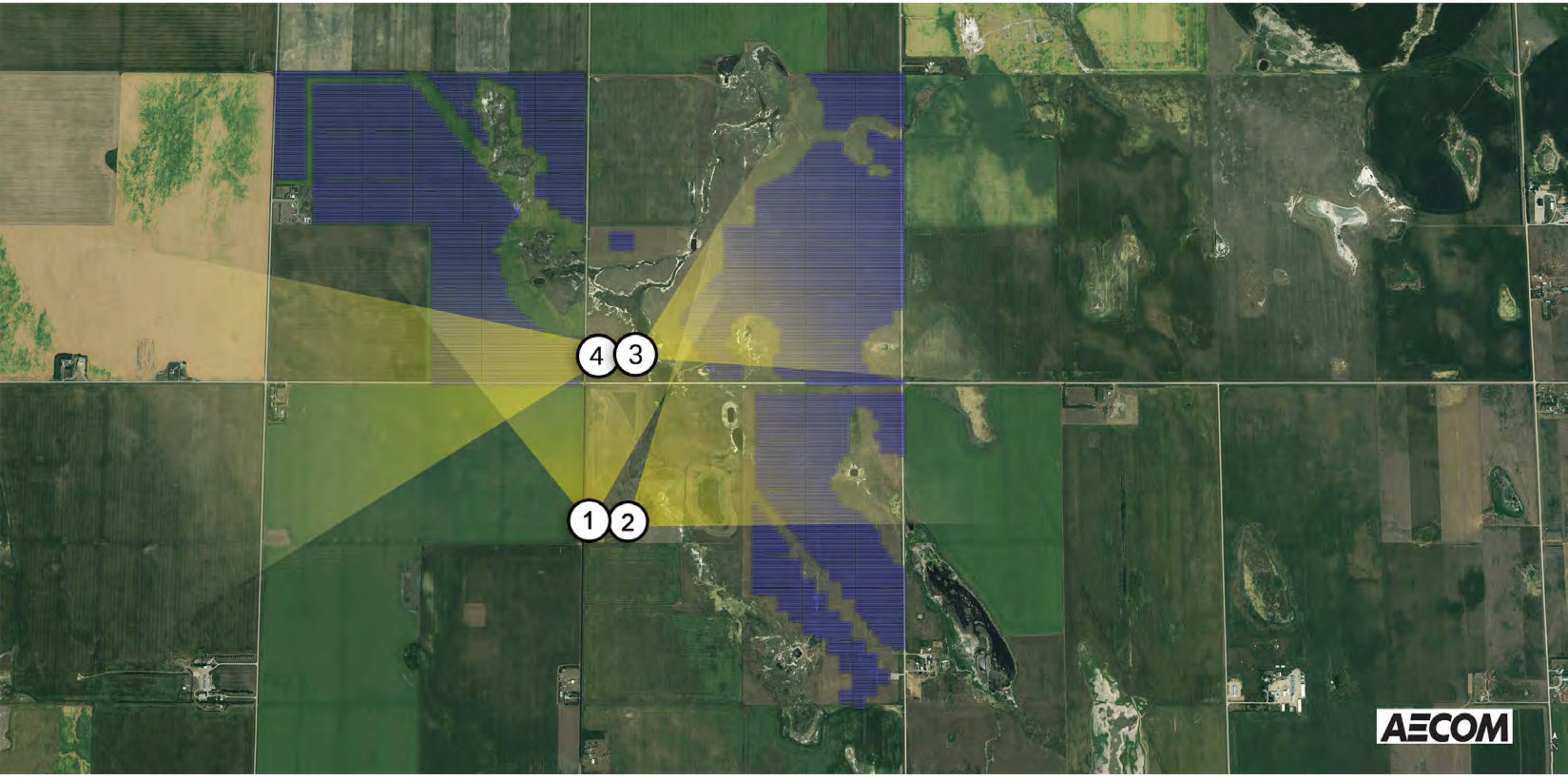
13.4 Injured Wildlife

In the event that injured wildlife is found within the Project boundaries during operations, AEP will be notified and injured wildlife will be handled in accordance with regulatory direction and requirements.

APPENDIX “C”

Visualizations of Solar Project and the Physical Dimensions of Canadian Solar Panels

(Note: visualizations are based on the preliminary project footprint submitted at the time of CSI’s Land Use Rezoning Application. Following consultation with local stakeholders, the project footprint was reduced, therefore the visual impact of the project will correspondingly be reduced compared to these project visualizations. Moreover, due to supply constraints with First Solar and dynamic pricing from other panel suppliers, mono- or poly-crystalline panels are being considered as the project continues to be value engineered. The visual impact of the selected technology will not be materially different from the photo renders supplied.


4
3
1
2


AECOM


te: Due to a change in layout based on stakeholder consultation, the panels in the SE corner of SE-1-13-24-W4 (pictured
ckground of this photo render) have now been moved. For the project, the closest panels to the Sippola residence on SE-1
would now be approximately 567m away. Elsewhere (e.g., SW-6-13-25-W4) the panels would be 400m or greater from the Sip
sidence. In all cases, any revised/updated project layouts would not have panels closer than 400m from the Sippola resid
AECOM

NEW

CanadianSolar

BiKu MODULE

NEW GENERATION BIFACIAL MODULE
FRONT POWER RANGE: 350W ~ 365W
ADDITIONAL BACK POWER OUTPUT UP TO 30%
CS3U-350|355|360|365PB-AG

FRONT BACK

 5BB cell  MBB cell

* Both 5BB and MBB modules will be supplied.

MORE POWER

UP TO 30% — Up to 30% more energy yield due to back side power generation

42°C — Low NMOT: 42 ± 3 °C
Low temperature coefficient (Pmax): -0.37 % / °C

Innovative module design, Better shading tolerance

MORE RELIABLE

Lower internal current, lower hot spot temperature

Minimizes micro-cracks and prevents snail trails

Fire Class A and Type 3 / Type 13

Heavy snow load up to 8100 Pa, wind load up to 4000 Pa *

* For detailed information, please refer to Installation Manual.

30 years power output warranty

10 years product warranty on materials and workmanship

MANAGEMENT SYSTEM CERTIFICATES*

ISO 9001 2008 / Quality management system
ISO 14001 2004 / Standards for environmental management system
OHSAS 18001 2007 / International standards for occupational health & safety

PRODUCT CERTIFICATES*

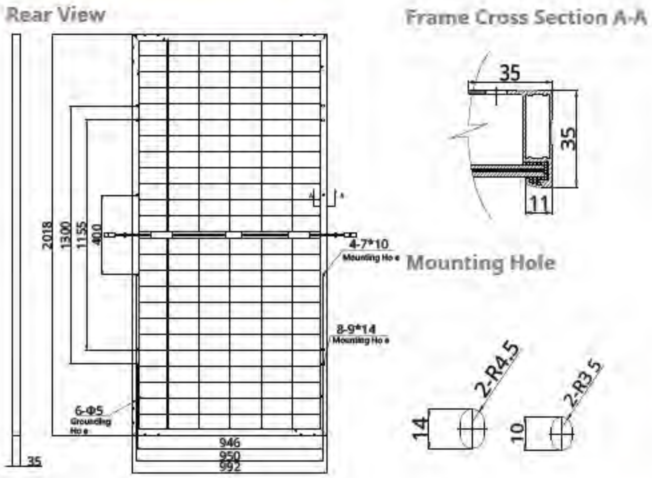
IEC 61215 / IEC 61730 VDE / CE
UL 1703 CSA

* If you need specific product certificates, and if module installations are to deviate from our guidance specified in our installation manual, please contact your local Canadian Solar sales and technical representatives.

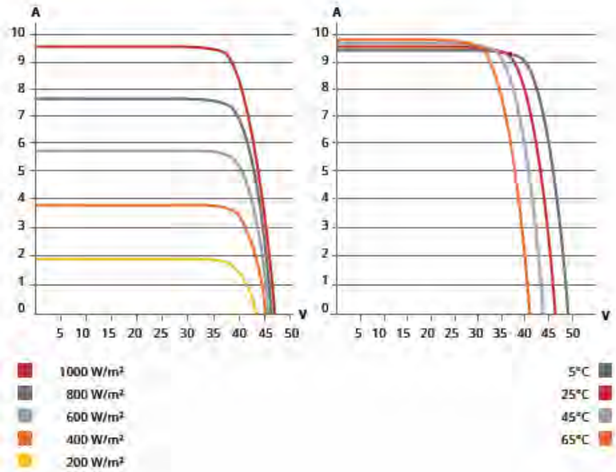
CANADIAN SOLAR INC. is committed to providing high quality solar products, solar system solutions and services to customers around the world. As a leading PV project developer and manufacturer of solar modules with about 30 GW deployed around the world since 2001, Canadian Solar Inc. is one of the most bankable solar companies worldwide.

CANADIAN SOLAR INC.
545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, www.canadiansolar.com, support@canadiansolar.com

ENGINEERING DRAWING (mm)



CS3U-355PB-AG / I-V CURVES



ELECTRICAL DATA | STC*

		Nominal Max. Power (Pmax)	Opt. Operating Voltage (Vmp)	Opt. Operating Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current (Isc)	Module Efficiency
CS3U-350PB-AG		350 W	39.2 V	8.94 A	46.6 V	9.51 A	17.48%
Bifacial Gain**	5%	368 W	39.2 V	9.39 A	46.6 V	9.99 A	18.38%
	10%	385 W	39.2 V	9.83 A	46.6 V	10.46 A	19.23%
	20%	420 W	39.2 V	10.73 A	46.6 V	11.41 A	20.98%
	30%	455 W	39.2 V	11.62 A	46.6 V	12.36 A	22.73%
CS3U-355PB-AG		355 W	39.4 V	9.02 A	46.8 V	9.59 A	17.73%
Bifacial Gain**	5%	373 W	39.4 V	9.47 A	46.8 V	10.07 A	18.63%
	10%	391 W	39.4 V	9.92 A	46.8 V	10.55 A	19.53%
	20%	426 W	39.4 V	10.82 A	46.8 V	11.51 A	21.28%
	30%	462 W	39.4 V	11.73 A	46.8 V	12.47 A	23.08%
CS3U-360PB-AG		360 W	39.6 V	9.1 A	47 V	9.67 A	17.98%
Bifacial Gain**	5%	378 W	39.6 V	9.56 A	47 V	10.15 A	18.88%
	10%	396 W	39.6 V	10.01 A	47 V	10.64 A	19.78%
	20%	432 W	39.6 V	10.92 A	47 V	11.6 A	21.58%
	30%	468 W	39.6 V	11.83 A	47 V	12.57 A	23.38%
CS3U-365PB-AG		365 W	39.8 V	9.18 A	47.2 V	9.75 A	18.23%
Bifacial Gain**	5%	383 W	39.8 V	9.64 A	47.2 V	10.24 A	19.13%
	10%	402 W	39.8 V	10.1 A	47.2 V	10.73 A	20.08%
	20%	438 W	39.8 V	11.02 A	47.2 V	11.7 A	21.88%
	30%	475 W	39.8 V	11.93 A	47.2 V	12.68 A	23.73%

* Under Standard Test Conditions (STC) of irradiance of 1000 W/m², spectrum AM 1.5 and cell temperature of 25°C.

** Bifacial Gain: The additional gain from the back side compared to the power of the front side at the standard test condition. It depends on mounting (structure, height, tilt angle etc.) and albedo of the ground.

ELECTRICAL DATA | NMOT*

	Nominal Max. Power (Pmax)	Opt. Operating Voltage (Vmp)	Opt. Operating Current (Imp)	Open Circuit Voltage (Voc)	Short Circuit Current (Isc)
CS3U-350PB-AG	260 W	36.2 V	7.18 A	43.7 V	7.67 A
CS3U-355PB-AG	264 W	36.4 V	7.25 A	43.9 V	7.74 A
CS3U-360PB-AG	268 W	36.6 V	7.31 A	44.1 V	7.80 A
CS3U-365PB-AG	271 W	36.8 V	7.38 A	44.3 V	7.87 A

* Under Nominal Module Operating Temperature (NMOT), irradiance of 800 W/m² spectrum AM 1.5, ambient temperature 20°C, wind speed 1 m/s.

MECHANICAL DATA

Specification	Data
Cell Type	Poly-crystalline
Cell Arrangement	144 [2 X (12 X 6)]
Dimensions	2018 × 992 × 35 mm (79.4 × 39.1 × 1.38 in)
Weight	26.3 kg (58.0 lbs)
Front / Back Glass	2.0 mm heat strengthened glass
Frame	Anodized aluminium alloy
J-Box	IP68, 3 diodes
Cable	4.0 mm² (IEC), 12 AWG (UL)
Cable Length (Including Connector)	Portrait: 400 mm (15.7 in) (+) / 200 mm (7.9 in) (-); landscape: 1250 mm (49.2 in); leap-frog connection: 1670 mm (65.7 in)*
Connector	T4 series
Per Pallet	30 pieces
Per Container (40' HQ)	660 pieces

* For detailed information, please contact your local Canadian Solar sales and technical representatives.

ELECTRICAL DATA

Operating Temperature	-40°C ~ +85°C
Max. System Voltage	1500 V (IEC) or 1000 V (IEC/UL)
Module Fire Performance	TYPE 3 / Type 13 (UL 1703) or CLASS A (IEC61730)
Max. Series Fuse Rating	20 A
Application Classification	Class A
Power Tolerance	0 ~ + 5 W

TEMPERATURE CHARACTERISTICS

Specification	Data
Temperature Coefficient (Pmax)	-0.37 % / °C
Temperature Coefficient (Voc)	-0.29 % / °C
Temperature Coefficient (Isc)	0.05 % / °C
Nominal Module Operating Temperature	42 ± 3°C

* The specifications and key features contained in this datasheet may deviate slightly from our actual products due to the on-going innovation and product enhancement. Canadian Solar Inc. reserves the right to make necessary adjustment to the information described herein at any time without further notice.

PARTNER SECTION

CANADIAN SOLAR INC.
545 Speedvale Avenue West, Guelph, Ontario N1K 1E6, Canada, www.canadiansolar.com, support@canadiansolar.com

APPENDIX “D”

Salinity Mapping for Resource Management

Salinity Mapping for Resource Management

within the M.D. of Willow Creek, Alberta

J. Kwiatkowski
L.C. Marciak
D. Wentz
C.R. King

Conservation and Development Branch
Alberta Agriculture, Food and Rural Development

March 1995

Canada

Agriculture - Building a Healthy Environment

Alberta

Abstract

This report presents a methodology to map salinity at a municipal scale and applies this procedure to the Municipal District of Willow Creek, a rural municipality in southern Alberta. The methodology was developed for the County of Vulcan (Kwiatkowski et al. 1994) and is being applied to other Alberta municipalities which have identified soil salinity as a concern.

Soil salinity is a major conservation issue in the Municipal District of Willow Creek. The information on salinity location, extent, type and control measures presented in this report will help Municipal District planners to target salinity control and resource management programs.

The methodology has four steps:

1. The location and extent of saline areas are mapped based on existing information including aerial photographs, maps, the Lethbridge Northern Irrigation District map, assessment data and technical reports, as well as information from local personnel and field inspections.

2. Saline areas are classified on the basis of the mechanism causing salinity. The mechanism is important because it determines which control measures are appropriate. Eight salinity types are recognized within the Municipal District of Willow Creek. These are: contact/slope change salinity, outcrop salinity, artesian salinity, depression bottom salinity, coulee bottom salinity, slough ring salinity, irrigation canal seepage salinity and natural/irrigation salinity.

3. Cost-effective, practical control measures are identified for each salinity type.

4. A colour-coded map at a scale of 1:100 000 is prepared showing salinity location, extent and type.

Analysis of the mapping data shows that 1 070 saline areas occur in the Municipal District and these areas occupy a total of 7 148 ha (17 753 ac). Salinity affects 1.5% of the M.D.'s area (464 538 ha). Only saline areas visible on the soil surface are mapped. The surrounding lands may have saline subsurface soils which can reduce yields of sensitive crops. Thus, salinity control practices may benefit crop yields over a much broader area than just the visible seep.

Depression bottom salinity is the most common salinity type (44.8% of saline areas in the Municipal District), followed by coulee bottom salinity (21.7% of saline areas), contact/slope change salinity (18.5%), outcrop salinity (5.1%), natural/irrigation salinity (4.9%), and irrigation salinity (3.6%). Artesian salinity and slough ring salinity are minor, totalling only 1.4% of saline areas.

Acknowledgements

This salinity mapping and analysis project for the M.D. of Willow Creek was conducted by the Conservation and Development Branch of Alberta Agriculture, Food and Rural Development. Funding provided by the Canada-Alberta Environmentally Sustainable Agriculture (CAESA) Agreement and the M.D. of Willow Creek is greatly appreciated.

The authors acknowledge the contributions made by: James Pittman and Eugene Kurinka, Conservation and Development Branch, Alberta Agriculture, Food and Development, for significant field work; Gerald Stark, Ron Blize and Longin Pawlowski, Conservation and Development Branch, Alberta Agriculture, Food and Rural Development, for preparing diagrams, logos and plotting the salinity map; and Elizabeth Alke for proofing the report. Comments on the salinity data from Kathy Sandy, Agricultural Fieldman, Agricultural Service Board, M.D. of Willow Creek, are greatly appreciated.

Contents

Tables

Figures

1.0 Introduction

1.1 Goal and Objectives

The goal of this project is to present information on salinity location, extent and type in the Municipal District (M.D.) of Willow Creek. Soil degradation is a key issue in conservation planning and salinity is one of the most visible soil degradation problems affecting the M.D. according to its Canada-Alberta Environmentally Sustainable Agriculture (CAESA) Agreement action plan. Therefore this mapping project aims to better define the salinity problem for the M.D. of Willow Creek.

The project's goal is achieved through the following objectives:

1. To derive and integrate existing salinity information for agricultural land in the M.D. of Willow Creek.
2. To determine the salinity type based on the salinity mechanism.
3. To recommend appropriate control methods for each type of salinity.
4. To compile a map depicting salinity location, extent and type.

The project differs from most salinity surveys by specifying the type, exact locations and control measures. This information can be used in municipal and farm conservation planning.

1.2 Methodology

The methodology for mapping salinity was developed for the County of Vulcan by Kwiatkowski et al. (1994). It is being applied to other Alberta municipalities where soil salinity is a concern. The process of salinity mapping consists of four stages:

1. Scan aerial photographs and digitize saline areas on a municipal base map.

2. Determine the types of salinity occurring in the municipality, based on hydrogeology, surface water flow, geology, topography, irrigation and soils. Determine appropriate cost-effective, practical control measures based on salinity types.

3. Field check the salinity data and submit the draft salinity information to a technical team consisting of a project manager, hydrogeologist, salinity specialist, and the local Agricultural Fieldman and District Specialist for review.

4. Prepare a colour-coded 1:100 000 map, showing salinity location, extent and type, and an accompanying report with a map in scale 1:200 000.

1.3 Information Sources

A variety of maps, aerial photographs and other information sources were used for this project. Information on climate, soils, parent material and hydrogeology was taken from four reports:

1. Soil Map at a scale of 1:126,720 - Lethbridge Area NW 82H (Kocaoglu 1977)
2. Soil Survey of Gleichen SW (82ISW) and SE (82ISE) map sheets (Walker et al. in press)
3. Hydrogeology of the Lethbridge-Fernie area, Alberta (Tokarsky 1973)
4. Hydrogeology of the Kananaskis Lake Area, Alberta (Borneuf 1980)

The Saline/Waterlogged Lands Map (in scale 1:100 000) from the Lethbridge Northern Irrigation District (1990) provided information on salinity in two categories: moderately and severely affected areas. The data were collected in 1982 and include sloughs, stock-watering ponds and small, temporary water bodies. This map covers only small area of the M.D. of Willow Creek north of Fort MacLeod. The main causes of salinization and waterlogging within irrigation districts are seepage from canals, poor water management, poor irrigation practices and inadequate drainage.

Aerial photographs from 1990 (scale of 1:30 000) were used to help determine the location, extent and type of salinity on a section-by-section basis.

Prairie Farm Rehabilitation Administration (PFRA) Salinity Investigation Reports for 25 sites throughout the M.D. were also valuable information sources (Prairie Farm Rehabilitation Administration various dates). These reports provided detailed data including information on drilling investigations, the severity and extent of salinity, and recommended control methods.

To ensure the accuracy of the salinity map, about two-thirds of the M.D. was field checked. Local personnel were also consulted to verify the findings.

2.0 Classification and Management of Saline Seeps

2.1 Transportation of Salts

The dominant salts in the M.D. of Willow Creek consist of sodium and magnesium sulphates. Analyses of groundwater, saline soils and parent material suggest that the primary source of salts is bedrock, and the secondary source is glacial till (Greenlee et al. 1968). Soils developed on the Bearpaw bedrock formations contain high salt levels.

Saline seeps form when saline groundwater rises to the ground surface. Contact and slope change seeps (described in Section 2.2.1) develop when water in a recharge area percolates down through the soil profile beyond the root zone and dissolves soluble salts (Figure 1). The water moves laterally to a lower position in the landscape and through capillarity rises to the surface, resulting in a saline seep. High evapotranspiration rates cause the capillary rise and the deposition of salts on the soil surface.

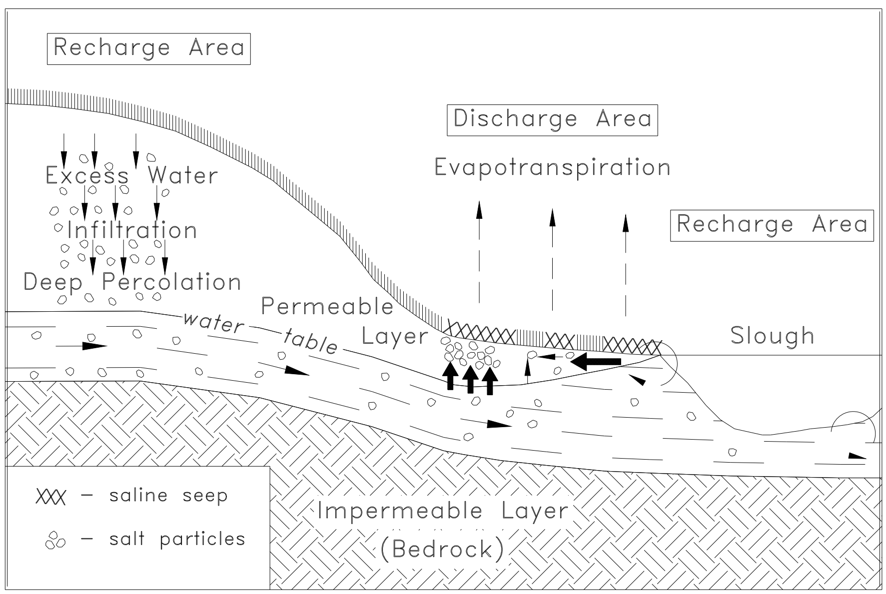


Figure 1. Generalized saline seepage mechanisms

Three different types of flow may be recognized within a groundwater basin: local, intermediate and regional. A local flow system occupies a relatively small area, with the recharge area at a higher elevation than the discharge area. An intermediate system consists of several interconnected local systems. A regional system has its recharge area at the water divide of a basin while the discharge area lies at the bottom of the basin. In the M.D. of Willow Creek, most of the groundwater flow systems are local, and the recharge areas are within a few hundred metres of their discharge area. Intermediate flow systems extend beyond 1 km (0.6 mi) of their discharge area. Regional flow systems extend over several kilometres.

Groundwater movement is influenced by topography as follows:

- In large, flat areas, groundwater movement is minimal or even impeded.
- In areas with well-defined local relief (e.g. hummocky or rolling landscapes), local systems are prevalent.
- In areas with one large slope, regional systems are prevalent.
- In large valleys, regional systems predominate.

2.2 Salinity Types

Based on hydrogeology, surface water flow, geology, topography, irrigation and soils, eight types of salinity are recognized within the M.D. of Willow Creek. The eight types can be grouped into six dryland (rainfed land) and two irrigation types as follows.

2.2.1 Dryland Salinity Types

1. Contact/Slope Change Salinity
Contact salinity and slope change salinity are grouped together because they cannot be differentiated on aerial photographs and because the same methods are used to control both types (see Section 2.3). The two types are described as follows:

a. *Contact salinity* occurs where a permeable water-bearing surface layer thins out above a less permeable layer (such as a fine textured layer). This forces the groundwater flow closer to the surface (Figure 2). Contact salinity dominates in sandy, gently rolling areas, mostly in the central portion (Granum and Claresholm areas, Twp. 10 Rge. 26, and Twp. 12, 13 Rge. 27) and northern portion (Parkland area, Twp. 15 Rge. 27, 28) of the M.D. Contact salinity also occurs at the shoulders of coulees or as seeps that are not necessarily associated with the low lying areas scattered throughout the M.D.

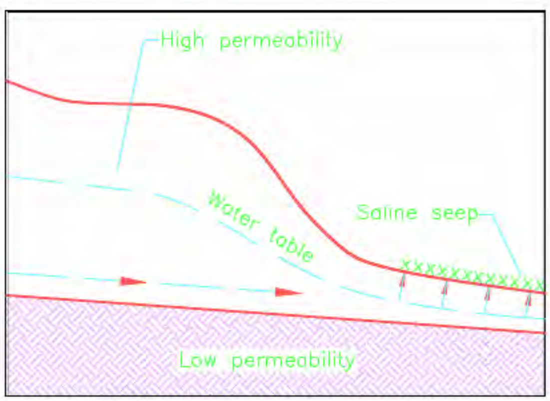


Figure 2. Contact salinity

b. *Slope change salinity* occurs where the slope decreases. This decrease results in a slowing of the groundwater flow and a shallower water table (Figure 3). This type of seep expands upslope. It occurs throughout the M.D. of Willow Creek.

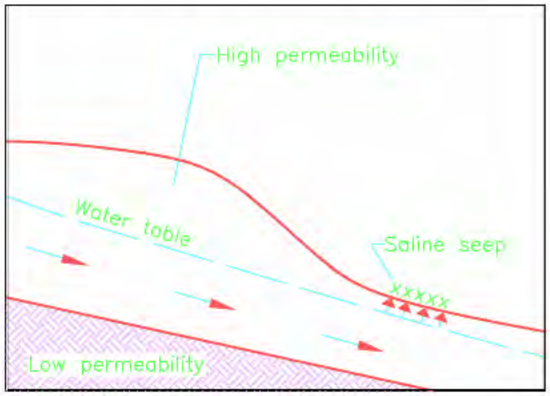


Figure 3. Slope change salinity

2. Outcrop Salinity

Outcrop salinity occurs where a permeable, water-bearing layer, such as a coal seam or fractured bedrock layer, outcrops at or near the surface (Figure 4). Outcrop salinity occurs along a slope at similar elevations. In the M.D. of Willow Creek, large areas of outcrop salinity occur west of Parkland (Twp. 15 Rge. 28) and southwest of Nanton (Twp. 16 Rge. 28).

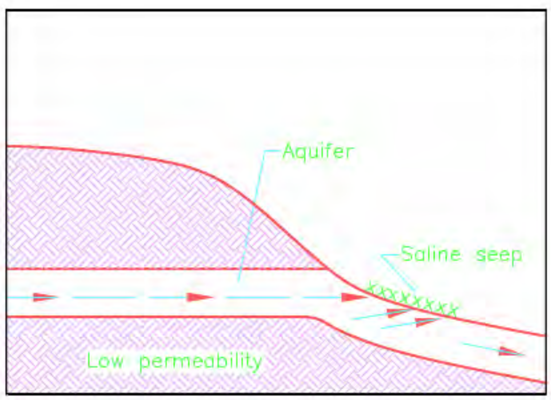


Figure 4. Outcrop salinity

3. Artesian Salinity
Artesian salinity occurs where water from a pressurized aquifer rises to or near the ground surface (Figure 5). It is usually associated with intermediate or regional groundwater flow systems. If the pressure is large enough, the water flows to the surface and produces a flowing well, spring or soap hole. Artesian seeps can be identified from the presence of these flow features and from hydrogeological maps.

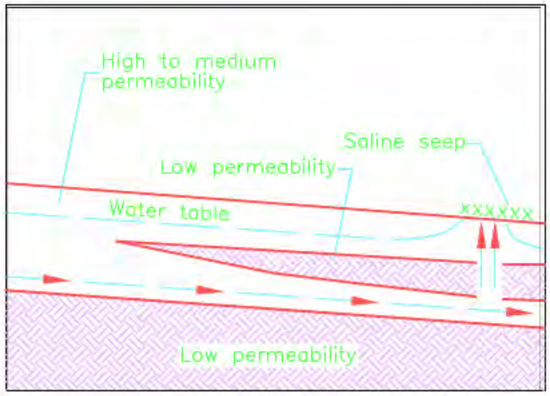


Figure 5. Artesian salinity

4. Depression Bottom Salinity
This salinity type occurs in low lying areas. Surface water is trapped temporarily in low areas until the water drains off and/or infiltrates the soil. The water in the soil flows upslope through the upper soil in an unsaturated state and then surfaces to evaporate and deposit salt at the edge of the ponded area (Figure 6). Once the surface water has disappeared, groundwater from the water table rises by capillary action to the surface in and around the previously ponded area. Depression bottom seeps are well defined with distinct, rounded edges. In the M.D. of Willow Creek, depression bottom salinity is the most common salinity type. The seeps occur in several landscapes with poor drainage, particularly in rolling and hummocky areas. They are also associated with Solonetzic soils which occur throughout the M.D. The seeps occur mainly in the Clear Lake area (Twp. 13, 14 Rge. 26, 26) and in the Mud Lake area (Twp. 9 Rge. 28).

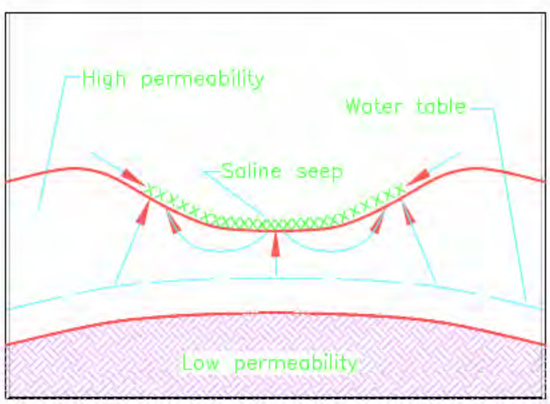


Figure 6. Depression bottom salinity

5. Coulee Bottom Salinity

Coulee bottom salinity forms in the bottoms of coulees and watercourses by the same mechanism as depression bottom salinity but on a larger scale. It typically develops over long periods of time so most lands affected by coulee bottom salinity have never been in agricultural production. It occurs extensively in the Pine Coulee and its tributaries and some coulees in the Nanton area (Twp. 15, 16 Rge. 28).

6. Slough Ring Salinity

This type of salinity occurs as a ring of salt immediately adjacent to a permanent water body (Figure 7). Water infiltrates from the water body into the permeable upper soil layer and flows upslope as shallow groundwater in an unsaturated state through this layer. The water may also flow downward, raising the water table. Water from the unsaturated flow and water raised from the water table by capillary action emerges at the surface where it evaporates, leaving salts at the edge of the slough. This salinity type occurs mainly in the vicinity of Clear Lake (Twp. 13 Rge. 25 and Twp. 14 Rge. 26).

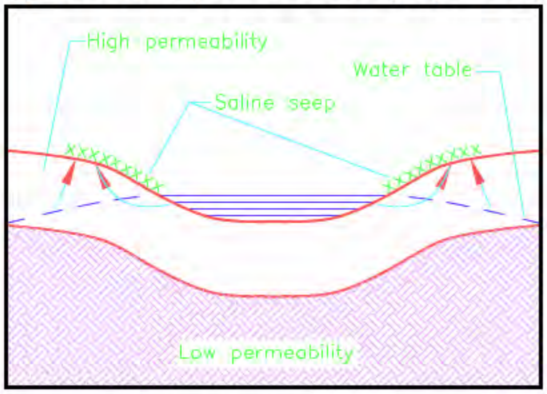


Figure 7. Slough ring salinity

2.2.2 Irrigation Salinity Types

1. Canal Seepage Salinity

This type of seep is dominant in irrigated areas where leakage from canals contributes to seeps (Figure 8). Because many canals are located along a topographic break, canal seepage often aggravates natural salinity. Lethbridge Northern Irrigation District covers small part of the M.D. of Willow Creek. Canal seepage salinity occurs only north of Fort MacLeod (Twp. 9, 10 Rge. 25, 26).

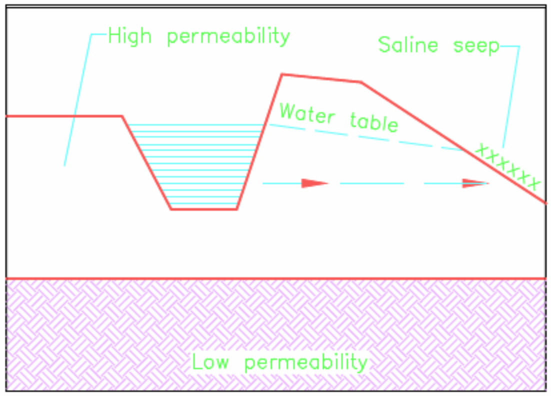


Figure 8. Canal seepage salinity

2. Natural/Irrigation Salinity
These seeps result from one or more of: natural seepage, canal seepage and excess irrigation. All seeps located on irrigated land and some distance from canals and supply ditches are given this classification.

2.3 Salinity Controls

Salinity is a complex problem caused by climatic, hydrogeological and agricultural factors. The opportunities for moderating the effects of climate and hydrogeological processes are limited and/or expensive. Therefore appropriate agricultural practices are used to help prevent or control saline seeps. The emphasis in this report is on cost-effective, agronomic measures. Specifically, cropping systems that intercept the available soil water in a recharge area before the water moves below the crop root zone are recommended.

Recommended control methods for the types of salinity found in the M.D. of Willow Creek are summarized in Table 1 and described in more detail in Sections 2.3.1 and 2.3.2.

2.3.1 Biological Controls

2.3.1.1 Salt-Tolerant Crops

Saline areas should not be left bare for extended periods. Very saline soils should be seeded to a mixture of salt-tolerant forage crops (Table 2). Saline areas are often wet, so crops may need to be tolerant of both salt and excess moisture. When electrical conductivity measurements exceed 8 to 10 mS/cm, salt-tolerant seed mixtures usually give the best results.

Establishing deep-rooted vegetation on a saline seep can be very difficult. Salt-tolerant grasses can be seeded in the fall when the saline seeps are dry and accessible. Seeding rates for saline seeps, especially when planted in the fall, should be double those for non-saline areas.

2.3.1.2 Deep-Rooted Crops

Deep-rooted crops prevent the buildup of groundwater, lower the water table, dry out the subsoil and restore the water storage capacity of the soil (Brown et al. 1982). The most commonly grown deep-rooted dryland crop is alfalfa. It roots up to 6 m (20 ft) in four to five

Table 1. Salinity types and control methods in the M.D. of Willow Creek

Salinity Type	Control
1. contact/slope change salinity	- salt-tolerant grasses in saline area and alfalfa in upslope recharge area (recharge area may be about three times area of seep)
2. outcrop salinity	- salt-tolerant grasses in saline area
3. artesian salinity	- salt-tolerant grasses in saline area - where applicable, install relief wells connected to suitable outlet
4. depression bottom salinity	- salt-tolerant grasses in saline area and along edge of depression in band 50 to 150 m (165 to 490 ft) wide - appropriate structural controls
5. coulee bottom salinity	- salt-tolerant grasses in saline area - appropriate structural controls
6. slough ring salinity	- deep-rooted and salt-tolerant grasses in a 20 to 60 m (65 to 195 ft) band around slough - appropriate structural controls
7. irrigation canal seepage salinity	- structural controls to prevent canal seepage (canal lining, cut-off curtains) and/or subsurface drainage of affected area
8. natural/irrigation salinity	- appropriate structural controls for irrigation-related salinity - salt-tolerant grasses for natural salinity

years and uses more than 760 mm (30 in.) of water per year. Perennial deep-rooted crops also increase soil organic matter content, improve soil structure and reduce soil erosion.

Alfalfa should be seeded into a firm, moist seed bed as shallowly as possible at a rate of about 7 kg/ha (6.2 lbs/ac). It can be seeded using a conventional seeder. Hoe drills often give the most effective results because of good depth control and packing capability. Disk drills work best if the seed bed is uniform and moderately firm. However, in loose soil, disk drills may place the seed too deeply, and in very firm soil, they may leave the seed on the soil surface. Both conditions result in poor germination.

Recharge areas identified during a salinity investigation should be seeded to alfalfa. On average, recharge areas are about three times larger than their saline seep. The best time for seeding alfalfa is early spring. Alfalfa should be seeded without any companion crops because competition will deter establishment of the alfalfa stand.

Table 2. Forage crops for saline soils and flooded areas (Henry et al. 1987)

Salinity Rating (EC)*	Forage Mix	Seeding Rate for Hay or Pasture (kg/ha)
	a. Soils with Little or No Spring Flooding (up to 2 weeks)	
Slight to Moderate (2-6 dS/m)	bromegrass + Russian wild ryegrass + alfalfa (Rambler)	4+4+4
	bromegrass + slender wheatgrass + alfalfa (Rambler)	4+4+4
	Russian wild ryegrass + alfalfa	6+3
	altai wild ryegrass + alfalfa	10+3
	crested wheatgrass + alfalfa	7+3
	altai wild ryegrass	11
	slender wheatgrass + sweet clover (short-term stands and not over 1 week of flooding)	8+6
Severe (6-10 dS/m)	bromegrass + Russian wild ryegrass + slender wheatgrass	4+4+4
	altai wild ryegrass + alfalfa	10+3
	altai wild ryegrass	11
	tall wheatgrass (moist districts or seepage areas)	12
Very Severe (10-15 dS/m)	Russian wild ryegrass + slender wheatgrass	4+4
	altai wild ryegrass + alfalfa	10+3
	altai wild ryegrass	10
	tall wheatgrass (moist districts or seepage areas)	12
	b. Soils with Spring Flooding (2 to 5 weeks)	
Little or No (0-2 dS/m)	reed canarygrass + bromegrass	4+6
	reed canarygrass + timothy	4+4
	timothy + bromegrass	4+6
	altai wild ryegrass + alfalfa	10+3
	altai wild ryegrass	11
Slight to Moderate (2-6 dS/m)	reed canarygrass + bromegrass	4+6
	reed canarygrass + bromegrass + slender wheatgrass	4+6+6
	altai wild ryegrass + alfalfa	10+3
	altai wild ryegrass	11
Severe to Very Severe (6-15 dS/m)	altai wild ryegrass + alfalfa	10+3
	slender wheatgrass	8
	altai wild ryegrass	11
	tall wheatgrass	12

* EC - electrical conductivity based on saturated paste, in deciSiemens per metre

Alfalfa has the ability to use atmospheric nitrogen through a symbiotic relationship with rhizobia nodule bacteria. Therefore, alfalfa inoculated with rhizobia will require less nitrogen fertilizer. Phosphorus, potassium and sulphur are important nutrients for optimum production. Alfalfa requires 5 kg of phosphorus per tonne of yield (10 lbs per ton of yield). This nutrient is very immobile in the soil and so application prior to seeding is highly recommended.

When alfalfa is seeded in a recharge area, it usually takes about five years to lower the water table in the associated saline seep. Once the water table is lowered to an acceptable level, the recharge area may be converted to cereal crops for a few years. The best approach is usually to establish a rotation of five years of alfalfa followed by three years of cereal crops. The cereals should be continuously cropped.

2.3.1.3 Flexible Cropping

In *flexible cropping*, fields are seeded if stored soil moisture and rainfall probabilities are favourable for satisfactory crop yields, and they are fallowed only if yield prospects are unfavourable (Jackson and Krall 1978). Flexible cropping involves careful management and planning; it is often simpler to use continuous cropping.

Snow trapping may increase stored soil moisture for recropping. Techniques to trap and manage snow include:

- *tall stubble/alternate height stubble* - Leaving tall stubble or strips of stubble at different heights increases stored soil moisture.
- *shelterbelts* - The ability of shelterbelts to trap snow can be manipulated by such practices as tree pruning and species selection.

Snow trapping should distribute snow evenly to avoid local accumulations of snowmelt from large drifts.

2.3.2 Structural Controls

2.3.2.1 Surface Drainage

Surface drainage of recharge areas and/or discharge areas can be used to control seeps (VanderPluym 1982). An open, shallow trench is normally used; deep trenches will obstruct farming operations. Trenches can be constructed with farm or contractor's equipment at a reasonable cost.

Grassed waterways are often used to drain excess surface water from recharge areas. Typical grassed waterways are broad, shallow channels with shallow slopes that carry water at slow speeds, preventing soil erosion. Grassed waterways ideally have channel slopes of less than 1% and side slopes of less than 25%. The channel should be at least 15 cm (5.9 in.) deep and

5 m (16 ft) wide. The grass should extend at least 5 m (16 ft) on both sides of the channel. A commonly used forage mix for grassed waterways is:

- brome or pubescent wheatgrass	- 10 kg/ha (9 lbs/ac), plus
- creeping red fescue	- 5 kg/ha (4.5 lbs/ac), plus
- crested wheatgrass	- 5 kg/ha (4.5 lbs/ac), plus
- alfalfa	- 10 kg/ha (9 lbs/ac), plus
- fall rye	- 1 kg/ha (0.9 lbs/ac)

2.3.2.2 Subsurface Drainage

Although subsurface (tile) drainage is used on irrigated lands to control salinity and waterlogging, it is not commonly used to control dryland salinity. However, a subsurface drainage system will satisfactorily lower water tables in dryland seeps if the system is properly designed, installed and managed. If the water is of good quality, it could be stored and used for stock water.

2.3.2.3 Relief Wells

Relief wells are costly but they can effectively control springs and soapholes associated with artesian salinity. The wells should be completed in the pressurized water-bearing layer. The wells may flow free and could be connected to a buried pipe 1 to 2 m (3.3 to 6.6 ft) deep. If the water is of good quality, it could be used for domestic or livestock purposes.

3.0 Salinity Distribution

The following statistical analysis describes the number and size of saline seeps for all types of salinity and for contact/slope change salinity in the M.D. of Willow Creek. These two examples indicate the general tendencies for the other salinity types.

The M.D. has 1 070 saline seeps which occupy a total of 7 185 ha (17 754 ac). This project depicts salinity which is visible on the soil surface. Most of these visible saline areas are out of agricultural production or have significantly reduced crop yields. However, the effects of salinity on crop yields are not usually limited to the visible saline areas. Often the surrounding lands have weakly to very weakly saline subsoils, reducing yields of sensitive crops. Thus, salinity control practices may benefit crop yields over a much broader area than just the visible seep.

Table 3 and Figure 9 present the area and percentage of saline seeps for each of the eight salinity types. Depression bottom salinity is the most common type (44.8% of the saline land), followed by coulee bottom salinity (21.7%), contact/slope change salinity (18.5%), outcrop salinity (5.1%), natural/irrigation salinity (4.9%), canal seepage salinity (3.6%), artesian salinity (0.8%), and outcrop salinity (0.6%).

Figure 10 shows the number of saline seeps by type. Overall, there are many small contact/slope change saline seeps and a few large coulee bottom saline seeps. Depression bottom salinity consists of 436 seeps and occupies 3 216 ha (7 946 ac). Contact/slope change salinity consists of 301 seeps and occupies 1 330 ha (3 286 ac). Coulee bottom salinity consists only 119 seeps and occupies 1 560 ha (3 855 ac). Average seep sizes are: 4.40 ha (10.87 ac) for contact/slope change saline seeps; 7.37 ha (18.20 ac) for depression bottom saline seeps; and 26.99 ha (66.69 ac) for coulee bottom saline seeps.

Figure 11 shows the frequency of different size ranges for all saline seeps. The seep areas vary from 183 m^2 to 366 ha (904 ac). Thirty percent of the seeps are between 0 and 1.0 ha (from 0 to 2.47 ac). Thirty-four percent are larger than 4 ha (9.9 ac); they are mainly coulee bottom or depression bottom salinity types. Only one seep, located in Pine Creek coulee, is greater than 300 ha (741 ac).

The areas for the contact/slope change saline seeps show a similar distribution (Figure 12). Of the 301 contact/slope change seeps, 163 (54%) are between 0 and 1.0 ha (0 and 2.47 ac), and 18% are larger than 6 ha (14.8 ac).

The typical measures to control contact/slope change salinity are to grow salt-tolerant grasses in the saline area and alfalfa in the recharge area. On average, recharge areas are about three times the size of their saline area. Thus, as a general guide, a recharge area about three times the size of the seep will need to be converted to alfalfa to control contact/slope change seeps.

Table 3. Salinity distribution by type in the M.D. of Willow Creek

Salinity Type	No. of Seeps	Area (ac)	Area (ha)	Percent of Total Saline Area
1. contact/slope change salinity	301	3 286.30	1 329.95	18.5
2. outcrop salinity	96	905.05	366.27	5.1
3. artesian salinity	16	134.38	54.38	0.8
4. depression bottom salinity	436	7 945.82	3 215.63	44.8
5. coulee bottom salinity	57	3 855.04	1 560.11	21.7
6. slough ring salinity	9	116.44	47.12	0.6
7. irrigation canal seepage salinity	36	640.07	259.03	3.6
8. natural/irrigation salinity	119	870.50	352.28	4.9
Total	1 070	17 753.60	7 184.77	100.0

Figure 9. Salinity Area by Type in the M.D. of Willow Creek

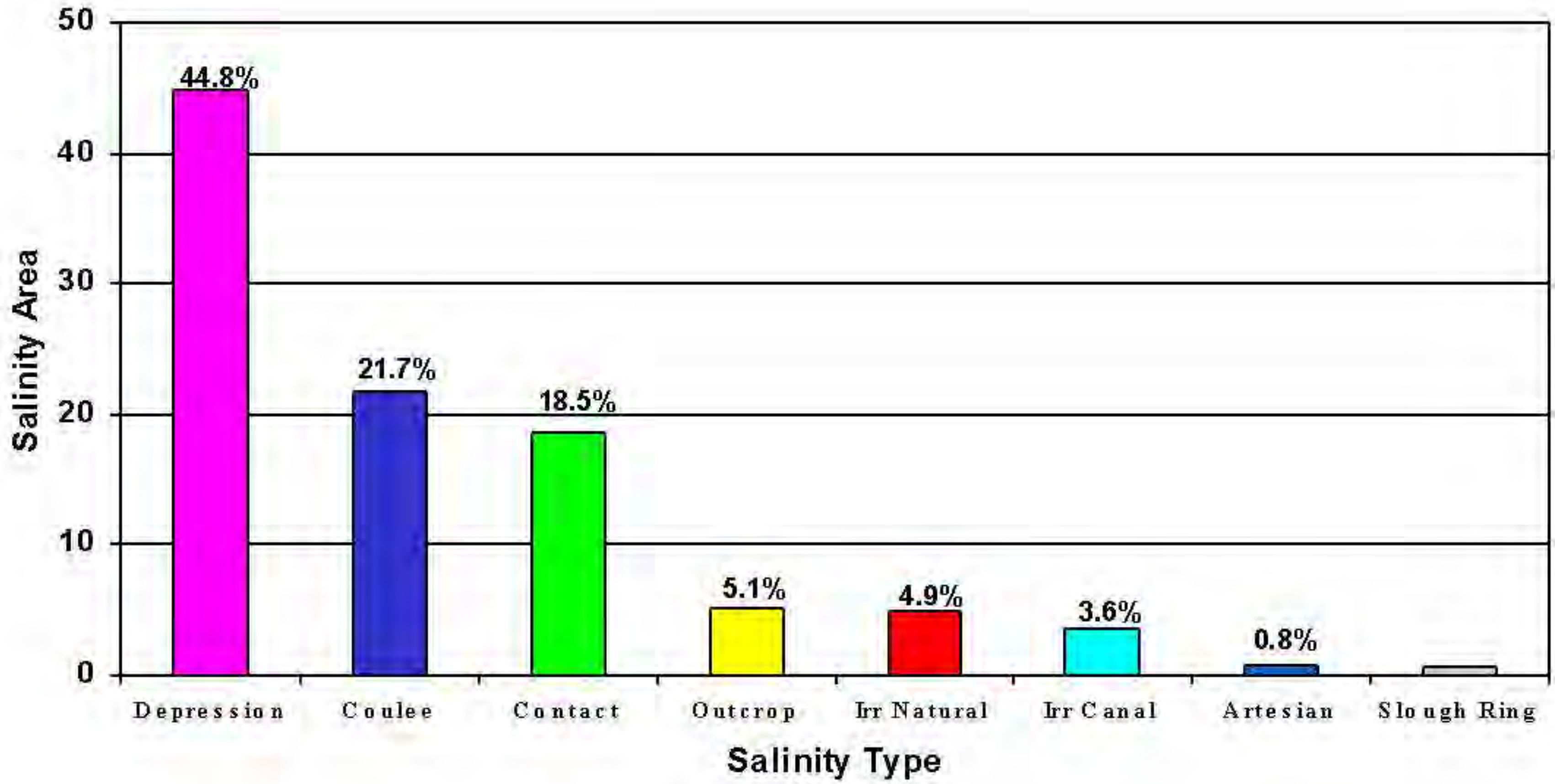


Figure 10. Number of Saline Seeps by Type in the M.D. of Willow Creek

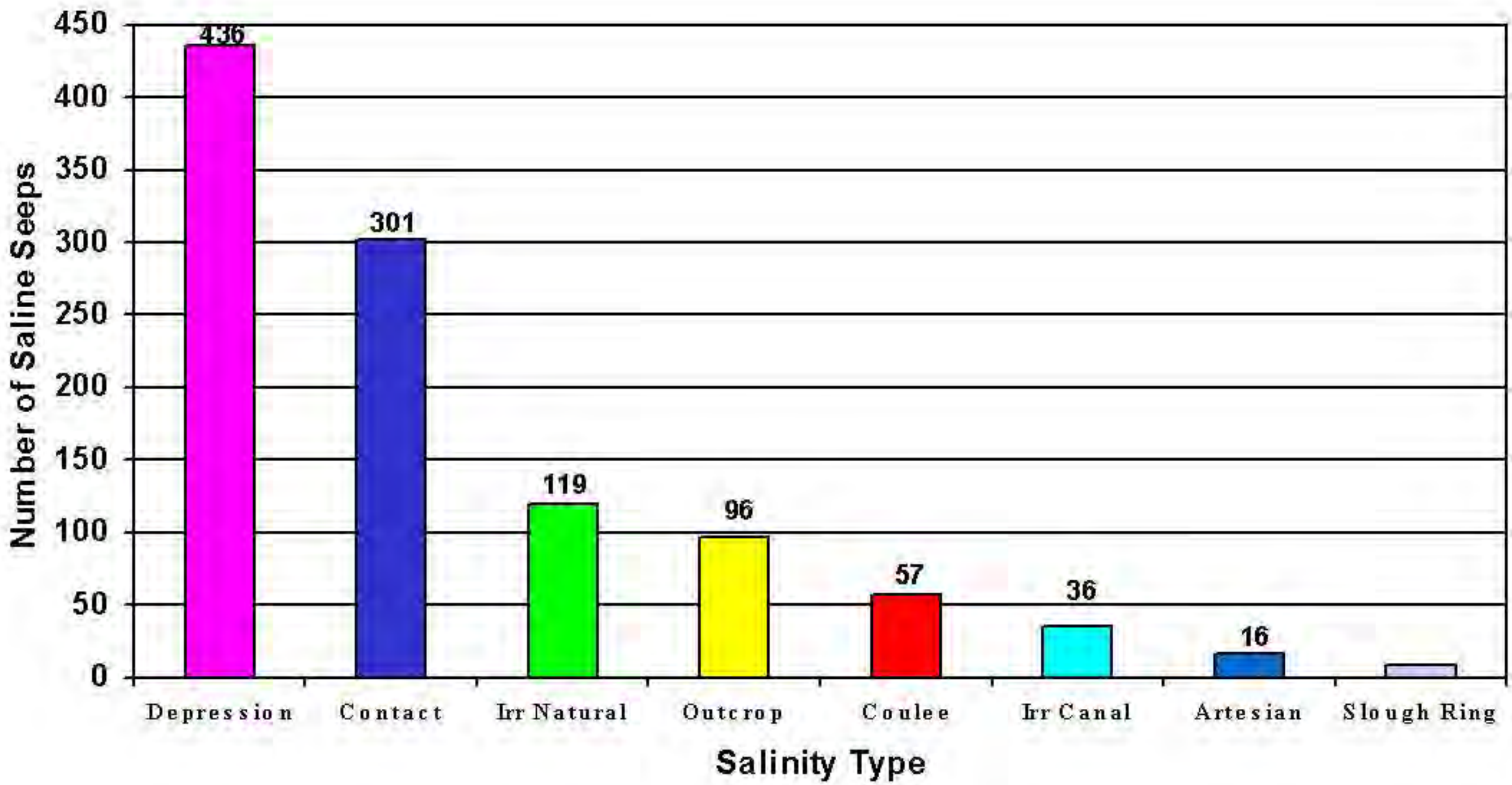


Figure 11. Number and Size of Saline Seeps in the M.D. of Willow Creek

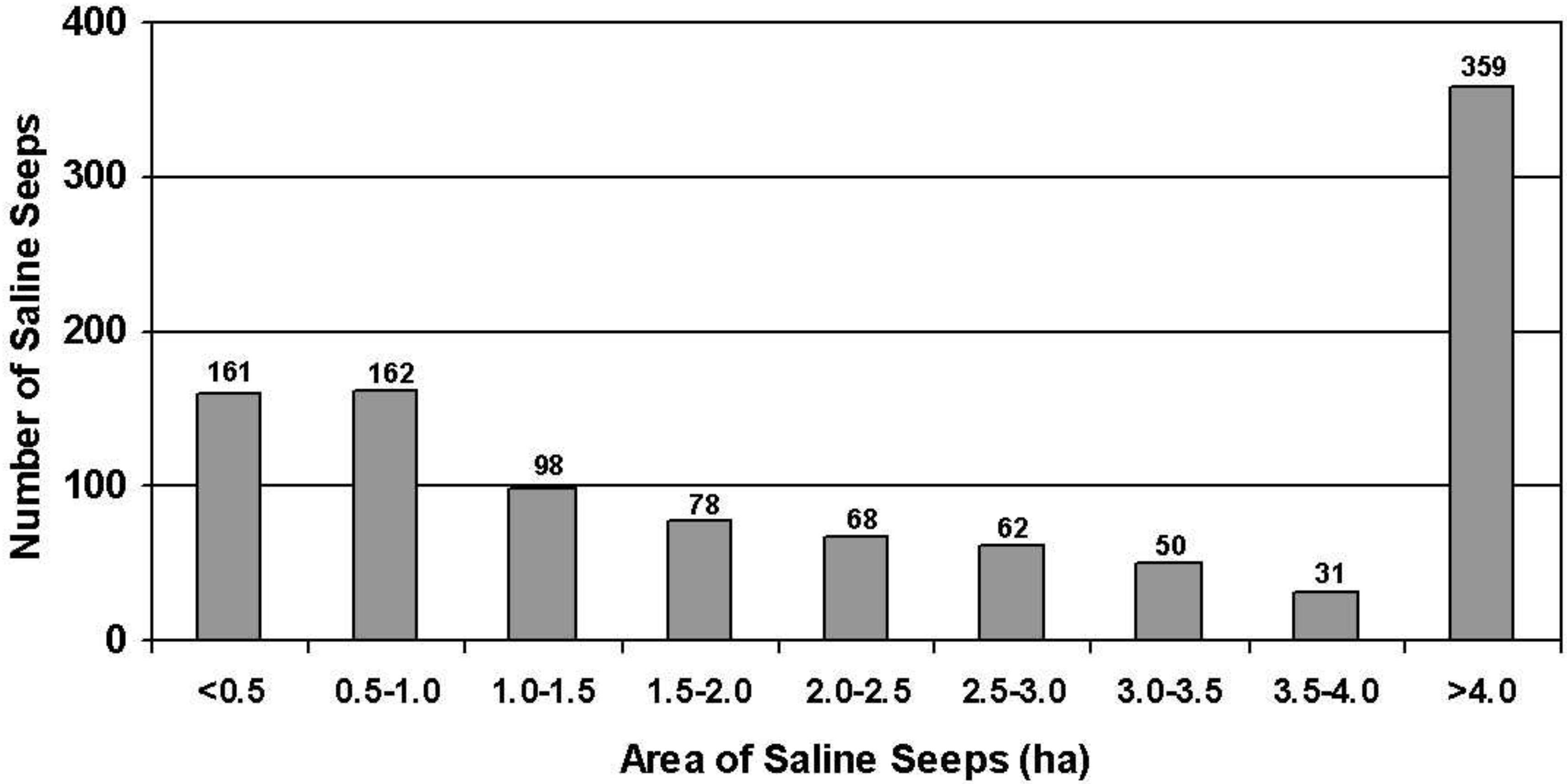
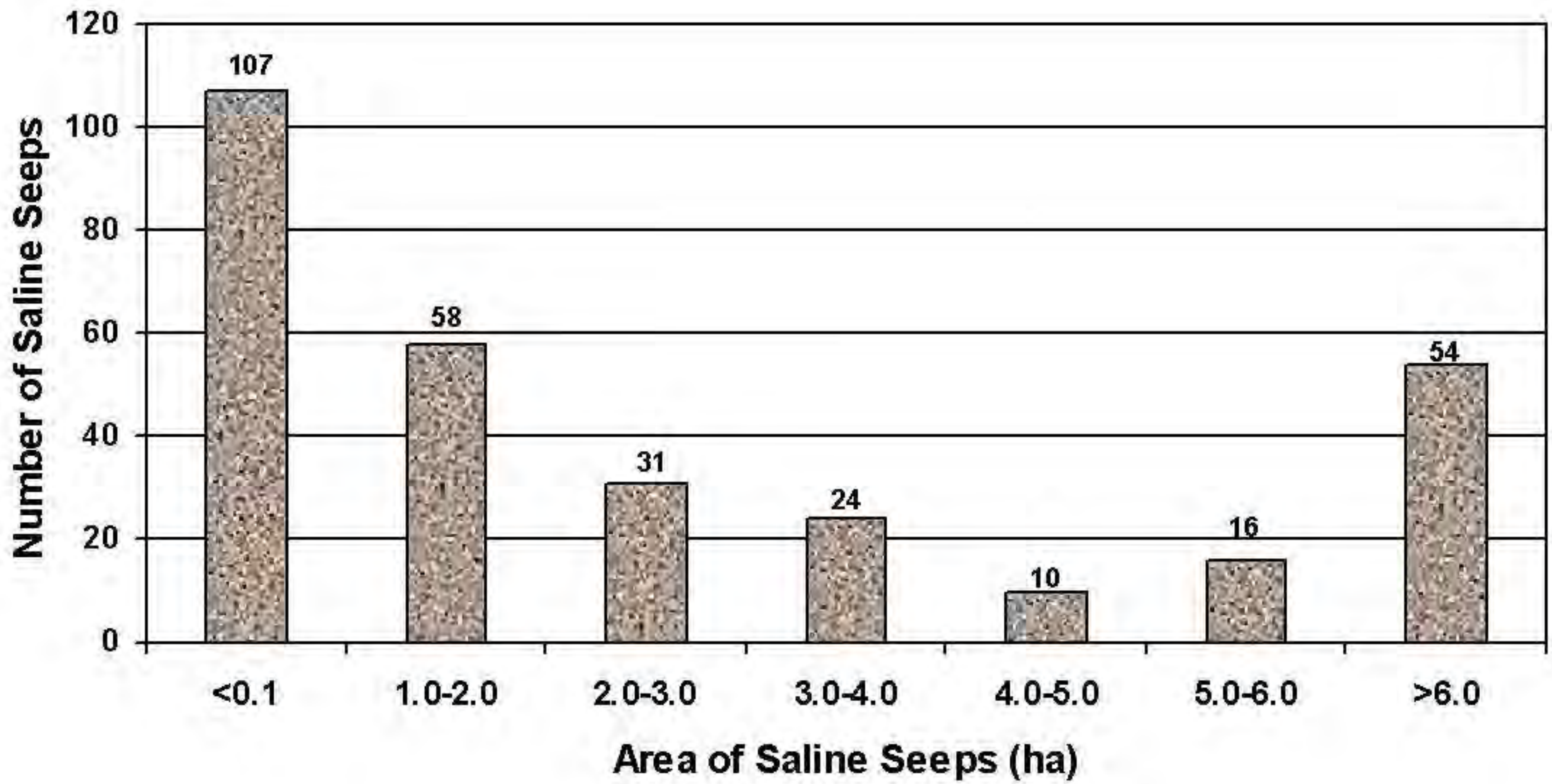


Figure 12. Number and Size of Contact/Slope Change Saline Seeps in the M.D. of Willow Creek



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Glossary

Aquifer - A body of earth material capable of transmitting water through its pores at a rate sufficient for water supply purposes. (VanderPluym and Harron 1992)

Artesian groundwater - Groundwater confined under an aquiclude or an aquifuge, so that water rises above the base of the aquiclude or aquifuge in a non-pumping well which penetrates it. (VanderPluym and Harron 1992)

Bedrock - The solid rock that underlies the soil and regolith or that is exposed at the surface. (Agriculture Canada 1976)

Capillary action - The action by which the surface of a liquid, where it is in contact with a solid, is elevated or depressed depending on the forces of adhesion and cohesion.

Electrical conductivity - A method of expressing salinity. An electrical conductivity (EC) measurement can be used to determine the salt content of soil in a saturated soil paste extract. The EC value is usually expressed in deciSiemens/metre (dS/m). For example, topsoil with an EC value of 2 dS/m is considered non-saline; topsoil with an EC value of 16 is very saline.

Flexible cropping - Cropping according to spring soil moisture conditions. That is, seeding when the spring soil moisture is adequate.

Groundwater - 1) Water that is passing through or standing in the soil and the underlying strata. It is free to move by gravity. (Agriculture Canada 1976). 2) Water in the ground that is in the zone of saturation, from which wells, springs and groundwater runoff are supplied. (VanderPluym and Harron 1992)

Parent material - The unconsolidated and more or less chemically weathered mineral or organic matter from which the solum of a soil has developed by pedogenic processes. (Agriculture Canada 1976)

Permeability, soil - The ease with which gases and liquids penetrate or pass through a bulk mass of soil or a layer of soil. (Agriculture Canada 1976)

Saline soil - A non-sodic soil containing enough soluble salts to interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 dS/m (at 25°C), the exchangeable sodium percentage is less than 15, and the pH is usually less than 8.5. (Agriculture Canada 1976)

Seepage - 1) The emergence of water from the soil along an extensive line, in contrast to a spring where water emerges from a local spot. (Agriculture Canada 1976). 2) The slow movement of water through small cracks, pores, interstices, etc. of a material into or out of a body of surface or subsurface water (VanderPluym and Harron 1992).

Till - Unstratified sediment deposited directly by a glacier and consisting of clay, sand, gravel and boulders intermingled in any proportion. (Agriculture Canada 1976)

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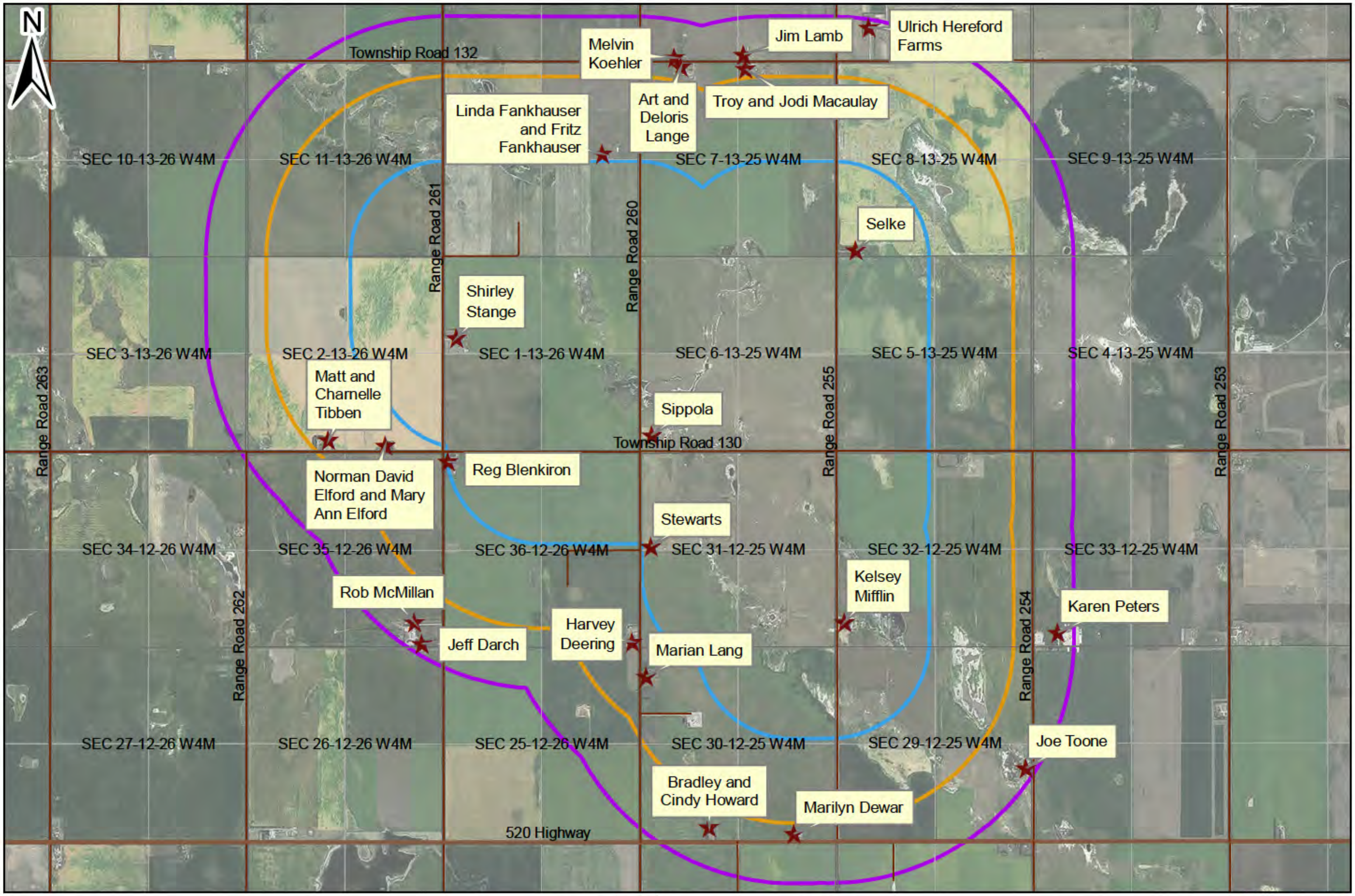
APPENDIX “E”

Residence Map

Claresholm Solar Project Area



Residences
Consultation Radius (800m)
Noise Buffer (1.5km)
Notification Radius (2.0km)

Meters

0 500 1,000 2,000 3,000

Prepared for: Perimeter Solar Inc.
Prepared by: Scott Land & Lease Ltd.
Date: September, 2017
Version: 2.0

SCOTT LAND & LEASE LTD - 25 YEARS -

APPENDIX “F”

Additional Team Member Information

Philipp Andres, *CSI Director and Secretary Treasurer* – Philipp has been involved in the renewable energy industry for twenty-five years and has developed ~ 320MW of renewable energy assets. He started with wind energy development in 1992 where he worked with NRCan and Ontario Hydro to perform wind energy assessments along the Lake Huron Shoreline in Ontario; this work resulted in Philipp leading the subsequent construction of the first commercial wind turbine in Ontario. He subsequently was Vice President (VP) of Project Development for the German wind turbine manufacturer, Tacke Windtechnik's Canadian subsidiary. He attracted rotor blade manufacturing for Tacke to Ontario, and most of this product was exported back to Europe. He later joined the world's largest wind turbine manufacturer, Vestas, as its General Manager (GM) of Canadian operations and its Senior VP of Business Development for North America. Under his leadership, he was involved on the supplier side in hundreds of MWs of projects in Alberta, the rest of Canada and the US. In 2001 he founded Port Albert Wind Farms Ltd. with his Calgary based partner David Thompson and developed the 40 MW Kingsbridge and the 270 MW K2 Wind Power Projects. Philipp later went on to partner with a local farmer to develop the 8.25MW Cruikshank Wind Farm; this project was later sold to Enbridge. Philipp is a former board member of: AWEA (2 yrs), CanWEA (total 4 yrs) & APPrO (10 yrs).

Prior to working in the renewable energy field, Philipp owned and operated his own Holstein dairy operation and also worked in the agricultural processing industry managing an alfalfa dehydration facility.

Philipp's References:

- Northern Cross Energy Limited contact: David Thompson, President (former CEO of Port Albert Wind Farms Ltd.) Phone: (403) 870-1524 email: dt@northerncross.ca

- 270 MW K2 Wind Power Project, contact: Jim Fitzowich, P.Eng., Managing Director, Western Power Partners Phone(403) 969-7327 email: jimf@wetpwr.net

- 40 MW Kingsbridge Project: contact: Ron Hankewich, Managing Director, Mirastar Energy Phone: (778) 995-9140 email: ronh@mirastar-energy.com

- 8.25 MW Cruickshank Wind Farm, contact: Kevin Cruickshank Phone: (519) 353-8346 email: kncruickshank@hurontel.on.ca

- Birendra (Bob) N. Singh, IESO Distinguished Research Fellow, Centre for Urban Energy, Ryerson University, Toronto, ON Phone: (416) 979-5000 ext. 2975 email: bnsingh@ryerson.ca

Hugh J. Campbell*, P.Eng., CSI President and Director* – Hugh is a mechanical technologist and engineer by education and is a registered professional engineer in good standing with the Professional Engineers of Ontario since 1986. He has thirty years of experience in industrial management, sales and engineering, including the last sixteen years in the renewable energy sector. His career experiences in renewable energy include asset evaluations, green field project development, project layout and contract negotiations for equipment procurement, warranties, engineering and construction services. Hugh's career in renewable energy began with Vestas

Canadian Wind Technology Inc. in 2001 where he worked in Sales and subsequently as GM for Canada. In 2006 he crossed over to a renewable energy start-up called Ventus energy as their VP. After an expansive wind energy development campaign in Prince Edward Island and New Brunswick, Ventus energy was purchased by SUEZ (aka GDF SUEZ and now ENGIE). In 2010, he came in on the ground floor as VP with another start-up called Sprott Power Inc., which later became Capstone Infrastructure. Through his sales, engineering, project acquisition and development experiences, Hugh has been involved in hundreds of MW's of renewable energy projects domestically and abroad.
Prior to working in the wind energy field, Hugh worked as an engineer in the agricultural processing industry.

Hugh's References:

- Don Bartlett, P.Eng.- President, B6 Consulting Inc., Bedford NS, p. 902.220.7918

- David Eva, P.Eng., M.Eng., CFA- Chief Executive Officer, Capstone Power Corp., Toronto ON, p. 416.649.5002

- Peter Prier - Sr. Principal Environmental Services (retired), Stantec Consulting Ltd., Guelph ON, p.
226.820.4666

- Jason Van Geel - President, Carlsun Energy Solutions Inc., Port Elgin ON, p. 519.832.4075

***Daniel Andres**, MSc. Ecology, CSI Vice President and Director* – As an ecologist, Daniel brings his comprehensive knowledge in Environmental Assessments and species at risk management to PSI. Daniel's experience includes work as an environmental consultant, where he focused on impact assessments for wildlife and species at risk habitat modeling for major energy and electrical infrastructure projects in Alberta and British Columbia. Daniel has also been instrumental in a variety of wildlife projects, including his current assistance to Simply Ag Solutions, a not-for-profit that provides funding to farmers and ranchers that enhance wildlife habitat on their farms. Daniel's expertise in the environmental and agricultural field has been critical to PSI's solar development activities and has allowed our company to select environmentally suitable sites and designs for solar projects in Western Canada.

Daniel's References:

- Dr. Philip McLoughlin – Associate Professor, Department of Biology, University of Saskatchewan. Phone: (306) 966-4451

- Dr. Kathreen Ruckstuhl – Associate Professor, Ecology & Evolution, University of Calgary. Phone (403) 220-8776 email: kruckstu@ucalgary.ca (Kathreen is only reachable by email during month of July, 2017)

- Travis Quirk - Executive Director, Simply Agriculture Solutions. Phone (306) 955-5477 (ext 204) email: travis@simplyag.ca

- Laura Keating, formerly Wildlife Planner with Tera Environmental Consultants, currently Conservation Research Analyst at Calgary Zoo, Phone: (403) 903-3335, email: lmkeating@gmail.com

***Mikkel Berthelsen**, Partner, Chief Legal Officer, Obton* – Mikkel is a law graduate from Aarhus University with studies in the U.S at both UC Hastings Law School and UC Berkeley. Mikkel has been employed at the Danish Embassy in Ottawa, Canada, and has practiced as a commercial lawyer. Over the last 10 years Mikkel has worked in the renewable energy industry in various commercial positions in Denmark, Germany and the U.S. In the course of his work in the renewable field, Mikkel has been responsible for the negotiation of contracts for renewable transactions totally over $2000mm CAD.

Nicky Larsen, Senior Business Developer at Obton A/S – Nicky is a commercial law graduate from Aarhus Business School. Over the last 10 years Nicky has been involved in project development, management and construction of renewable projects. Nicky has been the country manager for a Danish independent power producer in both Romania and Bulgaria and has driven the construction of more than 400 MW of renewable energy projects in Europe.

***Andreas Ditlev Duckert**, CFA, Partner, Chief Finance Officer at Obton A/S* – Andreas is a finance graduate from Copenhagen Business School and is a Chartered Financial Analyst. Over the last 9 years, he has worked on financing of PV projects and has completed project financing agreements at total value of more than CAD $1000mm. Previously, Andreas was a PV developer in both France and the U.K.

***Hans Peter Vestergaard**, Business Operation Manager at Obton A/S* – Hans Peter's formal education is as a Financial Engineer from the Business Academy in Aalborg, Denmark. Hans Peter has more than 11 years of experience in managing operating renewable assets, and for the past 6 years he has been responsible for daily management of Obton's operating European assets of more than 270MW.

For further information on PSI and Obton, please refer to our respective websites (www.perimetersolar.ca; http://www.obton.co.uk).

APPENDIX “G”

AESO Gate 2 Clearance Letter

August 2, 2017

Claresholm Solar Inc.
260, 2323-32nd Avenue NE
Calgary, AB T2E 7Z3

Attn: Hugh Campbell - President

Dear Mr. Campbell:

Re: P1879 – Claresholm Solar Project New POS (the "Project") – Acknowledgement of Gate 2 Completion

This letter provides AESO's acknowledgement that Claresholm Solar Inc. has met all Gate 2 requirements for the Project as outlined in the Connection Process. The completion date for Gate 2 has been set at August 2, 2017 and Stage 3 has commenced. The Project will now be listed in the AESO Connection Queue published monthly on the AESO's website: www.aeso.ca.

The target timeframe for Stage 3 is outlined in the Connection Queue Business Practices. The Project is expected to meet Gate 3 requirements as outlined in the Connection Process. Failure to do so may result in the SASR for the Project being cancelled and the Project being removed from the Project List and Connection Queue.

Should you have any questions or concerns in this regard, please contact me directly at [redacted]

Yours truly,

[redacted] 3-Aug-2017

Imtiaz Ali
Project Manager

cc:
1. Andrew Smith, AltaLink Management Limited.
2. Feng Chen, CF Power Ltd.

[redacted]

APPENDIX “H”

Report on Health and Safety Impacts of Solar Photovoltaics

NC CLEAN ENERGY TECHNOLOGY CENTER

Health and Safety Impacts of Solar Photovoltaics

MAY 2017

NC STATE UNIVERSITY

Health and Safety Impacts of Solar Photovoltaics

The increasing presence of utility-scale solar photovoltaic (PV) systems (sometimes referred to as solar farms) is a rather new development in North Carolina's landscape. Due to the new and unknown nature of this technology, it is natural for communities near such developments to be concerned about health and safety impacts. Unfortunately, the quick emergence of utility-scale solar has cultivated fertile grounds for myths and half-truths about the health impacts of this technology, which can lead to unnecessary fear and conflict.

Photovoltaic (PV) technologies and solar inverters are not known to pose any significant health dangers to their neighbors. The most important dangers posed are increased highway traffic during the relative short construction period and dangers posed to trespassers of contact with high voltage equipment. This latter risk is mitigated by signage and the security measures that industry uses to deter trespassing. As will be discussed in more detail below, risks of site contamination are much less than for most other industrial uses because PV technologies employ few toxic chemicals and those used are used in very small quantities. Due to the reduction in the pollution from fossil-fuel-fired electric generators, the overall impact of solar development on human health is overwhelmingly positive. This pollution reduction results from a partial replacement of fossil-fuel fired generation by emission-free PV-generated electricity, which reduces harmful sulfur dioxide (SO_2), nitrogen oxides (NO_x), and fine particulate matter ($PM_{2.5}$). Analysis from the National Renewable Energy Laboratory and the Lawrence Berkeley National Laboratory, both affiliates of the U.S. Department of Energy, estimates the health-related air quality benefits to the southeast region from solar PV generators to be worth 8.0 ¢ per kilowatt-hour of solar generation.[1] This is in addition to the value of the electricity and suggests that the air quality benefits of solar are worth more than the electricity itself.

Even though we have only recently seen large-scale installation of PV technologies, the technology and its potential impacts have been studied since the 1950s. A combination of this solar-specific research and general scientific research has led to the scientific community having a good understanding of the science behind potential health and safety impacts of solar energy. This paper utilizes the latest scientific literature and knowledge of solar practices in N.C. to address the health and safety risks associated with solar PV technology. These risks are extremely small, far less than those associated with common activities such as driving a car, and vastly outweighed by health benefits of the generation of clean electricity.

This paper addresses the potential health and safety impacts of solar PV development in North Carolina, organized into the following four categories:

(1) Hazardous Materials
(2) Electromagnetic Fields (EMF)
(3) Electric Shock and Arc Flash
(4) Fire Safety

1. Hazardous Materials

One of the more common concerns towards solar is that the panels (referred to as "modules" in the solar industry) consist of toxic materials that endanger public health. However, as shown in this section, solar energy systems may contain small amounts of toxic materials, but these materials do not endanger public health. To understand potential toxic hazards coming from a solar project, one must understand system installation, materials used, the panel end-of-life protocols, and system operation. This section will examine these aspects of a solar farm and the potential for toxicity impacts in the following subsections:

(1.2) Project Installation/Construction
(1.2) System Components
- 1.2.1 Solar Panels: Construction and Durability
- 1.2.2 Photovoltaic technologies
  - (a) Crystalline Silicon
  - (b) Cadmium Telluride (CdTe)
  - (c) CIS/CIGS
- 1.2.3 Panel End of Life Management
- 1.2.4 Non-panel System Components

(1.3) Operations and Maintenance

1.1 Project Installation/Construction

The system installation, or construction, process does not require toxic chemicals or processes. The site is mechanically cleared of large vegetation, fences are constructed, and the land is surveyed to layout exact installation locations. Trenches for underground wiring are dug and support posts are driven into the ground. The solar panels are bolted to steel and aluminum support structures and wired together. Inverter pads are installed, and an inverter and transformer are installed on each pad. Once everything is connected, the system is tested, and only then turned on.

Figure 1: Utility-scale solar facility (5 MW_{AC}) located in Catawba County. Source: Strata Solar

1.2 System Components

1.2.1 Solar Panels: Construction and Durability

Solar PV panels typically consist of glass, polymer, aluminum, copper, and semiconductor materials that can be recovered and recycled at the end of their useful life. [2] Today there are two PV technologies used in PV panels at utility-scale solar facilities, silicon, and thin film. As of 2016, all thin film used in North Carolina solar facilities are cadmium telluride (CdTe) panels from the US manufacturer First Solar, but there are other thin film PV panels available on the market, such as Solar Frontier's CIGS panels. Crystalline silicon technology consists of silicon wafers which are made into cells and assembled into panels, thin film technologies consist of thin layers of semiconductor material deposited onto glass, polymer or metal substrates. While there are differences in the components and manufacturing processes of these two types of solar technologies, many aspects of their PV panel construction are very similar. Specifics about each type of PV chemistry as it relates to toxicity are covered in subsections a, b, and c in section 1.2.2; on crystalline silicon, cadmium telluride, and CIS/CIGS respectively. The rest of this section applies equally to both silicon and thin film panels.

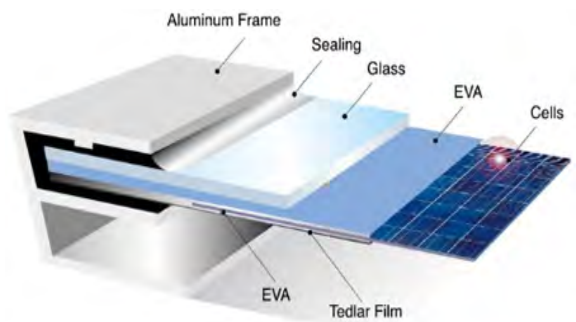


Figure 2: Components of crystalline silicon panels. The vast majority of silicon panels consist of a glass sheet on the topside with an aluminum frame providing structural support. Image Source: www.riteksolar.com.tw

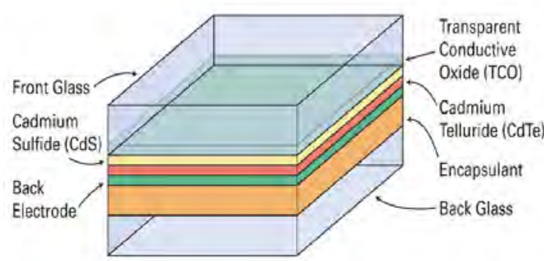


Figure 3: Layers of a common frameless thin-film panel (CdTe). Many thin film panels are frameless, including the most common thin-film panels, First Solar's CdTe. Frameless panels have protective glass on both the front and back of the panel. Layer thicknesses not to scale. Image Source: www.homepower.com

To provide decades of corrosion-free operation, PV cells in PV panels are encapsulated from air and moisture between two layers of plastic. The encapsulation layers are protected on the top with a layer of tempered glass and on the backside with a polymer sheet. Frameless modules include a protective layer of glass on the rear of the panel, which may also be tempered. The plastic ethylene-vinyl acetate (EVA) commonly provides the cell encapsulation. For decades, this same material has been used between layers of tempered glass to give car windshields and hurricane windows their great strength. In the same way that a car windshield cracks but stays intact, the EVA layers in PV panels keep broken panels intact (see Figure 4). Thus, a damaged module does not generally create small pieces of debris; instead, it largely remains together as one piece.

Figure 4: The mangled PV panels in this picture illustrate the nature of broken solar panels; the glass cracks but the panel is still in one piece. Image Source: http://img.alibaba.com/photo/115259576/broken_solar_panel.jpg

PV panels constructed with the same basic components as modern panels have been installed across the globe for well over thirty years.[3] The long-term durability and performance demonstrated over these decades, as well as the results of accelerated lifetime testing, helped lead to an industry-standard 25-year power production warranty for PV panels. These power warranties warrant a PV panel to produce at least 80% of their original nameplate production after 25 years of use. A recent SolarCity and DNV GL study reported that today's quality PV panels should be expected to reliably and efficiently produce power for thirty-five years.[4]

Local building codes require all structures, including ground mounted solar arrays, to be engineered to withstand anticipated wind speeds, as defined by the local wind speed requirements. Many racking products are available in versions engineered for wind speeds of up to 150 miles per hour, which is significantly higher than the wind speed requirement anywhere in North Carolina. The strength of PV mounting structures were demonstrated during Hurricane Sandy in 2012 and again during Hurricane Matthew in 2016. During Hurricane Sandy, the many large-scale solar facilities in New Jersey and New York at that time suffered only minor damage.[5] In the fall of 2016, the US and Caribbean experienced destructive winds and torrential rains from Hurricane Matthew, yet one leading solar tracker manufacturer reported that their numerous systems in the impacted area received zero damage from wind or flooding.[6]

In the event of a catastrophic event capable of damaging solar equipment, such as a tornado, the system will almost certainly have property insurance that will cover the cost to cleanup and repair the project. It is in the best interest of the system owner to protect their investment against such risks. It is also in their interest to get the project repaired and producing full power as soon as possible. Therefore, the investment in adequate insurance is a wise business practice for the system owner. For the same reasons, adequate insurance coverage is also generally a requirement of the bank or firm providing financing for the project.

1.2.2 Photovoltaic (PV) Technologies

a. **Crystalline Silicon**

This subsection explores the toxicity of silicon-based PV panels and concludes that they do not pose a material risk of toxicity to public health and safety. Modern crystalline silicon PV panels, which account for over 90% of solar PV panels installed today, are, more or less, a commodity product. The overwhelming majority of panels installed in North Carolina are crystalline silicon panels that are informally classified as Tier I panels. Tier I panels are from well-respected manufacturers that have a good chance of being able to honor warranty claims. Tier I panels are understood to be of high quality, with predictable performance, durability, and content. Well over 80% (by weight) of the content of a PV panel is the tempered glass front and the aluminum frame, both of which are common building materials. Most of the remaining portion are common plastics, including polyethylene terephthalate in the backsheet, EVA encapsulation of the PV cells, polyphenyl ether in the junction box, and polyethylene insulation on the wire leads. The active, working components of the system are the silicon photovoltaic cells, the small electrical leads connecting them together, and to the wires coming out of the back of the panel. The electricity generating and conducting components makeup less than 5% of the weight of most panels. The PV cell itself is nearly 100% silicon, and silicon is the second most common element in the Earth's crust. The silicon for PV cells is obtained by high-temperature processing of quartz sand (SiO_2) that removes its oxygen molecules. The refined silicon is converted to a PV cell by adding extremely small amounts of boron and phosphorus, both of which are common and of very low toxicity.

The other minor components of the PV cell are also generally benign; however, some contain lead, which is a human toxicant that is particularly harmful to young children. The minor components include an extremely thin antireflective coating (silicon nitride or titanium dioxide), a thin layer of aluminum on the rear, and thin strips of silver alloy that are screen-printed on the front and rear of cell.[7] In order for the front and rear electrodes to make effective electrical contact with the proper layer of the PV cell, other materials (called glass frit) are mixed with the silver alloy and then heated to etch the metals into the cell. This glass frit historically contains a small amount of lead (Pb) in the form of lead oxide. The 60 or 72 PV cells in a PV panel are connected by soldering thin solder-covered copper tabs from the back of one cell to the front of the next cell. Traditionally a tin-based solder containing some lead (Pb) is used, but some manufacturers have switched to lead-free solder. The glass frit and/or the solder may contain trace amounts of other metals, potentially including some with human toxicity such as cadmium. However, testing to simulate the potential for leaching from broken panels, which is discussed in more detail below, did not find a potential toxicity threat from these trace elements. Therefore, the tiny amount of lead in the grass frit and the solder is the only part of silicon PV panels with a potential to create a negative health impact. However, as described below, the very limited amount of lead involved and its strong physical and chemical attachment to other components of the PV panel means that even in worst-case scenarios the health hazard it poses is insignificant.

As with many electronic industries, the solder in silicon PV panels has historically been a lead-based solder, often 36% lead, due to the superior properties of such solder. However, recent advances in lead-free solders have spurred a trend among PV panel manufacturers to reduce or remove the lead in their panels. According to the 2015 Solar Scorecard from the Silicon Valley Toxics Coalition, a group that tracks environmental responsibility of photovoltaic panel manufacturers, fourteen companies (increased from twelve companies in 2014) manufacture PV panels certified to meet the European Restriction of

Hazardous Substances (RoHS) standard. This means that the amount of cadmium and lead in the panels they manufacture fall below the RoHS thresholds, which are set by the European Union and serve as the world's de facto standard for hazardous substances in manufactured goods.[8] The Restriction of Hazardous Substances (RoHS) standard requires that the maximum concentration found in any homogenous material in a produce is less than 0.01% cadmium and less than 0.10% lead, therefore, any solder can be no more than 0.10% lead.[9]

While some manufacturers are producing PV panels that meet the RoHS standard, there is no requirement that they do so because the RoHS Directive explicitly states that the directive does not apply to photovoltaic panels.[10] The justification for this is provided in item 17 of the current RoHS Directive: "The development of renewable forms of energy is one of the Union's key objectives, and the contribution made by renewable energy sources to environmental and climate objectives is crucial. Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources (4) recalls that there should be coherence between those objectives and other Union environmental legislation. Consequently, this Directive should not prevent the development of renewable energy technologies that have no negative impact on health and the environment and that are sustainable and economically viable."

The use of lead is common in our modern economy. However, only about 0.5% of the annual lead consumption in the U.S. is for electronic solder for all uses; PV solder makes up only a tiny portion of this 0.5%. Close to 90% of lead consumption in the US is in batteries, which do not encapsulate the pounds of lead contained in each typical automotive battery. This puts the lead in batteries at great risk of leaching into the environment. Estimates for the lead in a single PV panel with lead-based solder range from 1.6 to 24 grams of lead, with 13g (less than half of an ounce) per panel seen most often in the literature.[11] At 13 g/panel[12], each panel contains one-half of the lead in a typical 12-gauge shotgun shell. This amount equates to roughly 1/750th of the lead in a single car battery. In a panel, it is all durably encapsulated from air or water for the full life of the panel.[14]

As indicated by their 20 to 30-year power warranty, PV modules are designed for a long service life, generally over 25 years. For a panel to comply with its 25-year power warranty, its internal components, including lead, must be sealed from any moisture. Otherwise, they would corrode and the panel's output would fall below power warranty levels. Thus, the lead in operating PV modules is not at risk of release to the environment during their service lifetime. In extreme experiments, researchers have shown that lead can leach from crushed or pulverized panels.[15, 16] However, more real-world tests designed to represent typical trash compaction that are used to classify waste as hazardous or non-hazardous show no danger from leaching.[17, 18] For more information about PV panel end-of-life, see the Panel Disposal section.

As illustrated throughout this section, silicon-based PV panels do not pose a material threat to public health and safety. The only aspect of the panels with potential toxicity concerns is the very small amount of lead in some panels. However, any lead in a panel is well sealed from environmental exposure for the operating lifetime of the solar panel and thus not at risk of release into the environment.

b. Cadmium Telluride (CdTe) PV Panels

This subsection examines the components of a cadmium telluride (CdTe) PV panel. Research demonstrates that they pose negligible toxicity risk to public health and safety while significantly reducing the public's exposure to cadmium by reducing coal emissions. As of mid-2016, a few hundred MWs of cadmium telluride (CdTe) panels, all manufactured by the U.S. company First Solar, have been installed in North Carolina.

Questions about the potential health and environmental impacts from the use of this PV technology are related to the concern that these panels contain cadmium, a toxic heavy metal. However, scientific studies have shown that cadmium telluride differs from cadmium due to its high chemical and thermal stability.[19] Research has shown that the tiny amount of cadmium in these panels does not pose a health or safety risk.[20] Further, there are very compelling reasons to welcome its adoption due to reductions in unhealthy pollution associated with burning coal. Every GWh of electricity generated by burning coal produces about 4 grams of cadmium air emissions.[21] Even though North Carolina produces a significant fraction of our electricity from coal, electricity from solar offsets much more natural gas than coal due to natural gas plants being able to adjust their rate of production more easily and quickly. If solar electricity offsets 90% natural gas and 10% coal, each 5-megawatt (5 MW_{AC}, which is generally 7 MW_{DC}) CdTe solar facility in North Carolina keeps about 157 grams, or about a third of a pound, of cadmium *out of* our environment.[22, 23]

Cadmium is toxic, but all the approximately 7 grams of cadmium in one CdTe panel is in the form of a chemical compound cadmium telluride,[24] which has 1/100th the toxicity of free cadmium.[25] Cadmium telluride is a very stable compound that is non-volatile and non-soluble in water. Even in the case of a fire, research shows that less than 0.1% of the cadmium is released when a CdTe panel is exposed to fire. The fire melts the glass and encapsulates over 99.9% of the cadmium in the molten glass.[27]

It is important to understand the source of the cadmium used to manufacture CdTe PV panels. The cadmium is a byproduct of zinc and lead refining. The element is collected from emissions and waste streams during the production of these metals and combined with tellurium to create the CdTe used in PV panels. If the cadmium were not collected for use in the PV panels or other products, it would otherwise either be stockpiled for future use, cemented and buried, or disposed of.[28] Nearly all the cadmium in old or broken panels can be recycled which can eventually serve as the primary source of cadmium for new PV panels.[29]

Similar to silicon-based PV panels, CdTe panels are constructed of a tempered glass front, one instead of two clear plastic encapsulation layers, and a rear heat strengthened glass backing (together >98% by weight). The final product is built to withstand exposure to the elements without significant damage for over 25 years. While not representative of damage that may occur in the field or even at a landfill, laboratory evidence has illustrated that when panels are ground into a fine powder, very acidic water is able to leach portions of the cadmium and tellurium,[30] similar to the process used to recycle CdTe panels. Like many silicon-based panels, CdTe panels are reported (as far back ask 1998[31]) to pass the EPA's Toxic Characteristic Leaching Procedure (TCLP) test, which tests the potential for crushed panels in a landfill to leach hazardous substances into groundwater.[32] Passing this test means that they are classified as non-hazardous waste and can be deposited in landfills.[33, 34] For more information about PV panel end-of-life, see the Panel Disposal section.

There is also concern of environmental impact resulting from potential catastrophic events involving CdTe PV panels. An analysis of worst-case scenarios for environmental impact from CdTe PV panels, including earthquakes, fires, and floods, was conducted by the University of Tokyo in 2013. After reviewing the extensive international body of research on CdTe PV technology, their report concluded, "Even in the worst-case scenarios, it is unlikely that the Cd concentrations in air and sea water will exceed the environmental regulation values."[35] In a worst-case scenario of damaged panels abandoned on the ground, insignificant amounts of cadmium will leach from the panels. This is because this scenario is much less conducive (larger module pieces, less acidity) to leaching than the conditions of the EPA's TCLP test used to simulate landfill conditions, which CdTe panels pass.[36]

First Solar, a U.S. company, and the only significant supplier of CdTe panels, has a robust panel take-back and recycling program that has been operating commercially since 2005.[37] The company states that it is "committed to providing a commercially attractive recycling solution for photovoltaic (PV) power plant and module owners to help them meet their module (end of life) EOL obligation simply, cost-effectively and responsibly." First Solar global recycling services to their customers to collect and recycle panels once they reach the end of productive life whether due to age or damage. These recycling service agreements are structured to be financially attractive to both First Solar and the solar panel owner. For First Solar, the contract provides the company with an affordable source of raw materials needed for new panels and presumably a diminished risk of undesired release of Cd. The contract also benefits the solar panel owner by allowing them to avoid tipping fees at a waste disposal site. The legal contract helps provide peace of mind by ensuring compliance by both parties when considering the continuing trend of rising disposal costs and increasing regulatory requirements.

c. **CIS/CIGS and other PV technologies**

Copper indium gallium selenide PV technology, often referred to as CIGS, is the second most common type of thin-film PV panel but a distant second behind CdTe. CIGS cells are composed of a thin layer of copper, indium, gallium, and selenium on a glass or plastic backing. None of these elements are very toxic, although selenium is a regulated metal under the Federal Resource Conservation and Recovery Act (RCRA).[38] The cells often also have an extremely thin layer of cadmium sulfide that contains a tiny amount of cadmium, which is toxic. The promise of high efficiency CIGS panels drove heavy investment in this technology in the past. However, researchers have struggled to transfer high efficiency success in the lab to low-cost full-scale panels in the field.[39] Recently, a CIGS manufacturer based in Japan, Solar Frontier, has achieved some market success with a rigid, glass-faced CIGS module that competes with silicon panels. Solar Frontier produces the majority of CIS panels on the market today.[40] Notably, these panels are RoHS compliant,[41] thus meeting the rigorous toxicity standard adopted by the European Union even thought this directive exempts PV panels. The authors are unaware of any completed or proposed utility-scale system in North Carolina using CIS/CIGS panels.

1.2.3 Panel End-of-Life Management

Concerns about the volume, disposal, toxicity, and recycling of PV panels are addressed in this subsection. To put the volume of PV waste into perspective, consider that by 2050, when PV systems installed in 2020 will reach the end of their lives, it is estimated that the global annual PV panel waste tonnage will be 10% of the 2014 global e-waste tonnage.[42] In the U.S., end-of-life disposal of solar products is governed by the Federal Resource Conservation and Recovery Act (RCRA), as well as state policies in some situations. RCRA separates waste into hazardous (not accepted at ordinary landfill) and solid waste (generally accepted at ordinary landfill) based on a series of rules. According to RCRA, the way to determine if a PV panel is classified as hazardous waste is the Toxic Characteristic Leaching Procedure (TCLP) test. This EPA test is designed to simulate landfill disposal and determine the risk of hazardous substances leaching out of the landfill.[43, 44, 45] Multiple sources report that most modern PV panels (both crystalline silicon and cadmium telluride) pass the TCLP test.[46, 47] Some studies found that some older (1990s) crystalline silicon panels, and perhaps some newer crystalline silicon panels (specifics are not given about vintage of panels tested), do not pass the lead (Pb) leachate limits in the TCLP test.[48, 49]

The test begins with the crushing of a panel into centimeter-sized pieces. The pieces are then mixed in an acid bath. After tumbling for eighteen hours, the fluid is tested for forty hazardous substances that all must be below specific threshold levels to pass the test. Research comparing TCLP conditions to conditions of damaged panels in the field found that simulated landfill conditions provide overly conservative estimates of leaching for field-damaged panels.[50] Additionally, research in Japan has found no detectable Cd leaching from cracked CdTe panels when exposed to simulated acid rain.[51]

Although modern panels can generally be landfilled, they can also be recycled. Even though recent waste volume has not been adequate to support significant PV-specific recycling infrastructure, the existing recycling industry in North Carolina reports that it recycles much of the current small volume of broken PV panels. In an informal survey conducted by the NC Clean Energy Technology Center survey in early 2016, seven of the eight large active North Carolina utility-scale solar developers surveyed reported that they send damaged panels back to the manufacturer and/or to a local recycler. Only one developer reported sending damaged panels to the landfill.

The developers reported at that time that they are usually paid a small amount per panel by local recycling firms. In early 2017, a PV developer reported that a local recycler was charging a small fee per panel to recycle damaged PV panels. The local recycling firm known to authors to accept PV panels described their current PV panel recycling practice as of early 2016 as removing the aluminum frame for local recycling and removing the wire leads for local copper recycling. The remainder of the panel is sent to a facility for processing the non-metallic portions of crushed vehicles, referred to as “fluff” in the recycling industry.[52] This processing within existing general recycling plants allows for significant material recovery of major components, including glass which is 80% of the module weight, but at lower yields than PV-specific recycling plants. Notably almost half of the material value in a PV panel is in the few grams of silver contained in almost every PV panel produced today. In the long-term, dedicated PV panel recycling plants can increase treatment capacities and maximize revenues resulting in better output quality and the ability to recover a greater fraction of the useful materials.[53] PV-specific panel recycling technologies have been researched and implemented to some extent for the past decade, and have been shown to be able to recover over 95% of PV material (semiconductor) and over 90% of the glass in a PV panel.[54]

A look at global PV recycling trends hints at the future possibilities of the practice in our country. Europe installed MW-scale volumes of PV years before the U.S. In 2007, a public-private partnership between the European Union and the solar industry set up a voluntary collection and recycling system called PV CYCLE. This arrangement was later made mandatory under the EU’s WEEE directive, a program for waste electrical and electronic equipment.[55] Its member companies (PV panel producers) fully finance the association. This makes it possible for end-users to return the member companies’ defective panels for recycling at any of the over 300 collection points around Europe without added costs. Additionally, PV CYCLE will pick up batches of 40 or more used panels at no cost to the user. This arrangement has been very successful, collecting and recycling over 13,000 tons by the end of 2015.[56]

In 2012, the WEEE Directive added the end-of-life collection and recycling of PV panels to its scope.[57] This directive is based on the principle of extended-producer-responsibility. It has a global impact because producers that want to sell into the EU market are legally responsible for end-of-life management. Starting in 2018, this directive targets that 85% of PV products “put in the market” in Europe are recovered and 80% is prepared for reuse and recycling.

The success of the PV panel collection and recycling practices in Europe provides promise for the future of recycling in the U.S. In mid-2016, the US Solar Energy Industry Association (SEIA) announced that they are starting a national solar panel recycling program with the guidance and support of many leading PV panel producers.[58] The program will aggregate the services offered by recycling vendors and PV manufacturers, which will make it easier for consumers to select a cost-effective and environmentally responsible end-of-life management solution for their PV products. According to SEIA, they are planning the program in an effort to make the entire industry landfill-free. In addition to the national recycling network program, the program will provide a portal for system owners and consumers with information on how to responsibly recycle their PV systems.

While a cautious approach toward the potential for negative environmental and/or health impacts from retired PV panels is fully warranted, this section has shown that the positive health impacts of reduced emissions from fossil fuel combustion from PV systems more than outweighs any potential risk. Testing shows that silicon and CdTe panels are both safe to dispose of in landfills, and are also safe in worst case conditions of abandonment or damage in a disaster. Additionally, analysis by local engineers has found that the current salvage value of the equipment in a utility scale PV facility generally exceeds general contractor estimates for the cost to remove the entire PV system.[59, 60, 61]

1.2.4 Non-Panel System Components (racking, wiring, inverter, transformer)

While previous toxicity subsections discussed PV panels, this subsection describes the non-panel components of utility-scale PV systems and investigates any potential public health and safety concerns. The most significant non-panel component of a ground-mounted PV system is the mounting structure of the rows of panels, commonly referred to as “racking”. The vertical post portion of the racking is galvanized steel and the remaining above-ground racking components are either galvanized steel or aluminum, which are both extremely common and benign building materials. The inverters that make the solar generated electricity ready to send to the grid have weather-proof steel enclosures that protect the working components from the elements. The only fluids that they might contain are associated with their cooling systems, which are not unlike the cooling system in a computer. Many inverters today are RoHS compliant.

The electrical transformers (to boost the inverter output voltage to the voltage of the utility connection point) do contain a liquid cooling oil. However, the fluid used for that function is either a non-toxic mineral oil or a biodegradable non-toxic vegetable oil, such as BIOTEMP from ABB. These vegetable transformer oils have the additional advantage of being much less flammable than traditional mineral oils. Significant health hazards are associated with old transformers containing cooling oil with toxic PCBs. Transfers with PCB-containing oil were common before PCBs were outlawed in the U.S. in 1979. PCBs still exist in older transformers in the field across the country.

Other than a few utility research sites, there are no batteries on- or off-site associated with utility-scale solar energy facilities in North Carolina, avoiding any potential health or safety concerns related to battery technologies. However, as battery technologies continue to improve and prices continue to decline we are likely to start seeing some batteries at solar facilities. Lithium ion batteries currently dominate the world utility-scale battery market, which are not very toxic. No non-panel system components were found to pose any health or environmental dangers.

1.4 Operations and Maintenance – Panel Washing and Vegetation Control

Throughout the eastern U.S., the climate provides frequent and heavy enough rain to keep panels adequately clean. This dependable weather pattern eliminates the need to wash the panels on a regular basis. Some system owners may choose to wash panels as often as once a year to increase production, but most in N.C. do not regularly wash any PV panels. Dirt build up over time may justify panel washing a few times over the panels' lifetime; however, nothing more than soap and water are required for this activity.

The maintenance of ground-mounted PV facilities requires that vegetation be kept low, both for aesthetics and to avoid shading of the PV panels. Several approaches are used to maintain vegetation at NC solar facilities, including planting of limited-height species, mowing, weed-eating, herbicides, and grazing livestock (sheep). The following descriptions of vegetation maintenance practices are based on interviews with several solar developers as well as with three maintenance firms that together are contracted to maintain well over 100 of the solar facilities in N.C. The majority of solar facilities in North Carolina maintain vegetation primarily by mowing. Each row of panels has a single row of supports, allowing sickle mowers to mow under the panels. The sites usually require mowing about once a month during the growing season. Some sites employ sheep to graze the site, which greatly reduces the human effort required to maintain the vegetation and produces high quality lamb meat.[62]

In addition to mowing and weed eating, solar facilities often use some herbicides. Solar facilities generally do not spray herbicides over the entire acreage; rather they apply them only in strategic locations such as at the base of the perimeter fence, around exterior vegetative buffer, on interior dirt roads, and near the panel support posts. Also unlike many row crop operations, solar facilities generally use only general use herbicides, which are available over the counter, as opposed to restricted use herbicides commonly used in commercial agriculture that require a special restricted use license. The herbicides used at solar facilities are primarily 2-4-D and glyphosate (Round-up®), which are two of the most common herbicides used in lawns, parks, and agriculture across the country. One maintenance firm that was interviewed sprays the grass with a class of herbicide known as a growth regulator in order to slow the growth of grass so that mowing is only required twice a year. Growth regulators are commonly used on highway roadsides and golf courses for the same purpose. A commercial pesticide applicator license is required for anyone other than the landowner to apply herbicides, which helps ensure that all applicators are adequately educated about proper herbicide use and application. The license must be renewed annually and requires passing of a certification exam appropriate to the area in which the applicator wishes to work. Based on the limited data available, it appears that solar facilities in N.C. generally use significantly less herbicides per acre than most commercial agriculture or lawn maintenance services.

2. Electromagnetic Fields (EMF)

PV systems do not emit any material during their operation; however, they do generate electromagnetic fields (EMF), sometimes referred to as radiation. EMF produced by electricity is non-ionizing radiation, meaning the radiation has enough energy to move atoms in a molecule around (experienced as heat), but not enough energy to remove electrons from an atom or molecule (ionize) or to damage DNA. As shown below, modern humans are all exposed to EMF throughout our daily lives without negative health impact. Someone outside of the fenced perimeter of a solar facility is not exposed to significant EMF from the solar facility. Therefore, there is no negative health impact from the EMF produced in a solar farm. The following paragraphs provide some additional background and detail to support this conclusion.

Since the 1970s, some have expressed concern over potential health consequences of EMF from electricity, but no studies have ever shown this EMF to cause health problems.[63] These concerns are based on some epidemiological studies that found a slight increase in childhood leukemia associated with average exposure to residential power-frequency magnetic fields above 0.3 to 0.4 µT (microteslas) (equal to 3.0 to 4.0 mG (milligauss)). µT and mG are both units used to measure magnetic field strength. For comparison, the average exposure for people in the U.S. is one mG or 0.1 µT, with about 1% of the population with an average exposure in excess of 0.4 µT (or 4 mG).[64] These epidemiological studies, which found an association but not a causal relationship, led the World Health Organization's International Agency for Research on Cancer (IARC) to classify ELF magnetic fields as "possibly carcinogenic to humans". Coffee also has this classification. This classification means there is limited evidence but not enough evidence to designate as either a "probable carcinogen" or "human carcinogen". Overall, there is very little concern that ELF EMF damages public health. The only concern that does exist is for long-term exposure above 0.4 µT (4 mG) that may have some connection to increased cases of childhood leukemia. In 1997, the National Academies of Science were directed by Congress to examine this concern and concluded:

> "Based on a comprehensive evaluation of published studies relating to the effects of power-frequency electric and magnetic fields on cells, tissues, and organisms (including humans), the conclusion of the committee is that the current body of evidence does not show that exposure to these fields presents a human-health hazard. Specifically, no conclusive and consistent evidence shows that exposures to residential electric and magnetic fields produce cancer, adverse neurobehavioral effects, or reproductive and developmental effects."[65]

There are two aspects to electromagnetic fields, an electric field and a magnetic field. The electric field is generated by voltage and the magnetic field is generated by electric current, i.e., moving electrons. A task group of scientific experts convened by the World Health Organization (WHO) in 2005 concluded that there were no substantive health issues related to *electric* fields (0 to 100,000 Hz) at levels generally encountered by members of the public.[66] The relatively low voltages in a solar facility and the fact that electric fields are easily shielded (i.e., blocked) by common materials, such as plastic, metal, or soil means that there is no concern of negative health impacts from the electric fields generated by a solar facility. Thus, the remainder of this section addresses magnetic fields. Magnetic fields are not shielded by most common materials and thus can easily pass through them. Both types of fields are strongest close to the source of electric generation and weaken quickly with distance from the source.

The direct current (DC) electricity produced by PV panels produce stationary (0 Hz) electric and magnetic fields. Because of minimal concern about potential risks of stationary fields, little scientific research has examined stationary fields' impact on human health.[67] In even the largest PV facilities, the DC voltages and currents are not very high. One can illustrate the weakness of the EMF generated by a PV panel by placing a compass on an operating solar panel and observing that the needle still points north.

While the electricity throughout the majority of a solar site is DC electricity, the inverters convert this DC electricity to alternating current (AC) electricity matching the 60 Hz frequency of the grid. Therefore, the inverters and the wires delivering this power to the grid are producing non-stationary EMF, known as extremely low frequency (ELF) EMF, normally oscillating with a frequency of 60 Hz. This frequency is at the low-energy end of the electromagnetic spectrum. Therefore, it has less energy than other commonly encountered types of non-ionizing radiation like radio waves, infrared radiation, and visible light.

The wide use of electricity results in background levels of ELF EMFs in nearly all locations where people spend time – homes, workplaces, schools, cars, the supermarket, etc. A person's average exposure depends upon the sources they encounter, how close they are to them, and the amount of time they spend there.[68] As stated above, the average exposure to magnetic fields in the U.S. is estimated to be around one mG or 0.1 μT, but can vary considerably depending on a person's exposure to EMF from electrical devices and wiring.[69] At times we are often exposed to much higher ELF magnetic fields, for example when standing three feet from a refrigerator the ELF magnetic field is 6 mG and when standing three feet from a microwave oven the field is about 50 mG.[70] The strength of these fields diminish quickly with distance from the source, but when surrounded by electricity in our homes and other buildings moving away from one source moves you closer to another. However, unless you are inside of the fence at a utility-scale solar facility or electrical substation it is impossible to get very close to the EMF sources. Because of this, EMF levels at the fence of electrical substations containing high voltages and currents are considered "generally negligible".[71, 72]

The strength of ELF-EMF present at the perimeter of a solar facility or near a PV system in a commercial or residential building is significantly lower than the typical American's average EMF exposure.[73, 74] Researchers in Massachusetts measured magnetic fields at PV projects and found the magnetic fields dropped to very low levels of 0.5 mG or less, and in many cases to less than background levels (0.2 mG), at distances of no more than nine feet from the residential inverters and 150 feet from the utility-scale inverters.[75] Even when measured within a few feet of the utility-scale inverter, the ELF magnetic fields were well below the International Commission on Non-Ionizing Radiation Protection's recommended magnetic field level exposure limit for the general public of 2,000 mG.[76] It is typical that utility scale designs locate large inverters central to the PV panels that feed them because this minimizes the length of wire required and shields neighbors from the sound of the inverter's cooling fans. Thus, it is rare for a large PV inverter to be within 150 feet of the project's security fence.

Anyone relying on a medical device such as pacemaker or other implanted device to maintain proper heart rhythm may have concern about the potential for a solar project to interfere with the operation of his or her device. However, there is no reason for concern because the EMF outside of the solar facility's fence is less than 1/1000 of the level at which manufacturers test for ELF EMF interference, which is 1,000 mG.[77] Manufacturers of potentially affected implanted devices often provide advice on electromagnetic interference that includes avoiding letting the implanted device get too close to certain sources of fields such as some household appliances, some walkie-talkies, and similar transmitting devices. Some manufacturers' literature does not mention high-voltage power lines, some say that exposure in public areas should not give interference, and some advise not spending extended periods of time close to power lines.[78]

3. Electric Shock and Arc Flash Hazards

There is a real danger of electric shock to anyone entering any of the electrical cabinets such as combiner boxes, disconnect switches, inverters, or transformers; or otherwise coming in contact with voltages over 50 Volts.[79] Another electrical hazard is an arc flash, which is an explosion of energy that can occur in a short circuit situation. This explosive release of energy causes a flash of heat and a shockwave, both of which can cause serious injury or death. Properly trained and equipped technicians and electricians know how to safely install, test, and repair PV systems, but there is always some risk of injury when hazardous voltages and/or currents are present. Untrained individuals should not attempt to inspect, test, or repair any aspect of a PV system due to the potential for injury or death due to electric shock and arc flash, The National Electric Code (NEC) requires appropriate levels of warning signs on all electrical components based on the level of danger determined by the voltages and current potentials. The national electric code also requires the site to be secured from unauthorized visitors with either a six-foot chain link fence with three strands of barbed wire or an eight-foot fence, both with adequate hazard warning signs.

4. Fire Safety

The possibility of fires resulting from or intensified by PV systems may trigger concern among the general public as well as among firefighters. However, concern over solar fire hazards should be limited because only a small portion of materials in the panels are flammable, and those components cannot self-support a significant fire. Flammable components of PV panels include the thin layers of polymer encapsulates surrounding the PV cells, polymer backsheets (framed panels only), plastic junction boxes on rear of panel, and insulation on wiring. The rest of the panel is composed of non-flammable components, notably including one or two layers of protective glass that make up over three quarters of the panel's weight.

Heat from a small flame is not adequate to ignite a PV panel, but heat from a more intense fire or energy from an electrical fault can ignite a PV panel.[80] One real-world example of this occurred during July 2015 in an arid area of California. Three acres of grass under a thin film PV facility burned without igniting the panels mounted on fixed-tilt racks just above the grass.[81] While it is possible for electrical faults in PV systems on homes or commercial buildings to start a fire, this is extremely rare.[82] Improving understanding of the PV-specific risks, safer system designs, and updated fire-related codes and standards will continue to reduce the risk of fire caused by PV systems.

PV systems on buildings can affect firefighters in two primary ways, 1) impact their methods of fighting the fire, and 2) pose safety hazard to the firefighters. One of the most important techniques that firefighters use to suppress fire is ventilation of a building's roof. This technique allows superheated toxic gases to quickly exit the building. By doing so, the firefighters gain easier and safer access to the building, Ventilation of the roof also makes the challenge of putting out the fire easier. However, the placement of rooftop PV panels may interfere with ventilating the roof by limiting access to desired venting locations.

New solar-specific building code requirements are working to minimize these concerns. Also, the latest National Electric Code has added requirements that make it easier for first responders to safely and effectively turn off a PV system. Concern for firefighting a building with PV can be reduced with proper fire fighter training, system design, and installation. Numerous organizations have studied fire fighter safety related to PV. Many organizations have published valuable guides and training programs. Some notable examples are listed below.

- The International Association of Fire Fighters (IAFF) and International Renewable Energy Council (IREC) partnered to create an online training course that is far beyond the PowerPoint click-and-view model. The self-paced online course, "Solar PV Safety for Fire Fighters," features rich video content and simulated environments so fire fighters can practice the knowledge they've learned. www.iaff.org/pvsafetytraining
- Photovoltaic Systems and the Fire Code: Office of NC Fire Marshal
- Fire Service Training, Underwriter's Laboratory

- Firefighter Safety and Response for Solar Power Systems, National Fire Protection Research Foundation
- Bridging the Gap: Fire Safety & Green Buildings, National Association of State Fire Marshalls
- Guidelines for Fire Safety Elements of Solar Photovoltaic Systems, Orange County Fire Chiefs Association
- Solar Photovoltaic Installation Guidelines, California Department of Forestry & Fire Protection, Office of the State Fire Marshall
- PV Safety & Firefighting, Matthew Paiss, Homepower Magazine
- PV Safety and Code Development: Matthew Paiss, Cooperative Research Network

Summary

The purpose of this paper is to address and alleviate concerns of public health and safety for utility-scale solar PV projects. Concerns of public health and safety were divided and discussed in the four following sections: (1) Toxicity, (2) Electromagnetic Fields, (3) Electric Shock and Arc Flash, and (4) Fire. In each of these sections, the negative health and safety impacts of utility-scale PV development were shown to be negligible, while the public health and safety benefits of installing these facilities are significant and far outweigh any negative impacts.

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Published by the N.C. Clean Energy Technology Center at N.C. State University

NC CLEAN ENERGY
TECHNOLOGY CENTER

APPENDIX “I”

Project Specific Information Package

Sheep resting in the shade beneath a solar installation
(photo credit: Solar Trade Association)

Potential Impacts

The solar panels on site will reach approximately 3.3 meters (10.5 feet) above ground level. The promotion of grassland on site combined with the limited height of the solar panels will help the project to blend into the existing agricultural landscape.

Following construction, the operation of the project will not generate noticeable noise. As part of the Alberta Utilities Commission (AUC) process, we are conducting a noise impact assessment that will document anticipated noise levels. The AUC's Rule 012 "Noise Control", sets limits on the ambient noise levels for projects like this.

Melkof/Düssin
15 megawatt solar farm located along the high speed railway between Hamburg and Berlin, owned and operated by partner Obton A/S.

To learn more about the application and review process, please contact:
ALBERTA ULTILITIES COMMISSION (AUC)
780-427-4903 (toll-free by dialing 310-0000 before the number.)

Claresholm Solar is committed to protecting your privacy. Collected personal information will be protected under the provincial Personal Information Protection Act (PIPA). As part of the regulatory process for new generation projects, Claresholm Solar may be required to provide your personal information to the AUC.

Claresholm Solar Inc.
'Energy for a brighter future'

Claresholm Solar Inc.
260, 2323 – 32nd Ave N.E
Calgary, Alberta
T2E 6Z3

July 2017

Claresholm Solar Project

The Claresholm Solar project is a 130 MW AC solar farm located approximately 10km east of the town of Claresholm, Alberta. The project site consists of 1,261 acres of private agricultural land located within a saline basin and is adjacent to an existing 138kV electrical transmission line. When in operation, the solar farm is anticipated to produce over 237 million kWh per year of electricity – that's enough to power roughly 33,000 Alberta homes for a year. The tentative commercial operation date is September 2020. With an operational lifespan of over 30 years, this project will produce renewable electricity for decades.

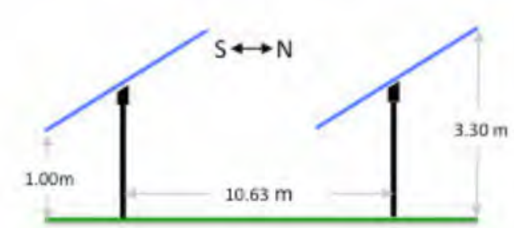
Community Open House
We invite you to join us at our community open house to learn more about the project:
Thursday August 17, 2017
5:00 pm – 8:00 pm
Claresholm Community Centre
(5920 – 8th Street W)

Company Profile

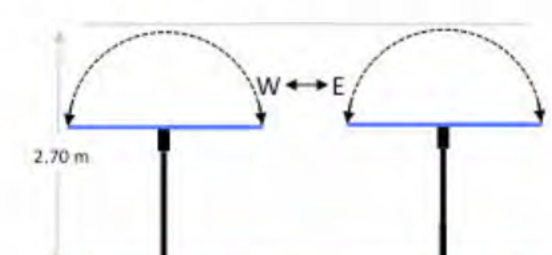
Claresholm Solar Inc. is a project-dedicated company owned by Perimeter Solar Inc (PSI). As a company, Perimeter Solar has extensive experience in renewable energy development that includes the expertise of the founding members and partner, Obton A/S. For more information about Perimeter Solar's founders and Obton A/S, please visit **perimetersolar.ca** and **www.obton.co.uk**

Facility Details

The solar farm will consist of solar photovoltaic (PV) panels mounted on ground-based racking structures. These solar panels convert the energy from the sun directly into electrical energy. The solar panels used for the solar farm may be either a fixed-mounted system or a tracker-type system, as shown in the below figures. The preliminary layout of the solar farm is based on single-axis trackers with panel rows lining up in a north-south direction. In the case of fixed axis trackers, the panel rows would orient east-west.



Fixed-mounted System



Tracker-type System

Facility Details Continued

Additional components within the solar farm will include:

- Substation with transformers and electrical control equipment
- Electrical inverter stations to convert the generated DC power to AC Power
- Buried electrical collector lines to transmit AC power from inverters to substation
- Interconnection facility to connect solar project to provincial transmission system
- Operations & Maintenance and control building located at the substation site
- Fencing around the perimeter of the project to regulate access to the site

Below we have included an approximate schedule of anticipated milestones for the project from 2017 to the anticipated project commercial operation date in 2020.

Project Stage	Completion Date
Alberta Electric System Operator (AESO) Gate 2 Clearance	July 2017
Public Consultation	August 2017
Preliminary Engineering	September 2017
Environmental Investigation & Reporting	November 2017
Alberta Environment & Parks review and approval process	December 2017
Detailed Engineering	February 2018
Alberta Utilities Commission application review and approval process	April 2018
Equipment Supply Contracts	May 2018
Contractor Selection and Engagement	May 2018
Commercial Operation	September 2020

Photo of the host landowner's sheep grazing in the foothills of Alberta

Project Benefits

The site for this solar facility has been selected because of its proximity to an existing transmission line and for its environmental features. Approximately 65% of the site is tame pasture land and the remaining 35% is land that was recently converted from tame grass to annual crop land. With these features, we have sought approaches that benefit the environment and the rural agricultural economy.

Environmental and Agricultural Considerations

Perimeter Solar (PSI) has been finding innovative ways to harness the energy from the sun in harmony with the environment and agriculture. As part of our approach, we have sought non-native grasslands and marginal agricultural land that can host a solar farm while promoting wildlife and continued livestock production on the land. With this goal in mind, the Claresholm site was chosen. As part of ongoing environmental studies on site, no conflicts with sensitive species and habitats have been identified, which reflects our careful selection of the project site.

As part of the operations of the solar farm, the landowner will be able to graze their sheep flock within the site, allowing for continued agricultural production. As part of this, the land that was recently converted from grassland to cropland will be returned to pasture through forage planting. Not only will this offer the sheep quality grazing, but in time perennial grasslands can also improve soil health through building soil organic matter, alleviating salinity issues which are observed on site, and promote habitat for a range of wildlife.

3 megawatt single axis tracker park built on an old waste site - owned by Obton A/S
Location: Dirac, France (near Bordeaux)

Community Benefits

The total capital cost of the project is anticipated to be over $210 million, which represents a significant investment in the Province of Alberta and the local area. During the construction phase of the project, between 250 to 300 people would be employed, and factoring in the time of the construction period (roughly 18 months), around 150 person years of employment would be directly generated. With many of the construction contractors lodging in the local area, further benefits will be generated to local businesses such as hotels and restaurants.

During the operation phase of the project, which is anticipated to last 30 years or more, approximately 3 to 4 permanent technician jobs will be created for the maintenance of the solar facility. In addition, contractors will be hired for ongoing maintenance related to such things as snow clearing and dust control on gravel roads. PSI will strive to hire local suppliers and contractors wherever possible. Beyond direct job creation, the solar farm will also generate significant tax revenue for the MD of Willow Creek and for the Province of Alberta. This tax contribution will promote the services provided by the municipal district and province and can also help alleviate the tax burden placed on residents for these services.

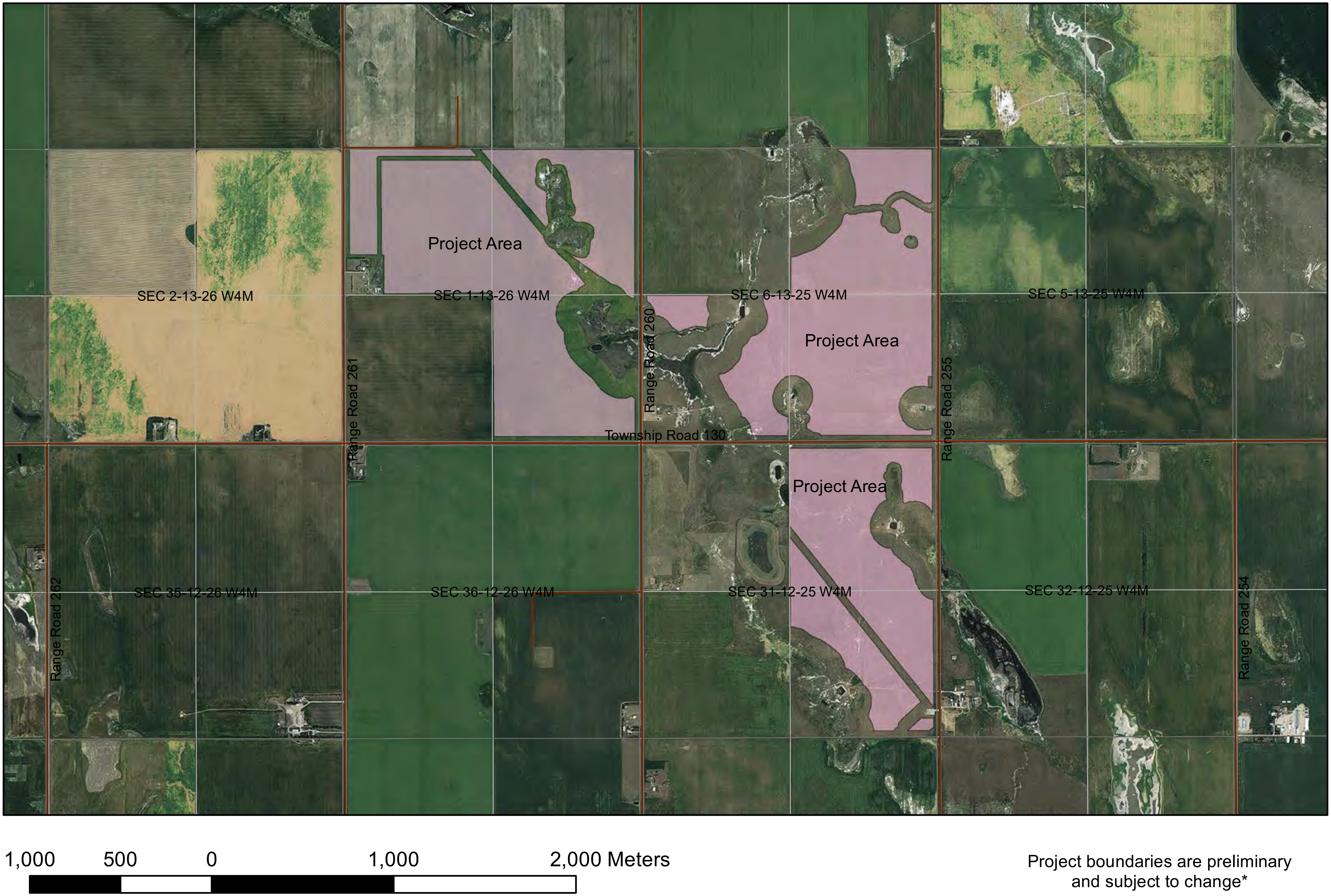
Public Engagement

We welcome the public's input on the Claresholm Solar farm and are keen to work with the local community in improving the design of the project.

Early stage consultations have begun with landowners neighbouring the project, and if we have not already met or spoken to you, then we look forward to doing so in the near future. For further information or to arrange a personal consultation, please contact:

Scott Land & Lease Ltd.
Suite 900, 202 – 6th Ave SW
Calgary, AB T2P 2R9
Samantha Brown
403-261-6541 or ClaresholmSolar@Scottland.ca

Claresholm Solar Project Area



Project boundaries are preliminary and subject to change*

Step 6: The public hearing process*

The public hearing process provides an opportunity for those who have been unable to resolve their concerns with the applicant and have made a filing, to express their views directly to a panel of Commission members. The panel reviews the initial filings and grants what is referred to as standing to those who may be directly and adversely affected by the proposed project. Standing is necessary to continue involvement as an intervener in the proceeding which may include the filing of evidence and participation in an oral or written hearing.

The AUC will issue a notice of hearing setting out the hearing date, location and additional process steps and deadlines. An AUC public hearing operates similarly to a court proceeding and is a quasi-judicial process. The general public is welcome to attend as an observer and the hearings are often broadcast online so that those interested can listen-in.

Participants in a hearing can either represent themselves or be represented by legal counsel. In addition, participants may hire experts to assist in preparing and presenting evidence to support their position.

Persons who hire legal counsel or technical experts must be aware that while reimbursement for the costs of legal and technical assistance may be available under Rule 009, recovery of costs is subject to the Commission assessing the value of the contribution provided by counsel and technical experts. People with similar interests and positions are expected to work together to ensure that any expenditures for legal or technical assistance are minimized and costs are not duplicated.

Step 7: The decision

For electric transmission facilities, the need for transmission development filed by the Alberta Electric System Operator to the AUC must be considered to be correct unless someone satisfies the Commission that the needs application is technically deficient, or that to approve it would be contrary to the public interest. For electric needs applications, the Commission can either approve, deny, or send the application back with suggestions for change.

Commission decisions made about applications filed for a specific utility development, including electric transmission lines, gas utility pipelines and power plants, may be approved, approved with conditions or denied. Decisions are typically released within 90 days from the close of the record as a written report. The decision, available on the AUC website, will summarize the Commission's findings and state its reasons for the decision with any conditions or approval time limits if applicable.

Sometimes needs and facility applications are considered together in a single proceeding.

Step 8: Right to appeal

A participant in a hearing who is dissatisfied with the decision of the Commission may request that the Commission review and vary its decision. Such a request must follow the procedure set out in Rule 016: *Review of Commission Decisions*.

A dissatisfied participant may also file a leave to appeal motion in the Court of Appeal of Alberta within 30 days from the date the decision is issued.

Step 9: Construction and operation

Any applicant that receives a permit to construct and licence to operate a facility from the Commission must adhere to any conditions that were set out in the decision. If you notice something during the construction or operational phases of a project that concerns you, bring this to the attention of the applicant's attention. If you are not satisfied with the response you receive, please bring your concerns to the attention of the AUC.

***Denotes opportunity for public involvement**

The Alberta Utilities Commission is committed to ensuring that Albertans whose rights may be directly and adversely affected by utility development in Alberta have the opportunity to have their concerns heard, understood and considered. If you believe you may be directly and adversely affected, you can become involved in the AUC application and review process.

Contact information

Phone: 780-427-4903
Email: consumer-relations@auc.ab.ca

Dial 310-0000 prior to the 10-digit number and then press 1 for toll-free access anywhere in Alberta.

Information session

It is our goal to ensure that you understand the process, and your opportunities for involvement in proceedings to consider utility development applications. For those interested in having an AUC staff member further explain the application and review process or answer questions you may have about your involvement in utility development proceedings, please contact us as we may schedule a formal information session for you. The virtual information session on our website, found under Involving Albertans, will also provide you with further details which could assist you in understanding the process and having your say in a utility development proceeding.

This brochure provides general information only. Specific participation opportunities may differ depending on the type of application.

Updated October 2014

AUC
Alberta Utilities Commission

Public involvement in a proposed utility development

Understanding your rights and options for participating in a proceeding to consider applications for a proposed project in your area

Application process

Step 1*
Public consultation by the applicant.

Step 2
Application filed with the AUC.

Step 3
The AUC issues a notice of application or notice of hearing.

Step 4*
Interested parties submit filings to the AUC with any outstanding issues or objections.

If the AUC does not receive any submissions, the application will be reviewed and a decision may be made without a hearing.

Step 5*
The AUC issues a notice of hearing, if it was not already issued in Step 3.
- **Continued opportunity for consultation and negotiation with the applicant.**

Step 6*
Public hearing.

Step 7
The AUC issues its decision. Below are the options the AUC may consider for:

Needs applications from the Alberta Electric System Operator:
- **Approval of application.**
- **Return to the Alberta Electric System Operator with suggestions.**
- **Denial of application.**

Facilities applications:
- **Approval of application.**
- **Approval of application with conditions.**
- **Denial of application.**

Step 8
Option to appeal decision or ask the AUC to review its decision.

Step 9
Approvals, construction and operation of facility, if approved.

Having your say

Early discussions with the applicant about proposed utility developments will often result in greater influence on what is filed in the application for approval. Utility developments include natural gas pipelines, electric transmission lines and substations (including Alberta Electric System Operator needs identification documents), and power plants. Should you have concerns related to a proposed utility development, it is best to have early and ongoing discussions with the applicant.

If your objections cannot be resolved, or you have outstanding concerns upon the filing of an application with the AUC, you have an opportunity to submit an initial filing with your objections in writing to the AUC containing the following information:
- **How you may be affected by the proposed project and the location of your land or residence in relation to it or any alternative proposed in the application.**
- **The potential effect the proposed project may have on your property or interest in the property .**
- **A description of the extent to which you may be affected, and how you may be affected in a different way or to a greater degree than other members of the general public.**

Following this initial filing, you may be able to fully participate in the proceeding. This could include having legal representation and participation in a public hearing. It is important to note that any applied for routes and segments (preferred and alternate) could be chosen as the approved route in the AUC decision.

Step 1: Public consultation prior to application*

Prior to filing an application with the AUC for the approval of a proposed utility development, the applicant is required to conduct public consultation in the area of the proposed project, so that concerns may be raised, addressed and if possible, resolved.

The requirements for consultation and notification, namely the participant involvement requirements, are set out in Rule 007 for electric facilities and Rule 020 for gas utility pipelines.

Potentially affected parties are strongly encouraged to participate in the initial public consultation, as early involvement in discussions with an applicant may lead to greater influence on project planning and what is submitted to the AUC for approval.

Step 2: Application to the AUC

When the participant involvement requirements have been completed, the proponent of the utility development files an application with the AUC. The application must indicate the issues which came up during the public consultation and any amendments considered or made to the project. Any unresolved objections or concerns which arose from the public consultation must be identified in the application.

***Denotes opportunity for public involvement**

Step 3: Public notification

The Commission will issue a notice when it receives an application that, in the Commission's opinion, may directly and adversely affect the rights of one or more people. The notice is typically sent by mail to residents in the project area and may also be published in local newspapers. The notice will provide key dates, contacts and participation information for those interested in becoming involved in the application process.

Step 4: Public filings to the AUC*

If you have unresolved objections or concerns about the proposed project filed with the AUC for approval and wish to participate in an AUC proceeding, you must make an initial written filing. Your filing must include your contact information, concern or interest in the application, an explanation of your position and what you feel the AUC should decide. Please be aware that any information or materials filed with the AUC, except information granted confidentiality, is available to the public.

Filing your concerns

The eFiling System is a web-based tool created to manage applications and filings made to the AUC through a proceeding-based review. This system gives access to all public documents associated with applications filed with the AUC and is the most efficient way to provide your input to the AUC and monitor the related proceeding filings.

Those who do not have access to the Internet can send filings, evidence and other material by mail or fax and the AUC will upload the submission on your behalf.

Participant cost reimbursement

A person determined by the Commission to be a local intervener can apply for reimbursement of reasonable costs incurred while participating in an AUC proceeding. Details regarding recovery of participants' costs are described in Rule 009: *Rules on Local Intervener Costs.*

Step 5: Consultation and negotiation*

The Commission supports ongoing efforts to reach a positive outcome for the applicant and all affected parties. The Commission encourages the applicant and those who have made filings to continue to attempt to resolve any outstanding issues. If all concerns can be satisfactorily resolved this may eliminate the need for a formal hearing. However, if there continues to be unresolved issues, typically those matters will be addressed at an AUC public hearing.

APPENDIX “J”

Letter of support from Hutterian Brethren Church of Granum

FROM: Hutterian Brethren Church of Granum

[redacted]

TO WHOM IT MAY CONCERN:

Re: Claresholm Solar Project Letter of Authorization

We, the Hutterian Brethren Church of Granum, the owner of the lands mentioned below, hereby give Claresholm Solar Inc., and its agents permission to act as our agent to acquire the necessary permits and information from the municipality or other authorities concerned, needed to approve the construction of the Claresholm Solar Project. For clarity, permission is granted to Claresholm Solar Inc., to apply for any land rezoning and Development Permit Application as may be required for gaining approval from the municipality or other authorities for the construction of the Claresholm Solar Project.

Lands:		
SE-1-13-26-W4	NE-6-13-25-W4	NE-31-12-25-W4
NE-1-13-26-W4	SE-6-13-25-W4	SE-31-12-25-W4
NW-1-13-26-W4	SW-6-13-25-W4	

Sincerely,

Hutterian Brethren Church of Granum

Per: [redacted]
Leonard Hoffer

Per: [redacted]
George Tschetter

HUTTERIAN BRETHERN CHURCH OF GRANUM

September 13, 2017

HAND DELIVERED

MD WILLOW CREEK NO. 26
BOX 550
CLARESHOLM, ALBERTA
T0L 0T0

Dear Madam/Sir:

Re: CLARESHOLM SOLAR INC.
Proposed Claresholm area Solar Project
E ½ 31-12-25 W4M
E ½ 6 & SW 6-13-25 W4M
E ½ 1 & NW 1-13-26 W4M

Please be advised that Claresholm Solar Inc. has a valid Lease Agreement with the Hutterian Brethren Church of Granum in connection with the above noted project on the above noted lands. Further, we approve and fully support the Development Permit Application in connection with the above mentioned project. The Hutterian Brethren Church of Granum also hold an interest in Claresholm Solar Inc. and fully support this project.

Should you have any questions or concerns, please contact the writer.

Yours truly,

HUTTERIAN BRETHERN CHURCH OF GRANUM

Per: ________________
LEONARD HOFER

APPENDIX “K”

Alberta Culture & Tourism Historical Resources Act letter of approval and form of Standard Requirements

Alberta Culture and Tourism

HRA Number: 4941-17-0027-002

September 15, 2017

Historical Resources Act Approval

Proponent: Perimeter Solar Inc.

Contact: Hugh Campbell

Agent: Arrow Archaeology Limited

Contact: Neil Mirau

Project Name: **Claresholm Solar Project**

Project Components: Solar Power

Application Purpose: Requesting HRA Approval / Requirements

Amendment to Project Submitted Previously

Historical Resources Act approval is granted for the activities described in this application and its attached plan(s)/sketch(es) subject to Section 31, "a person who discovers an historic resource in the course of making an excavation for a purpose other than for the purpose of seeking historic resources shall forthwith notify the Minister of the discovery." The chance discovery of historical resources is to be reported to the contacts identified within Standard Requirements under the *Historical Resources Act*: Reporting the Discovery of Historic Resources.

Sheila Macdonald

Regulatory Approvals Coordinator

Lands Affected: Additional Lands

Proposed Development Area:

MER	RGE	TWP	SEC	LSD List
4	25	13	6	1-10,15,16
4	26	13	1	1,2,7-16
4	25	12	31	1,2,7,8,9,10,15,16

Documents Attached:

Document Name	Document Type
amended map of project area	Illustrative Material

Alberta Culture and Tourism

STANDARD REQUIREMENTS UNDER THE *HISTORICAL RESOURCES ACT*: REPORTING THE DISCOVERY OF HISTORIC RESOURCES

If development proponents and/or their agents become aware of historic resources during the course of development activities, they are required, under Section 31 of the *Historical Resources Act*, to report these discoveries to the Heritage Division of Alberta Culture and Tourism. This requirement applies to all activities in the Province of Alberta.

1.0 REPORTING THE DISCOVERY OF ARCHAEOLOGICAL RESOURCES

The discovery of archaeological resources is to be reported to Eric Damkjar, Head, Archaeology, at 780-431-2346 (toll-free by first dialing 310-0000) or eric.damkjar@gov.ab.ca.

2.0 REPORTING THE DISCOVERY OF PALAEONTOLOGICAL RESOURCES

The discovery of palaeontological resources is to be reported to Dan Spivak, Head, Resource Management, Royal Tyrrell Museum of Palaeontology, at 403-820-6210 (toll-free by first dialing 310-0000) or dan.spivak@gov.ab.ca.

3.0 REPORTING THE DISCOVERY OF HISTORIC PERIOD SITES

The discovery of historic structures to be reported to Ronald Kelland, Acting Manager, Historic Places Research and Designation Program, at 780-431-2334 (toll-free by first dialing 310-0000) or ronald.kelland@gov.ab.ca. Please note that some historic structure sites may also be considered Aboriginal traditional use sites.

4.0 REPORTING THE DISCOVERY OF ABORIGINAL TRADITIONAL USE SITES

The discovery of any Aboriginal traditional use site that is of a type listed below is to be reported to Valerie Knaga, Director, Aboriginal Heritage Section, at 780-431-2371 (toll-free by first dialing 310-0000) or valerie.k.knaga@gov.ab.ca.

Aboriginal Traditional Use sites considered by Alberta Culture and Tourism to be historic resources under the *Historical Resources Act* include:

Historic cabin remains;
Historic cabins (unoccupied);
Cultural or historical community camp sites;

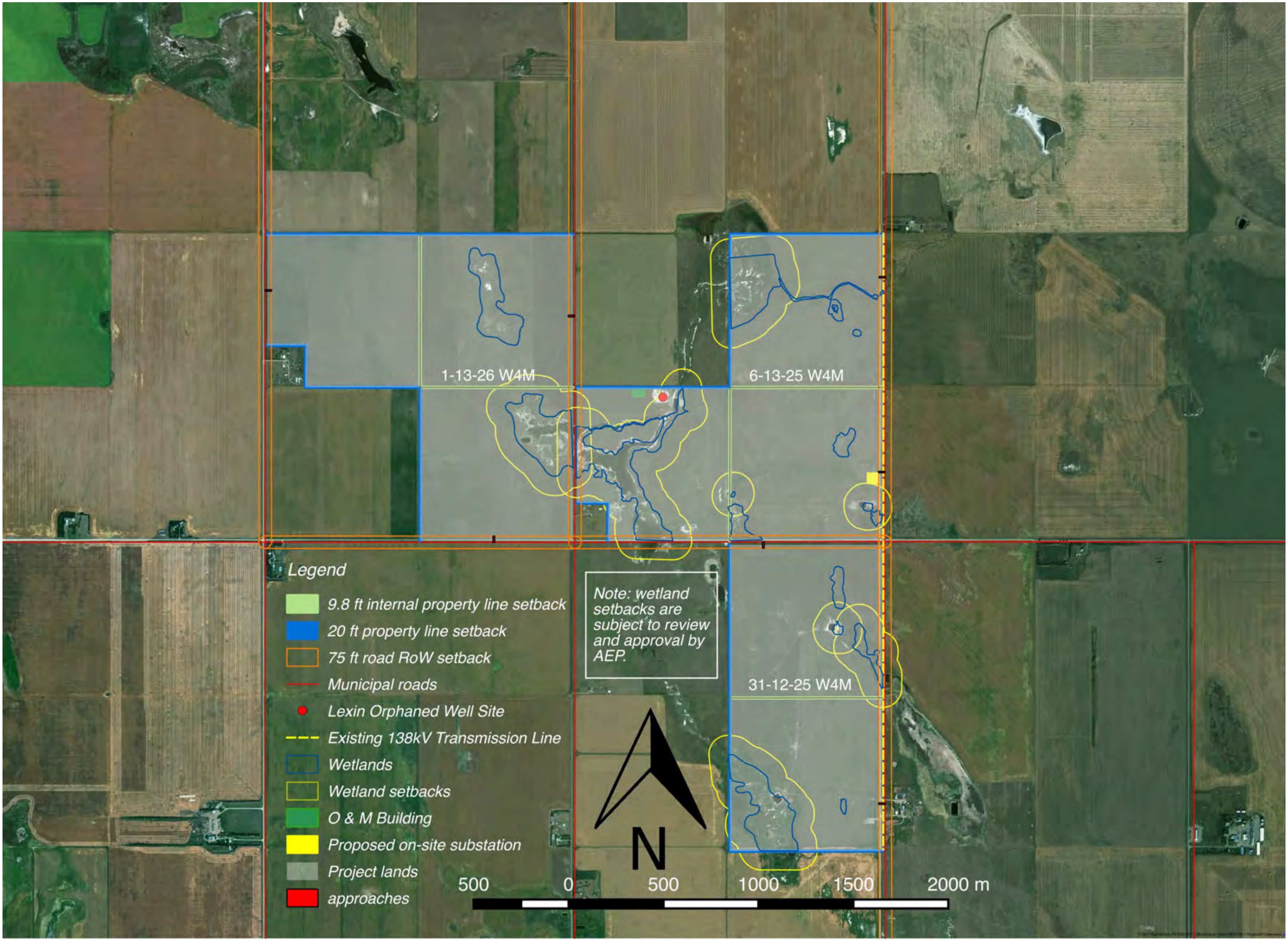
Ceremonial sites/Spiritual sites;
Gravesites;
Historic settlements/Homesteads;
Historic sites;
Oral history sites;
Ceremonial plant or mineral gathering sites;
Historical Trail Features; and,
Sweat/Thirst/Fasting Lodge sites

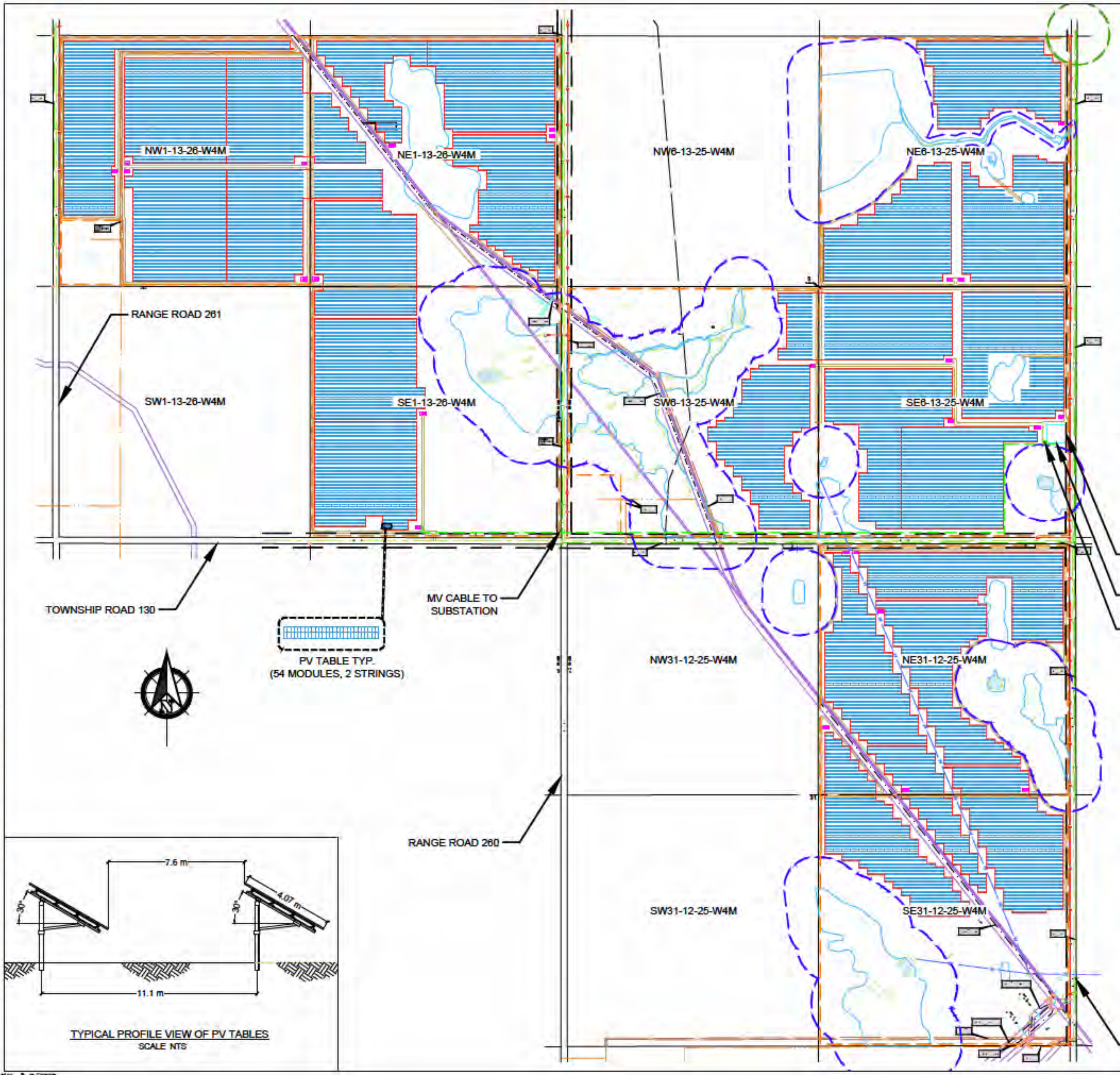
5.0 FURTHER SALVAGE, PRESERVATIVE OR PROTECTIVE MEASURES

If previously unrecorded historic resources are discovered, proponents may be ordered to undertake further salvage, preservative or protective measures or take any other actions that the Minister of Alberta Culture and Tourism considers necessary.

APPENDIX “M”

Site Plan


1-13-26 W4M
6-13-25 W4M
31-12-25 W4M
Legend
9.8 ft internal property line setback
20 ft property line setback
75 ft road RoW setback
Municipal roads
Lexin Orphaned Well Site
Existing 138kV Transmission Line
Wetlands
Wetland setbacks
O & M Building
Proposed on-site substation
Project lands
approaches
Note: wetland setbacks are subject to review and approval by AEP.
N
500
0
500
1000
1500
2000 m



TOTAL FIXED TILT SYSTEM DESCRIPTION	
NUMBER OF PV MODULES	477,198
NUMBER OF STRINGS	17,674 (27 MODULES PER STRING)
SYSTEM SIZE(DC)	172.97 MW
NAMEPLATE CAPACITY (AC)	132 MW
NAMEPLATE CAPACITY (AC) TOTAL INTERCONNECTED CAPACITY	130 MW
DC/AC RATIO	1.31

GENERAL NOTES:

THIS IS A PRELIMINARY DESIGN.

SUBSTATION DETAILS:

TOTAL INTERCONNECTED CAPACITY 130 MW-AC

A-FRAME SWITCHING STRUCTURES AND SLACK SPAN TO 138 kV POWER LINE

GRANUM 604S SUBSTATION

MAINTENANCE BUILDING

RANGE ROAD 255

LEGEND:

- PV TABLES
- INVERTER MV TRANSFORMER STATION
- SUBARRAY BOUNDARY
- ACCESS ROADS
- YARD SETBACK
- ROAD SETBACK
- WETLAND
- WETLAND BUFFER
- BIRD OBSERVATION BUFFER
- EXISTING 138 kV 180 L POWER LINE
- BURIED WATERLINE
- BURIED PIPELINE

AECOM

PROJECT

CLARESHOLM SOLAR
TOWNSHIP RD 130
CLARESHOLM, AB CANADA

CLIENT

Claresholm Solar Inc.
260, 2323 - 32 Ave NE
Calgary, Alberta
T2E 6ZE

DESIGNER

AECOM CANADA LTD
48 Quarry Park Blvd SE, Suite 300
Calgary, AB T2C 5P2, Canada
1.403.254.3301 tel
www.aecom.com

NOT FOR CONSTRUCTION

REGISTRATION

ISSUE/REVISION

I/R	DATE	DESCRIPTION
C	2018-06-XX	CANADIAN SOLAR UPDATE
C	2018-05-25	WETLAND SETBACK UPDATE
B	2018-01-26	SUBSTATION UPDATE
A	2017-11-30	PRELIMINARY LAYOUT

KEY PLAN

SHEET TITLE

CLARESHOLM SOLAR
PRELIMINARY SOLAR LAYOUT

E1.1

SHEET X OF X

Legend

Project Fencing