# Volume 2, Section 2 Snake Lake Reservoir Expansion Environmental Impact Assessment Approach

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## Tables



## Abbreviations

| | |
|---|---|
| ARSA | Aquatic Regional Study Area |
| CEA | Cumulative Effects Assessment |
| EIA | Environmental Impact Assessment |
| EID | Eastern Irrigation District |
| FTOR | Final Terms of Reference |
| LSA | Local Study Area |
| RSA | Regional Study Area |
| SLR | Snake Lake Reservoir |
| TRSA | Terrestrial Regional Study Area |

## 2.1 ASSESSMENT APPROACH

The following is a summary of the steps used by each discipline lead to perform an Environmental Impact Assessment (EIA). Details then follow. Steps used to complete the (EIA) included:

1. Resources were selected for assessment. These were based on requested attributes, measures, or analyses specified in the Final Terms of Reference (FTOR; Volume 2, Appendix A) or additional resources needed to address needs specific to the discipline, to meet regulatory requirements, or to address specific characteristics of the planned development site. These selected resources and analysis were then subjected to a screening assessment to ensure the final resources include those most likely change due to Project development.
2. Measurable indicators for each resource were determined (measures that can be qualified or quantified) to describe each of the resources.
3. Appropriate local and regional study areas were selected.
4. The current (Baseline Case) conditions of each indicator in the local and regional study areas were then determined. Literature reviews or modelling were used as needed to provide baseline information where direct measurements were not practical.
5. Project-related changes to indicators were predicted, based on Project/footprint design, construction activities, timing and duration of activities, and the application of mitigation measures and use of best practices, reclamation or offsets to reduce effects.
6. A comparison was competed between Baseline and Project Cases to determine if there will be positive, negative, or neutral effects on resources. This determination was based on assessment of residual impact criteria. In some assessments, impacts were assessed at the maximum amount of potential impact during construction and again for residual impacts, once the Project is completed and operating. The culmination of this step was the determination of a residual impact rating for each resource or analysis.

The Project has been assessed in the context of three scenarios, summarized below:

1. **Baseline Case**: the current conditions of each resource are described and quantified or qualified in appropriate local and regional study areas.
2. **Application (EIA) Cases**: the conditions of each resource are described and quantified or qualified during various Project scenarios, including a Project construction case (worst case) and residual impact case (operations case) in local and regional study areas:
    - the worst (construction) case describes the Project area while construction and other activities are occurring, prior to mitigation measures; and
    - the residual (operations) case described the Project area after construction is completed, mitigation measures have been implemented, and reclamation or offsets have occurred.
    - for some disciplines there is also a reservoir filling scenario, used to assess specific changes that occur for the period after construction is complete, until the reservoir is filled and operating.
3. **Planned Development Case**: this assessment describes conditions that will occur in a regional area due to the combined effects of past activities and projects, the planned

Project, and likely or reasonably foreseeable future activities and projects, for completion of a cumulative effects assessment (CEA).

For the Environmental Impact Assessment (EIA), an evaluation of potential Project impacts was based upon measured, estimated, or reasonably expected changes to resources between the Baseline Case and Application Cases. Changes were assessed by evaluating impact criteria for each change to a resource. These criteria included direction, geographic extent, magnitude, duration, confidence, and ecological or social context. These are described in detail in the following sections. The criteria are then summarized to determine a residual impact rating.

## 2.2 BOUNDARIES

### 2.2.1 Spatial Boundaries (Study Areas)

Selection of the study areas included identifying appropriate spatial and temporal boundaries for assessment of effects. For each discipline, study areas had to be large enough to include the extent of Project activities where direct effects will occur, plus a reasonable buffer area where indirect effects may occur. Each study area was sized appropriately, allowing detailed information on environmental attributes to be measured or estimated for the Baseline Case and effects from the Project to be predicted with a reasonable degree of accuracy and confidence. Three study areas were described:

- Project area (or footprint);
- Local Study Area; and
- Regional Study Area.

The Project area is the location where direct effects on resources will occur and is the area most intensely studied.

Local Study Areas (LSA) include the Project area and immediately surrounding areas where direct or indirect Project effects may occur. The LSAs made use of all available detailed measurements and analyses for the Project area plus a limited amount of field sampling and analysis for surrounding areas to describe the baseline and application cases.

The Regional Study Area (RSA) includes the Project area plus a much larger buffer to address regional issues. The RSA was used for the assessment of regional impacts in the EIA, and for assessment of cumulative effects in the CEA. Because the CEA considers interactions with other past, present, or future projects, the RSA had to be large enough for each discipline to consider near and distant projects that could reasonably interact with the Project.

### 2.2.2 Temporal Boundaries

The temporal boundaries for the assessment were defined based on the timing and duration of Project activities and the nature of the interactions with each resource or indicator. The timeframe of the EIA corresponds to the timing and characteristics of the Project phases including the shipping of rock and aggregate (2025 to 2027), construction phase (2026 to 2029), reclamation (2028 to 2030), the filling phase (2029 up to 2031, if required), and the operation phase (starting as early as 2029 to 2030 depending on the previous steps). As the Project purpose is to increase water storage within the Eastern Irrigation District (EID) it is planned to remain in place indefinitely.

For the CEA, activities and disturbance are divided into four periods, historic (pre-1950), baseline (1950-2024), Project shipping and construction (2025 to 2029) and future (post-Project development to 2050). Given regulatory and construction timelines may vary, the dates provided may shift forward or backward.

## 2.3 RESOURCE SELECTION AND SCREENING

Not all resources can be directly measured; in these cases, indicators that describe each of the resources were identified and used for measurements. Indicators are measurable attributes that describe a resource and its condition, or in cases where a given resource cannot be quantitatively measured, a qualitative rating may be used as an indicator. Some indicators may also be divided into sub-indicators. For simplicity of this report, the term “resources” is used to encompass indicators and sub-indicators, where applicable.

Resources for assessment of each discipline were determined from a variety of sources, including:

- those identified in, or related to analysis requests in the Final Terms of Reference;
- additional resources needed to address needs specific to the discipline or to meet regulatory requirements; and
- resources related to specific characteristics of the planned development site.

These were then screened so that the impact assessment only examined resources that:

- had data or information available to be described in the Baseline Case;
- could be reasonably evaluated or predicted at the Application Case; and
- were reasonably likely to show effects due to Project activities.

The screening resulted in the following outcomes for each resource:

- the potential effects that Project activities may have on each resource was determined;
- some resources were screened-out (not included in the assessment) where data was not available or could not be collected or predicted from exiting information sources;
- other resources were screened-out if they were unlikely to be affected, or to show negligible or neutral effects, at most;
- some resources were determined to be measurable or predictable in the local study area only;
- some resources could only be measured or predicted at the Baseline Case; and
- for all resources to be assessed, it was determined whether the resource could be measured quantitatively or qualitatively (if a qualitative assessment was needed, professional knowledge, previous experience for similar sites, and/or available methods to rate resource quality was required, with references to back up the approach).

Following the screening, a summary of those resources that would be assessed at baseline, for local Project effects, or for regional Project effects was determined. This summary was used to guide the analysis and reporting for the residual impact assessment of each discipline report.

## 2.4 BASELINE CASE DESCRIPTION

The Baseline Case (Table 2-1) establishes the existing conditions prior to initiation of the Project or the conditions that would exist if the Project was not developed. It is not a pre-disturbance case

as existing disturbances are included. Information contained in the Baseline Case comes from government databases, field measurements and observations, qualitative and quantitative analysis, modelling, mapping, and knowledge gained from literature reviews. Data collection and analysis methods for each discipline are described in each discipline report.

The Baseline for this Project was established based on observed data and information collected during 2021 to 2024. It was considered to represent 2022 conditions as they would have been if the exploratory site work and other pre-Project activities had not yet occurred. This Baseline includes the following:

- cattle grazing and hydrocarbon resource extraction occur on the project area as they were the dominant land uses prior to Project exploration and preparation activities;
- recent surface disturbances completed as part of the exploration or engineering-design processes, including construction of access trials, test digs and berm construction trials, and borehole and core hole drilling are not included; and
- remediation of resource extraction sites and facilities (pipelines and wellsites), and realignment of powerlines are considered to have not happened yet.

## 2.5 APPLICATION (PROJECT) CASES

Application Cases (Table 2-1) include the Baseline Case plus all effects of the Snake Lake Reservoir Expansion Project, including exploratory and pre-development site activities. This allows the assessment to be considered conservative, such that any assessed effects will be identified as if they are occurring all at once. It is assumed that if effects from this assessment are low, they will still be low if or when the activities are subdivided into stages (i.e., shipping rock, surface stripping, excavation, etc.). Application Cases included:

- Project Construction Case (Maximum Impact or Worst-Case Scenario);
- Reservoir Filling Phase; and
- Residual Assessment Case (Fully Mitigated, Operations Phase).

This Reservoir Filling Phase may be applicable to disciplines such as Aquatic Resources and Surface Waterbodies, where different predicted outcomes would occur during this activity. For other disciplines the activities of this case are included within the assessed Project Construction Case.

A Project decommissioning case was not assessed as the Project will be a permanent facility.

### 2.5.1 Project Construction Case (Worst-Case Scenario)

The Project Construction Case (maximum construction footprint) identifies the full extent of change that would occur prior to implementation of mitigations. Construction of the Project will remove all the vegetation, soils, and wetlands within the new reservoir footprint (areas to be the reservoir and outer berms/dams), including a notch in the existing east dam to connect the reservoir basins, and includes new embankment (dam or berm) construction, as well as development and use of temporary activity and storage sites. It includes the upgrading of onsite access to accommodate heavy (loaded) truck traffic. However, shipping activities on county or provincial roads, and any upgrades or increased maintenance activities on these roads to facilitate

shipping are not part of the Project. Construction traffic on roads, including workers commuting from Bassano, Brooks, or other in-County sites is considered part of the Project, but commuter traffic from outside of the county to accommodation in the County of Newell is not part of the Project. Worker accommodation is also not part of the Project.

### 2.5.2 Reservoir Filling Phase

This phase is a subset of the Project Construction Case and will be addressed for some disciplines on resources that are strongly affected during this activity period. The differences for this phase are that most mitigations for features inside the new reservoir will be completed, whereas mitigations and reclamation for features outside the reservoir are considered pending. The SLR will be drawn down to permit heavy equipment work, and possibly in water work (while a section of the SLR East Dam is cut out to connect the reservoirs). All rock hauling and other construction activities in the new reservoir will be completed, except work to test the reservoir outlet and dam integrity that may be underway on first filling. At this phase, anticipated wildlife mitigation to protect nesting species, fisheries work (fish isolation, capture and salvage or transfer to expansion area, if required), and water quality monitoring, will be the most likely impacts on resources.

### 2.5.3 Residual Impact Case (Operations Scenario)

This case examines the Project after the reservoir is built, commissioned, operating, outer berms are reclaimed, and infrastructure has been removed and replaced. Construction activities have ceased, and operations activities and monitoring are ongoing. The only impacts that remain are the permanent land changes, new (filled) reservoir, berms, and associated activities. Temporary workspace and topsoil storage areas are considered fully reclaimed, even though this may not be completed until many years after construction. Mitigations, reclamation, and offsets are fully implemented. The comparison of The Residual Case to Baseline is used assess residual impacts.

Mitigation measures, reclamation, and offsets are fully implemented in the Application Case. Assessment of the Application Case included a description of resources with the Application Case and a description of mitigation measures, reclamation plans, and offsets. Specific methods for assessing the Application Case vary based on the discipline and are described in further detail within each discipline section.

## Table 2-1: Baseline and Project Case Descriptions

| | Baseline Case | Project Construction | Reservoir Filling | Residual, Operations |
|---|---|---|---|---|
| **Conditions** | Grasslands and woodlots present as in 2022. | Maximum surface area disturbance, vegetation and soils cleared, topsoil stored. | Maximum surface area disturbance, vegetation and soils cleared, topsoil stored. | Topsoil storage area restored to baseline conditions. |
| | Onsite disturbances present as in 2022. | Berms constructed but not reclaimed.<br>Outer ditch constructed. | Berms constructed but not reclaimed.<br>Outer ditch constructed.<br>Notch between reservoirs being constructed. | Reclamation of berms and workspaces to native grassland. Offsets completed. Outer ditch is functioning. |
| | SLR at Full Supply Level (FSL) Snake Lake Canal operating. | SLR at FSL.<br>Snake Lake Canal operating. | SLR drawn-down.<br>Snake Lake Canal decommissioned in reservoir. | Reservoirs fully connected through notch and filled.<br>Snake Lake Canal decommissioned in reservoir. |
| | Not applicable at Baseline. | Reservoir walls not coated with rip-rap. | Reservoir walls rip-rap coated. | Reservoir walls rip-rap coated. |
| | Existing trails and access roads on site, including a partially developed county road allowance. Above-ground powerline traverses east of SLR and East Branch Canal. | Construction access roads, gate and fences present. Road allowance closed. Above-ground powerline is moved onto edge of Project outside of the new berms. | Construction access roads, gate and fences present. Road allowance closed. Above-ground powerline is moved onto edge of Project outside of the new berms. | Recreational and county access roads and infrastructure sites present. |
| **Activities** | SLR and Snake Lake Canal Operations. | SLR and Snake Lake Canal Operations. | Operations temporarily halted. | Expanded SLR and Snake Lake Canal Operations. |
| | Recreation permitted at SLR only. | Recreation permitted at SLR only. | Recreation permitted at SLR only. | Recreation uses permitted all areas. |
| | Grazing and hydrocarbon extraction land uses. | No grazing or hydrocarbon extraction | No grazing or hydrocarbon extraction. | No grazing or hydrocarbon extraction. |
| | Not applicable at Baseline. | Excavation, construction, earthmoving, and reclamation. Utility, pipeline, and energy infrastructure removal. | Notch construction and reclamation activities. | Activities for operational measurement and monitoring, and continuing mitigation activities. |
| | Not applicable at Baseline. | Shipping of rip-rap and aggregate | Not applicable during filling. | Not applicable at operations. |
| | Not applicable at Baseline. | Wood debris left in place. | Debris collected and removed. | Not applicable at operations. |
| | Not applicable at Baseline. | New Reservoir empty of water. | Reservoir filling activities. | Reservoir fully filled and operational. |

# 2.6 RESIDUAL IMPACT ASSESSMENT

## 2.6.1 Assessment Methods

### *2.6.1.1 Comparison of Cases*

The residual impact assessment compared, measured or qualified values at the Project Construction Case (worst case scenario) and Residual Impacts (Operations) Case to Baseline Case. An additional comparison of the Filling case to Baseline was completed if relevant for an indicator or resource.

### *2.6.1.2 Quantitative or Qualitative Comparisons*

Quantitative changes are typically expressed as a percent change from baseline case (e.g., a 5% decrease in area or a measured quantity). Sometimes these are measured or absolute changes that are compared to a threshold or guideline value. There may also be a change in discrete classes (e.g., percent low, medium and high). Qualitative changes are determined if there is a change in rating value (e.g., High quality habitat decreases to low value).

## 2.6.2 Assessment Criteria

Impacts on resources were assessed by examining one or more measurable criteria that can be quantified or qualified. These criteria were modified from The Responsible Authority's Guide to the *Canadian Environmental Assessment Act* (Government of Canada [GOC], 1994) and were applied to describe and evaluate the predicted residual impacts between the Application Case and the Baseline Case. The criteria are defined and described below.

### *2.6.2.1 Direction*

This criterion describes whether the change is positive (beneficial or improves the resource), negative (has detrimental or negative consequences for the resource), or whether the effect is neutral (no change for the resource).

Direction is determined by comparing the baseline condition to the Project condition at full Project Construction Case, and post-reservoir filling and operations after mitigation and offsets have been applied. Direction may be based on one or more measured indicators for each resource.

Criterion Classes:

Positive: The Project increases the quality of the resource. This can be either an increase or decrease in indicator values, whichever identifies a benefit (e.g., increase in wildlife habitat, or decrease in total disturbance are both positive effects).

Neutral: No Project-related change to the quality of the resource compared to Baseline.

Negative: The Project will result in decreased quality of the resource.

*Note*:

- If Direction is Neutral: Geographic Extent, Magnitude, and Duration are also rated Neutral and the residual effect is rated as Neutral.

- If Direction is Positive: Geographic Extent, Magnitude, and Duration are rated into Positive classes (e.g., High Positive).

### 2.6.2.2 Magnitude

Magnitude describes the severity of the effect on a resource, as the change from Baseline, or the change to a value to exceed a guideline or threshold value, after restoration and mitigation.

Criterion Classes for Project Impacts:

| | |
|---|---|
| N/A: | Effects are neutral |
| Low: | Effects are limited (<5% change) |
| Medium: | Effects will have a noticeable effect, but most of the resource area or resource quality will remain intact (5 to 25% change) |
| High: | A large amount of change will occur, strongly affecting the resource (>25%) |

For threshold or qualitative assessments, the rating needed to be qualified, and backed up with professional knowledge, previous experience for similar sites, and/or based on existing methods and backed up with references.

### 2.6.2.3 Geographical Extent

Geographical Extent describes the spatial area where direct and/or indirect effects on the resource occur. Spatial values of local and regional refer to discipline specific LSA and RSA.

Criterion Classes:

| | |
|---|---|
| Footprint: | Effects are confined only to areas of direct Project disturbances. |
| Local: | Effects occur within or closely beyond the footprint within the discipline specific Local Study Area (LSA) because of direct and indirect effects. |
| Regional: | Effects occur beyond the defined LSA, with effects on the discipline specific Regional Study Area (RSA), or effects have consequences (moderate or higher effect) in the RSA. |
| Extra-regional: | Effects occur beyond the defined RSA, or effects have consequences (moderate or higher effect) beyond the RSA. |

### 2.6.2.4 Duration

Duration describes the time during which the receptor remains notably different from Baseline levels. It's not about the moment of the activity but about its consequences.

Criterion Classes:

| | |
|---|---|
| Temporary: | The consequence of the activity happens over a few days to 6 months. |
| Short-term: | The consequence of the activity happens for up to 5 years (e.g., during construction to start of operations). |
| Medium-term: | The consequence of the activity lasts from 5 to 25 years (e.g. continues beyond start of operations until it is fully reversed). |

Long-term: The consequence of the activity lasts greater than 25 years (continues well after start of operations and is never fully reversed).

### 2.6.2.5 Confidence

Confidence describes the ability to assess whether a change will occur, given potential uncertainty of the data, the analytical methods used to obtain results and conclusions, uncertainty as to the rate or outcome of natural processes that are expected to occur or uncertainty in the success of mitigations, reclamation, and offsets. Confidence was used to adjust the impact rating (i.e., increase the rating level when confidence is low since the effects are less certain, such that the actual impacts might be greater than predicted). If results were less certain, there may be additional reason to monitoring for effects post-construction.

Confidence relies on the level of certainty in measurements or observations. If predictive tools are used, it relies on the known reliability of the model, the reliability of input parameters, and the robustness of the model as supported by sensitivity analysis or comparison to independent data for verification analysis, and the knowledge of the accuracy of the model based on professional experience.

Criterion Classes:

High: Very certain that the predicted change was correctly predicted (e.g., >99% probability it will occur as predicted).

Medium: There is some uncertainty in the data, analysis, or likelihood that affects confidence (e.g. 80%-99% probability it will occur as predicted).

Low: There is much uncertainty; the data is unreliable, limited in use, or was modelled on untested assumptions (e.g., <80% probability it will occur as predicted).

### 2.6.2.6 Ecological and Social Context

This criterion is an additional consideration which can affect how an impact is rated based on specific information about the functioning and uniqueness of the site and how it is expected to respond to change due to Project effects. Context allows for a judgement to be made on the value of a resource or on the consequence of effects, which may be greater than the predicted effect shown by the measured or modelled change to the resource. As with Confidence, a rating may will be adjusted if a resource is rated high for context.

The following examples may be considered for Ecological and Social Context:

- **Ecological Hotspot**: if the assessed area represents high quality habitat for a given species, which is low in supply in the province, any impact may be more important than rated, such that the overall rating should be adjusted.
- **High Public Value**: this is the social equivalent of Ecological Hotspot. For example, areas designated as protected for any reason, or areas with known cultural importance.
- **Uniqueness**: Some features are highly important, and loss of even a small area or number of these features is consequential. Examples include: habitats known to support an At-Risk species, a unique ecological community, or disjunct species.

- **Social Relevance**: if the local economy is depressed, any new project could have higher importance for their positive effects on the local economy; alternatively, if the local economy is overheated, a new project may put undue stress on the system.
- **Traditional Importance**: a species or habitat may be important for Indigenous or cultural uses and thus a loss, though small, may have higher consequences.

In the determination of the residual impact of a resource, leads considered the ecological or social importance and the confidence in the result. If a site has an important ecological or social context, there may be additional justification to monitor changes over time, or increase a rating (e.g., low to medium).and additional discussion should be included.

### *2.6.2.7 Residual Impact Rating*

To evaluate the residual impact, each criterion was first classified. A ranking approach was used to determine the Residual Impact Rating. Assessed ratings for each criterion were assigned a numeric value, which were summed to determine an impact score. These scores were then used to rate the residual impact.

- **Direction**: Positive (+1 multiplier), Neutral (0), Negative (-1 multiplier)
- **Magnitude**: High (9), Medium (6), Low (3), N/A (if Neutral)
- **Extent**: Extra Regional (5), Regional (4), Local (3), Footprint (2), N/A (if Neutral)
- **Duration**: Long-term (5), Medium-term (3), Short-term (2) Temporary (1), N/A (if Neutral)
- **Confidence**: High or Medium (no change), Low (+ 1 ranking), N/A (if Neutral or Positive)
- **Context**: High (+ 1 ranking), N/A (), (if No Change Direction Neutral or Positive)

The impacts that remain during the Application Case, including mitigations and reclamation are referred to as residual impacts. The residual impacts may be classified into the following seven categories:

- High Positive
- Medium Positive
- Low Positive
- Neutral
- Low Negative
- Medium Negative
- High Negative

The magnitude, extent, and duration values are summed, resulting in an initial rating (Table 2-2.)

**Table 2-2: Categories and range for key criteria**

| Initial Impact Rating | Summed Score |
|---|---|
| Neutral | 0 |
| Low | <10 |
| Medium | 10 - 13 |
| High | >13 |

Direction is then considered. If Neutral, the overall rating is also Neutral. If Negative or Positive, the Initial Rating is unchanged but takes on the direction.

Finally, Confidence and Ecological or Social Context are considered. If Confidence is rated low or Ecological or Social Context is rated high, the Initial Impact Rating will be altered as listed in Table 2-3, with altered impact ratings as below:

- **if Confidence is Low**: Rating increases 1 level (to maximum of High); and
- **if Context is High**: Rating increases 1 level (to maximum of High).

Application of modifiers to determine residual impact ratings are provided in Table 2-3

**Table 2-3: Modifier application**

| Confidence | Ecological or Social Context | Outcome |
|---|---|---|
| Low | High | +2 ranks |
| Low | N/A | +1 rank |
| High | High | +1 rank |
| High | N/A | Same results as initial rank |

Note. Modifiers are only applied to Negative Impacts

## 2.7 CUMULATIVE EFFECTS ASSESSMENT

Cumulative effects are changes to the environment caused by the combined actions of an assessed project with past and future activities and disturbances in a regional study area. A single project's effects are often small on a regional scale, as they occur within a local area specific to the Project. However, when combined with the effects of other activities, disturbances, and planned projects additional impacts on resources may be identified. Additionally, the total effect may be greater than the sum of the individual projects or activities, if there are interactions resulting further changes to an assessed resource. For example, the combined effect of habitat area loss, fragmentation of habitat areas, alteration of food resources, loss of nesting trees, increase in industrial light and noise, and increased mortality due to vehicle collisions, may combine to severely reduce the habitat quality or population size of an assessed species. A cumulative effects assessment, or CEA, is a process to examine these combined effects.

Alberta Environment and Protected Area's FTOR for the Project requires that the EIA address the potential for cumulative effects. Guidance for assessing cumulative effects under the *Alberta Environmental Protection and Enhancement Act* is available at: https://open.alberta.ca/publications/cumulative-effects-assessment-in-environmental-impact-assessment-reports-required-under-aepea. A CEA differs from a Project-specific environmental assessment by considering larger geographic study areas, longer time frames, and unrelated projects or activities that have been, or will be, developed.

For this assessment, a defined Planned Development Case was developed by including known or inferred measures of past land use changes and disturbances (Historic to Baseline), the Snake Lake Expansion Project (Application), and future developments including known, disclosed, and reasonably foreseeable developments that may affect changes to air, water, lands, and other resources within discipline specific Regional Study Areas.

### 2.7.1 CEA Approach

Resources assessed in the EIA that have adverse residual effects are assessed in the CEA. Adverse has been defined as Medium to High Negative Residual impacts. Resources assessed as having low negative impacts do not require a CEA and therefore some disciplines will not have this section. A CEA is also not warranted when there are positive or neutral residual impacts. Additionally, resources where there is insufficient data or information to assess the result in the regional areas cannot be assessed. Each discipline will include a discussion explaining which resources had adverse residual effects and thus require a CEA. If a CEA was not completed, justification was provided.

The assessment of regional cumulative effects on resources is based on the following formula:

A + B + C = Cumulative Effect

Where: A = Effect of existing or baseline conditions (i.e., changes from past to present) on a resource

B = Effect of proposed Project activities on the resource

C = Effect of likely current and future activities on the resource

Note: this is not a comparison project and future activities vs. Baseline, as this would only tell how much new change will happen compared to baseline and would be strongly affected by the current size of the Baseline condition.

Assessments for the CEA may be determined quantitively (e.g., change in area or measurable values) or qualitatively (change in value of a resource that cannot be numerically assessed).

### 2.7.2 Boundaries

The temporal boundary includes past developments dating back to 1950 and future developments up to 2050 have been considered. The temporal boundaries were selected based on data availability (i.e., the first comprehensive aerial imagery was available for 1950) and the confidence and ability to reasonably predict future projects. The same RSAs identified for the technical disciplines were applied as the spatial boundaries for each assessment.

### 2.7.3 Relevant Activities and Disturbances for the Assessment

Aerial imagery and database review within the defined spatial and temporal boundaries was completed to identify potential projects to include in the CEA. Reasonably foreseeable and recently disclosed future projects and activities were identified through a review of:

- local and regional planning documents on the County of Newell's website (County of Newell, 2024) specifically the County of Newell Municipal Development Plan (Bylaw No. 2057-23) (County of Newell, 2023);
- government resources such as Major Projects Alberta (Government of Alberta [GOA], 2024); and
- local and regional news sources.

Once the information was captured and turned into a spatial file, the effects of change could be added to total activities, projects or disturbances and the loss of water or upland resources could be determined. Potential projects that are in the feasibility stages were excluded from the assessment as there is not enough confidence that they will go ahead and there is not sufficient information to assess their contribution to regional cumulative effects. This includes the proposed Eyremore dam in which a feasibility study began in spring 2024. The proposed location would be approximately 43 kilometres downstream of the Bassano Dam (Brooks Bulletin, 2024).

Once past and future projects were identified, they were grouped into activity types that affect resources (Table 2-4). For example, the Lathom Solar Project, Luna Solar Project Phase 1 & 2, and Brooks Solar Farm were grouped under Future Solar Developments.

**Table 2-4: Past and future activity and disturbance classes in the region**

| Feature Type | Activity and Disturbance Classes |
|---|---|
| **Past Activities and Disturbances** | |
| EID Canals | 12 Springhill Canal, C Springhill Canal, 01C Springhill Pipeline Conversion |
| Roads and Rail | TransCanada Highway, CPKC Rail line, Other Roads and Trails |
| Pipelines and other Linear Disturbances | Abandoned railway, Pipelines, Water pipelines, Reclaimed berms |
| Anthropogenic Waterbodies | Dugouts, Existing SLR |
| Residential / Urban Development | Acreages and Farmsteads |
| Agricultural lands | Cultivated, Irrigated Cultivated, and Grazing Lands |
| **Project Disturbances** | |
| Snake Lake Reservoir Expansion (divided into disturbance classes) | |
| **Future Activities and Disturbances** | |
| EID Canals | Snake Lake Canal Upgrade, 16 Spring Hill Pipeline, 03 East Branch Pipeline, Main Bantry Canal Bank Lift |
| Roads and Rail | N/A |
| Pipelines and other Linear Disturbances | Powerlines |
| | Pipelines |
| Anthropogenic Waterbodies (Reservoirs, Dugouts) | N/A |
| Residential / Urban Development | Cassils Growth |
| | County of Newell: Future Residential/Business developments |
| Industrial (permanent or long-term facilities) | N/A |
| Solar | Lathom Solar Project, Luna Solar Project Phase 1 & 2, Brooks Solar Farm |
| Cultivated Lands | Increased Irrigation Land (Reasonably Foreseeable) |
| Pasture / Grazing Lands | Increased Cropland Conversion |

For each assessed resource, the relevant activity and disturbances classes from Table 2-4 that may affect the resource were selected. Then the potential effects on resources were determined for the past, Project and future cases. For area-based CEA assessments, the total area affected by each resource and the changes in land use classes were then determined for the Terrestrial Regional Study Area (TRSA; Table 2-5) and the Aquatic Regional Study Area (ARSA; Table 2-6) for terrestrial and aquatic based assessments, respectively. This was done by checking a box next to each activity in Table 2-7, which showed the increase in disturbance and/or loss of area of land and water resources for the past, Project and future cases.

**Table 2-5: Land use changes for the past, Project and future cases in the Terrestrial Regional Study Area.**

| Land Uses | Area (ha) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Historic (1950) | Baseline (2024) | Historic Change (1950 to 2024) | Snake Lake Expansion Project | Project Change (2024 to Project) | Future Activities (2050) | Future Change (Project to 2050) | Total Cumulative Change (1950 to 2050) |
| Anthropogenic Waterbodies (Reservoirs, Dugouts) | 385.1 | 821.1 | 436.0 | 1,582.6 | 761.5 | 1,568.5 | -14.1 | 1,183.4 |
| Canals | 429.0 | 645.9 | 217.0 | 633.5 | -12.5 | 627.0 | -6.5 | 198.0 |
| Cultivation (Crops) | 9,483.22 | 29,352.8 | 19,869.6 | 29,339.6 | -13.2 | 25,119.5 | -4,220.1 | 15,636.3 |
| Ditch | | 76.7 | 76.7 | 73.6 | -3.1 | 73.1 | -0.56 | 73.1 |
| Grassland / Pasture | 68,800.1 | 45,391.5 | -23,408.6 | 44,688.1 | -703.4 | 42,964.0 | -1,724.1 | -25,836.1 |
| Industrial (permanent or long-term facilities, including gravel pits) | 0.0 | 607.2 | 607.2 | 604.9 | -2.4 | 499.5 | -105.3 | 499.5 |
| Industrial – Agriculture (feedlots and infrastructure) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 1,968.7 | 1,968.7 | 1,968.7 |
| Industrial – Solar | 0.00 | 0.0 | 0.0 | 0.0 | 0.0 | 4,717.6 | 4,717.6 | 4,717.6 |
| Railway (Active) | 421.5 | 174.9 | -246.7 | 174.9 | 0.0 | 160.2 | -14.7 | -261.4 |
| Residential / Urban | 205.0 | 878.9 | 673.9 | 878.9 | 0.0 | 829.7 | -49.2 | 624.7 |
| Road | 310.4 | 1,007.1 | 696.6 | 1,013.4 | 6.3 | 909.2 | -104.1 | 598.8 |
| Temporary Linear Feature[1] | 0.0 | 1,090.0 | 1,090.0 | 1,135.4 | 45.3 | 1,059.2 | -76.1 | 1,059.2 |
| Trail | 0.0 | 114.1 | 114.1 | 112.7 | -1.5 | 107.2 | -5.4 | 107.2 |
| Trees | 0.0 | 57.6 | 57.6 | 47.0 | -10.6 | 47.0 | 0.0 | 47.0 |
| Waterbodies (open water, wetlands) | 8,371.2 | 7,980.1 | -391.1 | 7,913.5 | -66.6 | 7,564.5 | -349.0 | -806.7 |
| Watercourses | 0.00 | 57.2 | 57.2 | 57.2 | <0.1 | 56.2 | -1.0 | 56.2 |
| Wellsite | 0.00 | 149.8 | 149.8 | 149.8 | <-0.1 | 133.8 | -16.0 | 133.8 |
| **Total[2]** | **88,405.5** | **88,404.8** | | **88,404.8** | | **88,404.9** | | |

[1] Includes: Abandoned railway, pipelines, water pipelines, reclaimed berm
[2] Discrepancies in total Project area are a result of rounding errors

**Table 2-6: Land use changes for the past, Project and future cases in the Aquatic Regional Study Area**

| Land Uses | Area (ha) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Historic (1950) | Baseline (2024) | Historic Change (1950 to 2024) | Snake Lake Expansion Project | Project Change (2024 to Project) | Future Activities (2050) | Future Change (Snake Lake to 2050) | Total Cumulative Change (1950 to 2050) |
| Anthropogenic Waterbodies (Reservoirs, Dugouts) | 870.4 | 967.0 | 96.6 | 1,728.0 | 761.0 | 1,713.0 | -15.0 | 842.6 |
| Canals | 608.8 | 810.2 | 201.4 | 789.0 | -21.2 | 776.3 | -12.7 | 167.5 |
| Cultivation (Crops) | 24,157.2 | 48,250.3 | 24,093.1 | 48,238.9 | -11.5 | 43,030.3 | -5,208.5 | 18,873.1 |
| Ditch | 0.0 | 118.3 | 118.3 | 115.2 | -3.1 | 111.2 | -4.0 | 111.2 |
| Grassland / Pasture | 77,862.2 | 46,473.3 | -31,388.9 | 45,797.3 | -676.0 | 44,144.9 | -1,652.4 | -33,717.4 |
| Industrial (permanent or long-term facilities, including gravel pits) | 0.0 | 2,042.2 | 2,042.2 | 2,039.9 | -2.4 | 1,679.3 | -360.6 | 1,679.3 |
| Industrial – Agriculture (feedlots and infrastructure) | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 3,306.5 | 3,306.5 | 3,306.5 |
| Industrial – Solar | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 4,723.5 | 4,723.5 | 4,723.5 |
| Railway (Active) | 542.5 | 292.1 | -250.4 | 292.1 | 0.0 | 274.0 | -18.1 | -268.5 |
| Residential / Urban | 903.7 | 3,191.9 | 2,288.3 | 3,191.9 | 0.0 | 3,263.8 | 71.9 | 2,360.2 |
| Road | 550.3 | 1,671.7 | 1,121.4 | 1,677.0 | 5.3 | 1,520.7 | -156.3 | 970.4 |
| Temporary Linear Feature[1] | 0.0 | 1,494.7 | 1,494.7 | 1,540.6 | 45.9 | 1,448.4 | -92.2 | 1,448.4 |
| Trail | 0.0 | 143.1 | 143.1 | 141.6 | -1.5 | 134.6 | -7.0 | 134.6 |
| Trees | 0.0 | 51.5 | 51.5 | 41.0 | -10.5 | 41.0 | 0.0 | 41.0 |
| Waterbodies (open water, wetlands) | 10,217.0 | 9,954.8 | -262.2 | 9,868.7 | -86.2 | 9,311.7 | -557.0 | -905.3 |
| Watercourses | 0.0 | 78.1 | 78.1 | 78.1 | 0.0 | 76.7 | -1.4 | 76.7 |
| Wellsite | 0.0 | 173.4 | 173.4 | 173.4 | <-0.1 | 156.8 | -16.6 | 156.8 |
| **Total[2]** | **115,712.0** | **115,712.7** | | **115,712.6** | | **115,712.6** | | |

[1] Includes: Abandoned railway, pipelines, water pipelines, reclaimed berm
[2] Discrepancies in total project area are a result of rounding errors

**Table 2-7: Table used to select relevant activities, disturbances, and land use changes for reach resource**

| | Activities or Land Uses | Change (ha) TRSA[1] | Change (ha) ARSA[2] | Resource | Change (ha) TRSA[1] | Change (ha) ARSA[2] | Resource | Change (ha) TRSA[1] | Change (ha) ARSA[2] | Resource |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Past Projects (1950 to 2024) | | | SLR Expansion Project | | | Future Projects (2025 – 2050) | | |
| Activities | Anthropogenic Waterbodies (Reservoirs, Dugouts) | +436.0 | +96.6 | ☐ | +761.5 | +761.0 | ☐ | -14.1 | -15.0 | ☐ |
| | Canals | +216.9 | +201.4 | ☐ | -12.5 | -21.2 | ☐ | -6.5 | -12.7 | ☐ |
| | Cultivation (Agri) | +19,869.5 | +24,093.1 | ☐ | -13.2 | -11.5 | ☐ | -4,220.1 | -5,208.5 | ☐ |
| | Ditch | +76.7 | +118.3 | ☐ | -3.1 | -3.1 | ☐ | -0.6 | -4.0 | ☐ |
| | Industrial | +607.2 | +2,042.2 | ☐ | -2.4 | -2.4 | ☐ | -105.3 | -360.6 | ☐ |
| | Industrial – Agriculture | --- | --- | ☐ | --- | --- | ☐ | +1,968.7 | +3,306.5 | ☐ |
| | Industrial – Solar | --- | --- | ☐ | --- | --- | ☐ | +4,717.6 | +4,723.5 | ☐ |
| | Railway (active) | -246.7 | -250.4 | ☐ | --- | --- | ☐ | -14.7 | -18.1 | ☐ |
| | Residential / Urban | +673.9 | +2,288.3 | ☐ | --- | --- | ☐ | -49.2 | +71.9 | ☐ |
| | Road | +696.6 | +1,121.4 | ☐ | +6.3 | +5.3 | ☐ | -104.1 | -156.3 | ☐ |
| | Temp. Linear Features | +1,090.0 | +1,494.7 | ☐ | +45.3 | +45.9 | ☐ | -76.1 | -92.2 | ☐ |
| | Trail | +114.1 | +143.1 | ☐ | -1.5 | -1.5 | ☐ | -5.4 | -7.0 | ☐ |
| | Wellsite | +149.8 | +173.4 | ☐ | -0.0 | -0.0 | ☐ | -16.0 | -16.6 | ☐ |
| Land Uses | Grassland / Pasture | -23,408.6 | -31,388.9 | ☐ | -703.4 | -676.0 | ☐ | -1,724.1 | -1,652.5 | ☐ |
| | Treed | +57.6 | +51.5 | ☐ | -10.6 | -10.5 | ☐ | --- | --- | ☐ |
| | Waterbody (natural) | -391.1 | -262.2 | ☐ | -66.6 | -86.2 | ☐ | -349.0 | -557.0 | ☐ |
| | Watercourse | +57.2 | +78.1 | ☐ | +0.0 | --- | ☐ | -1.0 | -1.4 | ☐ |
| **Activities Sum** | | | | | | | | | | |
| **Percent Change** | | | | | | | | | | |

[1] Total area of the TRSA is approximately 88,404.9 ha
[2] Total area of the ARSA is approximately 115,712.0 ha

### 2.7.4 CEA Rating Methods

The CEA was completed for all resources assessed in the EIA where the Project will result in negative adverse effects on the resource (and where sufficient information is available for assessment). If there is a positive change in land use or loss of disturbed area for an activity, it will be selected only if this has a negative effect on the resource. If there was a negative effect for an activity, it was only be selected if there is a negative effect on the resource.

The area changes for each resource were then summed. If the effect is better understood based on land use change, only the applicable land use changes will be summed. In some cases, such as the loss of water resources, both losses of natural and anthropogenic water resources may be applicable. If the assessment relies on changes in other parameters (other than area), the approach to assessing the cumulative effects will rely on qualitative judgment or other measured values in the regional assessment.

The percent change relative to the total hectares of the regional study area applicable to each resource for the past, Project and future cases. This was entered into Table 2-8.

**Table 2-8: Summary of area changes for each assessed resource**

| Project Type | Effect of Projects on Discipline Resources | | | |
|---|---|---|---|---|
| | ***Resource 1*** | ***Resource 2*** | ***Resource 3*** | ***Resource 4*** |
| Past Projects and Activities | | | | |
| Snake Lake Reservoir | | | | |
| Future Projects and Activities | | | | |
| **Overall Cumulative Effect** | | | | |
| **Relative Project Contribution** | | | | |

Next, the total change for the three periods, past, the Project, and future, is summed to determine the overall cumulative effect area. The cumulative effect area is then divided by the relevant land area for comparison (usually the entire area of the discipline specific RSA) and multiplied by 100 to express as a percentage. In some cases, the denominator for the assessment of percent change may be a subset of the study area. For example, if the resource only is affected by changes to water body area, the percent change relative to total water area in the RSA was calculated, rather than the total area of the RSA.

A description of the CEA Rating based on measured change from past to future cases is provided in Table 2-9, with suggestions for the percent change ranges for each CEA rating. In all cases, the written description of the rating classes must be met; the percentages are only a guide to meeting these rating classes and can be modified as needed.

**Table 2-9: Cumulative effect ratings based on percent of study area affected**

| CEA Rating | Description |
|---|---|
| Negligible | Resource would not experience noticeable change (e.g., less than 2% loss)* |
| Low | Resource would experience noticeable changes, but these would not be detrimental to the continued viability of the resource (e.g., >2 to 10% loss)* |
| Moderate | Resource would experience changes between the Low and High ratings (e.g. >10 to 25% loss)* |
| High | Resource would experience detrimental effects, such that the viability of the resource would be threatened (e.g., 25% loss or greater)* |

* Strict percentage changes may not be suitable for assessing some resources and would not apply for a qualitative assessment. In these cases, professional judgement may be used to determine if the measured or qualitative change to the resource is likely to affect the continued health or functioning of the resource. For example, loss of 25% of the habitat in an area may be detrimental to a highly sensitive species but not so to a tolerant species. In other cases, there may be assessment threshold or guideline values for comparison (e.g., noise or air emission level or concentration at which effects on health may occur).

For resources that use a different unit (i.e., not area) to assess the level of impacts, it is likely the change up to Baseline cannot be measured or estimated. In this case, the CEA may need to be determined as the change in Project and Future cases only. The rating percentages suggested in Table 2-9 may still be used if it can be assumed that past changes (up to Baseline) were negligible or would not greatly affect the assessment rating. For some qualitative assessments, it is possible to summarize the area covered by each rating class, e.g., area of good vs poor habitat. In these cases, if the unit of interest was the increase in poor habitat, the CEA assessment could be still based on area. However, if the analysis provides a qualitative rating for an entire study area for each period, the assessment must be based on professional judgement backed by experience or knowledge of the resource and how it is affected by changes. Some additional guidance to qualitative assessment of CEA ratings is provided below:

- **Negligible** – The cumulative effect for a resource will not have any effects greater than what is already present in absence of any new activities or disturbances.
- **Low** – Cumulative effects are likely minor and hard to notice despite a substantial measure for change, possibly due to the presence of sufficient areas that can compensate for losses.
- **Moderate** – The cumulative effect in a resource will be easily observed but will not seriously affect the long-term viability of the resource.
- **High** – The cumulative effect in a resource will be easily observed and will affect the long-term viability of the resource.

### 2.7.5 Relative Project Contribution

Based on relative percent changes in Table 2-9, the Relative Project Contribution is then determined. Per the previous formula for cumulative effects, Relative Project Contribution is the percent of the Project change relative to the total cumulative effect, or:

Relative Project Contribution = B / (A + B + C) x 100

The Relative Project Contribution can be Low, Medium, or High as follows:

- **Low**: Project effects will have little contribution to total regional change (<5%)
- **Medium**: Project effects will have a fair contribution to total regional change (5 to 25%)
- **High**: Project effects will have a substantial contribution to total regional change (>25%)

Relative Project Contribution can also be determined for any other unit value (e.g., change in temperature or increase in abundance), if the same unit is measured for each period. However, if a resource is assessed qualitatively, the relative contribution must also be determined qualitatively. For example, if the cumulative effect is rated poor and the Project effect is rated good, then the relative effect is likely to be low, and vice versa.

Depending on the resource, the Project may have a large or small relative Project contribution, whether the CEA is rated high or low, for example:

- if the Project is the only activity in the regional study area affecting a resource it will have a high relative Project contribution, but the overall effect may be low; while
- if the Project is the only activity out of many in the regional study area affecting a resource it will have a low relative Project contribution, especially if the overall effect is high.

### 2.7.6 Mitigation Measures or Management Strategies to Reduce Cumulative Effects

If the cumulative effect is low or negligible, there is no need to further mitigate or manage these effects beyond the planned actions for the Project area, whether the Project contribution is high or low.

Where the Project contribution to moderate to high cumulative effects is medium to high, further mitigation measures to reduce effects of the Project should be considered. Additionally, this may be an area to consider regional offsets or other actions to reduce overall cumulative effects. Even if the Project contribution is low, any cumulative effects rated Moderate to High are a management concern that should be addressed; however, in this case, the effects may best be addressed as part of regional or government led cooperative initiatives.

Examples of regional cooperative initiatives may include actions or programs such as:

- enhancing wildlife habitat on corridors such as road ditches and pipeline or powerline rights-of-way to promote the use by wildlife;
- promoting the use of pronghorn friendly fencing to reduce effects on wildlife movement;
- continuing to support waterfowl and other water-dependent species by maintaining water levels in ditches and ponds; or,
- promoting the use of well maintained and clean equipment and/or higher-grade fuels for construction activities to prevent weed spread and reduce noise or emissions.

These initiatives and mitigations would be tailored to the protection of each resource with moderate to high cumulative effects.

## 2.8 REFERENCES

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