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Acronyms and Abbreviations

AENV	Alberta Environment
ASP	Area Structure Plan
bpd	barrels per day
C&R	conservation and reclamation
CP	Canadian Pacific
ESA	environmentally sensitive area
IH	Heavy Industrial
IM	Medium Industrial
LSA	local study area
MDP	Municipal Development Plan
PSLs	permissible sound levels
RSA	regional study area
the upgrader	TOTAL Upgrader Project
ToR	Terms of Reference
TOTAL	TOTAL E&P Canada Ltd.

15 Land Use

15.1 Introduction

The land use assessment addresses the interaction between upgrader construction, operations and decommissioning and land use. The assessment addresses the information requirements of the Terms of Reference (ToR) issued by Alberta Environment to TOTAL (AENV 2007). For additional information on land use baseline conditions, see the [Environmental Baseline Study: Land Use](#) on CD.

15.2 Setting

The project development area (PDA) is located in Strathcona County in Alberta's Industrial Heartland. The nearest urban centre is Fort Saskatchewan, Alberta; the northeast corner of the Fort Saskatchewan boundary abuts the western boundary of the PDA. These lands are designated for heavy industrial use with a small part designated as medium industrial (Strathcona County 2007, Internet site).

15.3 Assessment Focus

15.3.1 Scoping

Key issues were used to focus the analysis of effects of the upgrader on land use. Key issues were selected primarily through consulting Alberta Environment's Terms of Reference (ToR) (AENV 2007) for the upgrader, although internal scoping exercises, and knowledge and experience from previous land use assessments for other oil and gas projects, e.g., upgraders, in the region were also used.

Based on review of the ToR, baseline studies, preliminary results of the assessment and proposed mitigation measures, and because the PDA is located on private land, the following were not included in the land use assessment:

- resource harvesting, i.e., forestry, food collection, trapping, fishing and hunting
- cultural use

15.3.2 Key Issues

For the key issues for land use, applicable section of the ToR and relevance to the upgrader, see [Table 15.3-1](#).

Table 15.3-1 Key Issues for Land Use

Project Stage	Key Issue	Terms of Reference	Relevance to Project
Construction	Compliance with local and regional land use management	Alberta Environment ToR, Section 5.10.2	The project must conform to all local and regional bylaws, development plans and area structure plans.
	Changes in residential land use	Alberta Environment ToR, Section 5.10.2	Locally, project construction will remove areas available for residential use. Regionally, air emissions, noise, night light, changes in aesthetics and altered hydrogeology have the potential to affect residential use. See Section 3: Air , Section 4: Noise , Section 5: Light , Section 6: Visibility and Section 7: Groundwater .
Construction, Operations and Decommissioning	Changes in or conflicts with domestic water use	Alberta Environment ToR, Section 5.4.2	Project construction and operations could affect water flows and water quality leaving the development site, both of which could affect local water users. In addition, water withdrawal from the river will further increase demands on the river and downstream water availability.
	Changes in agricultural land use	Alberta Environment ToR, Section 5.10.2	Project construction will alter agricultural activities in the LSA for the life of the project. Project operations might increase levels of acidifying emissions in the airshed, which could alter soil chemical properties, leading to changes in agricultural capability in the RSA. See Section 11: Terrain and Soils and Section 12: Vegetation .
	Changes in recreational land use (including wildlife habitat)	Alberta Environment ToR, Section 5.10.2	As recreational use of the LSA does not occur, the project will have no local effects on recreational land use. Regionally, project operations have the potential to cause effects on recreation in the area, from noise, air emissions and altered aesthetics, as well as indirect effects (such as changes in the occurrence of vegetation or wildlife). See Section 3: Air , Section 4: Noise , Section 6: Visibility , Section 12: Vegetation and Section 13: Wildlife . Indirect effects, such as changes in vegetation communities, have the potential to affect wildlife habitat. Project air emissions and noise have the potential to cause health risks for resident or seasonally occurring wildlife. Effects on species of concern from increased noise and nocturnal lighting are possible. See Section 3: Air , Section 4: Noise , Section 5: Light , Section 12: Vegetation , Section 13: Wildlife and Section 14: Human Health .

Table 15.3-1 Key Issues for Land Use (cont'd)

Project Stage	Key Issue	Terms of Reference	Relevance to Project
Construction, Operations and Decommissioning (con't'd)	Changes in, or conflicts with, industrial land uses	Alberta Environment ToR, Section 5.10.2	Increased traffic from the project and adjacent industrial developments might result in road congestion. Increased demand for construction and operations workers could cause increased competition for personnel. See Volume 1, Section 5: Socio-Economic Assessment .
	Changes in natural land use (including protected areas)	Alberta Environment ToR, Section 5.10.2	The RSA has three protected natural areas, but the LSA has none. Project construction will avoid all areas protected under federal and provincial legislation. Project operations have the potential to indirectly affect natural land use through air emissions on terrestrial and aquatic resources and water quality. See Section 9: Surface Water Quality , Section 10: Aquatic Resources , Section 11: Terrain and Soils , Section 12: Vegetation and Section 13: Wildlife .

15.4 Study Area

15.4.1 Local Study Area

The land use LSA consists of the 426-ha PDA. These lands are located in parts of the west half of Section 18, most of Section 19 and the west half of Section 20, in Township 55, Range 21, West of the Fourth Meridian, 4 km northeast of Fort Saskatchewan, Alberta (see [Figure 15.4-1](#)). This LSA represents the area where direct project-related land use changes are expected to occur.

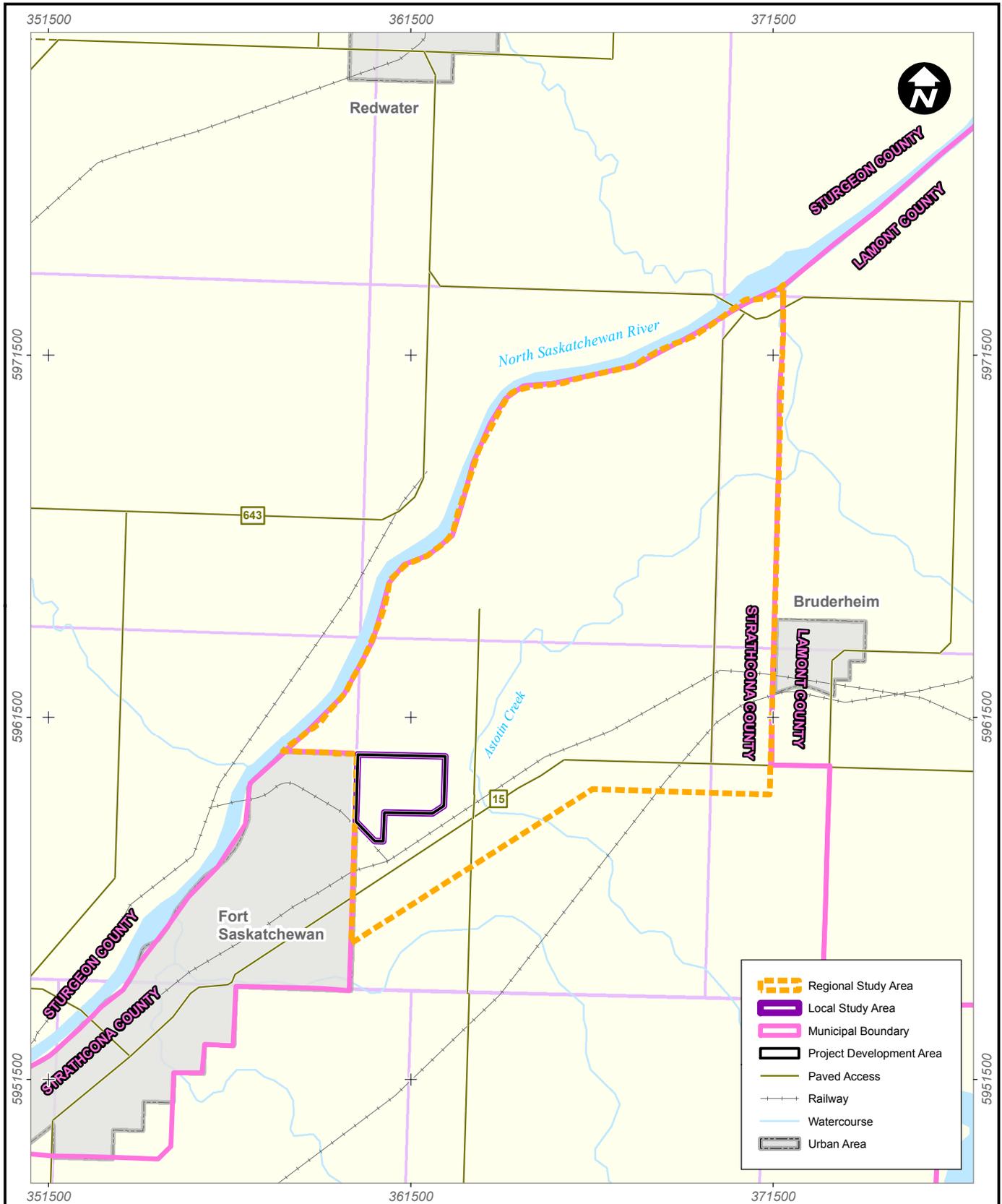
15.4.2 Regional Study Area

The land use RSA is defined as the Strathcona County portion of the Alberta Industrial Heartland. This area was selected to identify existing land uses and planning parameters in and around the PDA. The RSA is bounded by the North Saskatchewan River to the north and northwest, Lamont County and Bruderheim to the east, Fort Saskatchewan to the southwest, and the Alberta Industrial Heartland boundary (which runs south of and parallel to Highway 15) to the south (see [Figure 15.4-1](#)).

15.5 Methods

15.5.1 Effects Characterization

For the descriptors and associated definitions used to characterize the level and consequence of project effects on land use, see [Table 15.5-1](#).



TITLE

**FIGURE 15.4-1
LAND USE LOCAL AND
REGIONAL STUDY AREAS**

SCALE



Table 15.5-1 Effects Characterization for Land Use

Attributes	Description	Rating	Definition
Magnitude (all land use key indicators, except for land use management)	Degree of an effect, described as the amount of change in a measurable parameter relative to baseline conditions in the LSA.	Negligible	Effect occurs that might or might not be detectable, but does not alter current level of land use activity.
		Low	Effect occurs that is detectable, but does not alter current level of land use activity.
		Moderate	Effect occurs that is detectable and alters current level of land use activity, but does not result in loss of the land use activity.
		High	Effect results in loss of land use activity.
Duration	Length of time over which the effect is measurable.	Short term	Less than one year.
		Medium term	More than one year, but not beyond the end of project decommissioning.
		Long term	Beyond the life of the project.
Frequency	Number of times an activity occurs throughout the life of the project.	Once	Effect occurs once.
		Intermittent	Effect occurs occasionally or periodically throughout the project.
		Continuous	Effect occurs continuously throughout the project.
Seasonal timing	Specific times of year that an effect might be present or persist.	Season specific	Effect on resource use occurs at specific times of the year.
		Year-round	Effect on resource use occurs year-round.
Reversibility	Potential for the measurable parameter to return to baseline conditions in the absence of the project.	Reversible	Parameter will likely revert to baseline conditions following or before project decommissioning.
		Nonreversible	Parameter will not likely revert to baseline conditions after project decommissioning.
Land Use consequence	Potential for the project to immeasurably affect land or resource use within the boundaries of the RSA.	None	No change in land use diversity and/or value.
		Low	Project will result in changes in land use diversity and/or values that are consistent with regional land and resource use plans and objectives.
		Moderate	Project will result in changes in land use diversity and/or values that will require a variance or special conditions currently accommodated by regional land and resource use plans.
		High	Project will result in changes in land use diversity and/or values that represent a variance or special conditions not currently accommodated by regional land and resource use plans.

15.5.2 General Approach

For further information on analytical approach, see [Section 15.8.1](#).

15.6 Baseline Conditions

The following sections provide a brief summary of the land use baseline conditions for the LSA and RSA, and the current land use management structure. For a detailed discussion of baseline land use conditions, see [Environmental Baseline Study: Land Use](#) on CD.

15.6.1 Local Study Area

Current land use in the LSA is characterized as follows:

- about 65% of the land in the LSA has been developed for agricultural, residential or industrial use; the remaining 35% has native vegetation cover
- there is one unoccupied residence in the LSA
- about 27% of the land suitability survey area in and around the LSA is classified as Class 3 and lower, and is thus rated as more than marginally suitable for agricultural (crop) production
- industrial activities in the LSA include a wood pallet manufacturing plant, a water pump and parts manufacturing facility, underground pipelines and transmission lines
- no parks, protected areas, ESAs or recreational facilities exist in the LSA
- priority wildlife habitat types in the LSA include wooded upland habitat in the northern part of the LSA, which also potentially serves as a wildlife movement corridor

15.6.2 Regional Study Area

Current land use in the RSA is characterized as follows:

- **residential use:** the RSA has 85 rural residences, 10 of which are located within 1.5 km of the LSA
- **heavy industrial use:** Strathcona County has the third-largest petrochemical complex in North America and contains over half of Canada's petrochemical industry. The total capacity of the three bitumen upgrader facilities under construction, or currently in the planning stages in the RSA is estimated at 1.21 million barrels per day (Mbpd), when all project stages are completed.
- **protected areas:** the three provincial protected areas in the RSA are Astotin Natural Area, Northwest of Bruderheim Natural Area and parts of North of Bruderheim Natural Area
- **environmentally sensitive areas:** four locally or regionally significant ESAs occur in the RSA. However, the North Saskatchewan River Valley Area is the only provincially significant ESA, and is an important wildlife corridor, riparian habitat and nesting area for migratory waterfowl.
- **recreational use:** recreational opportunities in the RSA are limited to passive recreation in the four ESAs (North Saskatchewan River Valley, Astotin Natural Area, Northwest of Bruderheim Natural Area and parts of North of Bruderheim Natural Area). The RSA has one private campground, and various outdoor associations and clubs use lands in the RSA for recreation.

15.6.3 Land Use Management

Existing policies and guidelines that govern land use management in the upgrader area include:

- *Strathcona County Heartland Area Structure Plan (ASP)*. This is the main planning policy document that applies to the LSA and RSA. The LSA is located in the Scotford Heavy Industrial Policy Area of the ASP.
- *Strathcona County Municipal Development Plan (MDP)*. The LSA is in the Heavy Industrial Policy Area of the MDP. Most of the LSA is identified as medium-priority Environmental Management Area. Native vegetation communities occupying a portion of the northern half of the LSA have been mapped as a high-priority Environmental Management Area.
- *Strathcona County Land Use Bylaw 8-2001*. The LSA is designated as mainly heavy industrial (HI) and general agriculture (AG), and a small part is designated medium industrial (IM).

15.7 Project Design and Mitigation to Reduce Effects

Design and mitigation measures to limit project impacts on land use include the following:

- The appropriate separation distances, screens and buffers (e.g., setback from the river, retaining a buffer zone and vegetation) will be applied between the development and surrounding land uses.
- The applicable municipal, provincial and federal safety, risk and environmental assessment requirements and policies in any subsequent health, safety and emergency response plans will be followed.
- An application was submitted to Strathcona County in November 2007 to rezone lands in the PDA to Heavy Industrial.
- Strathcona County will be consulted regarding any variances or special conditions of approval pertaining to the Conservation Policy Area associated with the North Saskatchewan River valley, if necessary.
- Soil conservation and site reclamation will follow commitments in the Conservation and Reclamation (C&R) Plan (see [Volume 1, Section 6.5](#)).

15.8 Project Residual Effects

15.8.1 Analysis

Potential upgrader effects on each key assessment issue were assessed using:

- analysis of project effects on land use
- results of effects assessments from other components (e.g., noise, air, vegetation and wildlife impact assessments)

15.8.2 Compliance with Local and Regional Land Use Management

Potential upgrader effects on local and regional land use management were assessed relative to the following three land use and development planning documents:

- *Strathcona County Heartland ASP*
- *Strathcona County MDP Bylaw 1-2007*
- *Strathcona County Land Use Bylaw 8-2001*

15.8.2.1 Heavy Industrial Policy Area

The PDA is located in the Scotford Heavy Industrial Policy Area of the Strathcona County Heartland ASP and the Heavy Industrial Policy Area of the Strathcona County MDP (see [Figure 15.4-1](#)). Although portions of the PDA are currently considered agricultural lands, the entire PDA will be zoned heavy industrial before construction.

The proposed redesignation of these lands to Heavy Industrial aligns with classification of the PDA in the Scotford Heavy Industrial Policy Area of the Strathcona County Heartland ASP and in the Industrial Heavy Policy Area of the Strathcona County MDP. Therefore, Strathcona County approval would be expected.

The upgrader will conform to the objectives, guidelines and other land use policies set out in the Strathcona County Heartland ASP. The upgrader will meet the five objectives for the Scotford Heavy Industrial Area.

The upgrader will also meet the Strathcona County Heartland ASP policy area performance criteria for industrial facility development. These performance criteria refer to particular standards an industrial activity must comply with, such as protecting natural features, having vegetation buffers or municipal watercourse setbacks.

The upgrader will also conform to the objectives and policies set out in the Strathcona County MDP for developments in the Heavy Industrial Policy Area of the MDP.

15.8.2.2 Environmental Management Policies

TOTAL plans to construct a river water intake and pump house, and a treated discharge water outfall at the North Saskatchewan River, as well as associated pipelines between these facilities and the upgrader. The facilities and pipelines will fall in the North Saskatchewan River Environmental Policy Area of the Strathcona County Heartland ASP. These facilities will be designed and developed to adhere to the objectives of the North Saskatchewan River Environmental Policy Area and the MDP.

One of the environmental management policies in the MDP states that a 50-m setback from the top of the bank of the North Saskatchewan River must be maintained (no buildings or structures permitted), except under unique and appropriate circumstances. TOTAL will apply for a variance to construct facilities within this 50-m setback, as accommodated by the MDP.

Given adherence to the objectives, policies, development regulations and performance criteria contained in the local and regional land use and development planning documents, the upgrader will be compliant with local and regional land use management.

15.8.3 Changes in Residential Land Use

There are no occupied residences in the PDA. The PDA is located in an area that has been or will be zoned for heavy industrial use and classified for industrial development in regional land use planning documents. Residential land use is described as discretionary, and only for single dwellings according to the land use bylaw for the Heavy Industrial Zone. The Strathcona County Heartland ASP also states that intensification of residential development will be discouraged in the Scotford Heavy Industrial Policy Area, and that no new residences or residential subdivisions will be permitted in the area. Only a new residence that replaces an existing older residence will be permitted.

The western boundary of the PDA and RSA borders the City of Fort Saskatchewan boundary, but no urban population centres occur in the RSA. Most of the scattered residences in the RSA are single detached dwellings associated with agricultural operation, and a few are small acreages. Most of the RSA is in one of the four heavy industrial policy areas, which discourage residential development.

Upgrader development will not reduce existing levels of residential development in and immediately around the PDA, but will reduce future opportunities for residential development. Therefore, effects are considered to be high magnitude. However, given the location of the upgrader in an area zoned for industrial development, and the low residential use of these areas, the land use consequence of the upgrader with respect to residential development is considered low.

15.8.4 Changes in or Conflicts with Domestic Water Use

As discussed in [Section 8: Hydrology](#), no defined streams are intersected by the PDA, and the drainage area lost as a result of the PDA stormwater management plan will not have noticeable effects on nearby streams near the upgrader. In addition, as indicated in [Section 7: Groundwater](#), there are no wells, dugouts or other surface water facilities used by landowners in the potential zone of groundwater drawdown that could be affected by dewatering during construction. Therefore, the upgrader's effects on local water use will be negligible in magnitude, with no land use consequence.

TOTAL is also requesting *Water Act* approval to withdraw water from the North Saskatchewan River, which will add to current demands on the river. However, Alberta Environment administers water withdrawal approvals to ensure that downstream aquatic conditions and water users are not unacceptably affected by licensed withdrawals. Therefore, proposed project withdrawals will not affect current levels of water use and associated land use activity downstream of the proposed river water intake and pump house, and the land use consequence of the upgrader with respect to existing water use is considered low (see [Section 7: Hydrology](#)).

15.8.5 Changes in Agricultural Land Use

Agriculture is currently the dominant land use in the LSA, with about 60% of the LSA used for cultivation and grazing. Suitability ratings of soils for agriculture in and around the LSA (see [Section 11](#)) are a mixture of Class 2 (slight limitations) to Class 7 (not suitable). In the LSA, the upgrader will reduce agricultural opportunities during the life of the project. In the RSA, the upgrader's contribution to cumulative emissions has the potential to affect offsite agricultural production. For a discussion of emission effects on crops, see [Section 12: Vegetation](#).

15.8.5.1 Reduction in Agricultural Land

In the LSA, one of the main effects on agriculture from the upgrader will be the direct loss of agricultural land available for future agricultural practices. Construction will require that the entire LSA be cleared and graded. This will result in the loss of 65 ha of cultivated land and 192 ha of pasture land in the LSA.

According to 2001 census data (Statistics Canada 2001), 103,709 ha of land in Strathcona County are used for various agricultural purposes. The loss of 257 ha as a result of upgrader construction represents a loss of less than 1% of agricultural land from the county. In addition, while the upgrader will represent a loss of agricultural activity in the LSA (i.e., high-magnitude effect), it is consistent with regional land and resource use plans and objectives. Therefore, the land use consequence of the upgrader with respect to agriculture during the project life is considered low.

15.8.5.2 Agricultural Suitability at Decommissioning

The PDA is currently zoned for heavy and medium industrial development, and future plans for the PDA support this zoning. Therefore, the site is unlikely to support nonindustrial uses after closure. However, conceptual closure measures outlined in the C&R Plan (see [Volume 1, Section 6.5](#)) are intended to restore the lands to pre-disturbance equivalency.

Results of the terrain and soils assessment (see [Section 11](#)) indicate that upgrader effects on the agricultural suitability of salvaged and reconstructed soils in the LSA will be of low magnitude and low environmental consequence, and that agricultural and reclamation suitability will be restored to pre-disturbance equivalency at the time of decommissioning. Therefore, after decommissioning, the land use consequence of the upgrader with respect to agriculture would be negligible.

15.8.6 Changes in Recreational Land Use

15.8.6.1 General Effects in and Around the LSA

No designated recreational facilities, parks or protected areas occur in, or overlap, the LSA. However, some recreational associations and clubs use lands adjacent to the LSA for activities such as wildlife viewing, cross-country skiing and snowmobiling, and the quality of these activities immediately adjacent to the LSA may be affected by the upgrader.

A potential wildlife movement corridor, associated with upland woodlands and reaches of Astotin Creek, is partially encountered by the northern half of the LSA. This potential corridor connects the North Saskatchewan River valley to upland woodland habitats in Astotin Natural Area and North of Bruderheim Natural Area (Westworth and Knapik 1987; Strathcona County 2001). Although parts of this corridor in the LSA retain sufficient cover habitat to support wildlife, the corridor is considerably fragmented by agricultural development northeast of the LSA. Therefore, its functionality is questionable. Nevertheless, wildlife use and associated viewing values are anticipated to decline with the construction of the upgrader.

The PDA is located near Astotin Creek, which flows through the Astotin Natural Area. The required 30-m setback from the top of the bank of Astotin Creek will not be compromised by the upgrader, as the eastern boundary of the PDA is about 870 m away from the top of the bank at Astotin Creek.

With the increasing industrial development anticipated in the area, levels of recreational activities will likely decline in the vicinity of the upgrader and other nearby industrial facilities. In addition, while the upgrader will likely reduce recreational opportunities within and adjacent to the LSA (i.e., moderate magnitude effect), it is consistent with regional land and resource use plans and objectives. Therefore, the land use consequence of the upgrader with respect to recreation during the project life is considered low.

As discussed in the previous section, the site is unlikely to support nonindustrial uses after closure. However, conceptual closure measures outlined in the C&R Plan (see [Volume 1, Section 6.5](#)) are intended to restore the lands to pre-disturbance equivalency. The plans call for a mix of agricultural lands and native vegetation to be re-established on the site. Therefore, after decommissioning, the land use consequence of the upgrader with respect to recreation would be negligible, assuming that the public was allowed access to and around the land.

15.8.6.2 General Effects in Designated ESAs and Natural Areas

Four areas in the RSA are used for outdoor recreation activities, all of which fall more than 1 km from the boundaries of the LSA. These include:

- the North Saskatchewan River Valley Area, a regionally significant ESA
- Astotin Natural Area, a provincial protected area
- Northwest of Bruderheim Natural Area, a provincial protected area
- parts of North of Bruderheim Natural Area, a provincial protected area

The North Saskatchewan River Valley Area is available for low-intensity recreation activities, such as hiking, biking, birdwatching and wildlife viewing, and also contains a series of recreation trails. The other three provincial protected natural areas are available for low-intensity recreational activities, such as birdwatching, wildlife viewing, horseback riding, hiking and cross-country skiing.

Astotin Natural Area is soon to lose its designation as a natural area, to accommodate other land use activities. The recreational values afforded by this natural area are also likely to be eliminated in the near future. Potential replacement lands outside the RSA, to compensate for this loss of status as a natural area, are being evaluated by the provincial government and will be in place in the near future.

The upgrader PDA will not result in direct loss of recreational land or opportunities in the RSA beyond the LSA boundaries. Project construction and operations activities will not directly affect any of the four recreation areas. However, use, quality and enjoyment of recreational areas in the RSA might be indirectly affected through air emissions, noise and traffic generated by the upgrader.

The upgrader will result in short-term, occasional and intermittent noise related to construction, flaring, road and rail traffic, and long-term, continuous noise effects from operations. Results of the noise assessment (see [Section 4](#)) indicate that predicted upgrader sound levels are all well below the applicable permissible sound levels (PSLs) at the residences within 3 km of the LSA boundary. As most recreational activities will occur well beyond the LSA boundary, potential effects on recreational users in the recreational areas as a result of noise associated with the upgrader are expected to be negligible.

Noise has the potential to affect the behaviour of wildlife species (especially bird species), thus altering the diversity and distribution of species observed by birdwatchers, photographers or naturalists in the RSA. Noise levels during operations are predicted to remain within EUB-required PSLs (see [Section 4](#)). Modelled sound levels are predicted to range from 44 to 51 dBA at all receptor locations (after mitigation) during construction and up to 32 dBA in remaining forested habitats immediately adjacent to the PDA during operations. Although effects of noise on wildlife are poorly understood (see [Section 13](#)), predicted sound levels for the upgrader are not likely to have a substantial effect on bird behaviour, particularly in the four natural areas more commonly used by birders. Therefore, birders, photographers and naturalists using recreational areas in the RSA are unlikely to be affected by changes in wildlife characteristics as a result of noise, and the land use consequence of the upgrader with respect to recreation would be negligible in the RSA.

15.8.7 Changes in, or Conflicts with Industrial Land Use

The upgrader is located in the Strathcona County portion of Alberta's Industrial Heartland, in an area zoned for heavy industrial development. Numerous manufacturing plants and petrochemical and hydrocarbon-upgrading facilities are also situated in the Industrial Heartland area, and several new facilities are currently under construction or proposed. Upgrader construction and operations will not interfere with any existing leases, permits or infrastructure in the LSA. As TOTAL owns the lands proposed for development, direct effects on other industrial users in the area will not occur.

Upgrader effects that will influence industrial land use in the rapidly growing Industrial Heartland will be related to workforce (e.g., competition for skilled labour, accommodation and services), transportation and infrastructure. For a detailed discussion of these issues, see [Volume 1: Section 5](#).

TOTAL is committed to fulfilling all regulatory and planning requirements for development in Strathcona County and the Alberta Industrial Heartland. TOTAL will also work with other industrial partners, government agencies and stakeholders to identify and implement appropriate solutions to achieve sustainable development in the region.

Upgrader effects on industrial land use are rated as negligible. As the upgrader will not reduce industrial land use opportunities in the area, the land use consequence is predicted to be negligible.

15.8.8 Changes in Natural Areas

The LSA does not encounter any parks or protected areas. As discussed above, four areas with either ESA or Natural Area status occur in the RSA, all of which fall more than 1 km from the boundaries of the LSA. These include:

- the North Saskatchewan River Valley Area, a regionally significant ESA
- Astotin Natural Area, a provincial protected area
- Northwest of Bruderheim Natural Area, a provincial protected area
- parts of North of Bruderheim Natural Area, a provincial protected area

Although upgrader construction and operations will not directly affect these protected areas, potential indirect effects could result from air emissions on terrestrial and aquatic resources and water quality.

For effects of air emissions on terrestrial resources in the RSA, see [Section 11: Terrain and Soils](#), [Section 12: Vegetation](#) and [Section 13: Wildlife and Wildlife Habitat](#). While minor changes in the structure and botanical composition of more sensitive vegetation communities (i.e., lichens, bryophytes) could occur as a result of cumulative emissions, it is unlikely that these minor changes would measurably change the recreational use of these areas. Therefore, emission-related effects would be of negligible magnitude to land use, and the land use consequence of the upgrader with respect to recreational use of these areas would be negligible.

15.8.9 Project Residual Effects Summary

Residual effects on residential, recreational, industrial and natural land use will be of negligible to low environmental consequence. For a summary of results of the residual project effects assessment for land use, see [Table 15.8-1](#).

15.9 Cumulative Effects Assessment

While land use options on TOTAL lands during upgrader construction and operations will be reduced, this is to be logically expected on lands that are being transformed from agricultural and natural ecosite conditions to lands now zoned for heavy industrial development. Therefore, project contributions to cumulative losses of land use activities and opportunities were not assessed.

15.10 Prediction Confidence

As baseline data quality is reliable, prediction confidence in baseline data is high. Information was gathered through literature review, website searches and personal communication.

Prediction confidence in analyses is moderate. As land use assessments are primarily qualitative and results subjective, varying from user to user, effects are difficult to predict.

Prediction confidence in mitigation measures is high because mitigation measures include adhering to applicable requirements and policies. As the mitigation measures for soil conservation and site reclamation were based on commonly used, researched, effective, industry-accepted practices, the planned mitigation measures are expected to be effective.

15.11 Climate Change Effects

Predicted effects on land use are not expected to change as a result of climate change.

15.12 Management and Monitoring

No monitoring programs are recommended for land use.

Table 15.8-1 Summary of Residual Project Effects on Land Use

Project Stage	Issue or Measurable Parameter	Magnitude/ Extent ¹	Duration ¹	Reversibility ¹	Frequency ¹	Seasonal Timing ¹	Environmental Consequence ¹
Construction and Operations	Compliance with local and regional land use management	N/A	N/A	N/A	N/A	N/A	Negligible
	Changes in residential land use	High	Medium term	Reversible	Once	Year-round	Low
	Changes in domestic water use	Negligible	N/A	N/A	N/A	N/A	Negligible
	Changes in agricultural land use	High	Medium term	Reversible	Once	Year-round	Low
	Changes in recreational land use	Moderate	Medium term	Reversible	Continuous	Season-specific	Low
	Changes in or conflicts with or industrial land use	Negligible	Medium term	Reversible	Continuous	Year-round	Negligible
	Changes in natural land use	Negligible	Medium term	Reversible	Once	Year-round	Negligible

NOTES:

N/A not applicable

For definitions of effects characterization, see [Table 15.5-1](#).

15.13 References

15.13.1 Literature Cited

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