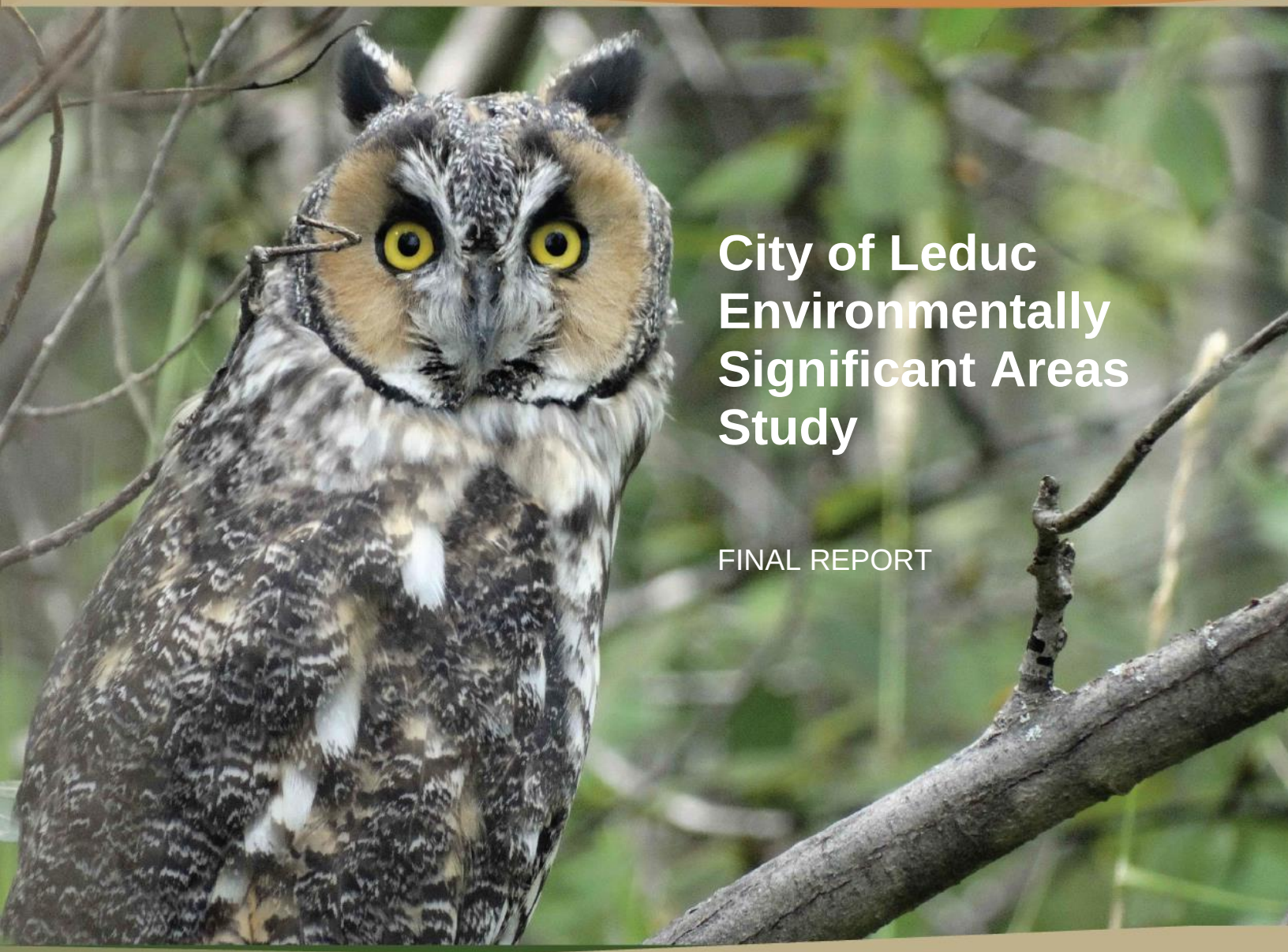

# City of Leduc Environmentally Significant Areas Study

FINAL REPORT

**Prepared for:**
The City of Leduc

June 2017

Project #1607

FIERA
Biological Consulting

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**Photo Descriptions and Credits**

All photos in this report were taken by Fiera Biological Consulting Ltd. in the City of Leduc during field surveys conducted during the summer of 2016.

Cover Photo: Long-eared owl (*Asio otus*), Telford Lake, Natural Area 70, ESA 1

Page i: Nodding begger-ticks (*Bidens cernua*), Natural Area 47, ESA 5

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# Executive Summary

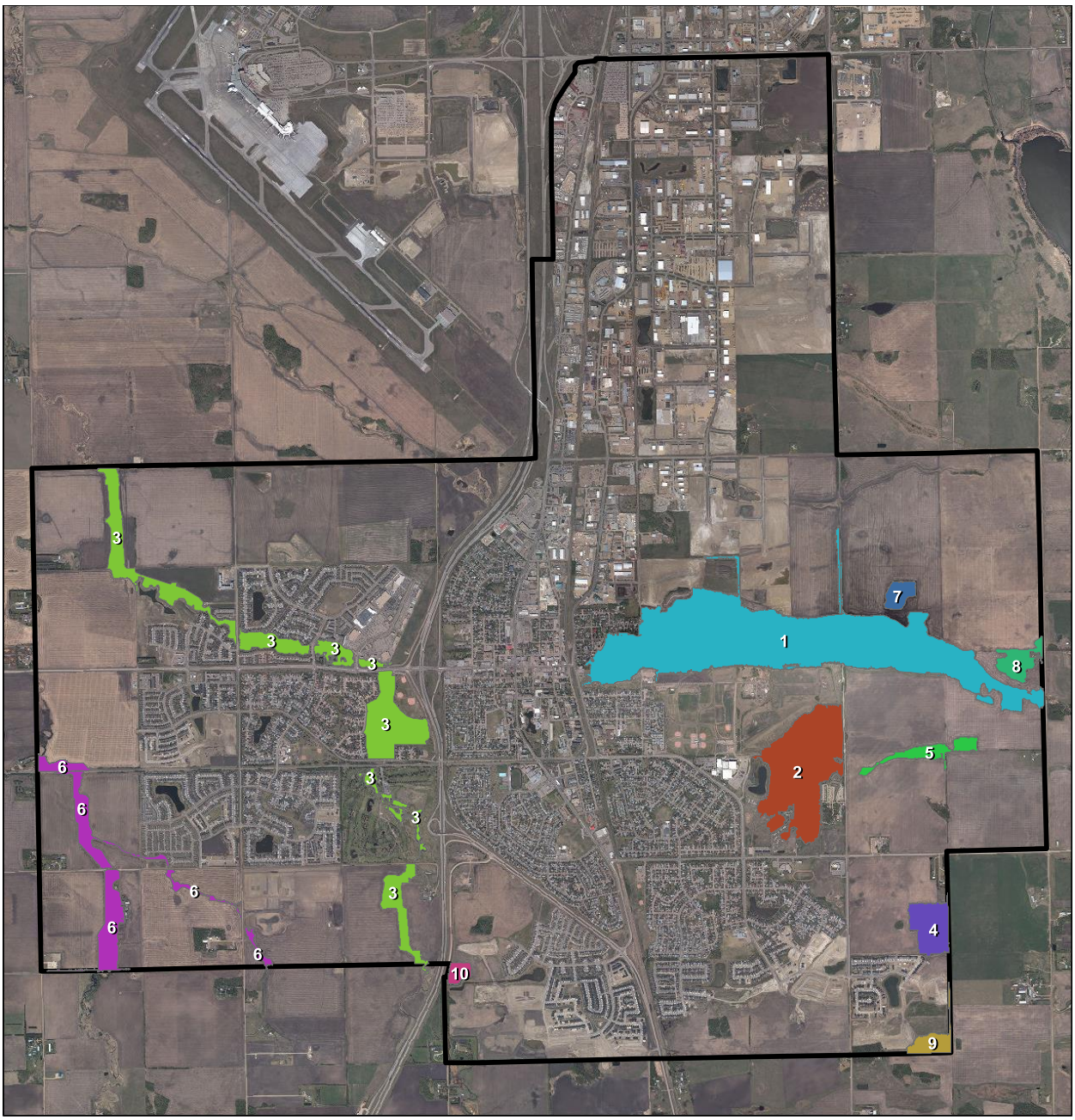
The City of Leduc is a diverse and dynamic municipality located central Alberta that has experienced rapid growth over the last decade. This growth has put increasing pressure on a number of locally, regionally, and provincially significant natural areas, many of which create unique spaces that contribute to the high quality of life experienced by the City's residents. As Leduc grows and expands, there is a need to better understand the ecological value of the natural areas contained within the City's boundaries, including how these areas contribute to local and regional biodiversity. In addition, there is growing need for science-based information that can be used to prioritize natural areas for retention, such that these areas can be managed to maintain their ecological, social, and economic values, while also allowing the City to grow in a contiguous manner.

In order to ensure that natural areas within the City of Leduc are identified and managed appropriately, the City of Leduc initiated this study to inventory and assess the significance and condition of natural areas in the City, as well as to identify natural areas that qualify as Environmentally Significant Areas (ESAs) using credible and scientifically defensible methods.

In total, 86 natural areas were identified within the City of Leduc, covering 459 ha, or 11% of the City. Of these, 10 natural areas were identified as Environmentally Significant Areas. Two ESAs (Whitemud Creek tributary and Deer Creek) are located west of Highway 2, while the remaining eight ESAs are located to the east of the highway. The ESAs range in size from 2.7 ha to 148 ha, and collectively cover 328 ha.

The natural areas identified as Environmentally Significant Areas cover approximately 8% of the City of Leduc, and include aquatic habitats (lake, streams, and wetlands) as well as upland tree stands. Several of the ESAs represent important wildlife corridors through the City (e.g., Deer Creek and the Whitemud Creek tributary), and others (e.g., Telford Lake) are very large habitat patches that likely serve as core habitat for wildlife at both the local and regional scale. Together, this portfolio of Environmentally Significant Areas represents a range of habitat types that support a diversity of wildlife, and these areas are foundational to the development and conservation of a local and regional network of natural areas that will provide important ecosystem services to the community.

Moving forward, land-use planning in the City of Leduc needs to consider environmental values along with the social, economic, cultural considerations that traditionally drive municipal planning and land use decisions. This ESA study represents scientifically defensible information that can be integrated into future land-use planning decisions. Given that the options for municipalities to conserve and protect natural areas are often cost-prohibitive, the City should also consider developing new environmental policies and tools that can further support land use planning and decision making. These new policies and tools will contribute to the conservation and management of important environmental areas in the City for the benefit and enjoyment of citizens over the long term.




**Environmentally Significant Areas**

# Environmentally Significant Area

City of Leduc

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# 1.0 Introduction

## 1.1. Background

The City of Leduc is a diverse and dynamic municipality located central Alberta that is home to nearly 30,500 residents (City of Leduc 2016). Since 2006, the City has experienced a growth rate of 80% and this rapid growth has put increasing pressure on a number of locally, regionally, and provincially significant natural areas. These areas, in combination with the City's existing parks network, create unique spaces that contribute to the high quality of life experienced by the City's residents. As Leduc grows and expands, there is a need to better understand the ecological value of the natural areas contained within the City's boundaries, including how these areas contribute to local and regional biodiversity. In addition, there is growing need for science-based information that can be used to identify Environmentally Significant Areas in the City, such that these areas can be managed to maintain their ecological, social, and economic values.

Environmentally Significant Areas are defined as areas that are vital to the long term maintenance of biological diversity, physical landscape features, and/or other natural processes (Jennings and Reganold 1991). Over the last 30 years, several ESA studies have been completed by the provincial government, with the most recent ESA update occurring in 2014 (Fiera Biological 2014). While ESAs have been identified throughout Alberta by the provincial government, these provincial-scale ESAs do not consider the ecological, social, economic, or policy context specific to each municipality. As a result, several municipalities throughout Alberta, including Leduc County, Parkland County, Mountain View County, and the Municipal District of Foothills, have undertaken their own ESA studies. These more detailed studies allow municipalities to identify areas with high ecological value, and provide an opportunity for land managers to target these areas for retention and sustainable management through the development of municipal tools and policies. The information gathered from these studies, along with the development of new policies and tools, allows municipal planners, managers, and Council members to make more informed land use decisions, which ultimately leads to more sustainable integration of Environmentally Significant Areas into municipal planning and development.

In order to ensure that natural areas within the City of Leduc are identified and managed appropriately, the City of Leduc initiated this study to inventory and assess the significance and condition of natural areas in the City, as well as to identify natural areas that qualify as Environmentally Significant Areas (ESAs) using credible and scientifically defensible methods. The results of this study will be used to inform future municipal plans and initiatives related to the management of natural areas in the City of Leduc.

# 2.0 Study Area

The City of Leduc is an urban municipality located in central Alberta, which covers an area of approximately 43 km$^2$. Land use within the City includes a mix of agricultural, residential, industrial, and commercial land uses, with the Edmonton International airport located immediately to the north west of the City limits. The majority of lands to the east, west, and south are dominated by Urban Reserve, and a major industrial/business park located within the County of Leduc is located immediately to the north. Edmonton, a major city with nearly a million residents, is located less than 10 km to the north. The City of Leduc is located within the Central Parkland Natural Subregion and is part of the Whitemud Creek Hydrologic Unit Code 8 (HUC 8) watershed, which is part of the North Saskatchewan River Basin.

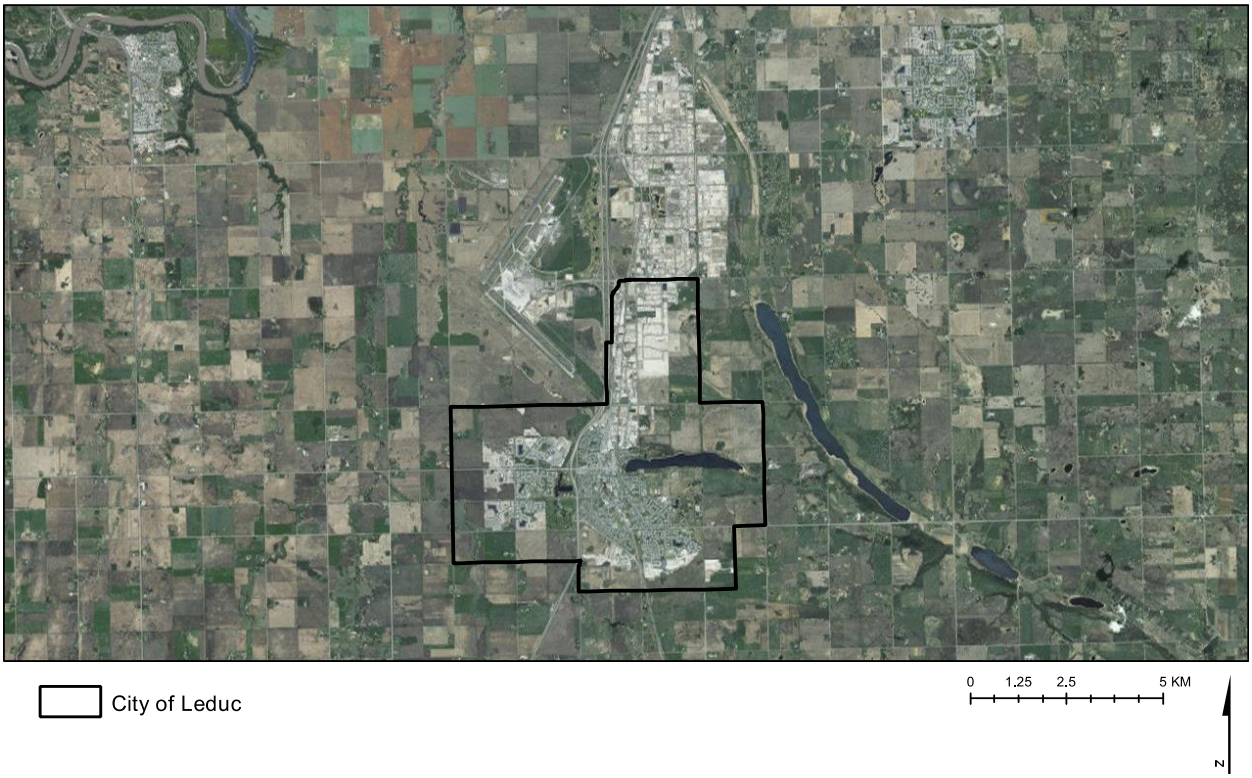



Figure 1. The City of Leduc.

# 3.0 Approach & Methods

To complete this study, we undertook five major steps (Figure 2). These steps included:

Step 1: Creation of a Natural Area Inventory for the City of Leduc

Step 2: Ranking of Natural Areas using a Desktop Assessment, which included to following:

- Step 2(a): Habitat Connectivity Analysis
- Step 2(b): Ecological Significance Analysis

Step 3: Evaluation of the Habitat Condition of a select number of Natural Areas through field assessment

Step 4: Identification of Environmentally Significant Areas using Ecological Significance Scores calculated in Step 2

Step 5: Review and Outline Potential tools for future management of Environmentally Significant Areas

A more detailed description of the work conducted as part of each of these steps is provided below.

## Step 1: Create a Natural Area Inventory

**Creating a Natural Area Inventory for the City of Leduc**

Before Environmentally Significant Areas could be identified in the City of Leduc, we first had to identify and map “natural areas” (i.e., areas with natural vegetative cover) within the City limits. In order to do this, we identified a variety of different natural and human-related land cover and land use types within the City, as well as within a 1.5 km buffer surrounding the City, using a high resolution air photo from 2015, satellite imagery, and existing City of Leduc spatial data (Figure 3 and Figure 4). Land use and land cover was classified into 14 categories, and natural cover types (e.g., open water, low cover, shrub, tree) were used to identify locations within the City with natural vegetative cover. Natural cover types that were ecologically or hydrologically connected were joined into a single natural area, and all natural areas >0.5 ha in size were mapped.

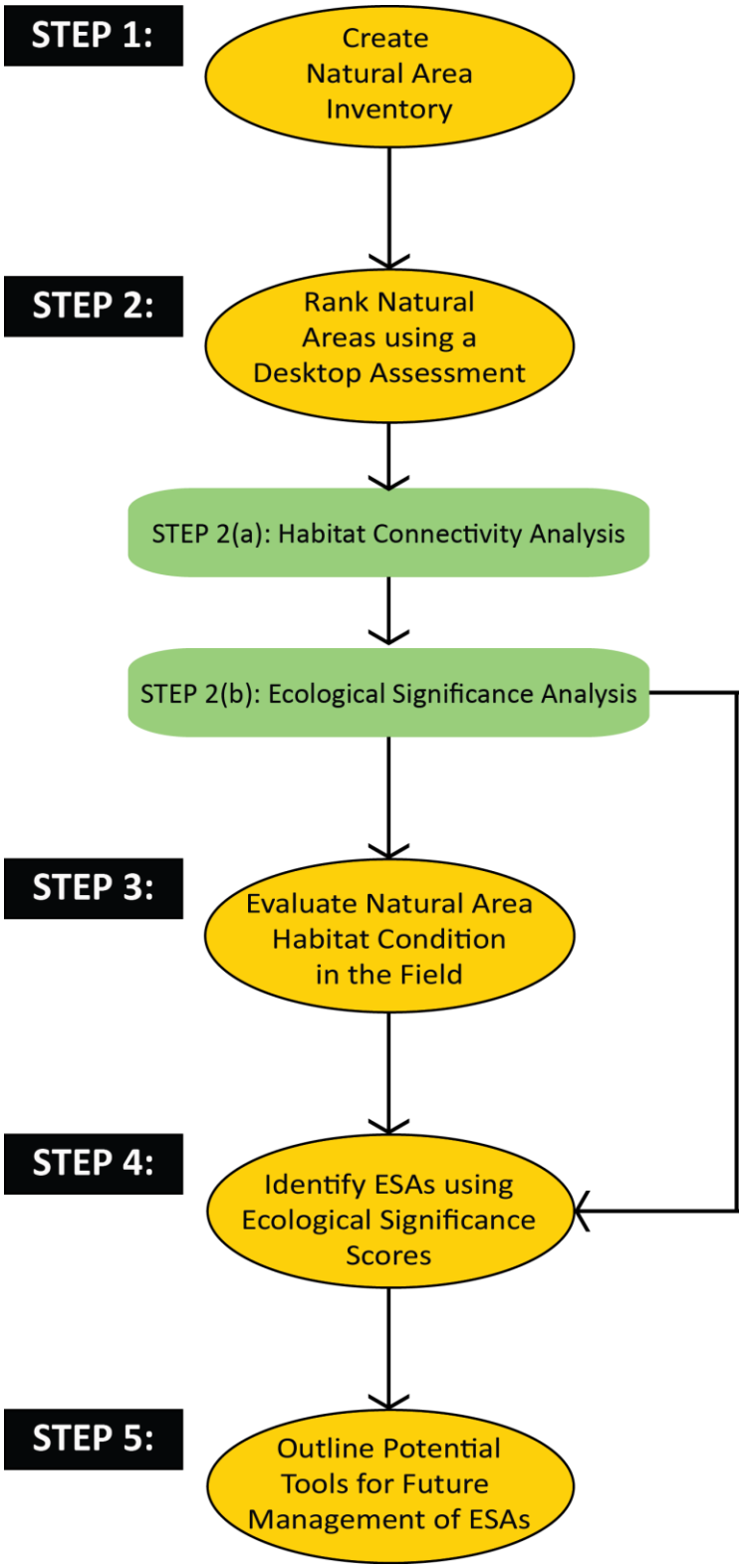



Figure 2. The five major methodological steps used to identify and assess natural areas and Environmentally Significant Areas in the City of Leduc.

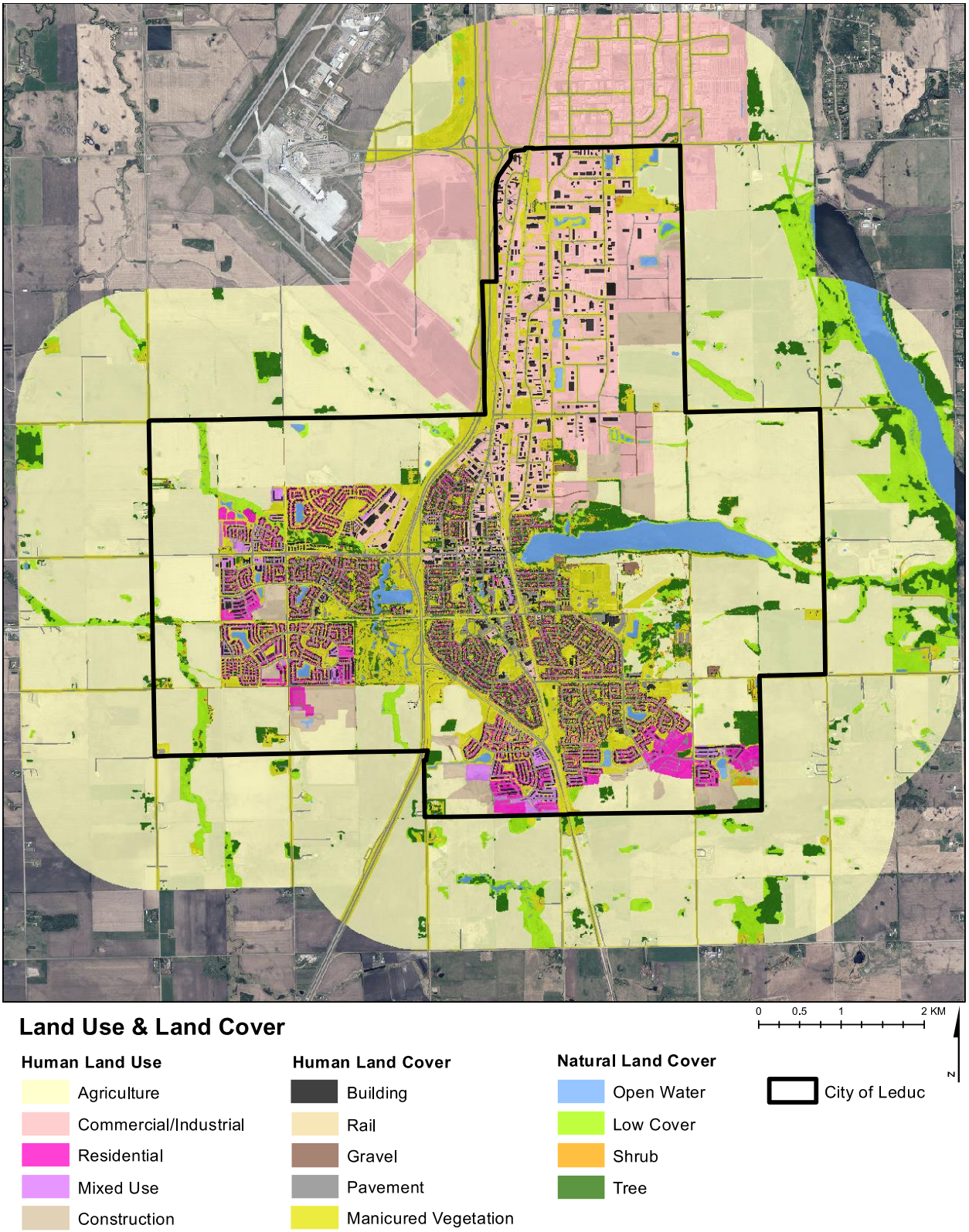



Figure 3. Land use and land cover map for the City of Leduc and a 1.5 km buffer.


Figure 4. Detailed view of land use and land cover map created for the City of Leduc.

# Step 2: Rank Natural Areas using a Desktop Assessment

### Step 2(a): Assessing Natural Area Habitat Connectivity

Urban landscape areas are diverse and heterogeneous, characterized by complex arrangements of human development (e.g., buildings, roads, parking lots), semi-natural habitats (e.g., manicured lawns, golf courses), and remnant natural areas (e.g., grasslands, wetlands, forest stands). To assess natural area connectivity in the City of Leduc, we assumed that resistance to wildlife movement is related to the degree of "naturalness", with wildlife movement being more likely to occur in natural or semi natural areas, as opposed to areas that are highly disturbed or modified by human activities. We also acknowledge that there are varying degrees of "naturalness", particularly in urban environments, and that some species are more tolerant of human disturbance and habitat modification than others. Thus, we avoided the use of a binary "natural" or "non-natural" classification, and instead, chose to quantify resistance along a gradient of human disturbance and modification.

Like the majority of connectivity studies that have been complete to-date (see Zeller et al. 2012 for a review), we used land cover data as the foundation for building the resistance surface for the City of Leduc. The land cover layer for the buffer and the City includes 23 distinct classes that were assigned a "resistivity value" ranging between 1 and 1000, with more natural land cover types being assigned a lower value and highly modified land cover classes being assigned a higher value (Table 1). Once the resistivity values were assigned to each land cover class, the land cover layer was converted to a raster surface with a pixel size of 5 m x 5 m. If multiple land cover types were contained within a pixel, the value of the majority land cover type present was assigned to the pixel. The resistivity values assigned to each land cover class were based on expert opinion and literature review. The connectivity model was not validated with an independent dataset, and as such, this connectivity model should be considered a hypothesis of structural habitat connectivity in the City of Leduc.

Table 1. Land cover classes and associated resistivity values for the City of Leduc. Resistivity values represent a estimate of the resistance to movement across the landscape for terrestrial wildlife, with lower values representing more natural land cover types where resistance to movement is lower, and higher values representing land cover types that pose higher resistance or barriers to movement.

| Land Cover Class | Resistivity Value |
|---|---|
| Highway | 1000 |
| Arterial/Ramp | 800 |
| Collector Road | 500 |
| Building | 100 |
| Commercial | 100 |
| Construction | 100 |
| Gravel Area | 100 |
| Industrial | 100 |
| Mixed Use | 100 |
| Paved Area | 100 |
| Rail | 100 |
| Residential | 100 |
| Road (Gravel) | 100 |
| Road (Paved) | 100 |
| Sidewalk | 100 |
| Agriculture | 25 |
| Manicured | 25 |
| Trail in Park (Gravel) | 25 |
| Trail in Park (Paved) | 25 |
| Open Water | 10 |
| Low Cover | 1 |
| Shrub | 1 |
| Tree | 1 |

We identified potential connectivity linkages in the City of Leduc by modeling current flow using the software Circuitscape (McRae et al. 2013). This modeling approach was selected because it uses random walk theory to identify all possible movement pathways within the network using simulated electron flow, and is therefore suitable for broadly assessing connectivity over larger spatial extents and within highly complex heterogeneous landscapes. Following Pelletier et al (2014), we modeled "omnidirectional connectivity" across the City of Leduc, which allowed for the identification of potential pathways between neighbouring natural area patches, as well as movement pathways at the City-scale.

The resulting output map is a raster grid of connectivity values. These values were range standardized between 0 and 100, with higher values indicating areas that have higher predicted ecological connectivity in the City of Leduc (Figure 8). The average connectivity score for each natural area was calculated from this City-wide grid.

### Step 2(b): Assessing Natural Area Ecological Significance

One of the main objectives of this project was to assign an ecological value to each natural area identified in the inventory using rigorous, objective, relevant, and scientifically defensible methodology. We used a GIS-based multi-criteria decision analysis as the foundation for assessing the ecological value of natural areas in the City of Leduc.

Key criteria for identifying ecologically important natural areas in the City of Leduc were identified and organized into a hierarchy of sub-criteria and indicators. At the highest level, the identification of ecologically important natural areas was represented by criteria that characterized important conditions or processes, and each criteria was broadly representative of specific environmental elements of interest (e.g. biodiversity, ecological integrity, etc.). Each criterion was associated with one or more sub-criterion, which in turn, was represented by one or more specific indicator that was measureable in a GIS environment. Given that a single criteria is unlikely to be representative of all desired components of an ecologically important natural area, we incorporated multiple criteria, sub-criteria, and indicators into the framework. This multi-tiered approach incorporated a broad set of environmental indicators at a variety of spatial scales, thereby identifying important ecological and evolutionary processes at different levels of organization (Groves et al. 2000; Poiani et al. 2000).

The criteria selected to identify ecologically important natural areas in the City of Leduc included both coarse-filter and fine-filter indicators. Coarse-filter criteria were developed with the goal of maintaining native biota and natural ecosystem function, while fine-filter criteria were developed to capture environmental features that are required to maintain populations, species, ecosystems, or other special features that are not accounted for under coarse filter criteria (Groves et al. 2000). In order to maintain consistency between this study and other relevant ESA studies (e.g., the County of Leduc ESA study, the Provincial ESA study), the same framework for selecting criteria and indicators was employed. To ensure that the list of criteria and indicators were reflective of local conditions within the City of Leduc, we presented the criteria and indicators framework at a workshop that was attended by City Administration from various departments. The feedback that was gathered at the workshop was summarized, and where appropriate, the criteria and indicator framework was revised to reflect suggestions and feedback from the workshop.

In total, three criteria, eight sub-criteria, and 14 indicators were selected to define, measure, and map the ecological value of natural areas in the City of Leduc. A complete list of the proposed criteria, sub-criteria, and indicators is provided in Figure 5. Once all of the indictors scores had been calculated for each natural area, the scores were aggregated together to derive a single significance score for each natural area, with each criteria being given an equal weighting in the final score. The final ecological significance scores were range standardized between 0 and 100.

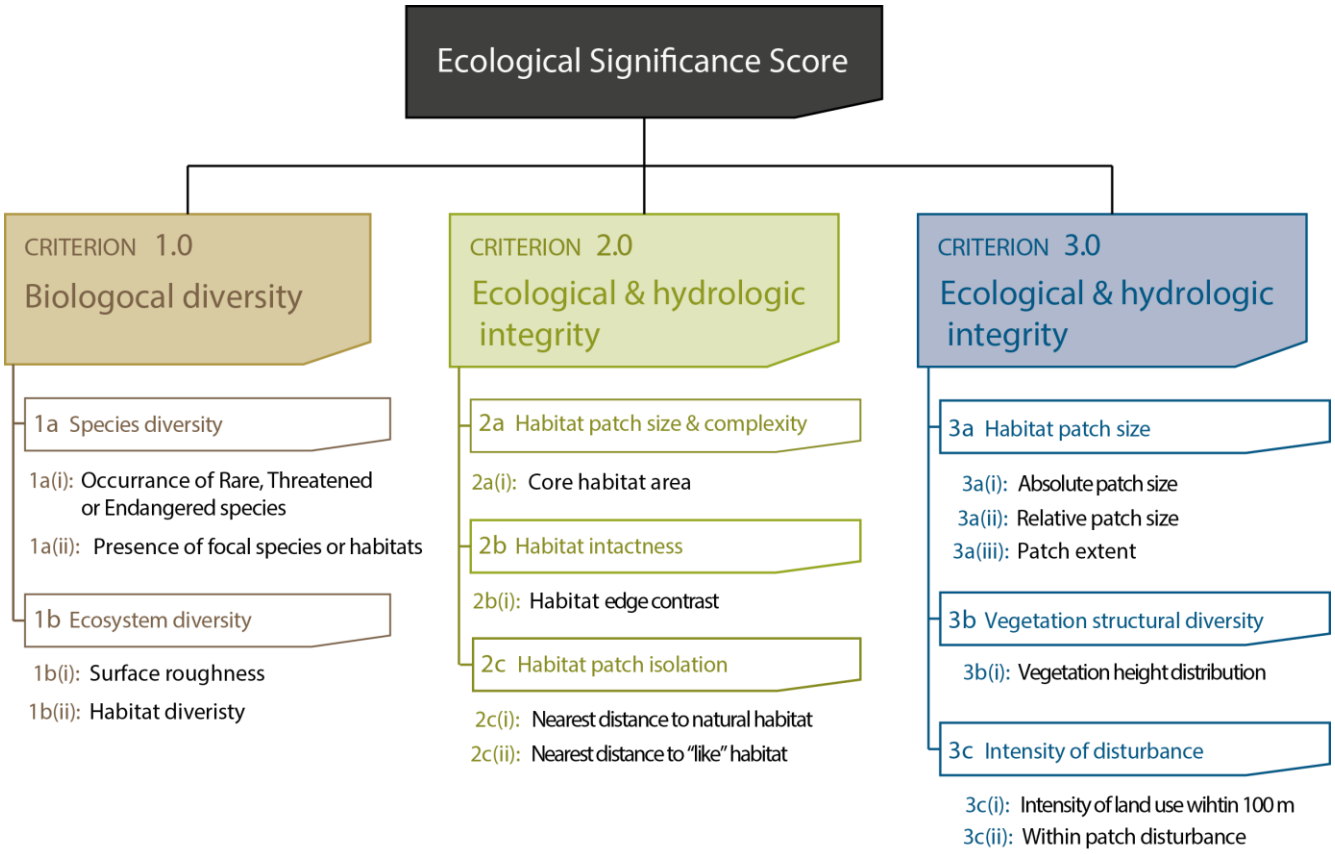



Figure 5. List of criteria, sub-criteria, and indicators that were used to calculate an Ecological Significance Score for each natural area in the City of Leduc using a GIS desktop analysis.

## Step 3: Evaluate Natural Area Habitat Condition in the Field

Once natural areas were identified and were broadly assessed for ecological significance and habitat connectivity using the desktop analysis tools, we assessed habitat condition in the field for a select number of natural areas. In addition to assessing habitat condition, the habitat mapping was checked in the field, and any habitat misclassifications or boundary inaccuracies were recorded. Very large natural areas (e.g., Telford Lake, Deer Creek, Whitemud Creek) were subdivided into natural area sub-units, and each sub-unit was assessed separately in the field.

The field assessments focused on natural areas with the highest Ecological Significance and Habitat Connectivity scores (Figure 9 and Figure 10). Field assessments were also limited to natural areas that were on publically accessible lands, or on private lands for which land access permission was granted. Storm water ponds were excluded from field sampling. Given these criteria and limitations for field sampling, just over 50% of the City's natural area was assessed as part of the field campaign (Figure 6).

In order to assess habitat condition within the targeted natural areas, four broad habitat categories were defined: Upland, Wetland, Stream, and Lake. For each of these specific habitat types, a separate field assessment tool was used to assess condition (Appendix 2). For the Upland, Stream, and Lake habitats, a new assessment tool was developed specifically for the City of Leduc. For Wetland habitats, we used the Alberta Wetland Rapid Evaluation Tool (ABWRET-A), which is a standardized assessment tool developed by the provincial government to assess wetland condition. Assessments for the Stream and Lake habitats were limited to the near-shore aquatic environment, the riparian zone, and any upland habitat within 10 m of the shore. The Leduc reservoir was also assessed using the Lake assessment tool. For each natural area assessed, a detailed list of wildlife and plant species observed in the field was also collected. This assessment tool can be used in the future to assess natural areas in the City of Leduc to track changes in the condition score over time.

For each natural area assessment, the habitat metrics specific to each habitat type were collected if the habitat was present within the natural area. The assessment tool was designed to broadly assess condition for each habitat present within a natural area. An overall natural area habitat condition score was calculated by aggregating the habitat category condition scores together. Habitat scores were aggregated together using an area-weighted average, where each of the habitat scores was multiplied by the proportion of the natural area that was made up of each distinct habitat type. For natural areas that were composed of sub-units, the score for each sub-unit were averaged to create an overall natural area score.

In addition to receiving an overall condition score, each natural area that was assessed in the field received a ranking for Habitat Quality, Plant Naturalness & Diversity, and Level of Human Impacts. The Habitat Quality ranking was derived for each habitat type, and included metrics related to habitat structure and function, such as forest age, forest layer intactness, bank characteristics, and quality of wetland buffer. The Plant Naturalness & Diversity ranking was aggregated from metrics that measured species richness, vegetation nativity, presence of invasive species, and weed distribution. The Level of Human Impacts ranking was derived from metrics that measured the presence and extent of anthropogenic impacts (e.g. grazing, dumping, paths, structures, vegetation clearing, inputs of contaminants or nutrients). These rankings were created to characterize conditions so that additional management guidance could be provided for each Environmentally Significant Area.

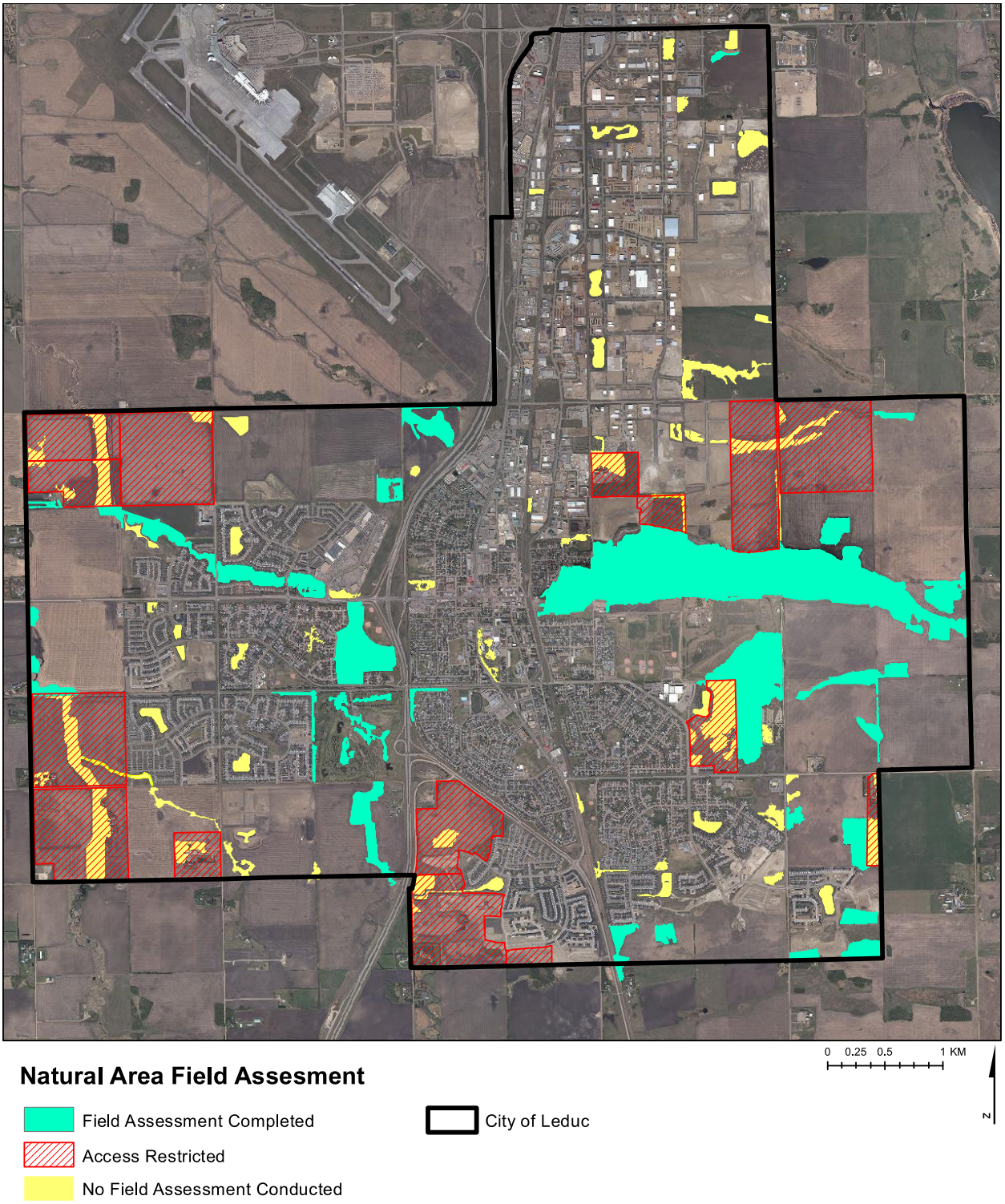



Figure 6. Natural areas that were assessed in the field during the summer of 2016, as part of the Environmentally Significant Areas study completed for the City of Leduc.

## Step 4: Identify Environmentally Significant Areas

At the conclusion of the field assessments, the land cover layer and other relevant spatial datasets were updated to reflect any required adjustments to habitat classes or habitat/natural area boundaries. Once the spatial data was updated, Habitat Condition Scores were calculated for each natural area. In addition, Ecological Significance were recalculated to reflected the most accurate and up-to-date spatial data for the natural areas that were assessed in the field during the summer of 2016.

Given that not all natural areas could be visited in field to assess habitat condition, the final determination of which natural areas were identified as an ESA was based upon Ecological Significance Scores only (Step 2b; Figure 6). This was done because the desktop-based assessment allowed for an assignment of a significance score to all natural areas, regardless of whether or not permission was granted to access natural areas on private land. Further, using a GIS-based scoring approach to assign significance to natural areas and select ESAs was consistent with the methods previously employed for both the provincial ESA study (Fiera Biological 2014) and the Leduc County ESA study (Fiera Biological 2015). Thus, this approach was consistent with, and comparable to, previous ESA studies that have been completed.

Once natural areas were assigned an Ecological Significance Score, a cut-off value had to be selected in order to determine which natural areas were identified as Environmentally Significant Areas. The distribution of Environmental Significance Scores was examined and a variety of methods were explored to objectively assign an ESA cut-off value, including statistical methods such as Jenks and percentile ranks. In consultation with personnel from the City of Leduc, the ten highest Ecological Significance Scores were selected, and these top scoring natural areas were identified as ESAs.

## Step 5: Outline Tools for the Management of Natural Areas

The first step in effective management of significant environmental areas is to inventory and map areas that are considered to be important. The second step is to use existing policies and/or tools to secure and manage these areas. In absence of existing policies and tools, it is important to identify critical management gaps that need to be addressed before significant natural areas can be retained and managed. As such, this report includes a review of the existing policies and tools that are currently available to the City of Leduc to retain, manage, and monitor natural areas that have been identified as ESAs. This included a literature review of relevant federal, provincial, and municipal legislation, policy, and guidelines, to provide an overview of what currently exists, as well as to identify critical gaps in existing management tools.

# 4.0 Natural Areas in the City of Leduc

## 4.1. Overview

In total, 86 natural areas were identified within the City of Leduc, covering 459 ha, or 11% of the City (Figure 7). The largest natural area (NA), Telford Lake (NA 70), accounts for 32% of the City's natural area. A variety of habitats types are represented in the natural area inventory (Table 2), with 42% of the area being comprised of upland habitat, 22% being comprised of lake habitat, and modified water bodies, stream habitat, and wetlands each representing 12% of the area of natural habitat in the City.

Table 2. Habitat representation within natural areas in the City of Leduc.

| Habitat | Habitat Area (ha) | Percent of NAs (%) by area |
|---|---|---|
| Upland | 192 | 42 |
| Lake | 101 | 22 |
| Modified Water Body* | 55 | 12 |
| Stream | 54 | 12 |
| Wetland - Unconfirmed | 34 | 7 |
| Wetland - Field-verified | 24 | 5 |

*Includes storm water management facilities and the Leduc reservoir.

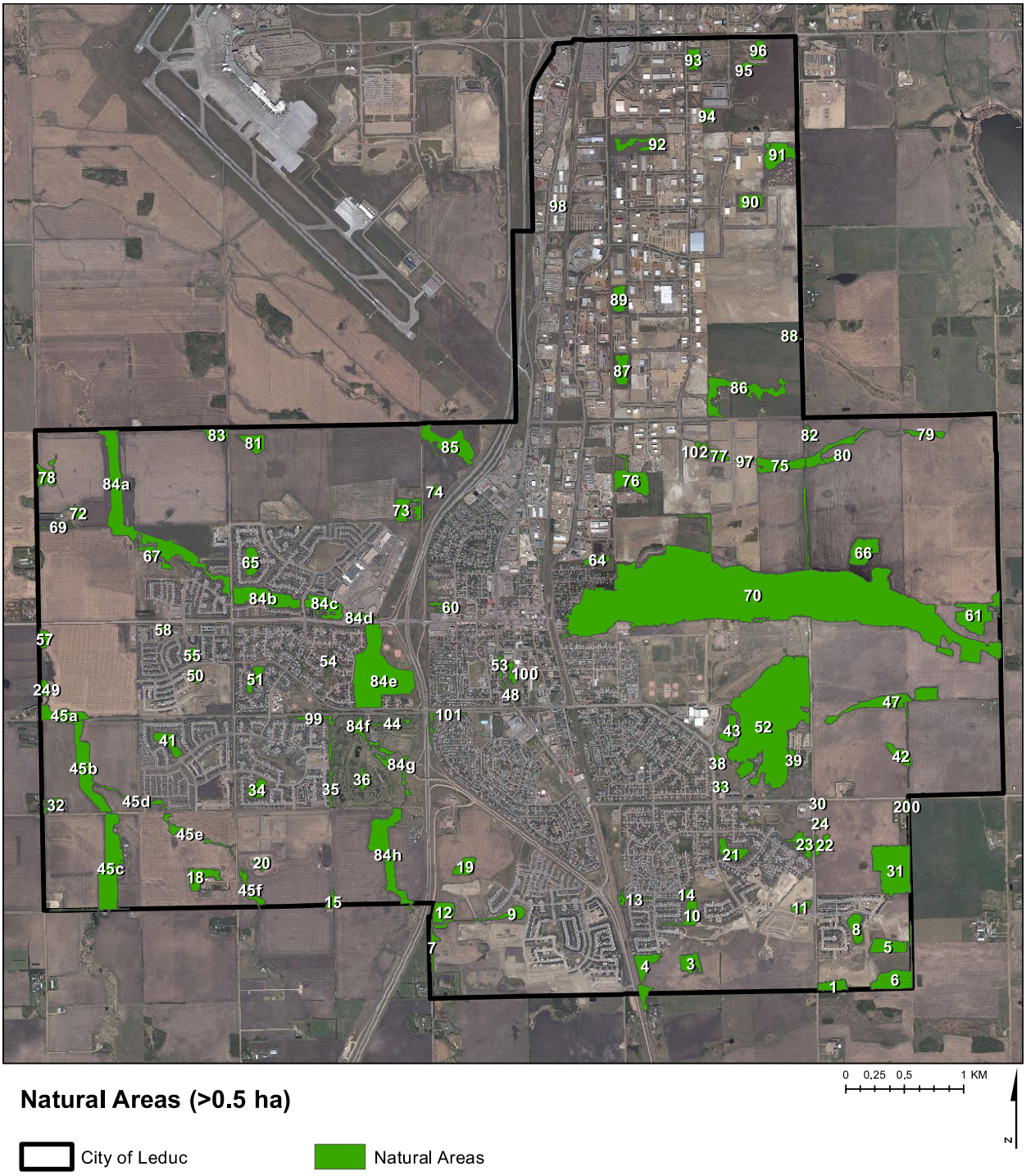



Figure 7. Natural areas (>0.5 ha) identified in the City of Leduc. Natural area identification numbers are noted in white.

## 4.2. Habitat Connectivity Scores

Habitat Connectivity was scored between 0 and 100, with higher scores reflecting areas with greater connectivity and lower resistance to movement by terrestrial wildlife (Figure 8 and Figure 9). Scores for natural areas in the City ranged from a low of 44 to a high of 75 (Table A-1). The highest Habitat Connectivity Scores were associated with smaller natural areas that provide important linkages between larger habitat patches (e.g., 99, 35, 101). In contrast, the lowest connectivity scores were generally associated with stormwater management facilities, which are relatively isolated from other natural areas and have little vegetation surrounding them.

A list of the 25 natural areas with the highest Habitat Connectivity scores in the City is provided in Table 3. A full list of connectivity scores, organized by natural area, is provided in Appendix 1.

Table 3. Top 25 average Habitat Connectivity Scores for natural areas in the City of Leduc.

| Rank | Natural Area (NA) | Habitat Connectivity Score (/100) |
|---|---|---|
| 1 | 99 | 75 |
| 2 | 7 | 75 |
| 3 | 101 | 72 |
| 4 | 45 | 71 |
| 5 | 35 | 67 |
| 6 | 47 | 67 |
| 7 | 69 | 67 |
| 8 | 6 | 67 |
| 9 | 79 | 65 |
| 10 | 44 | 64 |
| 11 | 13 | 62 |
| 12 | 42 | 62 |
| 13 | 83 | 61 |
| 14 | 36 | 61 |
| 15 | 61 | 61 |
| 16 | 70 | 61 |
| 17 | 18 | 60 |
| 18 | 84 | 60 |
| 19 | 12 | 60 |
| 20 | 48 | 60 |
| 21 | 249 | 60 |
| 22 | 3 | 59 |
| 23 | 66 | 59 |
| 24 | 15 | 59 |
| 25 | 31 | 59 |

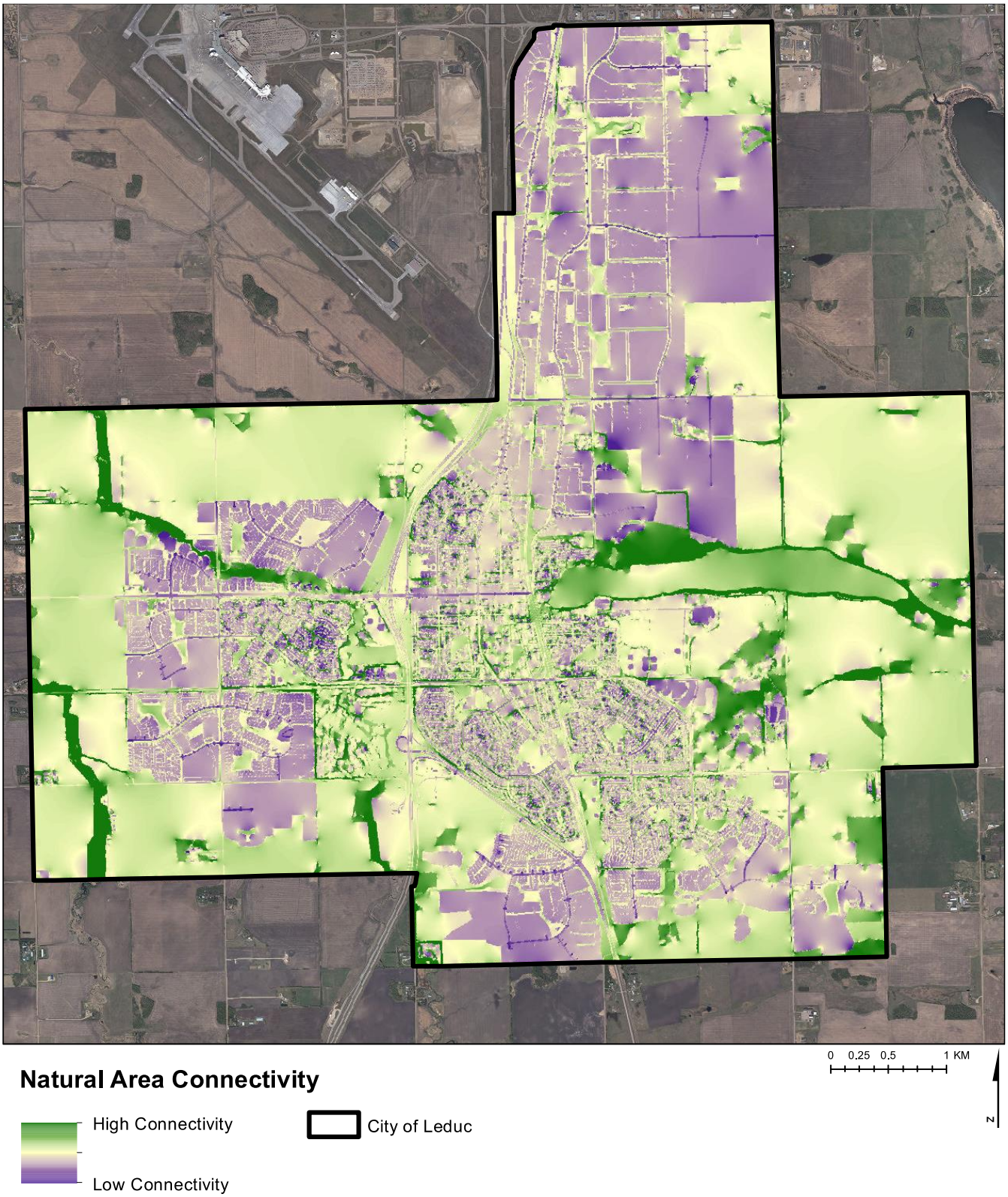



Figure 8. Natural area connectivity in the City of Leduc.

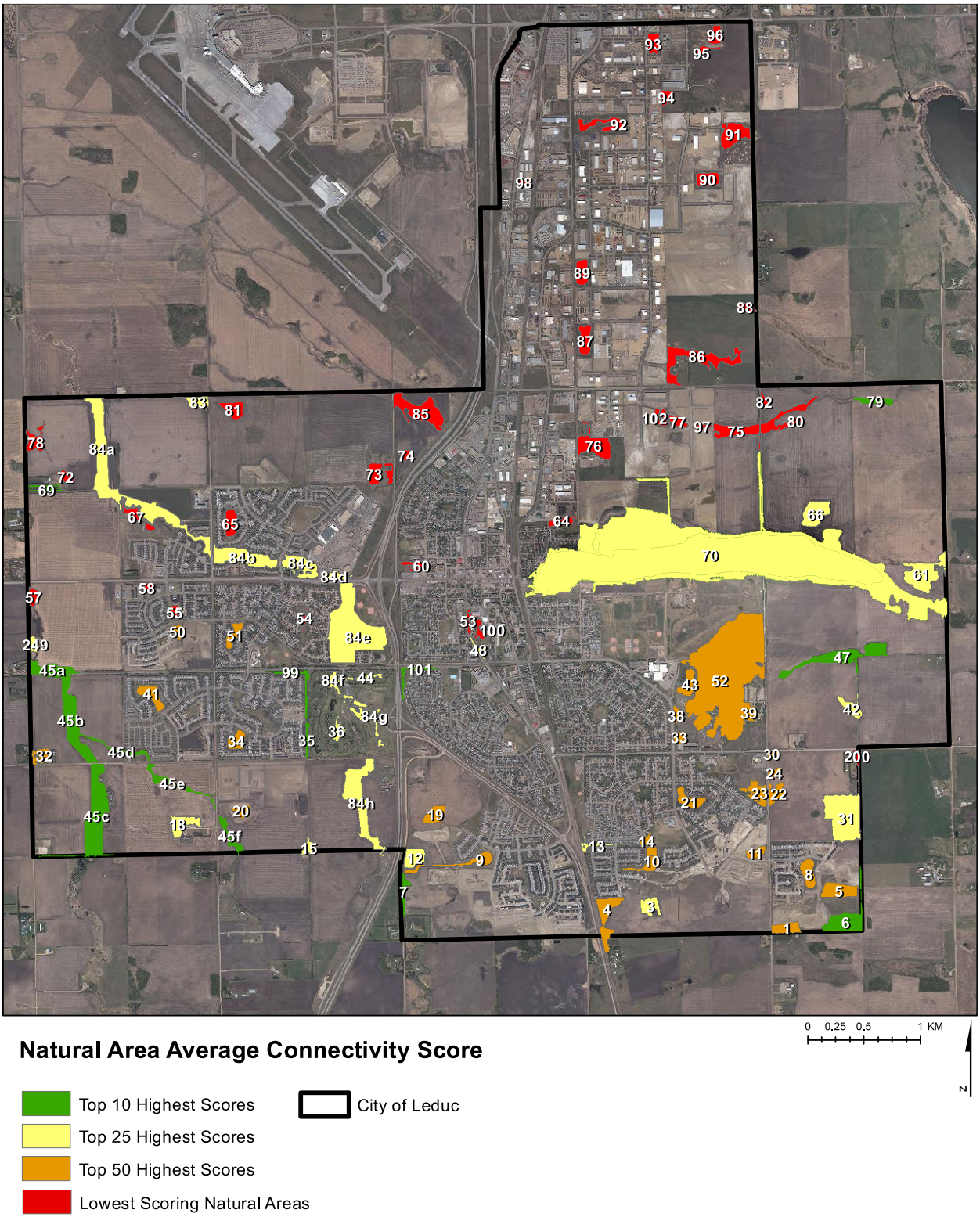



Figure 9. Average Habitat Connectivity Scores for the natural areas within the City of Leduc.

## 4.3. Ecological Significance Scores

Ecological Significance was scored between 0 and 100, with higher scores reflecting areas with greater ecological significance, as assessed using a desktop-based assessment of criteria and indicators (Figure 5). The natural area that received the highest Ecological Significance score in the City (84 out of 100) was Telford Lake (NA 70; Table 4). The top ten highest Ecological Significance scores included relatively large habitat patches (e.g., NA 31, 52, and 70), as well as linear stream corridors (e.g., 45 and 84), and unique habitats (Figure 10). The natural areas that fell into the top 25 included smaller discrete habitat patches located in areas with more human development, with the lowest scoring natural areas being those that are relatively isolated on the landscape and located in areas with the most intense land development activity in the City (Figure 10).

A list of the 25 natural areas with the highest Ecological Significance scores in the City is provided in Table 4. A full list of scores, organized by natural area, is provided in Appendix 1.

Table 4. Top 25 Ecological Significance Scores for natural areas identified in the City of Leduc.

| Rank | Natural Area (NA) | Ecological Significance Score (/100) |
|---|---|---|
| 1 | 70 | 84 |
| 2 | 52 | 74 |
| 3 | 84 | 60 |
| 4 | 31 | 59 |
| 5 | 47 | 59 |
| 6 | 45 | 58 |
| 7 | 66 | 57 |
| 8 | 61 | 56 |
| 9 | 6 | 55 |
| 10 | 12 | 54 |
| 11 | 42 | 53 |
| 12 | 73 | 52 |
| 13 | 19 | 52 |
| 14 | 7 | 52 |
| 15 | 99 | 52 |
| 16 | 43 | 51 |
| 17 | 36 | 51 |
| 18 | 3 | 50 |
| 19 | 10 | 50 |
| 20 | 18 | 50 |
| 21 | 85 | 50 |
| 22 | 83 | 50 |
| 23 | 67 | 49 |
| 24 | 200 | 49 |
| 25 | 74 | 49 |

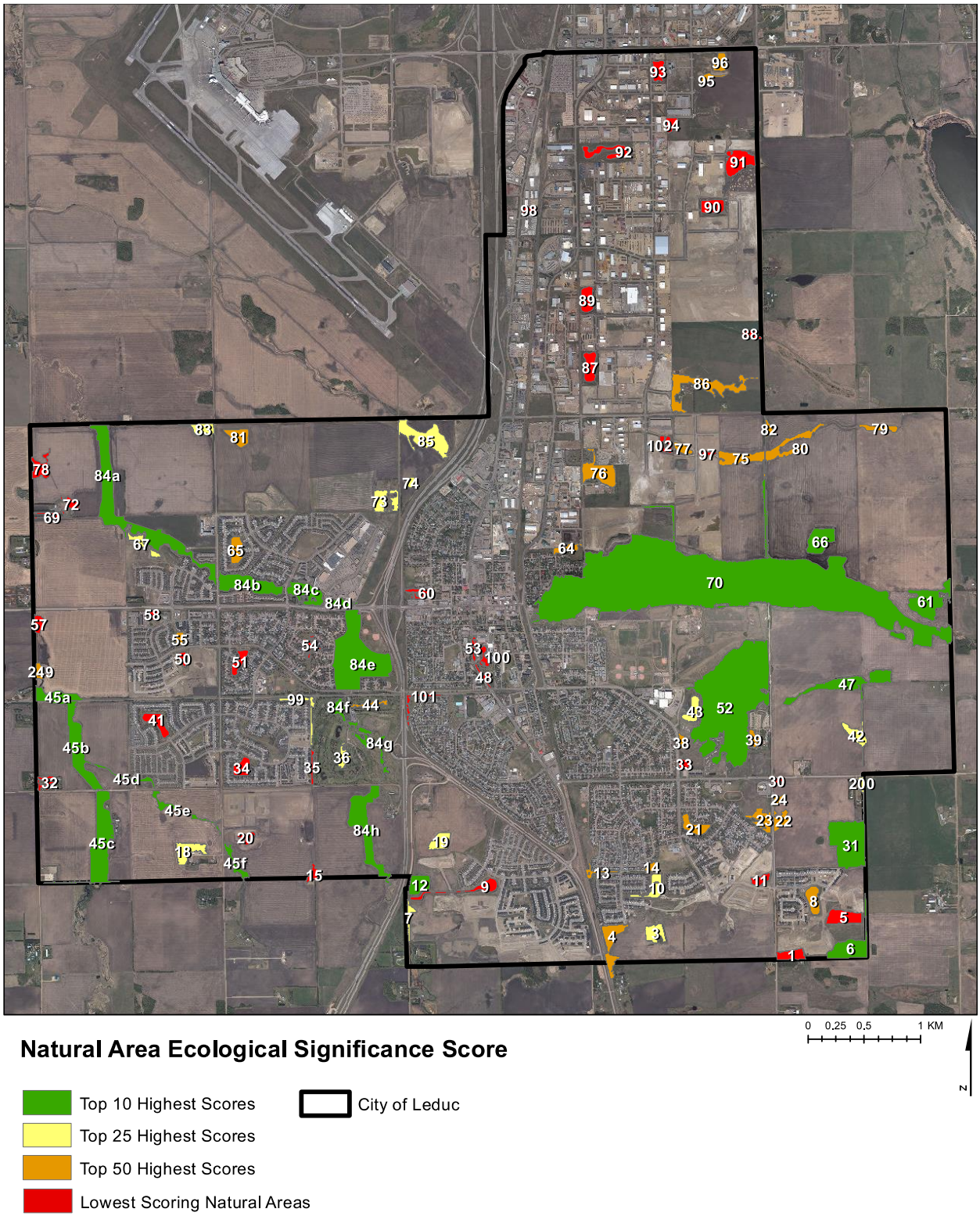



Figure 10. Ecological Significance scores for natural areas in the City of Leduc, derived using a desktop GIS analysis.

## 4.4. Habitat Condition Scores

Thirty-three natural area sub-units were assessed in the field, and these areas were assigned a Habitat Condition Score ranging between 0 and 100, with higher scores indicating natural areas with higher quality habitat (Table 5; Figure 11). There were areas of the City for which access to private land was not granted; thus, these areas could not be assessed in the field. In cases where land access was not granted for the entire natural area, only those areas where access was granted were visited and assessed.

The natural areas with the highest habitat condition score (NA 6, 31, and 1) included large, intact tree stands located in the south east corner of the City (Table 5). These areas had minimal human disturbance and high plant diversity and habitat quality. A full list of the 33 natural areas and natural area sub-units that were assessed in the field for habitat condition is provided in Table 5.

Table 5. Habitat Condition Scores for natural areas and natural area sub-units assessed in the City of Leduc.

| Rank | Natural Area and Natural Area Sub-units | Habitat Condition Score (/100) | Habitat Condition Categories | | |
|---|---|---|---|---|---|
| | | | Plant Naturalness & Diversity | Habitat Quality | Level of Human Impacts |
| 1 | 6 | 100 | High | High | Minimal |
| 2 | 31 | 99 | High | High | Minimal |
| 3 | 1 | 99 | High | High | Minimal |
| 4 | 66 | 88 | Moderate | High | Minimal |
| 5 | 47 | 85 | High | High | Minimal |
| 6 | 45a | 82 | Moderate | High | Minimal |
| 7 | 79 | 79 | Moderate | Moderate | Minimal |
| 8 | 61 | 77 | Moderate | High | Moderate |
| 9 | 35 | 75 | Moderate | Moderate | Minimal |
| 10 | 84b | 73 | Low | High | Minimal |
| 11 | 45b | 71 | Moderate | Moderate | Minimal |
| 12 | 36 | 65 | Moderate | Moderate | Moderate |
| 13 | 84h | 64 | Moderate | Moderate | Minimal |
| 14 | 99 | 64 | Moderate | Moderate | Moderate |
| 15 | 70 | 63 | Moderate | Moderate | Moderate |
| 16 | 84c | 62 | Moderate | Moderate | Moderate |
| 17 | 84f | 62 | Moderate | Moderate | Moderate |
| 18 | 84a | 61 | Low | Moderate | Minimal |
| 19 | 52 | 52 | Moderate | Moderate | Moderate |
| 20 | 101 | 52 | Moderate | Moderate | Moderate |
| 21 | 42 | 44 | Moderate | Low | Moderate |
| 22 | 45d | 41 | Low | Low | Moderate |
| 23 | 3 | 41 | Low | Moderate | Moderate |
| 24 | 73 | 39 | Low | Moderate | Moderate |
| 25 | 84e | 38 | Moderate | Moderate | Extensive |
| 26 | 69 | 27 | Low | Low | Moderate |
| 27 | 85 | 26 | Low | Low | Extensive |
| 28 | 22 | 24 | Moderate | Low | Extensive |
| 29 | 84g | 21 | Moderate | Low | Extensive |
| 30 | 44 | 18 | Low | Low | Moderate |
| 31 | 95 | 9 | Low | Low | Extensive |
| 32 | 4 | 1 | Moderate | Low | Extensive |

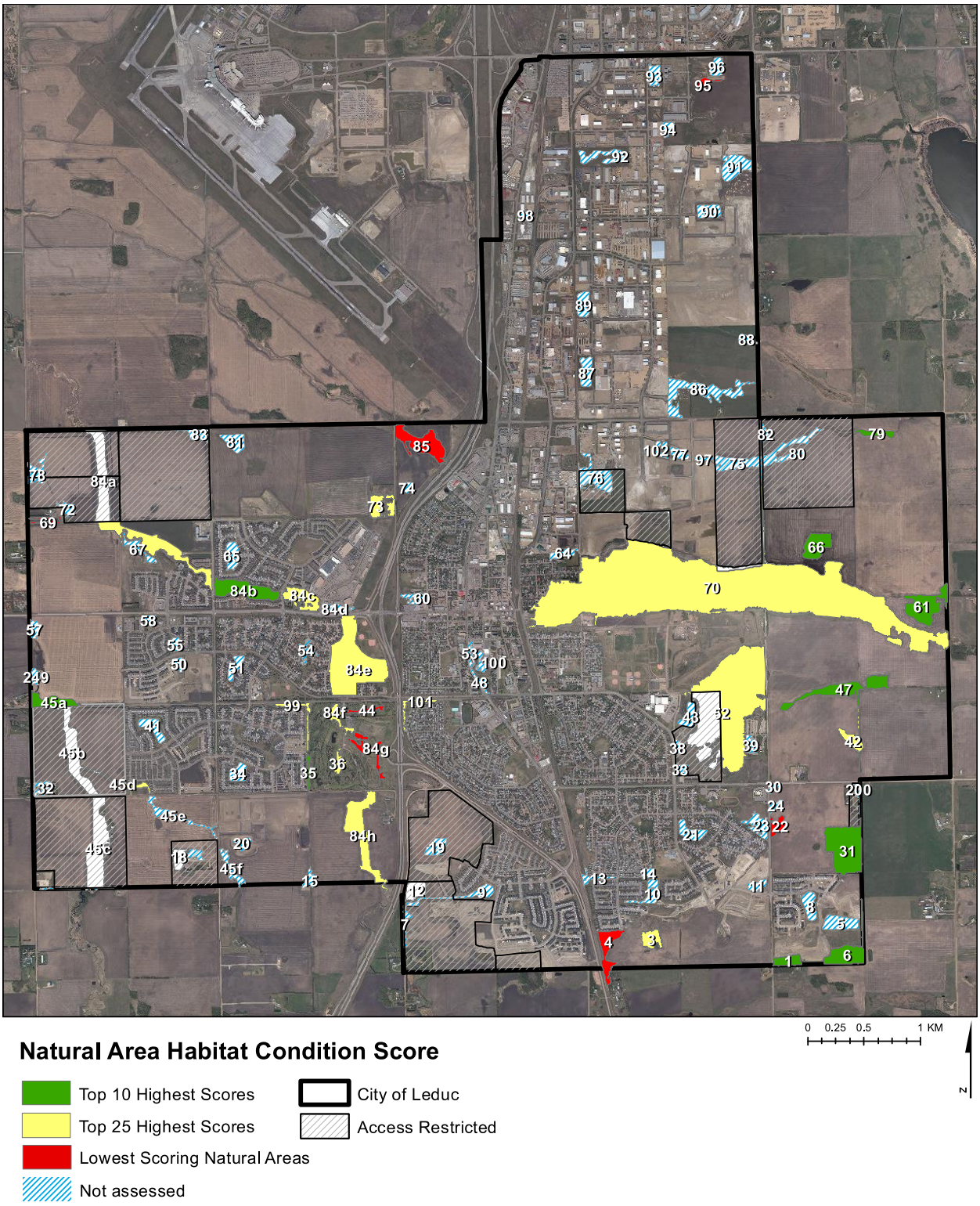



Figure 11. Habitat Condition Scores for natural areas assessed during the summer of 2016 in the City of Leduc.

# 5.0 Environmentally Significant Areas in the City of Leduc

## 5.1. Summary of Results

Of the 86 natural areas identified in the City of Leduc, the ten natural areas with the highest Ecological Significance Scores were identified as Environmentally Significant Areas. Two ESAs (Whitemud Creek tributary and Deer Creek) are located west of Highway 2, while the remaining eight ESAs are located to the east of the highway (Figure 12). The ESAs range in size from 2.7 ha (ESA 10) to 148 ha (ESA 1; Table 6). Collectively, ESAs cover a total of 328 ha, which constitutes 71% of the natural area within the City. Overall, 8% of the City is covered by natural areas that have been identified as an ESA.

Table 6. Summary table of Ecological Significance, Habitat Connectivity, ad Habitat Condition Scores the ten natural areas identified as Environmentally Significant Areas in the City of Leduc.

| ESA Number | Natural Area Number | Size (ha) | Ecological Significance Score (/100) | Habitat Connectivity Score (/100) | Habitat Condition Score (/100) |
|---|---|---|---|---|---|
| 1 | 70 | 148.0 | 84 | 61 | 63 |
| 2 | 52 | 49.5 | 74 | 54 | 52 |
| 3 | 84 | 64.2 | 60 | 60 | 54 |
| 4 | 31 | 11.7 | 59 | 59 | 99 |
| 5 | 47 | 7.3 | 59 | 67 | 85 |
| 6 | 45 | 27.8 | 58 | 71 | Not Assessed* |
| 7 | 66 | 4.3 | 57 | 59 | 88 |
| 8 | 61 | 7.1 | 56 | 61 | 77 |
| 9 | 6 | 5.2 | 55 | 67 | 100 |
| 10 | 12 | 2.7 | 54 | 60 | Not Assessed* |

*ESA was not assessed because permission to access private land was not granted by the land owner.

A range of habitat types are represented within the ESAs, including lake, stream, upland, and wetland habitat (Table 7; Figure 13). Certain modified water bodies are also included as ESAs (e.g., the Leduc reservoir), as they are hydrologically and ecologically connected to a larger natural area system (e.g., a stream corridor). Upland and lake habitat have the greatest ecological representation within the ESAs, with 44% of the ESAs by area being composed of upland habitat, and 31% being composed of lake habitat (Table 7).

Table 7. Ecological representation by habitat type for Environmentally Significant Areas in the City of Leduc.

| Habitat Type | Habitat Area (ha) | Representation within ESAs (proportion by area) |
|---|---|---|
| Upland | 143 | 44 |
| Lake | 101 | 31 |
| Stream | 53 | 16 |
| Modified Water Body | 15 | 5 |
| Wetland - Field-verified | 9 | 3 |
| Wetland - Unconfirmed | 6 | 2 |

The ESAs identified within the City of Leduc align well with those identified within Leduc County (Fiera Biological 2015) (Figure 14). For example, ESA 1 (Telford Lake) is adjacent to the Leduc County ESA that encompasses Saunders Lake, which is located directly east of Telford Lake. Further, the creeks within ESA 3 (Deer Creek) and ESA 6 (Whitemud Creek tributary) were also identified as ESAs in the Leduc County ESA study. Thus, the ESAs identified in the City of Leduc contribute to, and support, a larger regional ecological network of significant environmental sites.

Summaries of each of the ten natural areas that have been identified as ESAs in the City of Leduc are provided below, including a general description and key features of the ESA, ecological observations, and management recommendations.

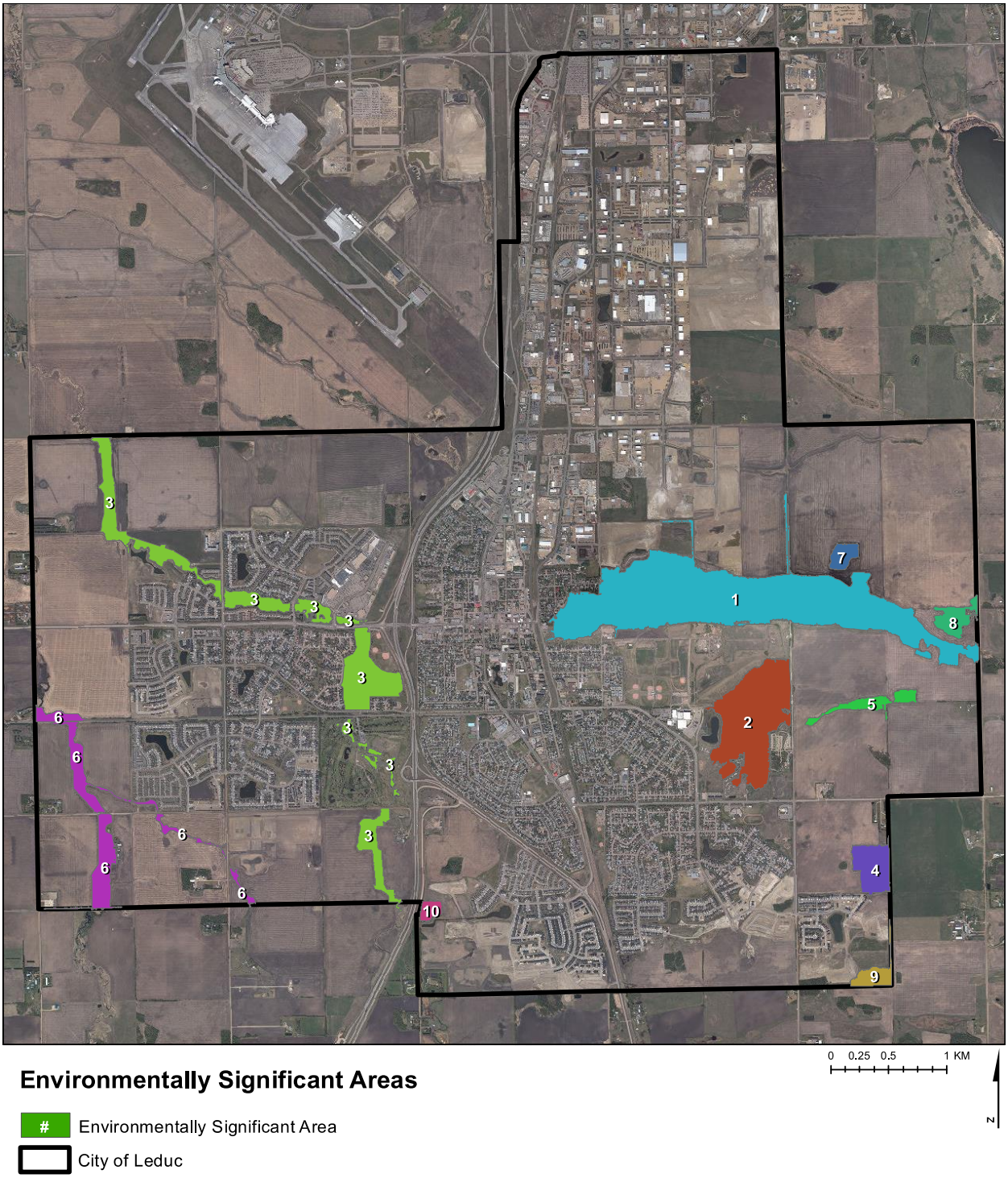



Figure 12. Environmentally Significant Areas identified in the City of Leduc. White numbers indicate the ESA identification number.

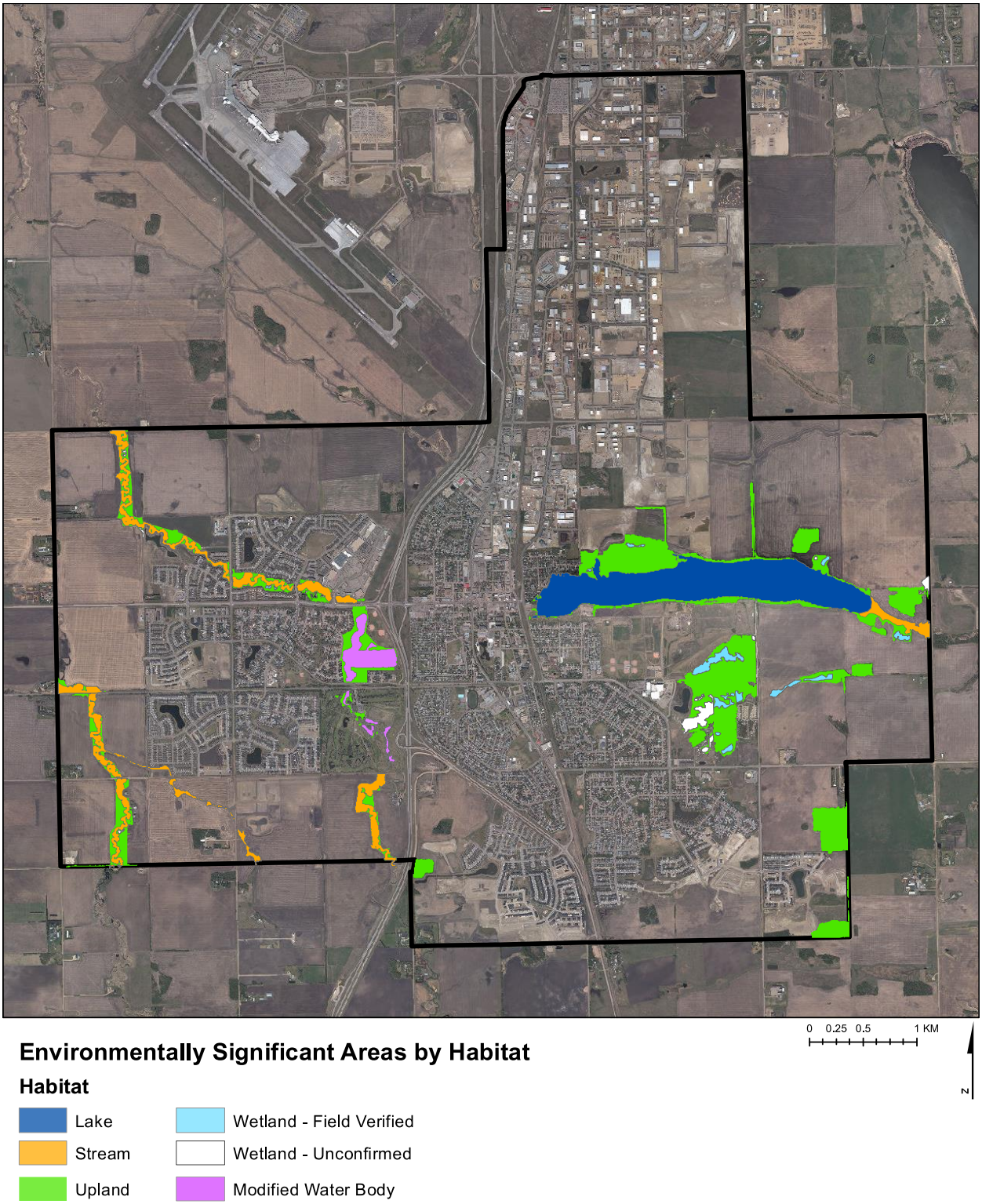



Figure 13. Representation of various habitat types within the Environmentally Significant Areas in the City of Leduc.

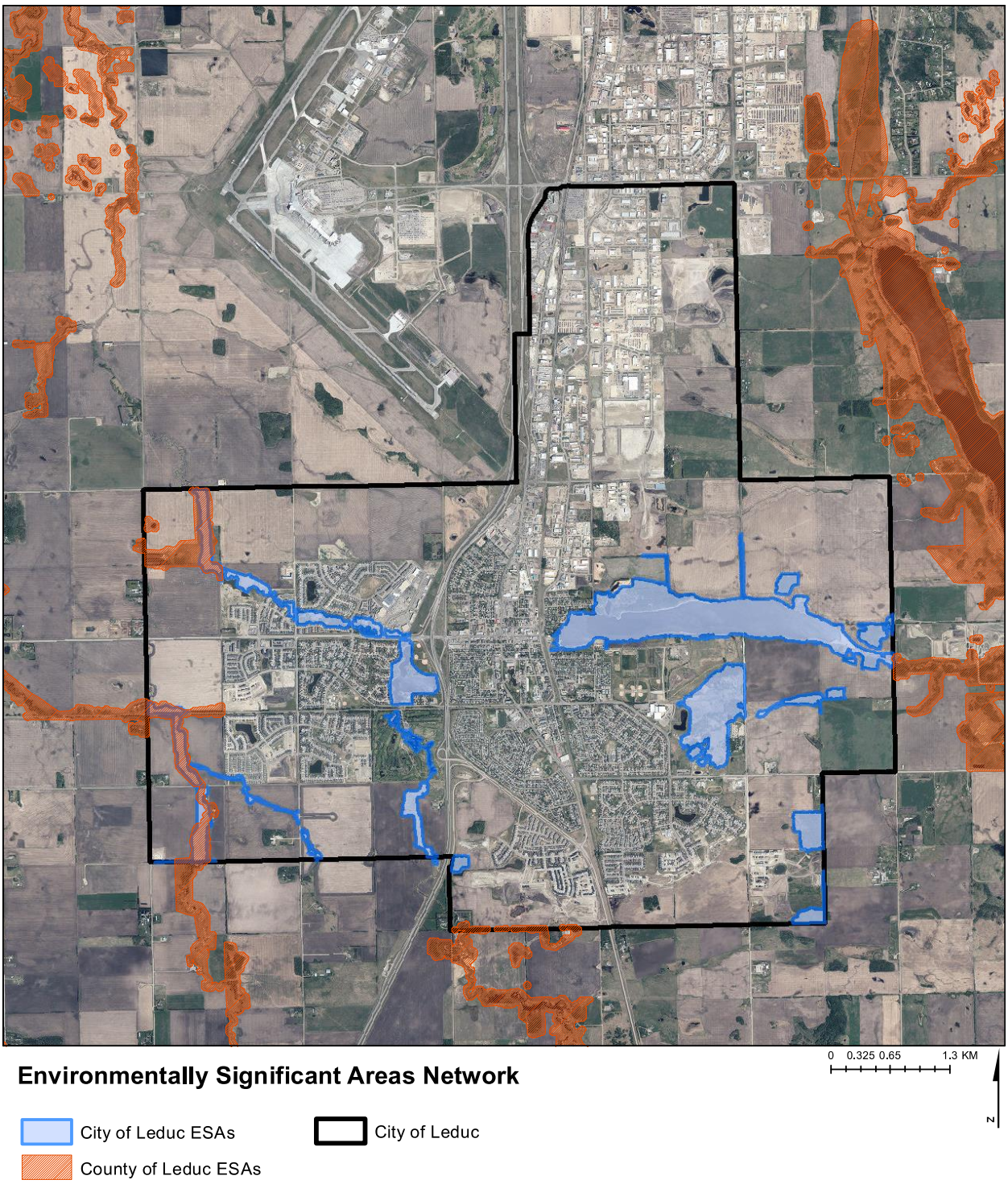
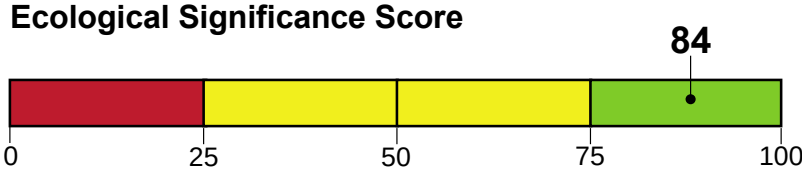


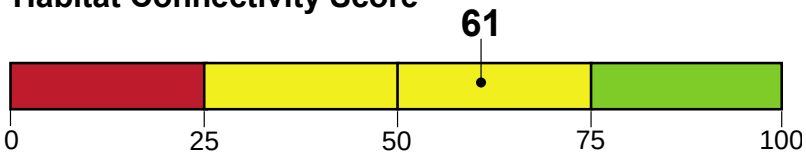

Figure 14. Environmentally Significant Areas within the City of Leduc and the County of Leduc.

# ESA #1: Telford Lake

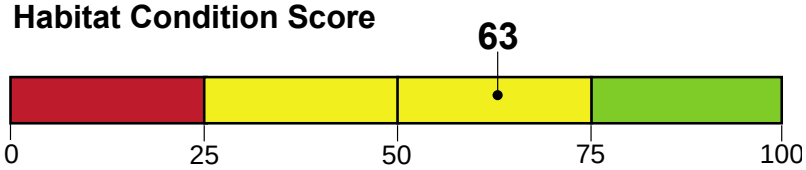
**Ecological Significance Score**




**Habitat Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** Moderate

**Habitat Quality:** Moderate

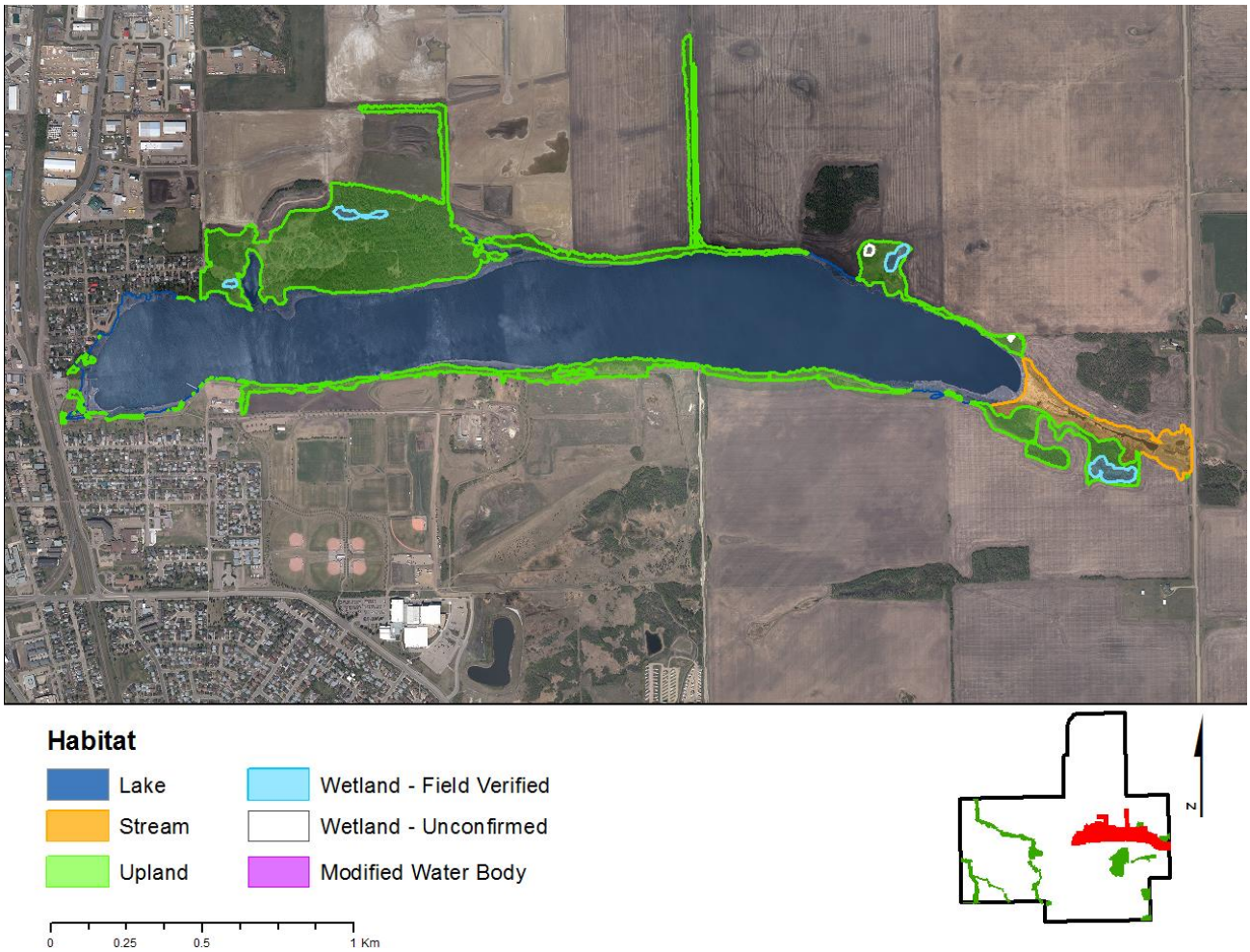
**Level of Human Impact:** Moderate

**Key Features:**

- This 148 ha lake and associated riparian and upland habitats is located in north eastern part of the City, and is the largest ESA in the City of Leduc.
- Important natural area for maintaining habitat connectivity, both locally within the City, and regionally.
- Weeds are moderately abundant throughout, with Purple loosetrife (Prohibited Noxious weed) detected in several locations.
- Natural area with the highest number of provincially sensitive species detected during field surveys in 2016.

# ESA #1: Telford Lake

ESA Number: 1 Natural Area Number: 70 **Size**: 148.0 ha




### General Description

ESA 1 includes Telford Lake and the riparian and upland habitats that surround the lake. The size and habitat diversity of this ESA makes it unique in the City of Leduc. This ESA provides important staging, foraging, and nesting habitat for waterfowl, shorebirds, and aquatic mammals, such as beaver and muskrat. Additionally, the forested areas provide important habitat for small, medium, and large-sized mammals, as well as important habitat for songbirds.

### Ecological Observations

During the field assessments, 114 plant species were observed within the Telford Lake ESA. Two of these species, Indian-pipe (*Monotropa uniflora*) and round-leaved hawthorn (*Crataegus chrysocarpa*) are considered provincially rare species, with an S3 (rare, but not immediately imperilled). Other studies that have been conducted in the Telford Lake area have identified a rare bryophyte species - purple-fringed riccia (*Ricciocarpos natans*) – in the large forested area on the northwest side of the Lake (ISL Engineering 2010). In addition to having an abundance and diversity of plant species, the Telford Lake ESA also supports a wide range of different wildlife. A total of 33 species of birds were heard or observed during field assessments, including five that are considered provincially Sensitive. In addition, six mammal species (beaver, moose, northern flying squirrel, red squirrel, southern red-backed vole, white-tailed deer) and one amphibian species was detected during the field assessment.

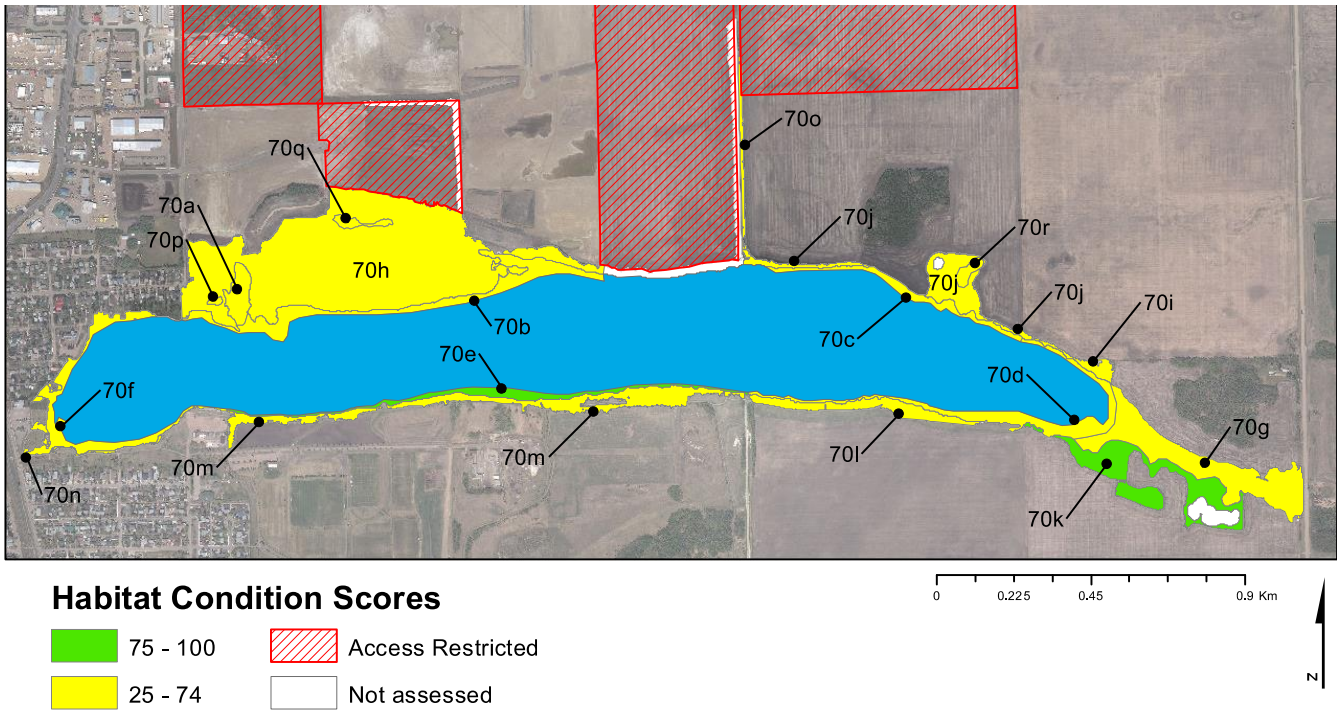
# ESA #1: Telford Lake

### Habitat Connectivity and Location within the Existing Ecological Network

Locally, Telford Lake provides important connectivity for a range of wildlife species. Given its large size, this ESA likely acts as core habitat for a range of species, and the diversity of habitat types contained within the ESA support waterfowl, shorebirds, songbirds, and raptors, as well as a range of small, medium, and large-bodied mammals. Within the local ESA network, Telford Lake is located in close proximity to a number of other ESAs (e.g., ESA 2, ESA 5, ESA 7), and it is likely that a number of wildlife species frequently move between this local network to feed, nest, and/or den. Regionally, Telford Lake is ecologically and hydrologically connected to Saunders Lake to the east, which has been identified an Environmentally Significant Area by Leduc County (Fiera Biological 2015).

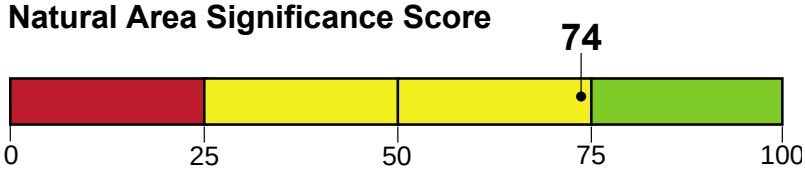
### Habitat Condition & Management Recommendations

For the purpose of field assessment, Telford Lake was divided into 18 different habitat subunits that were assessed individually, with the scores from each subunit being aggregated to derive an average habitat condition score for the ESA. Overall, the habitat condition for this ESA is moderate, with some areas of notable concern with respect to invasive weeds. This includes two detections of Purple loosestrife, a Prohibited Noxious weed, which was observed along the northern shore of the lake within subunit 70b. Purple loosestrife is a provincially regulated prohibited noxious weed, and controlling the infestation along the shores of Telford Lake is critical to ensuring that this weed does not spread to other areas within the City of Leduc or Leduc County. In addition, common tansy, a provincially designated Noxious weed, is also prevalent along the northeast shoreline (within subunits 70r, j, and i) and at the west end of the lake (subunit 70n). Efforts should be made to control the spread of this weed into other areas of the ESA and onto adjacent lands.

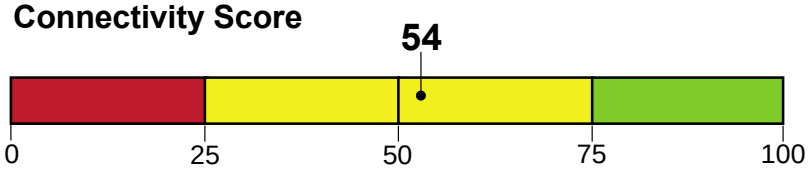


# ESA #2

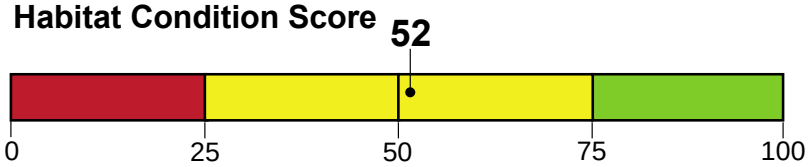
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** Moderate

**Habitat Quality:** Moderate

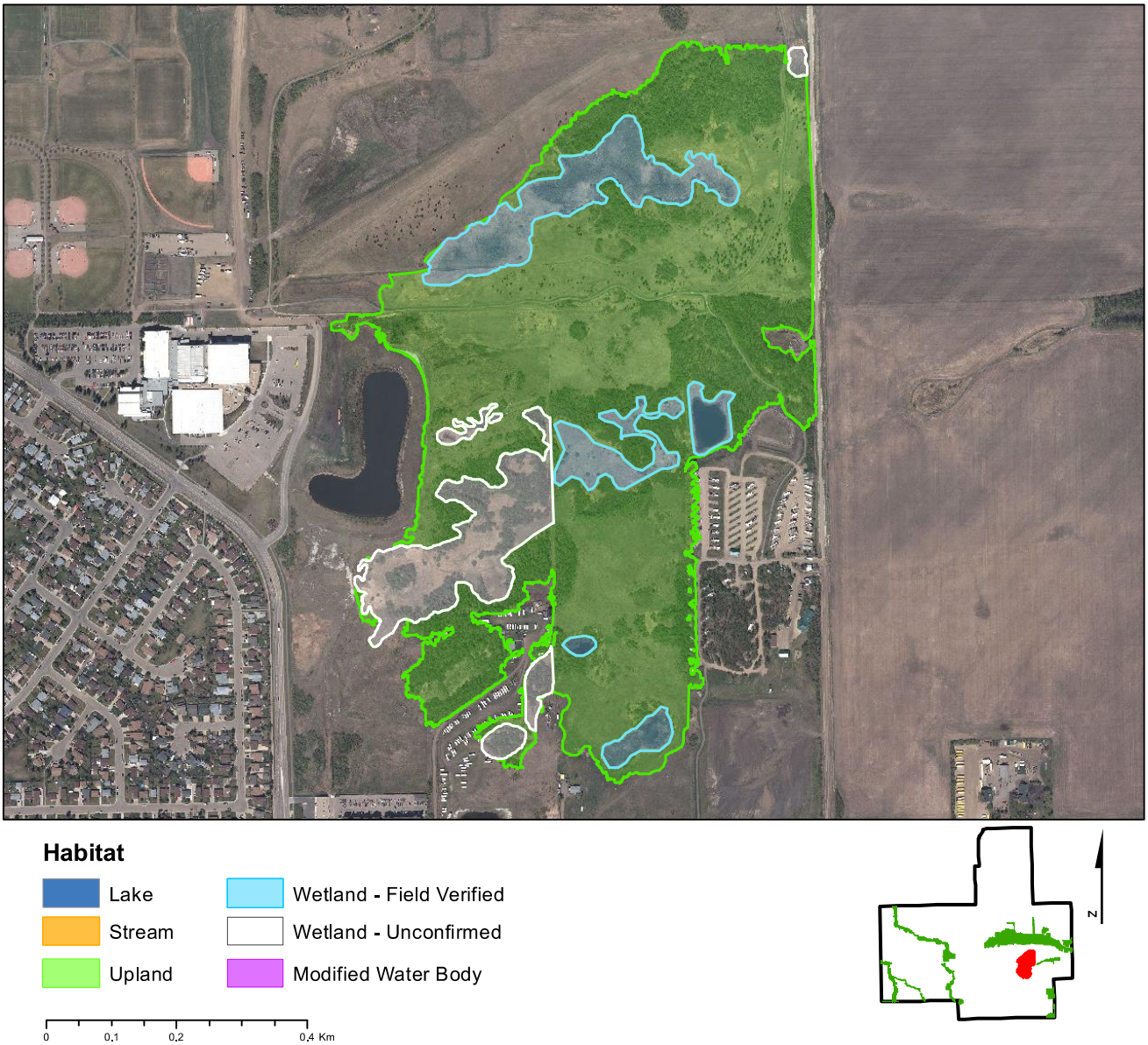
**Level of Human Impact:** Moderate

**Key Features:**

- This 49.5 ha ESA is located in E 25-49-25-4, and is the third largest ESA in the City of Leduc
- This ESA includes a diverse mix of habitats, include native grassland, forest, and wetlands
- The native grassland habitat detected in this ESA is unique within the City of Leduc
- Multiple large wetland habitats are also located within the ESA
- Weeds are abundant throughout the ESA, including Purple loosetrife, a Prohibited Noxious weed

# ESA #2

ESA Number: 2 | Natural Area Number: 52 | **Size**: 49.5 ha




## General Description

ESA 2 is the third largest in the City, and contains a diversity of habitat, including upland grassland and forest, as well as wetland habitat. The area of native grassland is notable, as this habitat type is rare within natural areas in the City of Leduc. This mixture of habitat types supports a wide range of different wildlife species, including mammals, ground-nesting and forest songbirds, waterfowl, shorebirds, and amphibians.

# ESA #2

### Ecological Observations

During the 2016 field season a total of 84 plant species were identified in this ESA. Two of these species are native grass species, including June grass (*Koeleria macrantha*) and Parry's oat grass (*Danthonia parryi*). These two grassland plant species were unique to this ESA, and were not detected anywhere else in the City during the 2016 field assessments.

### Habitat Connectivity and Location within the Existing Ecological Network

This ESA is located in close proximity (within 500 m) of the south shore of Telford Lake (ESA 1), and the two ESAs are connected to one another by Lede Park. As a result, ESA 2, together with Telford Lake and Lede Park, represent the largest patch of natural/semi-natural habitat in the City of Leduc. Given the large size of the habitat patch and the diversity of habitat types present, this ESA likely serves as an important core habitat for a wide range of species that may not be supported by other ESAs in the City. In particular, wildlife such as deer, coyotes and other medium sized mammals can access habitat within this larger habitat patch, and ESA 2 is connected to the regional ESA network because of its close proximity to Telford Lake, which in turn, is directly connected to Saunders Lake in Leduc County.

### Habitat Condition & Management Recommendations

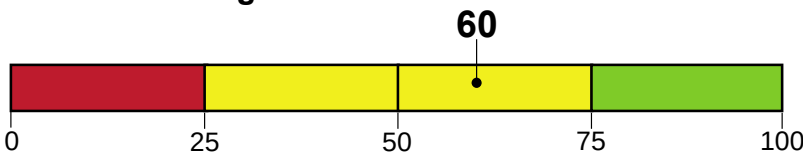
There are a number of noxious invasive weeds that were detected throughout this Environmentally Significant Area, including Purple loosestrife, which is a provincially regulated prohibited noxious weed. It is critical that this infestation of Purple loosestrife be managed to ensure that it does not spread to other areas within the City of Leduc or Leduc County. In addition, the noxious invasive weed Canada thistle was abundant within many of the wetlands in the ESA, and efforts should be made to manage and control this weed.

When air photographs taken over the past decade were reviewed, it appeared that many of the wetlands present within this natural area have experienced wetter conditions in the past, as compared to the conditions observed during the 2016 field assessment. This suggests that the hydrology of the area may have been altered, leading to drier soil conditions overall. This change in soil moisture may have caused changes in the vegetation communities present in the ESA.

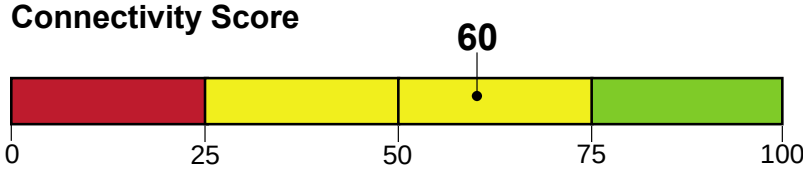
Overall, this ESA is an important component of the ESA network, as it is a large patch that provides a diverse range of habitat types, including grassland habitat that is rare in the City of Leduc. The close proximity of this ESA to Telford Lake, and the intervening Park habitat, together represent an large habitat patch that is connected to the regional ESA network. Thus, conservation and restoration of this ESA should be a high priority for the City, including the control of prohibited and noxious weeds (purple loosestrife, Canada thistle, common tansy). In addition, management efforts should be focused on ensuring that current and further development adjacent to the ESA does not further impact the hydrology of the wetland habitats present in the ESA.

# ESA #3: Deer Creek

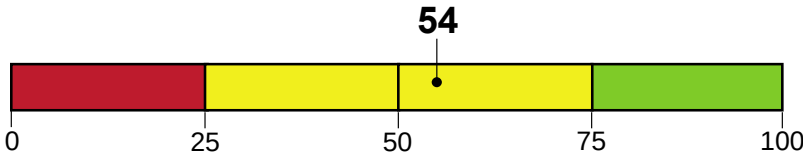
**Natural Area Significance Score**




**Connectivity Score**




**Average Habitat Condition Score**




**Plant Naturalness:** Moderate

**Habitat Quality:** Moderate

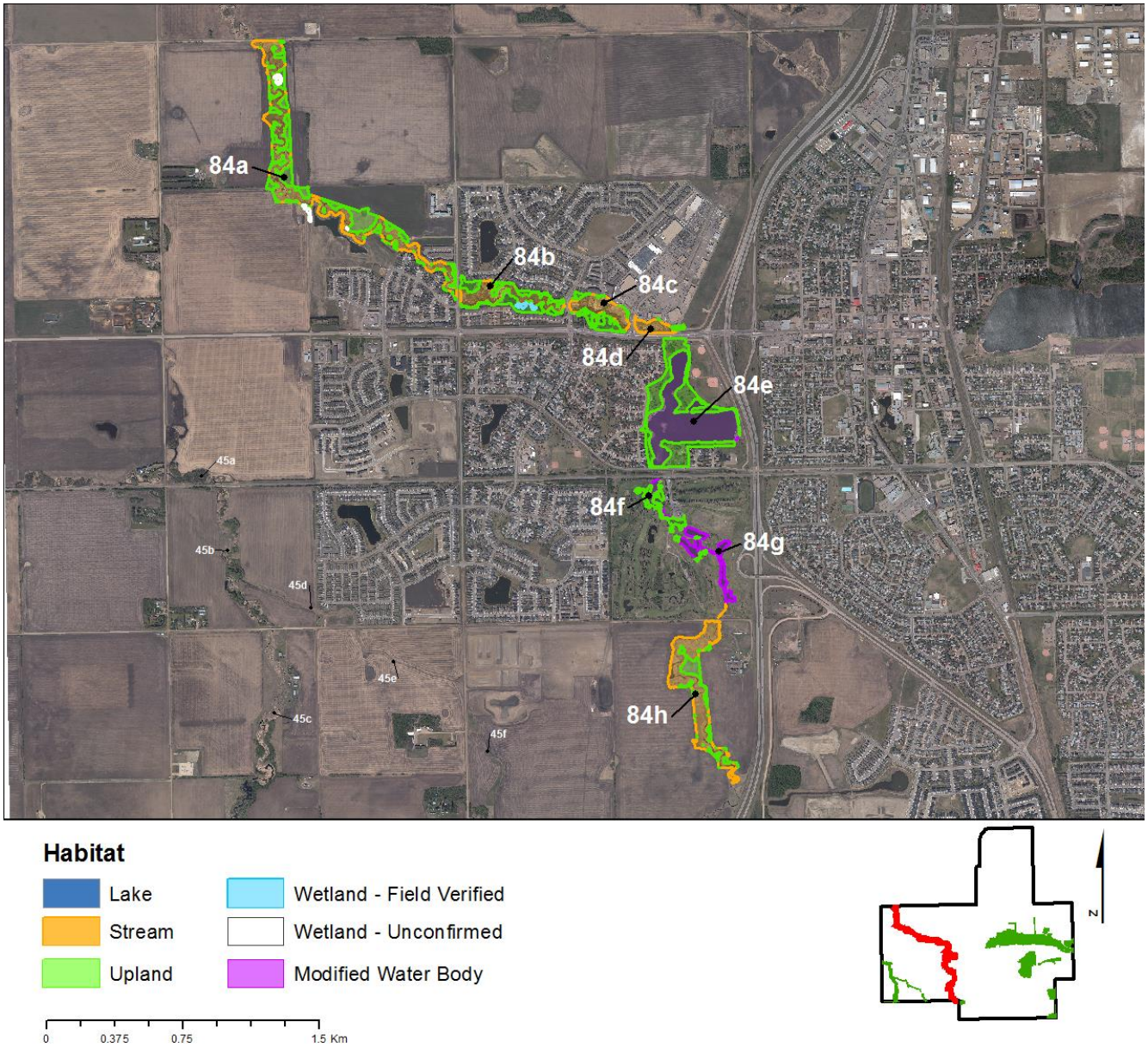
**Level of Human Impact:** Moderate

**Key Features:**

- This ESA is a major hydrological feature that flows through the western portion of the City
- Deer Creek flows downstream into Whitemud Creek, a fish-bearing stream that flows into the North Saskatchewan River
- This ESA provides important habitat and hydrologic connectivity, both locally and regionally
- A range of wildlife and vegetation species were detected in this ESA, including species considered to be provincially rare
- Weed management is an issue in some locations within this ESA

# ESA #3: Deer Creek

ESA Number: 3 Natural Area Number: 84 **Size**: 64.2 ha




### General Description

ESA 3 Deer Creek is the longest continuous ESA in the City of Leduc, and provides important ecological and hydrological connectivity both locally and regionally. This ESA contains a diversity of habitats, including stream, riparian, modified lake, and upland habitat. While the overall habitat condition of the ESA is moderate, several habitat areas within the ESA have been modified, and the condition score for some areas of the creek were rated as low. Despite this, Deer Creek offers important habitat for wildlife and vegetation, including several species that are provincially listed as rare.

# ESA #3: Deer Creek

### Ecological Observations

During the field assessment, a total of 117 plant species were identified within the Deer Creek ESA, once of which, false dragonhead (*Physostegia ledinghamii*), is considered a provincially rare (S3) species. Also among the plant species observed were eight Noxious weed species. Of particular concern was common tansy, a provincially regulated noxious weed that was abundant throughout the ESA.

In addition to the high abundance and diversity of plant species, Deer Creek ESA also supports a wide range of wildlife species. A total of 26 bird species were observed during field assessments, two of which (Black-throated green warbler and White pelican) are considered provincially Sensitive. Although no amphibians were observed during the field survey, habitat likely to support amphibians was observed throughout the ESA. Mammal observations during field assessment in 2016 included beaver, red squirrel, and southern red-backed vole, and previous biophysical assessments conducted along the creek have reported observations of coyote and deer (Stantec 2011). The Leduc Reservoir (84e) has been stocked with rainbow trout, with the most recent stocking event occurring in April, 2016, when 5,000 fish were released into the reservoir (Government of Alberta 2016). The stream reaches outside of the reservoir reportedly support native fish species, such as brook stickleback and fathead minnow (Westworth 2001), although no fish were observed during field surveys in 2016.

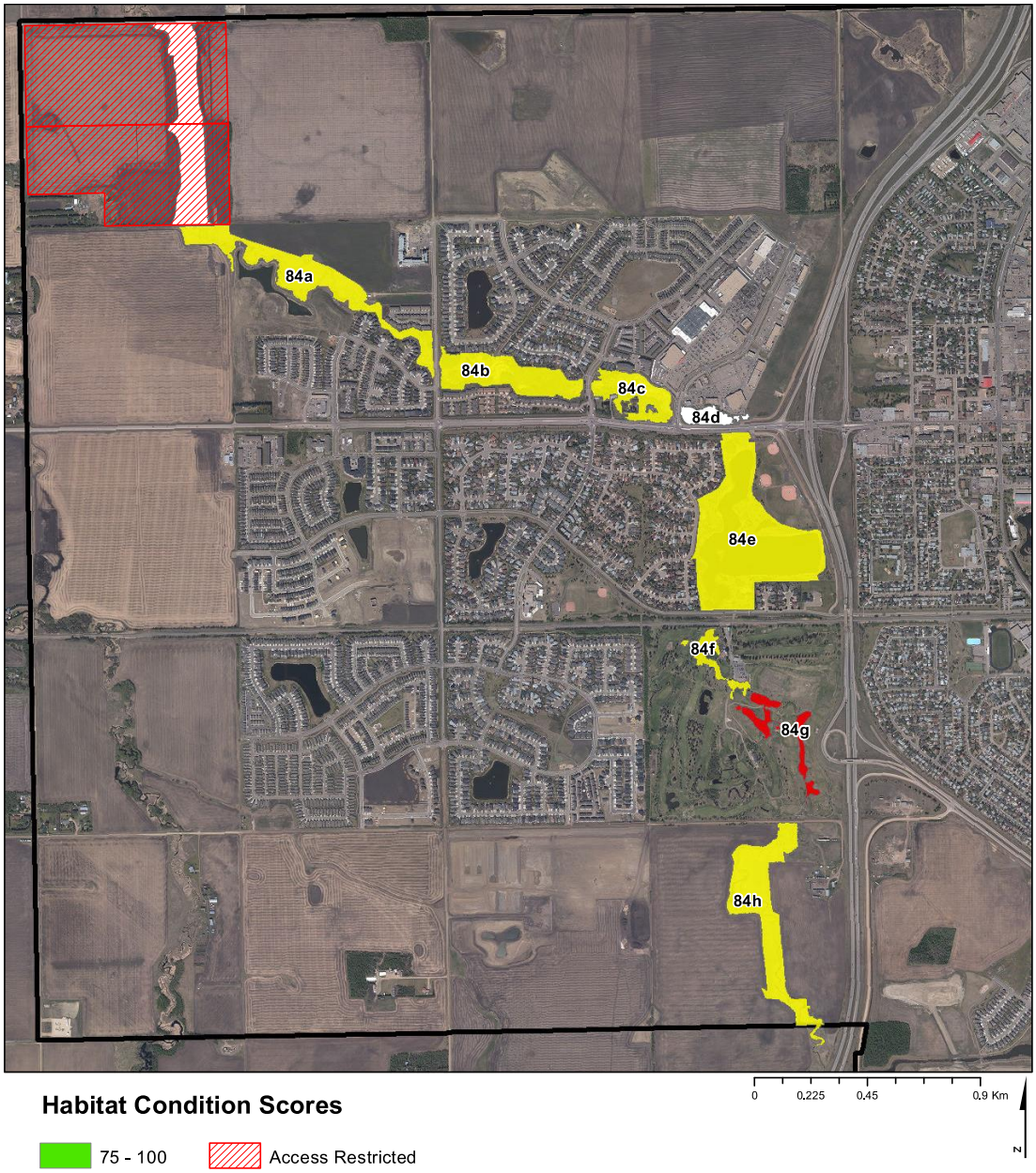
### Habitat Connectivity and Location within the Existing Ecological Network

Deer Creek provides important local hydrologic and terrestrial habitat connectivity, as it meanders nearly 7 km through the City of Leduc. The creek and associated riparian and upland habitats create a habitat corridor that provides connectivity through the City before flowing into Whitemud Creek, and ultimately, to the North Saskatchewan River. Regionally, the Leduc County ESA study has also identified portions of Deer Creek as an ESA, and portions of Whitemud Creek and adjacent lands have been identified as Environmentally Significant Areas by the Provincial government, as has much of the North Saskatchewan River. As such, the Deer Creek ESA through the City of Leduc is part of an important habitat corridor that supports a larger provincial network of ESAs. In particular, the diverse aquatic and riparian habitats along the creek provide vital habitat for nesting songbirds and waterfowl. Open grassland habitats are abundant, and provide tall grass habitats for small mammals such as mice and voles. In addition, old growth forest patches with abundant snags and downed woody debris are present along the creek, providing excellent nesting and foraging habitat for owls, woodpeckers, and other forest dwelling birds.

### Habitat Condition & Management Recommendations

For the purpose of field assessment, Deer Creek was divided into nine different habitat subunits that were assessed individually, with the scores from each subunit being aggregated to derive an average habitat condition score for the ESA. Overall, the habitat condition for this ESA is moderate, with some areas of notable concern with respect to habitat condition. Of particular concern is common tansy, a provincially designated Noxious weed that dominates some areas of Deer Creek ESA. The prevalence of this weed threatens the biodiversity of this ESA, and a weed management strategy is required to control the occurrence and spread of this weed.

Recognizing the ecological importance Deer Creek as a hydrologic feature and as a natural corridor for wildlife movement within and through the City of Leduc, future management of this ESA should include the establishment of appropriate buffers and development setbacks to ensure the ecological and hydrological integrity of the creek is maintained. Further, watercourse crossings should be minimized, and where they cannot be avoided, single-span open-bottom crossing designs that accommodate wildlife passage should be incorporated into roadway design. Where existing creek crossings have been constructed that do no accommodate wildlife passage, signage and reduced traffic speeds should be considered in proximity to the creek crossing to reduce risk of wildlife-vehicle collisions.



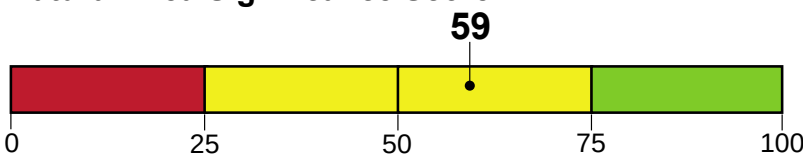

**Habitat Condition Scores**

- 75 - 100
- 25 - 74
- 0 - 24
- Access Restricted
- Not assessed

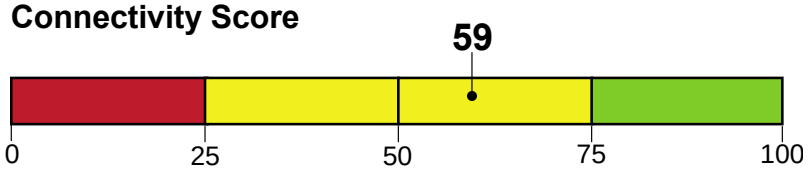
| Natural Area Subunit | Habitat Condition Score (/100) | Habitat Condition Categories | | |
|---|---|---|---|---|
| | | Plant Naturalness & Diversity | Habitat Quality | Level of Human Impacts |
| 84a | 61 | Low | Moderate | Minimal |
| 84b | 73 | Low | High | Minimal |
| 84c | 62 | Moderate | Moderate | Moderate |
| 84d | Not Assessed | - | - | - |
| 84e | 38 | Moderate | Moderate | Extensive |
| 84f | 62 | Moderate | Moderate | Moderate |
| 84g | 21 | Moderate | Low | Extensive |
| 84h | 64 | Moderate | Moderate | Minimal |

# ESA #4

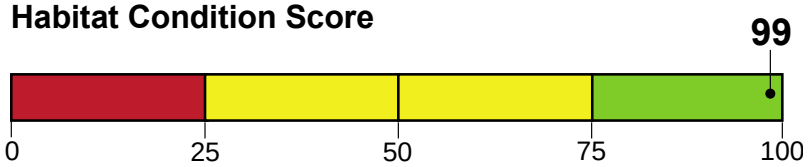
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




| | |
|---|---|
| **Plant Naturalness:** | **High** |
| **Habitat Quality:** | **High** |
| **Level of Human Impact:** | **Minimal** |

**Key Features:**

- This 11.7 ha tree stand is located in NW 19-49-24-4, and is the largest intact forest patch located within the City of Leduc
- This deciduous forest stand contains a high diversity of plant species, including mature trees that provide important habitat for birds
- This ESA has minimal human disturbance and a very low abundance of weeds relative to other ESAs in the City

# ESA #4

ESA Number: 4 Natural Area Number: 31 **Size**: 11.7 ha


### General Description

This ESA is the largest intact forest stand in the City of Leduc, and has minimal human disturbance and a low abundance of weeds. As a result, this ESA received the second highest habitat condition score of all the ESAs in the City. This forest stand has high structural diversity, and contains a healthy shrub and tree canopy layer that offers excellent habitat to songbirds, owls, raptors, and mammals.

# ESA #4

### Ecological Observations

A total of 49 plant species were observed during the field assessment in 2016, most of which were native species characteristic of forest habitats. A range of song bird species were also observed, as weel as a red-tailed hawk and an unidentified owl. A deer was also observed during the field assessment, in addition to numerous bedding sites used by ungulates (deer and/or moose).

### Habitat Connectivity and Location within the Existing Ecological Network

This ESA is located in the southeast corner of the City. Given its size, this stand likely functions as a core habitat for some small mammals (e.g., mice, voles, squirrels) and forest dwelling songbirds. As well, this stand acts as an important stepping stone habitat for a wide range of birds and medium and large-sized mammals, such as deer and moose.

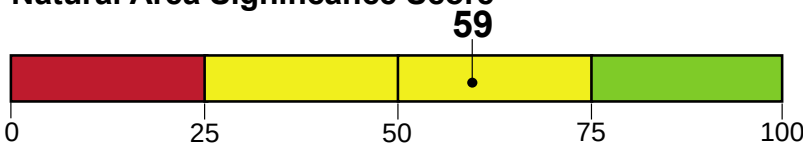
### Habitat Condition & Management Recommendations

This forest stand was dominated by mature trembling aspen (*Populus tremuloides*) and balsam poplar (*Populus balsamifera*), with a well-developed shrub layer dominated by beaked hazelnut (*Corylus cornuta*) and wild prickly rose (*Rosa acicularis*). Plant diversity was high throughout the stand, and non-native and invasive plant species abundance was relatively low; however, Common tansy and Canada thistle was abundant along the outer edges of the tree stand. Given the proximity of weeds to the stand, active management is required to prevent the spread of these weeds into the tree stand.

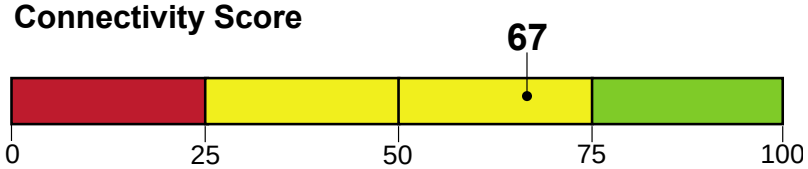
Given the very high condition score of this ESA, consideration should be given to restricting or controlling human use of the stand in the future, as the lands adjacent to the stand are developed. ESA 4 is a large area of undisturbed, intact forest, and controlled use of the area is required to ensure that the ecological function of the stand remains intact. Access into, and use of the ESA can be controlled by the creation and careful placement of trails, as well as educational signage explaining the importance of remaining on the trails to minimize impacts on the habitat and associated wildlife that utilize the stand.

# ESA #5

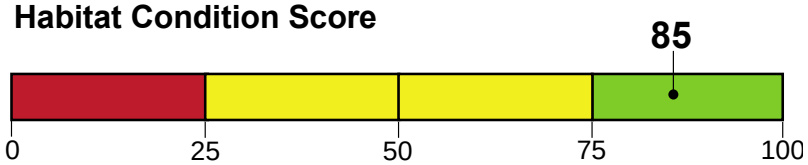
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** High

**Habitat Quality:** High

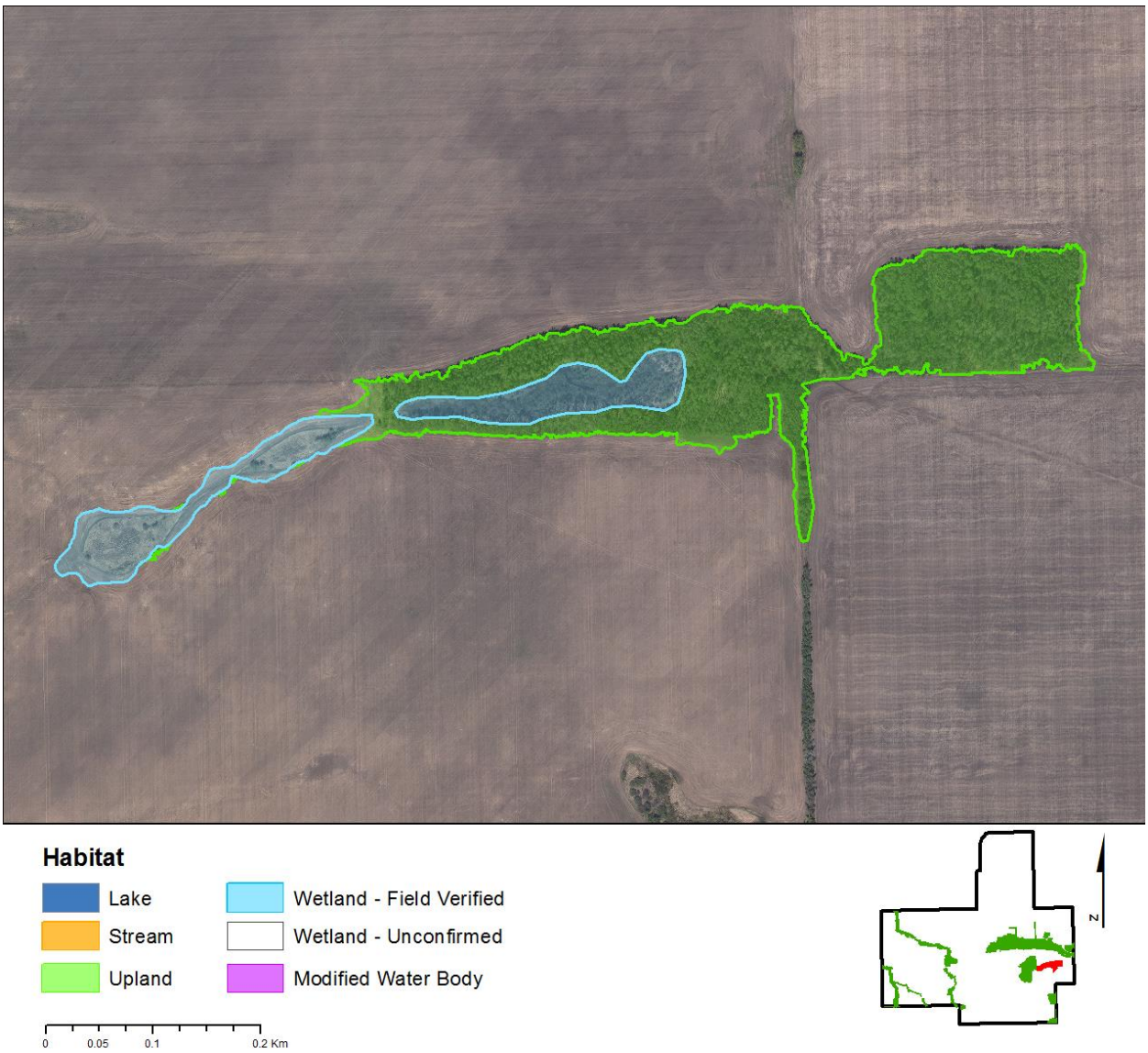
**Level of Human Impact:** Minimal

**Key Features:**

- This 7.3 ha wetland complex is located in Section 30-49-24-4, south of Telford Lake and directly east of ESA 2
- This natural area has a diverse mix of habitat types, including a large swamp wetland, which is a unique habitat type in the City of Leduc
- The close proximity of this ESA to other ESA habitats makes it important for local connectivity
- Weeds are moderately abundant throughout the ESA, including the noxious invasive weed common tansy
- Portions of the wetland have been drained, and restoration of these previously impacted areas would enhance the habitat quality of this ESA

# ESA #5

ESA Number: 5 Natural Area Number: 47 **Size**: 7.3 ha




### General Description

ESA 5 is located in Section 30, on the east side of the City, in close proximity to ESA 1 (Telford Lake) and ESA 2. This ESA contains an upland forest patch and two wetland habitats, including a swamp wetland that is a unique habitat type in the City. One of the wetlands has been previously impacted, with evidence of a drainage ditch through the western basin. Despite these impacts, this ESA provides excellent habitat for a range of species that rely on both upland and wetland habitats, including mammals of all sizes, (e.g., mice and voles, deer, moose, and coyote), songbirds, raptors, and amphibians.

# ESA #5

### Ecological Observations

During the field assessments, a total of 65 different plant species were observed within this ESA, the majority of which were native plants. In addition to the high abundance of native plant species, this ESA also supported a diversity of wildlife. During the field assessment in 2016, a total of nine bird species were observed or heard , along with three mammal species (coyote, moose, and white-tailed deer) and two amphibian species (wood frog and boreal chorus frog).

### Habitat Connectivity and Location within the Existing Ecological Network

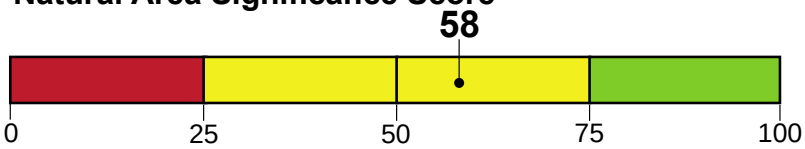
ESA 5 is located within 500 m of the south shore of Telford Lake (ESA 1), and is approximately 200 m to the east of ESA 2. In addition, this ESA is hydrologically connected to the stream that flows between Telford and Sanders Lake via an ephemeral stream network. The proximity of this ESA to other high quality habitats, as well as its hydrological connection to Telford and Saunders Lakes, makes it an important component of both the local and regional ecological and hydrological network. In particular, this ESA acts as a stepping stone habitat (i.e., a small patch of suitable habitat) for waterfowl and songbirds, as well as large, medium and small mammals such as moose and white-tailed deer. The mix of both wetland and upland habitat within this ESA also provides a unique mix of habitats for amphibians and small mammals.

### Habitat Condition & Management Recommendations

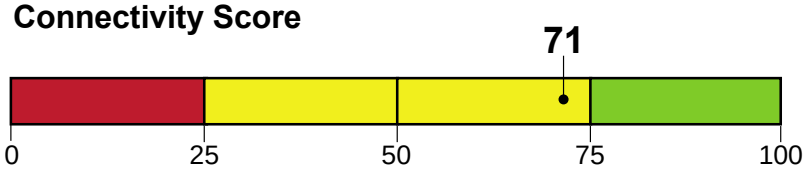
This ESA is hydrologically connected to the stream that flows between Telford and Saunders Lakes via an ephemeral stream network that was ditched sometime between 1979 and 1998. This ditch also extends through the ESA and to the west, towards ESA 2. This ditching has likely resulted in drier conditions within the wetland complex, and restoration of these wetlands through the plugging of these ditches would likely improve the overall habitat quality of the wetlands. Future management of this ESA should include the establishment of appropriate buffers and development setbacks to ensure the ecological and hydrological integrity of the wetlands is maintained or enhanced. Further, Common tansy was observed within this ESA, with high concentrations along the edge of the ESA. This noxious weed should be managed to control the existing population and limit its spread to other natural areas.

# ESA #6: Whitemud Creek Tributary

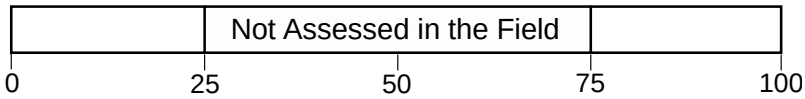
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** Not Assessed

**Habitat Quality:** Not Assessed

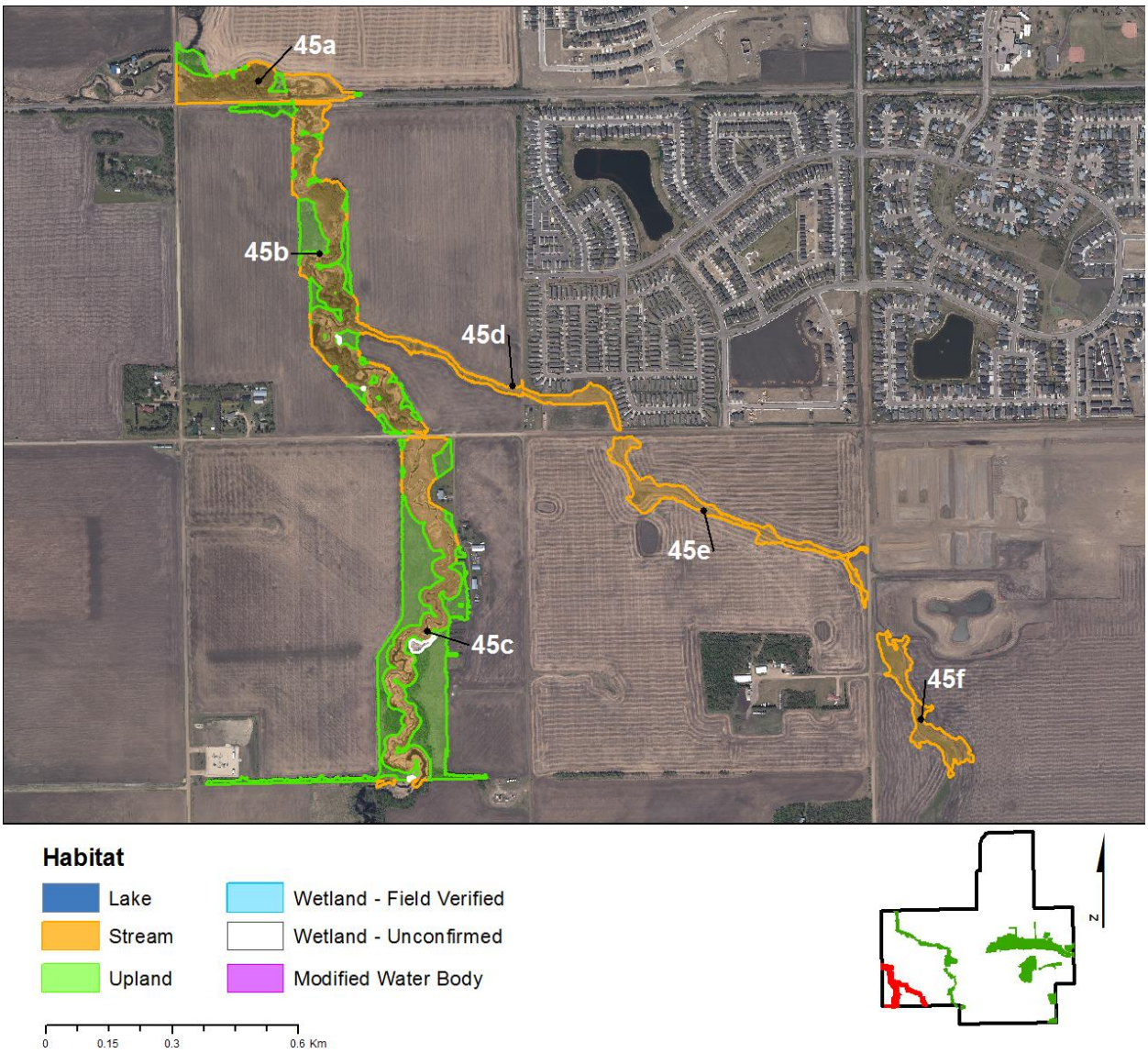
**Level of Human Impact:** Not Assessed

**Key Features:**

- This 27.8 ha ESA is a major hydrological feature in the City, and is a tributary to Whitemud Creek, a fish-bearing stream that flows into the North Saskatchewan River
- This stream ESA is important for maintaining local and regional habitat and hydrological connectivity, both locally within the City, and regionally
- Land access was not granted for this ESA; therefore, no field assessment was conducted in 2016
- Portions of the ESA appear to have been previously impacted by channelization and ditching

# ESA #6: Whitemud Creek Tributary

ESA Number: 6 Natural Area Number: 45 **Size**: 27.8 ha




### General Description

ESA 6 is the fourth largest natural area in the City of Leduc, and is composed of stream, wetland, riparian, and upland habitats. This ESA is composed of two primary stream reaches that cover five different quarter sections. The primary reach (45a, b, and c) meanders extensively through NW/SW 28-49-25-4 and NW 21-49-25-4, and has generally been buffered by intensive agricultural activities. The secondary reach (45d, e, and f), which flows through SW 28-49-25-4, NE 21-49-25-4, and NW 22-49-25-4 has been previously impacted by channel straightening and agricultural activities, with little or no natural vegetation remaining along the shore of the creek.

# ESA #6: Whitemud Creek Tributary

### Ecological Observations

Land access was not granted for the majority of the lands contained within this ESA; consequently, no field assessment was conducted in 2016. However, some of the lands identified as an ESA were assessed as part of the development of the Leduc West ASP (Bruce Thompson and Associates 2013). This included reach 45a in NW 28-49-25-4 and reach 45b in SW 28-49-25-4. No other reaches associated with this ESA have been assessed in the field.

As described in Bruce Thompson and Associates (2013), the vegetation along the shores of the creek in reaches 45a and b are primarily composed of mature to old deciduous trees (aspen and balsam poplar), in addition to willow thickets, and riparian meadows dominated by marsh reed grass and sedges. During the field assessment in 2013, 104 species of upland and wetland plants were observed, and the report also notes areas of “significant weeds”; however, a list of the weeds observed is not provided. The 2013 report also notes observations of moose and deer, as well as 18 species of birds. Given the diversity of habitats present along the creek, the report provides a long list of bird, mammal, and amphibian species that have the potential to occur in the ESA.

### Habitat Connectivity and Location within the Existing Ecological Network

This ESA is located in the south west corner of the City, and provides hydrological and ecological connectivity for birds, mammals, amphibians, and fish. As the City of Leduc continues to build out, this ESA is likely to become a key movement corridor for a variety of wildlife species. Regionally, this ESA is connected to the Whitemud Creek ESA identified by Leduc County, and maintaining or enhancing the habitat along the creek will be vital for supporting regional biodiversity.

### Habitat Condition & Management Recommendations

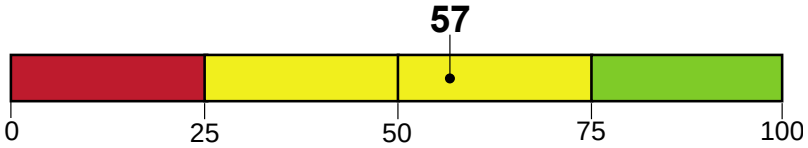
Given the range of habitat present along the creek, this ESA provides suitable habitat for a wide range of species. Open meadow areas provide suitable nesting habitat for a range of grassland and parkland bird species, while the shrub thicket areas provide nesting habitat for above-ground nesting songbirds, as well as providing browsing opportunities for moose and deer. Areas of mature and old forest support forest dwelling bird species such as owls and woodpeckers, and provide cover habitat for a wide range of mammals. Whitemud Creek is also considered to be fish bearing, and within this ESA, there may be areas of sufficient water flow and depth to support fish.

Given the ecological importance of Whitemud Creek ESA as a hydrologic feature, and as a natural corridor for wildlife movement within the City of Leduc and beyond, future management of this area should include appropriate buffers and development setbacks that will maintain or enhance water quality and ecological function of the stream corridor. In addition, serious consideration should be given to undertaking stream and habitat restoration along the secondary reach that flows through SW 28-49-25-4, NE 21-49-25-4, and NW 22-49-25-4. While this portion of the stream has been impacted previously by agricultural activities, restoration of the stream habitat along this portion of the creek will enhance the overall function and quality of the ESA.

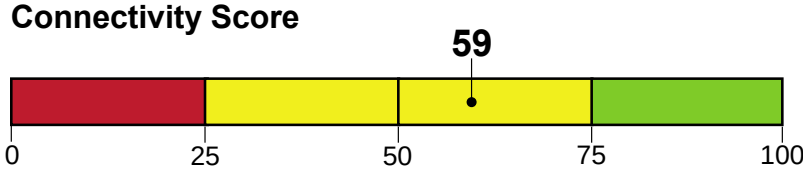
As development proceeds in the area, the hydrologic and ecological connectivity of the stream should be maintained to the maximum extent possible. To do this, the number of road crossings over the stream should be minimized, and where crossings can not be avoided, they should be constructed to accommodate wildlife movement.

# ESA #7

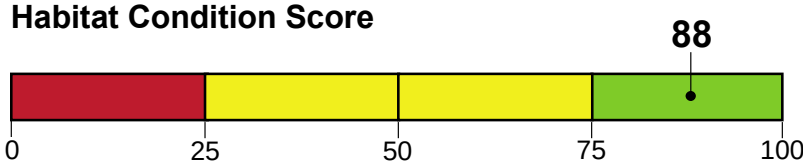
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** Moderate

**Habitat Quality:** High

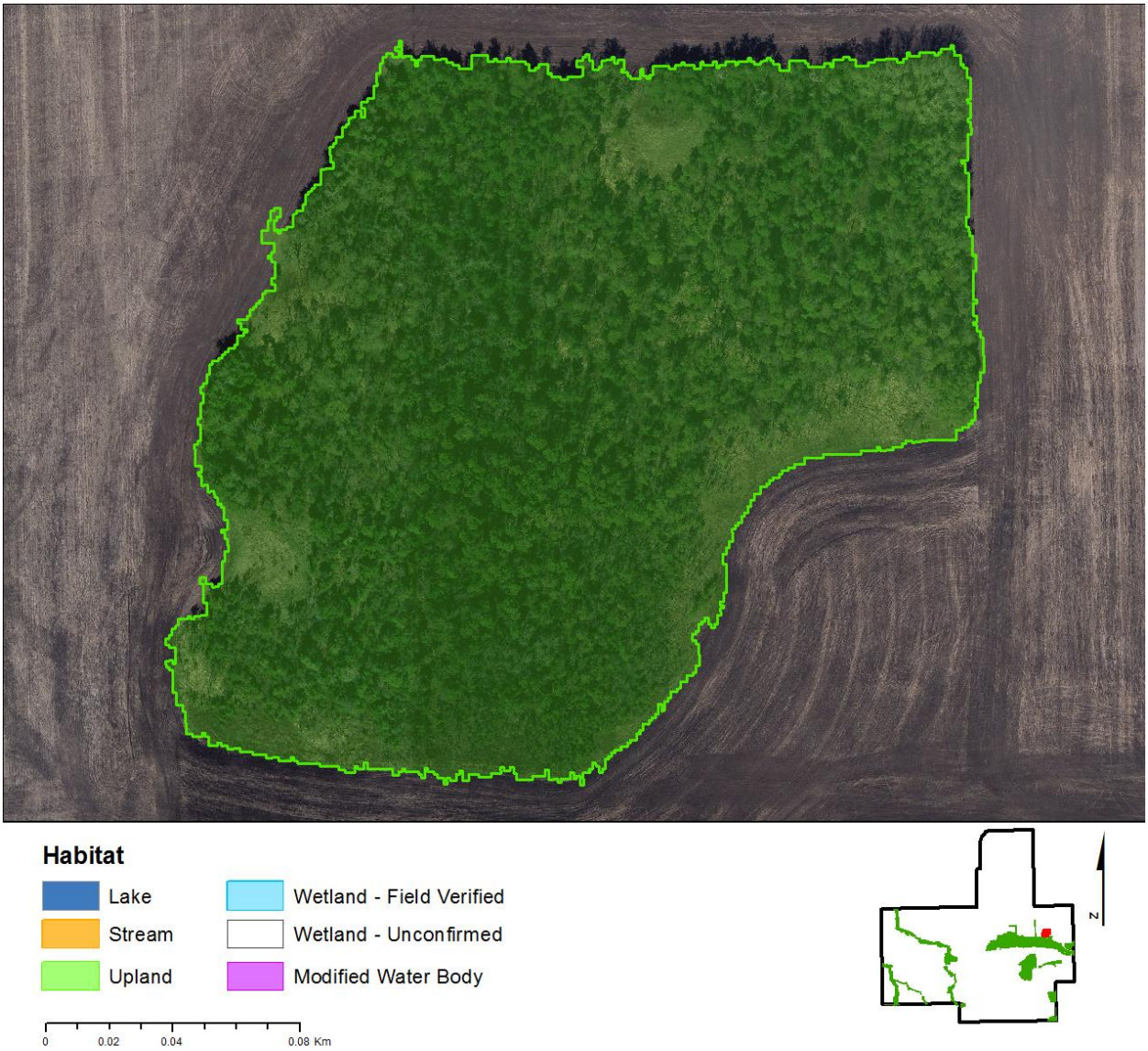
**Level of Human Impact:** Minimal

**Key Features:**

- This 4.3 ha tree stand is located less than 100m from the north shore of Telford Lake
- This ESA is composed of mature deciduous trees that provide excellent habitat for songbirds, raptors and woodpeckers
- An active red-tailed hawk nests was observed within the ESA during field assessments in 2016
- Common tansy, a Noxious invasive weed, was abundant throughout the tree stand

# ESA #7

ESA Number: 7 Natural Area Number: 66 **Size**: 4.3 ha




### General Description

ESA 7 is located approximately 70 meters north of the Telford Lake ESA, and is largely composed of large, mature aspen and balsam poplar trees. Large tree snags with cavities were abundant throughout the ESA, providing excellent habitat for primary and secondary cavity nesting birds such as woodpeckers, nuthatches, and owls. In addition, this stand had a dense shrub understory, which provides excellent habitat for shrub-nesting birds, and good cover for ungulates such as white-tailed deer and moose. Portions of this ESA were heavily impacted by Common tansy, which was dominate in open areas throughout the stand.

# ESA #7

### Ecological Observations

During the field assessments, 24 species of plants were identified within this ESA, four of which are listed as Noxious under the provincial Weed Control Act (Canada thistle, Tall buttercup, White cockle, and Common tansy). Deer and moose sign (tracks and scat) were abundant throughout the ESA, and an active red-tailed hawk nest was observed during the 2016 field assessment. The abundance of snags and tree cavities in this ESA, in addition to its proximity to Telford Lake, make this tree stand good habitat for waterfowl that nest in tree cavities, such as common goldeneye.

### Connectivity and Place in Existing Network

The relatively large size of this ESA, its close proximity to Telford Lake, and the presence of mature trees and a dense shrub layer, all make this ESA and important habitat patch in the local ecological network. This ESA likely acts as core habitat for small mammals, as well as providing important stepping stone habitat (i.e., a small patch of suitable habitat) for other large terrestrial species, such as moose and deer. The presence of an active red-tailed hawk nest also indicates that this stand offer critical breeding habitat for raptor species that require mature trees in proximity to open areas that are used for hunting..

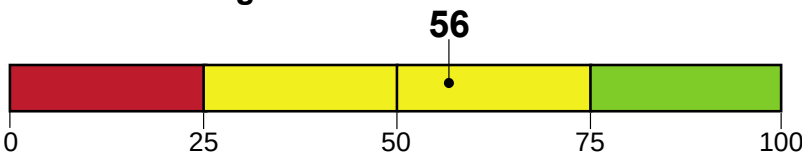
### Habitat Condition & Management Recommendations

This ESA received one of the highest Habitat Conditions Scores in the City of Leduc; however, the biodiversity and ecological function of this stand is threated by the presence of invasive species. Most notably, Common tansy is abundant in some areas of this tree stand, and without active management, weeds are likely to spread to other areas within the ESA, as well as to other neighbouring natural areas.

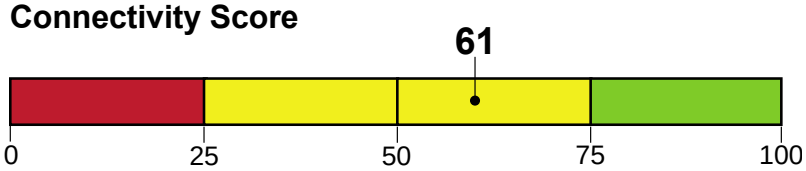
Other management considerations for this ESA include maintaining ecological connectivity to Telford Lake. As development proceeds in this area, the lands that connect ESA 7 to Telford Lake should be retained as a (restored) natural area or semi-natural Park space, such that the existing ecological connection between these two ESAs can be maintained and/or enhanced.

# ESA #8

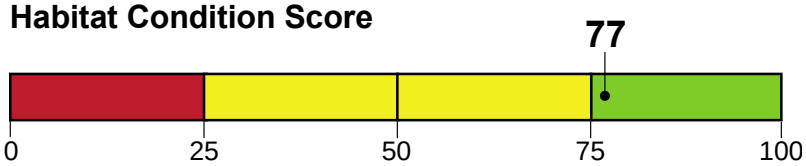
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** Moderate

**Habitat Quality:** High

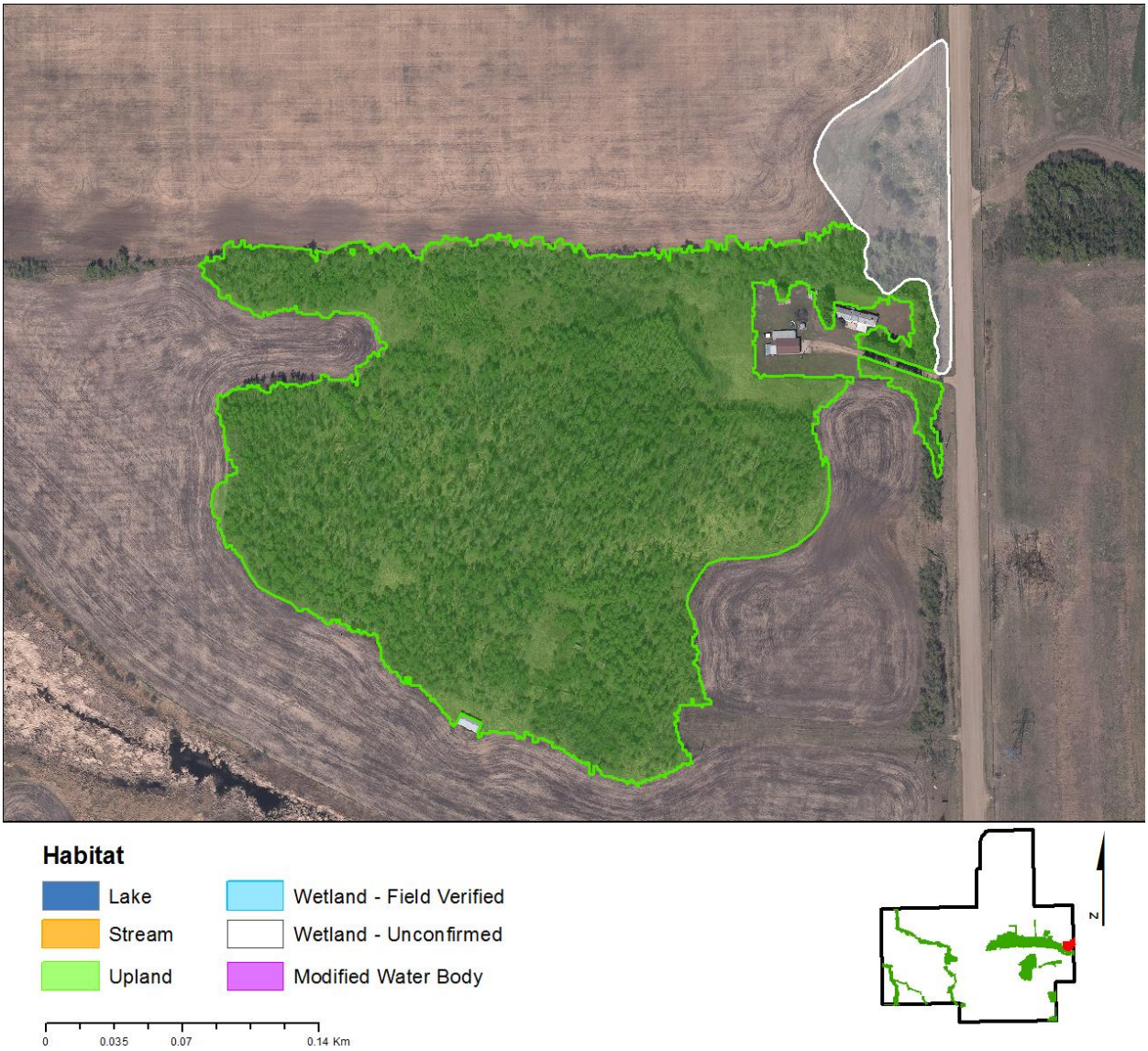
**Level of Human Impact:** Moderate

**Key Features:**

- This large (7.1 ha) forest stand and wetland complex is located at the east end of Telford Lake, within 60m of the north shore of the Lake
- The ESA is dominated by mature deciduous trees, and there is an abundance of snags and downed woody debris that provides excellent habitat for small mammals and cavity nesting species
- Signs of human impacts are evident throughout the ESA, including old buildings and fencing
- Common tansy, a Noxious weed, is abundant throughout the ESA

# ESA #8

ESA Number: 8 Natural Area Number: 61 **Size**: 7.1 ha




### General Description

ESA 8 contains a large deciduous-dominated tree stand and wetland complex that is located within 60 meters of the northeast shore of Telford Lake. Forest structure present within the stand was typical of mature deciduous forests, with a dense shrub layer and an abundance of snags, cavities, and downed woody debris which provide good habitat for cavity nesting birds and good cover and browse for ungulates such as white-tailed deer and moose.

# ESA #8

### Ecological Observations

The vegetation community within ESA 8 was relatively diverse, with a total of 24 plant species being detected during the 2016 field assessment, including the provincially regulated noxious weed Common tansy. In addition, a number of bird species were observed, including four primary or secondary cavity nesting species (downy woodpecker, northern flicker, house wren, and black-capped chickadee). Deer and moose sign (tracks, scat, browse, bedding sites) was also abundant throughout the ESA.

### Connectivity and Place in Existing Network

The relatively large size of this ESA, its close proximity to Telford Lake, and the presence of mature trees and a dense shrub layer, all make this ESA and important habitat patch in the local ecological network. This ESA likely acts as core habitat for small mammals, as well as providing important stepping stone habitat for other medium and large terrestrial species, such as coyote, deer, and moose. Together with Telford Lake, this ESA forms a larger habitat patch at the east end of the Lake, which is directly adjacent to the Saunders Lake ESA in Leduc County.

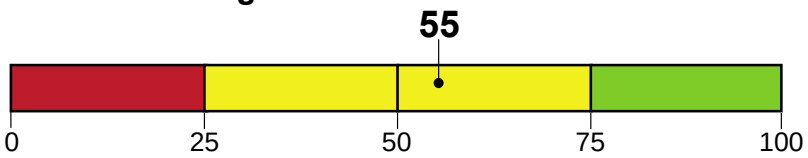
### Habitat Condition & Management Recommendations

While this ESA has a diversity of forest structure that provides good habitat for a range of species, the tree stand has also been previously impacted by human development, including old structures (buildings and fences) and impacts to vegetation caused by livestock grazing. In addition, several areas in the ESA are dominated by Common tansy, a provincially designated Noxious weed. Management and control of this weed is required to ensure that the ecological function of the ESA is not degraded further. In addition, restoration activities such as removal of old buildings and fences, would improve the overall condition of this ESA.

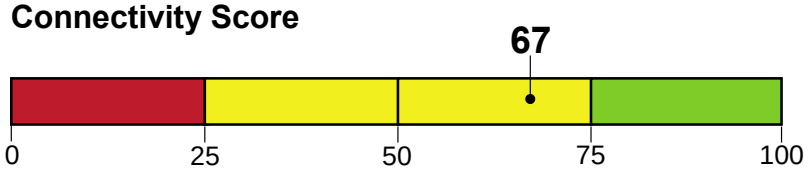
Other management considerations for this ESA include maintaining ecological connectivity to Telford Lake. As development proceeds in this area, the lands that connect ESA 8 to Telford Lake should be retained as a (restored) natural area or semi-natural Park space, such that the existing ecological connection between these two ESAs can be maintained and/or enhanced.

# ESA #9

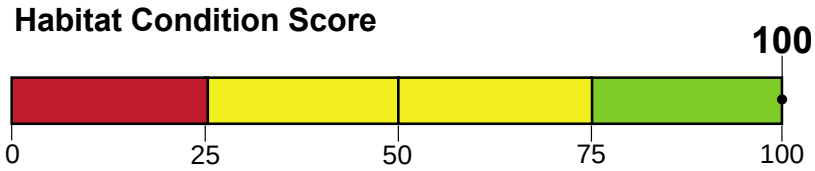
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** High

**Habitat Quality:** High

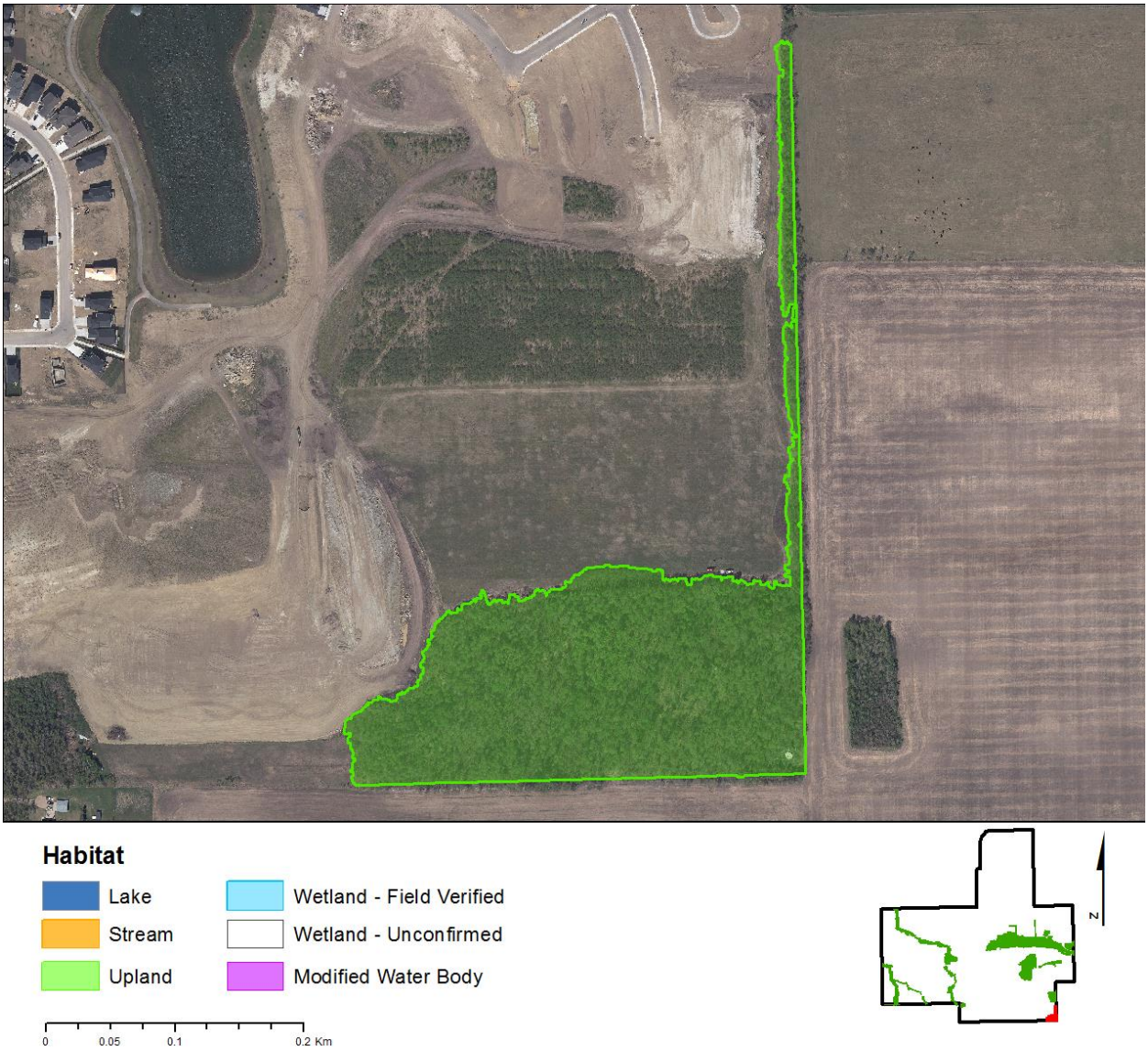
**Level of Human Impact:** Minimal

**Key Features:**

- This 5.2 ha tree stand is located in the south east corner of the City, in SW 19-49-24-4
- This mature deciduous tree stand received the highest habitat condition score in the City
- The ESA has an intact native forb layer and complex structure that provides important habitat for a wide range of wildlife species
- There are very few observable impacts in this ESA, and weed abundance is very low compared to other ESAs in the City
- Pileated woodpecker, a provincially Sensitive species, was observed in this ESA during the field assessment in 2016

# ESA #9

ESA Number: 9 Natural Area Number: 6 **Size**: 5.2 ha




**General Description:**

ESA 9 is a mature tree stand located in the south east corner of the City that is dominated by aspen and balsam poplar. This ESA has very little human disturbance, and the weed abundance is very low, compared to other ESAs in the City. The stand has good forest structure (e.g., shrub layer, snags with cavities, downed woody debris) that provides excellent habitat for song birds, particularly for primary and secondary cavity nesting birds such as woodpeckers and owls. Additionally this intact forest stand provides good habitat for small, medium, and large mammals including moose and deer.

# ESA #9

### Ecological Observations

During the field survey in 2016, thirty-seven plant species were observed in this ESA. Of particular note was the absence of many of the noxious weed species that area pervasive in other natural areas. While no noxious weeds were observed within this ESA, Common tansy and other provincially regulated weed species were observed within 100 m of the tree stand. These noxious weeds appeared to be associated with land development activities (e.g., soil stockpiles) occurring to the west within the Robinson neighbourhood. A number of bird species were also observed in the tree stand at the time of the 2016 assessment, including a pileated woodpecker, a provincially listed Sensitive species.

### Habitat Connectivity and Location within the Existing Ecological Network

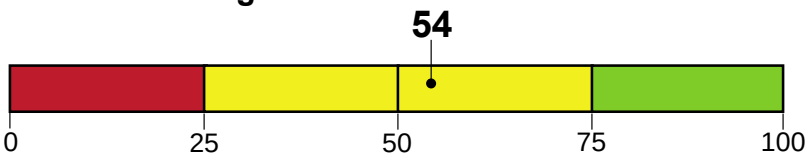
This ESA received one of the highest connectivity scores in the City, and given it relatively large size, it acts as an important stepping stone for wildlife both locally and regionally. In addition to ESA 9, there are several other natural areas located in the same quarter section, and ESA 4 is located approximately 600 m to the north. Together, this local network of natural areas function to provide important wildlife habitat in this corner of the City.

### Habitat Condition & Management Recommendations

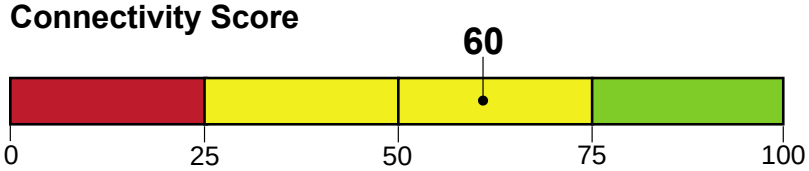
This ESA received the highest habitat condition score of all natural areas in the City because it has few observable impacts and a low abundance of weed species. However, nearby residential development has resulted in localize patches of noxious weeds, and controlling the spread of these weeds is critical to ensure the ecological condition of this ESA maintained. In addition, as this part of the City develops, maintaining ecological connectivity between ESA 4 and ESA 9 through the construction of a trail system or greenway, or by maintaining the existing hedgerow that currently runs between the ESAs, would serve to maintain important habitat connectivity between these ESAs.

# ESA #10

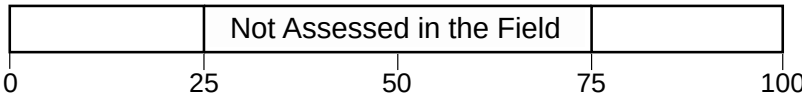
**Natural Area Significance Score**




**Connectivity Score**




**Habitat Condition Score**




**Plant Naturalness:** Not Assessed

**Habitat Quality:** Not Assessed

**Level of Human Impact:** Not Assessed

**Key Features:**

- This 2.7 ha tree stand is located in SW 23-49-25-4, directly across Highway 2 from ESA 3 (Deer Creek)
- This ESA acts as an important linkage and stepping stone between Deer Creek to the west, and other natural areas to the east
- Land access was not granted for this ESA; therefore, no field assessment was conducted in 2016

# ESA #10

ESA Number: 10 Natural Area Number: 12 **Size**: 2.7 ha


### General Description

ESA #10 is a small (2.7 ha) deciduous tree stand located in SW 23-49-25-4, within the Southfork neighbourhood. This ESA is located directly to the east of Highway 2, and is within 200m of the Deer Creek ESA (ESA 3) and a number of other natural areas, including a stormwater management facility (NA9) and a tree stand (NA 19). Permission to access this ESA for a field assessment in 2016 was not granted, nor was there any previously completed site-specific biophysical report available to us for review. Thus, there is no site-specific information about habitat condition for this ESA. However, forest stands of this size and type generally provide suitable habitat for song birds, as well as small and medium mammals.

# ESA #10

### Ecological Observations

This ESA could not be assessed in the field in 2016 due to land access restrictions; as a result, there are no direct field observations for this site; however, a review of air photographs suggests that this stand is dominated by mature deciduous trees (aspen and balsam poplar) and has little or no detectable human disturbance within it. Deciduous tree stands of this size and apparent condition provide suitable habitat for small and medium mammals (e.g., squirrels, hares, coyotes), as well as for songbirds, raptors, and owls. Given the proximity of this tree stand to nearby aquatic habitat (i.e., the stormwater management facility), this stand may also provide suitable habitat for toads.

### Habitat Connectivity and Location within the Existing Ecological Network

This ESA is located less than 200m to the east of the Deer Creek corridor (ESA 3), and given that these two ESAs are separated by a major four lane highway, this ESA likely acts as an important stepping stone habitat within the local ecological network.

### Habitat Condition & Management Recommendations

Given that there is no site-specific information about the habitat condition of this ESA, it is difficult to definitively provide management recommendations. However, given that weed management is generally an issue in the City, it should be noted here that any noxious or prohibited weeds within or near the ESA should be controlled to ensure that the overall condition of the tree stand is not degraded.

# 6.0 ESA Conservation & Management Toolbox

In order to successfully conserve and manage Environmentally Significant Areas in the City of Leduc, a number of tools can be utilized. In this section, we outline a framework for the conservation and management of Environmentally Significant Areas in the City of Leduc, including a list and description of the following key steps and associated tools:

Step One: Natural Area Securement
Step Two: Natural Area Management
Step Three: Public Engagement

## 6.1. Securement

The first step in the management of municipal natural areas is land securement. Securement of natural areas by the City of Leduc, or other third party conservation organizations, allows these areas to be managed to preserve their ecological function, as well as the ecological goods and services that are provided by these natural areas. Within a municipal development context, there are limited opportunities for the securement of natural areas, and the process of land securement can be further broken down into the following important steps:

**Ecological Inventories:**

A critical first step in natural area conservation is understanding where the natural areas are, the characteristics of each natural area, and priorities for the securement of natural areas at both the City and neighbourhood scale. This can be achieved through a wide range of different types of inventories and studies, of which this ESA Study is an example. Other examples of natural area inventories that can be used by the City of Leduc to identify the location, type of habitat, and habitat conditions associated with natural areas include:

- Provincial ESA Study
- Provincial Merged Wetland Inventory
- Leduc County ESA Study
- ASP & Outline Plan Biophysical Assessments
- Special Environmental Studies Commissioned by the City

**Environmental & Land use Guidelines, Policies, and Legislation:**

Once natural areas have been identified and characterized, it is important to have guidelines, policies, and legislation in place that direct land use planning and management decisions. Responsibility and direction for land use planning and development as it relates to natural area management is complex, and is split amongst various jurisdictions, including federal, provincial, and municipal governments.

Federal jurisdiction over natural areas in Alberta is somewhat limited in scope. Exceptions to this include the authority to manage natural areas and wildlife on federal land (e.g., First Nation Reserves, National Parks), as well as the authority to regulate migratory birds, fish and fish habitat, navigable waters, and species at risk. A summary of relevant federal laws and regulations that may apply to natural area and wildlife management in the City of Leduc are listed below in Table 8.

Table 8. List and description of Federal laws and regulations that may apply to the management of natural areas in the City of Leduc.

| Federal Law or Regulation | Application to the Management of Natural Areas |
|---|---|
| *Migratory Bird Convention Act* | This legislation is based on international treaty signed by Canada and the United States of America that aims to protect migratory birds from indiscriminate harvesting and destruction on all lands within Canada. Under this Act, efforts should be made to provide for and protect habitat necessary for the conservation of migratory birds, and to conserve habitats that are essential to migratory bird populations, such as nesting, wintering grounds, and migratory corridors. |
| *Fisheries Act* | Includes provisions for the protection of fish and fish habitat, and requires an authorization for activities that cause harmful alteration, disruption and destruction of fish habitat. |
| *Navigable Waters Protection Act* | Prohibits the placement of any work in, on, over, under, through, or across any navigable water unless the work, the site, and the plans have been approved and the work is built and maintained according to approved plans. This includes construction of structures on the shore of a water body (e.g., docks). |
| *Species At Risk Act* | The Federal government has jurisdiction over all SARA-listed species on federally owned lands, including national parks, Department of National Defence lands, and First Nations Reserve lands. Management of SARA-listed species on provincial crown land, or on lands held by private citizens of Alberta, falls under the jurisdiction of the provincial government. In these cases, the provincial government is obligated to protect listed species to the same standards set forth by the Federal government. In cases where provincial governments do not meet these standards, the Federal Minister may issue an order in council to protect federally listed species that occur on provincial or private lands |

The responsibility for managing natural resources and habitats across Alberta primarily falls under provincial jurisdiction, and the mechanisms through which natural areas are managed varies with respect to whether these areas are located on private land or public (crown) land. Regardless of where the natural area is located, or what the land use and associated activities may be, the provincial government has jurisdiction over the management of all water in the province under the *Water Act*. In addition, the provincial government has jurisdiction over all lands that are defined as “public” (i.e., regulated under the *Public Lands Act*), which includes the bed and shore of all permanent water bodies, regardless of whether

these water bodies are located on private land. The provincial government also has jurisdiction over the management of wildlife and wildlife habitat listed under the Wildlife Act, including species that are provincially or federally designated as species at risk.

In addition to provincial laws and regulations, the Government of Alberta has a wide range of policies, standards, or guidelines that provide direction for the management of natural areas, wildlife, and wildlife habitat. The majority of these policies are voluntary and require the application of best management practices to achieve the desired management goals. One exception to this is the provincial wetland policy. Wetlands are regulated as water bodies under the Water Act, and as such, an approval is required to undertake any works that may impact a wetland. Thus, the principles and goals of the wetland policy and the associated wetland compensation guide are enforced through the Water Act application process.

A list and description of provincial laws, regulations, and policies that may apply to the management of natural areas in the City of Leduc is provided in Table 7.

Table 9. List and description of Provincial laws, regulations, and policies that may apply to the management of natural areas in the City of Leduc.

| Legislation, Regulation, or Policies | Application to the Management of Natural Areas |
|---|---|
| Stepping Back from the Water: A Beneficial Management Practices Guide for New Developments Near Water Bodies | This document provides discretionary guidance to local authorities to assist with “decision making and watershed management relative to structural development near water bodies”, and includes recommendations for development setbacks (buffers) on water bodies to protect aquatic and riparian habitats. |
| Alberta Wetland Policy & Wetland Mitigation Directive | Pursuant to the Water Act, the provincial wetland policy prohibits the unauthorized drainage or disturbance of wetlands. The stated goal of the policy is to “conserve, restore, protect, and manage Alberta’s wetlands to sustain the benefits they provide to the environment, society, and economy”. Applications to assess wetland value are reviewed using the Alberta Wetland Policy Administrative Procedures. Based on five criteria (biodiversity, water quality improvement, flood reduction, human value, and relative abundance), the province determines the relative wetland value (four categories ranging from High-A to Low-D), which is be used to determine compensation ratios for wetland replacement. If wetland loss or impacts are authorized by the province under the Water Act, the permittee is responsible for the replacement of lost wetland habitat at the ratio stipulated by the province. |
| *Alberta Land Stewardship Act* | Creates authority of regional plans and enables the development of conservation and stewardship tools that can be used to acquire and manage natural areas. These tools include conservation easements, conservation directives, conservation offsets, and transfer of development credits, and are described further in Section 4 (Natural Area Acquisition) below. |
| *Weed Control Act* | Noxious and prohibited noxious weeds listed under Schedule 1 must be controlled (noxious weed) or destroyed (prohibited noxious weed) by the owner of the land on which the listed weed occurs. |

*Continued …*

Table 9 *continued …* List and description of Provincial laws, regulations, and policies that may apply to the management of natural areas in the City of Leduc.

| Legislation, Regulation, or Policies | Application to the Management of Natural Areas |
|---|---|
| *Environmental Protection and Enhancement Act (EPEA)* | This legislation aims to protect air, land and water by regulating the process for environmental assessments, approvals, and registrations. In particular, stormwater drainage that is directed to any surface water body requires an EPEA approval. Further, the Environmental Code of Practice for Pesticides provides a standard for operating practices that restrict the deposition of pesticides into or onto any open water body. |
| *Municipal Government Act (MGA)* | Provides municipalities with the authority to adopt statutory plans and bylaws that direct land use and development at subdivision. The Act also grants limited rights to designate reserves at subdivision that can be used to conserve natural areas. The Act also gives municipalities authority to regulate water on municipal lands, manage private land to control non-point source pollution, and adopt land use practices that are compatible with the protection of the aquatic environment, including development setbacks on water bodies. |
| Municipal Land Use Policies | Pursuant to Section 622 of the MGA, these Policies were established by Municipal Affairs to supplement planning provisions in the MGA and the Subdivision and Development Regulation, and to create a conformity of standard with respect to planning in Alberta. Section 5 of the Land Use Policies encourages municipalities to identify significant water bodies and watercourses in their jurisdiction, and to minimize habitat loss and other negative impacts of development through appropriate land use planning and practices. In addition, Section 6 encourages municipalities to incorporate measures into planning and land use practice that minimizes negative impacts on water resources, including surface and groundwater quality & quantity, water flow, soil erosion, sensitive fisheries habitat, and other aquatic resources. |
| *Public Lands Act* | Regulates and enforces activities that affect the Crown-owned bed and shore of water bodies, as well as Crown-owned riparian and upland habitats (e.g., forest and grazing leases). |
| *Water Act* | The stated purpose of this Act is to support and promote water conservation and management. Under the Act, any activity that causes or has the potential to cause an effect on the aquatic environment requires an approval. Regulations and Codes of Practice under this Act apply to water and water use management, the aquatic environment, fish habitat protection practices, in-stream construction practices, and storm water management. |
| *Wildlife Act* & Species at Risk Program | The provincial Species at Risk Program was initiated as a response to the Province's commitment to the Accord for the Protection of Species at Risk in Canada. The intent of the Accord is to prevent species in Canada from becoming extinct as a consequence of human activity. Any species that is designated as Endangered or Threatened becomes legally protected under Alberta's *Wildlife Act*. This legal designation prohibits the disturbance, killing or trafficking of these species, and provides immediate protection of birds of prey nests and den sites. Any species that is designated as "Sensitive" after a general assessment, or as "Special Concern" after a detailed assessment becomes eligible for special management actions designed to prevent the species from becoming "At Risk". |

While the provincial government holds the authority to regulate water and public land throughout the province, municipalities are given the authority to manage lands within their jurisdiction under the *Municipal Government Act* (MGA). Section three of the MGA outlines three primary purposes of a municipality, which include:

1) Providing good governance;
2) Providing services that are in the opinion of council to be necessary or desirable; and
3) Developing and maintaining safe and viable communities.

A primary power given to municipalities under the MGA is for land use planning and development, which allows municipalities to set the conditions under which lands are subdivided and developed. Further, the *Municipal Government Act* requires each municipality to develop statutory planning documents that provide a framework and vision for development and land use within their jurisdictions. Statutory planning documents that are required under the MGA include:

- Municipal Development Plans
- Intermunicipal Development Plans
- Area Structure Plans
- Area Redevelopment Plans

Within these planning documents, municipalities can provide specific direction for development requirements that may impact natural areas. In addition to statutory planning documents, municipalities can influence the management of natural areas by enacting Land Use Bylaws that set forth requirements for development setbacks on environmentally sensitive lands. For example, municipalities can provide specific direction for development requirements in or near riparian habitat, or set forth minimum development setback widths on Environmental Reserve (ER), environmentally sensitive land, or water bodies and watercourses.

The City of Leduc has a number of municipal planning documents that outline natural area retention and management as a priority for the City (Table 8). Taken together, these documents provide strong direction for the identification, retention, and management of natural areas and wildlife corridors in the City. In addition, these documents provide a framework for creating urban design that can accommodate wildlife movement and maintain habitat condition within the City. The specificity of the guidance within the documents varies, but in general, the recommendations are high-level and in most cases, there is a lack of specificity with respect to policy and process for implementation. A list and summary of the municipal planning documents that provide direction for natural area retention and management in the City of Leduc is provided in Table 8 below.

Table 10. List and description of municipal plans and policies that apply to the management of natural areas in the City of Leduc

| Municipal Plan or Policy | Application to the Management of Natural Areas |
|---|---|
| Capital Region Board (CRB) Growth Plan (2010) | The CRB Growth Plan include six principles for development, number one of which is to "protect the environment and resources". Consistent with these principles, the Plan outlines land use planning initiatives and priorities within the Capital Region, including considerations for maintaining ecological networks and assessing cumulative effects. |
| City of Leduc / Leduc County Intermunicipal Development Plan 2010-2044 | This document outlines various principles for jointly protecting, sustaining and enhancing the natural environment. Specifically, Section 1.3.3 outlines general principles for environmental stewardship, including: respecting natural systems; protecting environmentally sensitive areas, water bodies, wetlands, water courses and parkland landscapes; and cooperatively integrating development with natural areas and greenways to support wildlife corridors. The Plan outlines a requirement for an Environment Impact Assessment at the ASP stage, and outlines considerations for joint management plans for the Saunders Lake watershed and other creek/ravine systems within the IDP boundary. |
| Municipal Development Plan (2012) | The MDP provides strong direction for retaining natural areas as Environmental Reserve, as well as maintaining tree stands where practical. Specifically, Section 2F provides high-level guidance for the conservation and management of natural areas in new neighbourhoods, including neighbourhood design considerations for low impact development (e.g., appropriate buffers, bioswales, etc.). |
| Environmental Plan (2012) | This plan outlines specific environmental goals and actions to be undertaken by 2021. Specific to natural area management, this Plan states that the City will "protect natural areas and work on habitat restoration" and will further "complete a natural area habitat inventory that also addresses wildlife movement". In addition, the plan states a commitment to consider strategies for enhancing existing measures for the protection of natural areas through goal setting and identification of funding for land purchase. This Plan also emphasizes the need to identify and dedicate lands that qualify as Environmental Reserve. |
| Parks, Open Space & Trails Master Plan (2012) | This Plan references and reiterates the broad-level actions stated within the City's Environmental Plan. Specifically, this Plan recommends that all natural areas and tree stands in the City be retained, preserved, and managed for the benefit of citizens, with an emphasis on maintaining wildlife movement and restoring habitats to enhance ecological function. |
| Area Structure Plans (ASP) | Approved Area Structure Plans outline a framework for a proposed development and are used to inform more detailed planning at the Outline Plan stage. Natural areas designated as Environmental Reserve or Municipal Reserve are generally identified at this stage, and the majority of lands within the City of Leduc municipal boundary currently have an approved ASP. The City updating ASP requirements to include a natural area biophysical assessment, and guidelines outlining the requirements for the biophysical assessment are currently being drafted. |
| Outline Plans | An Outline Plan summarizes the land use concept at a finer scale than an ASP, and provides specific land use and planning detail. Municipal and Environmental Reserves are identified at this stage, and the application is reviewed by all relevant City departments to evaluate whether the proposed plan aligns with relevant environmental planning policies and documents. At present, the City is updating their requirements for Outline Plan submissions. |

*Continued …*

Table 10 *continued …* List and description of municipal plans and policies that apply to the management of natural areas in the City of Leduc.

| Municipal Plan or Policy | Application to the Management of Natural Areas |
|---|---|
| Telford Lake Master Plan (2010) | This Plan outlines specific development priorities for the Telford Lake area. A stated priority for this area is to balance recreation and development with environmental protection. Many general recommendations are made for maintaining and preserving the ecological condition of the lake and surrounding lands through alternative approaches to landscaping, stormwater management, and lot size, design, and layout. |
| Land Use Bylaw (2013) | Section 15.1.3 of the Land Use Bylaw includes a Land Use District defined as Environmental Restricted Development (ERD). An ERD District is intended to "protect environmentally sensitive areas by restricting Development to clearly compatible uses and providing access to the public in a manner that preserves the features". Permitted uses include Natural Conservation, Park (excluding playgrounds), Trail System, and Utility, and all development must minimize impacts to the natural environment. This Bylaw also outlines minimum development setbacks on Environmental Reserve and Municipal Reserve. |
| Parkland Bylaw (2007) | The Parkland Bylaw outlines regulations on accepted and restricted activities and behaviour while using any lands designated as Parkland, which may include natural areas. This bylaw prohibits the damage to or destruction of vegetation, as well as prohibits disturbance or harassment of wildlife. |
| Neighbourhood Design Guidelines (2009) | The Neighbourhood Design Guidelines is a planning tool that provides guidance for retention of natural areas within a new neighbourhood. Specifically, the guidelines indicate that natural areas and wildlife corridors should be protected using Municipal or Environmental Reserve designations, and that these features should be appropriately buffered to minimize impacts of development. The use of native or low-maintenance vegetation is also encouraged for landscaping in public park space. |
| Development Permit | A development permit allows a specific type of development on a specific parcel of land in the community to proceed with the zoning and development bylaws of the County. A development permit may stipulate some of the following conditions: the allowed use of the property, intensity of that use, building height, building site coverage, setbacks from property lines and other buildings and parking requirements |
| Community Standards Bylaw (2008) | This Bylaw outlines expectations related to property maintenance, and specifically requires property owners to control litter, garbage and weeds on their property. |

**Natural Area Acquisition:**

It is important to note that while there is a wide range of different federal, provincial, and municipal laws and policies that regulate activities within or near natural areas, these regulations by themselves to do not necessarily result in the conservation of natural areas. In many cases, existing laws regulate *activities* that may impact natural habitats (e.g., the provincial *Water Act*), but do not regulate the natural habitats themselves. As a result, many of the existing laws result in approvals that allow for the removal or alteration of natural areas under certain conditions outlined within the approval. In some cases, these regulations require compensation or replacement of impacted habitats (e.g., the Provincial wetland policy and the federal *Fisheries Act*), but in most cases, existing laws and policies do not prevent land development, and there is very little provision for natural area conservation in existing laws and policies, particularly as it relates to federal and provincial regulation.

At the municipal level, most municipalities may have environmental and land use legislation, policies, and guidelines that provide direction for how to target natural areas for conservation, as well as guidance for and how to integrate these natural areas into a neighbourhood post-development. However, there are only a small number of tools or mechanisms available that enable the *acquisition* of lands by the municipality (or a third party) for the purpose of conservation. In some cases, these tools are only available to municipalities at particular times during the development process (e.g., at subdivision). In other instances, there may be restrictions on the amount of land that municipalities can set aside for natural area conservation, as there are requirements to balance natural area conservation with other land use demands, such as school and park sites. In many cases, municipalities may have undertaken an ecological inventory to identify high priority natural areas for conservation, and have the appropriate legislation or policies in place to manage these areas, but may lack the appropriate tools (or associated resources) to acquire natural areas to ensure that they are conserved, rather than developed.

One of the most effective conservation mechanisms for aquatic habitats within municipalities is the *Public Lands Act*. Pursuant to this legislation, the Province of Alberta owns the bed and shore of all permanent and naturally occurring water bodies, including lakes, rivers, streams, and wetlands. Under this Act, all permanent and naturally occurring water bodies are Crown land, and development must avoid these features. If development can not be avoided, the Crown determines whether temporary construction or permanent occupation will be authorized, and in many cases, authorized activities that result in the loss of Crown land is subject to compensation. A claim of a water body by the Crown is often one of the most effective means for conserving aquatic natural areas in municipalities; however, these Crown claims to not extend to ephemeral or seasonal water bodies.

The second provincial legislation that enables municipalities to develop and implement land conservation and stewardship tools is the *Alberta Land Stewardship Act* (ALSA). Under ALSA, the following tools may be utilized to conserve natural areas in municipalities:

**Conservation Easement:**

A conservation easement is a voluntary contractual agreement between a private landowner and a qualified organization, such as a municipality, Land Trust organization, or conservation group. There are only three allowable purposes for a conservation easement under the *Alberta Land Stewardship Act*, and these include the protection, conservation and enhancement of 1) the environment, 2) natural scenic or aesthetic values, or 3) agricultural land or land for agricultural purposes. Under a conservation easement, the landowner retains title to the land, but certain land use rights are extinguished in the interest of conserving and protecting the land. The land use restrictions that apply to the property are negotiated and agreed to at the outset (for example, a restriction on subdivision), and the conservation easement (and the land use restrictions) are registered on title and are transferred to a new land owner if the land is sold. Conservation

easements can be negotiated by a private land owner at any time, but the easement must be held by a qualified organization.

**Conservation Directive:**

A conservation directive allows the Alberta Government to identify private lands within a regional plan for the purpose of protection, conservation, or enhancement of environmental, natural scenic, or aesthetic values. Ownership of the lands is retained by the land owner, and the directive describes the precise nature and intended purpose for the protection, conservation, or enhancement of the lands. A conservation directive must be initiated by the provincial government, and to date, this tools remain largely untested (Environmental Law Centre 2015).

**Conservation Offset:**

A conservation offset is a tool that allows industry to offset the adverse environmental effects of their activities and development by supporting conservation activities and/or efforts on other lands. In order for conservation offsets to be effective, there must first be guidelines and rules for where offsets can be applied, and provisions for accountability, including monitoring and compliance. While conservation offsets are available as a tool for the conservation of natural areas in Leduc, work would first have to be done to create a proper framework to create eligibility rules, pricing and bidding rules for selling and buying offsets, and rules for combining buyers and sellers.

**Transfer of Development Credits (TDCs):**

Transfer of development credits is a tool that creates and incentive to redirect development away from specific landscapes in order to conserve areas for agricultural or environmental purposes. This tool allows land development and conservation to occur at the same time, while also allowing owners of the developed and undeveloped lands to share in the financial benefits of the development activity. A TDC program can be used to designate lands as a conservation area for one or more of the following purposes:

- The protection, conservation and enhancement of the environment;
- The protection, conservation and enhancement of natural scenic or aesthetic values;
- The protection, conservation and enhancement of agricultural land or land for agricultural purposes;
- Providing for all or any of the following uses of the land that are consistent with the following purposes: recreational use, open space use, environmental education use, or use for research and scientific studies of natural ecosystems; and
- Designation as a Provincial Historic Resource or a Municipal Historic Resource under the *Historical Resources Act*.

Before TDCs can be used by municipalities as a conservation tool, they must be established through a regional plan, or they must be approved by the Provincial Government.

Outside of the conservation tools that have been created through the Alberta Land Stewardship Act, there are other mechanisms through which municipalities may acquire lands for conservation, most of which rely on voluntary conservation action taken by private land owners. These tools may be utilized at any time during the municipal planning and development process, and include:

**Land Purchase:**

Municipalities can purchase land from a private land owner at any time for the purpose of conservation. For example, the City of Edmonton established a Natural Areas Reserve Fund in 1999, with the purpose of using these funds to purchase and protect natural areas. While land purchase for conservation is an option that is available, many municipalities do not have the financial resources available to purchase lands within their municipal boundaries, as the market value for these lands can be very high.

**Land Swap:**

In some cases, a land developer may be willing to “swap” or exchange natural areas for other developable lands that are owned by the municipality. In this case, the municipality and the developer would enter into an agreement to exchange the lands, such that the natural areas can be conserved.

**Land Donation:**

Land donation involves the transfer of ownership from a private land owner to the municipality, or to a conservation organization or land trust, who would hold the land for conservation in perpetuity. Lands that are donated to a conservation organization or land trust are eligible for the federal government’s Ecological Gifts program which provides donors with significant tax benefits.

The final set of conservation tools are directly available to municipalities, and are the most common and frequently used tools for acquiring natural areas as part of land development and planning. However, these tools are enabled through the *Municipal Government Act*, which only gives municipalities the authority to use these tools at the time of subdivision. Thus, municipalities can only utilize these tools through formal land development and planning processes.

**Municipal Reserve (MR):**

The MGA enables municipalities at the time of subdivision to claim up to 10 percent of the total developable land area as Municipal Reserve. Lands designated as MR can only be used for a public park, public recreation area, school board purposes, or to separate lands that are used for different purposes (e.g., as a buffer, trails, walkways, etc.). In some cases, if the full 10 percent of the land is not required to accommodate the open space needs of the neighbourhood, some of the MR dedication may be used for the purpose of retaining upland habitat, such as tree stands. However, given the competing open space needs and the demand for parks and school sites in new neighbourhoods, the 10 percent allocation is often insufficient to accommodate conventional open space needs and natural area conservation. Thus, in many cases upland natural habitats such as tree stands can not be dedicated as Municipal Reserve at subdivision.

**Environmental Reserve (ER):**

Environmental Reserves are defined in the MGA as water bodies, watercourses, lands that are unstable or subject to flooding, and lands “not less than 6 metres in width abutting the bed and shore” of a water body or watercourse. While the MGA allows municipalities to take a *minimum* of a 6 metre setback on Environmental Reserve lands (with no stated maximum) , the conditions under which this taking is permitted is limited to cases where the setback is required to prevent pollution

or provide public access to the bed and shore of the water body or watercourse. In addition, Section 640(4)(l) of the MGA allows municipalities to establish development setbacks on lands subject to flooding, low lying or marshy areas, or within a specified distance to the bed and shore of any water body.

**Environmental Reserve Easement:**

In instances where the municipality and the landowner agree, Environmental Reserve lands may be designated as an Environmental Reserve Easement. An ER Easement serves the same purpose as ER, but differs in that the title of the reserve lands remains with the land owner; however, ER easements are registered on title by caveat in favour of the municipality.

An overview of these acquisition tools and mechanisms, including when they are available to municipalities for the acquisition of natural area, and how they relate to existing environmental legislation and policy, is presented in Figure 15.

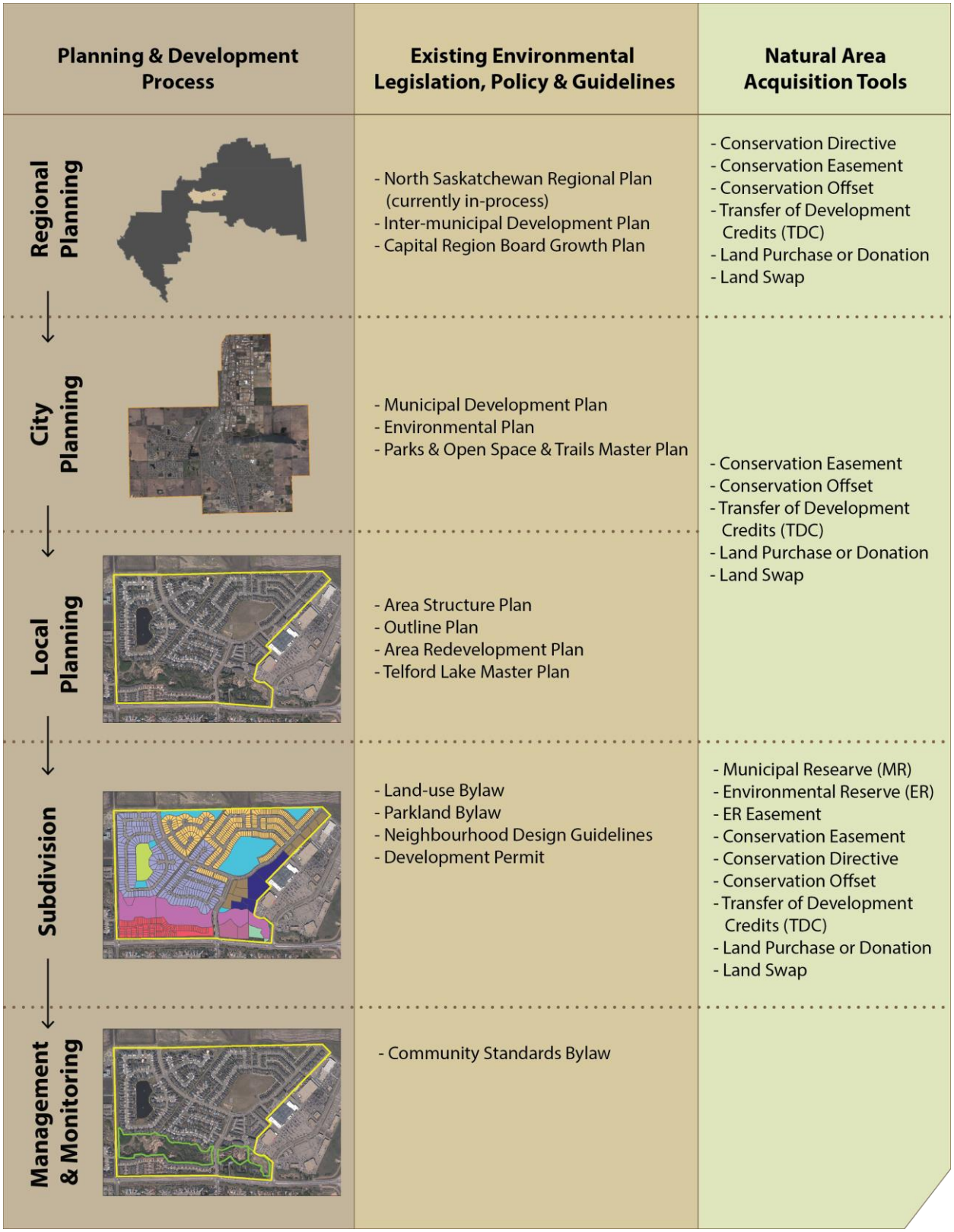



Figure 15. Illustration of the major steps involved in urban planning and development in the City of Leduc, including an overview of the existing environmental legislation and acquisition tools that are available at each step of the process.

## 6.2. Management & Monitoring

Once natural areas have been identified, prioritized, and acquired by the City of Leduc, the next step includes having adequate plans and processes in place to ensure that the ecological condition and integrity of the natural area is maintained. This includes plans to maintain or enhance the natural area itself, as well as to implement the supporting management policies, legislation, or guidelines that direct how development in or near natural areas should proceed, as well as the type and intensity of human activities that will be permitted in the natural area. At present, the City has a limited number of formal policies or procedures for the management of natural areas outside of what is currently outlined in the Community Standards Bylaw.

## 6.3. Public Engagement

Public engagement is a critical component to the successful conservation and management of natural areas. Without the support of the public, the successful implementation of restoration and management programs and activities that are required to maintain healthy and resistant natural areas are not possible. For example, ensuring that the public stay on designated trails through sensitive habitat, or that homeowners located adjacent to a natural area respect guidelines for “no mowing” of naturalized buffers, is critical to the success of such initiatives. Further, many of the natural area acquisition tools outlined in Section 7.1 rely on voluntary participation by the public (e.g., land donations and conservation easement). Thus, ensuring that the public are aware of the various voluntary programs that exist for natural area conservation, as well as formulating active partnerships that can capitalize on the public’s willingness to participate in such programs, is critical to increasing the inventory of natural areas that are retained within the City of Leduc. Public engagement can take several forms, including the following:

**Education, Extension and Outreach:**

Increasing public awareness and appreciation for natural areas is a critical component to effective conservation and management. Thus, creating educational opportunities and programs, as well as supporting local conservation and stewardship groups should be integrated into the City’s overall natural area conservation and management strategy.

At present, one of the primary vehicles for environmental education, extension, and outreach in the City is the Leduc Environmental Advisory Board (LEAB). LEAB consists of a number of residents, as well as a representatives from City Council, the business community, and the education system. This group advises Council on environmental matters, proposes programs and practices for the protection, enhancement and wise use of the environment, and disseminates information to and for the residents of the City to enhance appreciation of natural areas, as well as wise and prudent environmental practice.

**Partnerships:**

Given the limited number of tools available to municipalities for natural area acquisition, engaging in strategic partnerships to promote voluntary land conservation and management activities is essential. Central to this is developing partnerships with land trusts (e.g. Edmonton and Area Land Trust, Alberta Land Trust Alliance), stewardship and conservation organizations (e.g., Nature Conservancy, Land Stewardship Centre), regional municipalities (Leduc County and City of Edmonton), and the provincial government to promote and enhance collaboration and improve conservation outcomes.

# 7.0 Guiding Principles for ESA Conservation & Management

The following is a list of general management recommendations for sustainably integrating Environmentally Significant Areas, as well as other natural areas, into land development activities in the City of Leduc.

## 7.1. Buffers

Placing development setbacks on wetlands and natural area is important for maintaining the condition and health of retained natural features. Buffers are a transition zone between urban development and natural features, and these areas can help to improve the quality of surface waters entering the natural feature. Buffers also offer additional wildlife habitat, and in the case of forested areas, protect tree roots from damage. From the perspective of human use, buffers can improve the aesthetic appeal of a natural area and create both passive and active recreational opportunities for local residents

- Concentrate human activity and development, or other intensive land uses, in planned development areas, such that contiguous natural areas are maintained to the greatest extent possible.
- Ensure ESAs and natural area are separated from human activity and development by appropriately sized buffer zones.
- The size and location of the buffer area will depend on the type, severity, size, and proximity of the human activity or development, as well as the type of habitat within the ESA or natural area, and the sensitivity of that habitat to disturbance. For example, buffers on water bodies may need to be wider than buffers on tree stands in order to maintain and protect water quality.
- Buffer zones can consist of additional natural habitat, such as a riparian zone adjacent to sensitive wetland habitat, or of semi-natural habitat or land uses, such as recreational park spaces, multiways, naturalized stormwater management facilities, or other green spaces.
- Agricultural lands can often be restored or naturalized into highly functional buffer zones.

## 7.2. Vegetation & Wildlife Habitat

- Vegetation clearing should be minimized to the extent possible and any trails through natural areas should be located in areas that have already been disturbed.
- All vegetation plantings used within neighbourhoods for landscaping should be composed of native species, and should be an appropriate match for the type of habitat already present in the neighbourhood.
- To the extent possible, native eatable species should be planted in vegetated transition zones (e.g., Saskatoon, raspberry) and buffer areas.
- ESAs or natural areas in poor or moderate habitat condition should be targeted for habitat restoration activities. In particular, ESAs and natural areas with pervasive weed problems should be identified and a weed management plan should be developed and implemented.
- Timing restrictions should be applied to construction activities to protect wildlife:
    - All construction activities within 100 m of a wetland should be conducted outside of the critical breeding period for waterfowl and amphibian species to avoid disturbance. If land clearing activities must occur during this time, qualified personnel should systematically search all affected areas for active nests. If active nests are located, all land clearing activities should be rescheduled to occur outside critical breeding and nesting period.
    - Under Section 6(a) of the Migratory Bird Convention Act, it is an offence to “disturb, destroy or take a nest, egg, or nest shelter” of a migratory bird. As such, any land clearing activities should be scheduled to occur outside the breeding season for migratory song birds.
    - Under the provincial Wildlife Act, it is an offence to damage active nests of prescribed wildlife, including birds of prey. Thus, any tree clearing activities scheduled for February or March should be preceded by a breeding owl survey to ensure that clearing activities do not disturb nesting owls.

## 7.3. Habitat Connectivity & Wildlife Movement

- Provide habitat connectivity between ESAs and other natural areas by maintaining, creating, or restoring naturalized corridors.
- In particular, stream corridors in the City provide important areas for wildlife movement, and to the extent possible, these corridors should be maintained and enhanced (e.g., increase the width of the riparian and vegetated buffer) to ensure that these corridors remain functional as the City continued to expand and develop.
- Minimize disturbances within ESAs and other natural areas.
    - In particular, eliminate or limit the number of roads that cut through ESAs and natural areas.
    - If roads must be placed through or near natural areas, ensure that wildlife movement and habitat connectivity is considered as part of roadway design (e.g., construction of wildlife movement passages, traffic calming measures, etc.), particularly when roads are placed between multiple habitat patches (see Stantec 2010 for an example of existing municipal guidelines that address wildlife movement in urban areas).
    - Trails should be limited to the perimeter of ESAs and natural areas, particularly for those that are in good habitat condition. If trails are built through ESAs or natural areas, the number and width should be limited.

## 7.4. Hydrology

- Carefully plan site drainage to ensure that any tree stand that is retained as part of the neighbourhood development receives adequate moisture to be sustainable post-development. This information could be provided as part of a biophysical assessment.
- Ensure the drainage on-site does not negatively impact existing wetland or aquatic habitats. For example:
    - Pre- and post-development water inputs should be matched both in terms of volume and in the frequency/timing of input events. Water levels in wetlands should not be artificially over-stabilized, particularly for wetland types that naturally experience seasonal or annual hydrological drawn-downs.
    - Any water discharged into a natural wetland should be treated (e.g., delivered through a bioswale) and water quality standards should meet or exceed all regulatory requirements.
- New standards for stormwater management facility design should be developed that encourages constructed wetlands, rather than conventional retention ponds, to improve wildlife habitat and water quality (see Section 8 for more details).

## 7.5. Human Use and Safety

- Hazard trees (e.g., dead and dying trees) within the Park should be managed by topping the tree and leaving as much of the tree standing as possible. The portion of the tree that is removed should be retained on-site as coarse woody debris.

# 8.0 Gaps in Conservation & Management in Leduc

While there are a number of existing tools available to the City of Leduc to retain, conserve, and manage natural area, there are a number of gaps in the City's current approach to natural areas management that should be addressed in order to achieve better conservation outcomes. These gaps are discussed in more detail below.

## 8.1. Natural Area Acquisition and Conservation Fund

Given the limited set of tools available to municipalities for the acquisition of natural areas, direct purchase of land is one of the most effective mechanisms for conservation; however, many municipalities lack the financial resources to purchase natural areas directly. Thus, several municipalities in Alberta have created a reserve fund for the purpose of acquiring natural areas for conservation. For example, the City of Edmonton established a Natural Areas Reserve Fund in 1999, and as of 2005, annually contributes $1 million dollars to the fund. The fund is accompanied by a Natural Areas Acquisition strategy, which outlines strategic goals and criteria for the acquisition of natural areas using the conservation funds. Establishing a conservation fund for acquiring lands in the City of Leduc would similarly allow the City to purchase high priority natural areas for conservation.

## 8.2. Natural Area Assessment & Retention Guidelines

At present, the City of Leduc does not have a standard set of guidelines for the assessment of natural areas as part of the development of an ASP or Outline Plan. However, the City is in the process of updating ASP requirements to include a natural area biophysical assessment, and guidelines outlining the requirements for the biophysical assessment are currently being drafted. Creating a standard for how natural area assessments are conducted by qualified practitioners, as well as guidelines for how these natural areas should be prioritized for retention during the planning process, will create a standard of practice that should result in more consistency with respect to how natural areas are assessed and managed as part of the planning process. Creating standards for assessment will also allow the City administration to more meaningfully evaluate development proposals as they relate to natural area conservation and management.

## 8.3. Environmental Reserve Dedication Policy

Under the direction set out by the *Municipal Government Act* and the municipal Land Use Policies, many municipalities throughout the province have taken the initiative to enact policies that provide guidance on the dedication of lands that meet the definition of Environmental Reserve under the MGA, with particular attention being given to wetlands and riparian lands. For example, Edmonton, Calgary, Strathcona County, Strathmore, Cochrane, and Chestermere all have municipal wetland or riparian policies that provide direction for designating wetlands as Environmental Reserve at subdivision. Further, the City of Chestermere recently enacted a Wetland Bylaw that stipulates conditions for wetland retention and outlines restriction on land development adjacent to high priority wetlands.

Approximately half of the natural areas and Environmentally Significant Areas in the City of Leduc qualify as Environmental Reserve under the MGA, and as such, can be dedicated as ER at subdivision. This presents a substantial opportunity for the City, as the dedication of lands as ER is one of the most effective means for acquiring natural areas. Thus, creating a formal policy related to the conservation and management of ER lands in the City would formalize expectations around how wetlands, streams, and other aquatic habitats will be integrated into neighbourhood planning and design, which will lead to better and more consistent conservation outcomes. An important component to the effective management of ER lands includes buffers and development setbacks, which are discussed in more detail below.

## 8.4. Development Setback Policy and Guidelines

Water bodies such as wetlands, streams, and lakes receive surface runoff and groundwater inputs from adjacent lands. In particular, these water bodies are sensitive to surface water that is contaminated with pollutants (e.g., sediments, excessive nutrients, pesticides, etc.), and these pollutants can have serious negative impacts on wildlife and wildlife habitat. As a result, ensuring that appropriate buffers and development setbacks are applied to water bodies that are retained as Environmental Reserves in urban environments is essential to maintaining their hydrologic and ecological function. Further, appropriate buffers protect property and infrastructure from flood risk, and provide public access to natural areas for the public to enjoy.

Under the MGA, municipalities that designate land as Environmental Reserve are required to take a buffer of no less than 6 m to prevent pollution and provide public access to the water body. In most cases, this minimum buffer width is insufficient for preventing pollution of a surface water body, particularly in instances where the riparian vegetation has been removed or altered, or there are steep slopes or highly erodible soils adjacent to the water body. Several municipalities across Alberta have recognized the importance of having adequate buffers adjacent to a water body, and as such, have adopted development setback and riparian management policies that provide direction for buffer widths on water bodies (Clare and Sass 2012). For example, the City of Edmonton and the City of Calgary both have policies that require a 30m setback on seasonal, semi-permanent, and permanent wetlands. In their Stepping Back from the Water document, the Government of Alberta (2010) has similar development setback recommendations for wetlands and streams, in addition to a 50m setback recommendation for a named lake or major river. Other municipalities, such as MD of Foothills and LacLa Biche County, have variable setbacks that are determined through consideration of site-specific conditions that may influence buffer widths, such as slope, soil type, and vegetative cover. Regardless of whether static or variable buffer widths are applied to ER lands, it is important to have a municipal policy that establishes buffers that are scientifically valid and are appropriate for the protection of aquatic habitats.

In addition to having development setbacks recommendations for ER lands, developing a policy that stipulates a minimum development setback on natural areas that are composed of mature trees is also recommended. This buffer not only protects the roots of mature trees, but also protects people and property in the event of tree blow down.

## 8.5. Standards for Stormwater Management Facility Design

Stormwater management facilities were included in this study as natural areas, and overwhelmingly, these facilities received some of the lowest Ecological Significance scores in the City. These low scores can be explained by two primary design characteristics common to storm facilities in the City of Leduc:

1) Storm facilities are typically isolated from other natural and semi-natural habitats. In general, these facilities are designed such that they are completely surrounded by roads, impermeable surfaces or non-native vegetation, and/or houses without any greenway connection to other natural and semi-natural habitat, which severely reduces habitat connectivity.
2) The majority of existing storm facilities are conventional stormwater retention ponds, and have little or no natural vegetation within or adjacent to them. These facilities typically have manicured, non-native vegetation along the shores (e.g., Kentucky blue grass) and little or no emergent vegetation along the shores. As a result, these facilities suffer from water quality issues, and provide little or no habitat for wildlife other than geese, which are often considered to be undesirable and nuisance wildlife.

It should be noted here that the City of Leduc is located in close proximity to the Edmonton International Airport, and as such, is subject to restrictions on stormwater pond design as outlined in the Edmonton International Airport Vicinity Protection Area Regulation, and other Transport Canada and NAV CANADA policies and regulations. Many of these policies and regulations are intended to reduce bird attractants near airports, and stormwater pond size and design is highly regulated to ensure aviation safety. Many of the design features employed to reduce the attractiveness of stormwater ponds to birds include increasing slopes along the pond shoreline, as well as reducing vegetation habitat complexity and diversity within and near the pond. Thus, the prioritization of aviation safety in particular locations within the City necessarily results in a reduction in the habitat quality of storm ponds for many wildlife species.

In areas of the City where aviation restrictions related to the airport do not apply (e.g., the far western and south western portion of the City), consideration should be given to replacing traditional retention ponds with a naturalized or constructed wetland. Constructed wetlands have been shown to improve water quality over conventional retention pond design, and have lower overall maintenance costs (Ross and Martz 2013). In addition, constructed wetlands create wildlife habitat if properly designed to meet specific habitat design targets. Finally, constructing storm facilities that more closely resemble wetland habitat creates long-term aesthetic benefits for residents. Given the benefits associated with naturalized storm facilities, the City of Leduc should consider introducing new standards for stormwater management facility design, where feasible. General considerations for design standards include (but are not limited to the following):

- The shoreline and slopes of naturalized stormwater facilities should vary in consistency, size, and configuration to create distinct habitat zones that reflect the potential frequency of flooding.
- Habitat zones within the facility should include the following:
    - Deep marsh: these areas should have standing water depths that range between 15 and 90 cm (Shaw and Fredine 1971). Common vegetation in this zone includes herbaceous

emergent, floating, floating-leaved, and submergent vegetation, with the major dominance by cattails and bulrushes.

  - Shallow marsh: this habitat zone should have soils that are saturated or inundated by standing water, with water depths ranging between 5 and 15 cm (Shaw and Fredine 1971). Herbaceous emergent vegetation, such as bulrushes and sedges, and floating vegetation are common in this vegetation zone.
  - Wet meadow: this zone is permanently saturated and seasonally flooded, with water depths ranging between 0 and 5 cm. Common vegetation in this zone includes sedges and water-loving grasses and forbs.
  - Riparian zone: the shores adjacent to the naturalised facility should include vegetation such as shrubs (e.g. willows), that can function to filter nutrients and sediments from surface water runoff.
- Vegetation should be interspersed throughout the facility to improve water quality, create habitat for insects and amphibians, and discourage use by species such as Canada goose. This can be achieved through placement of floating islands, or through the creation of vegetation benches that are placed at the appropriate height to encourage establishment of deep marsh emergent vegetation.

## 8.6. Natural Area Management Plans

The development of a City wide and/or natural area specific management plan is important to provide broad guidance for management objectives and strategies that should be implemented by operational staff to ensure consistent and effective management. These plans should outline objectives and strategies for the management of vegetation, wildlife and their habitats, hydrology and aquatic ecosystems, human use and safety, and public education and engagement. These plan can also outline opportunities for community education, engagement, and stewardship.

## 8.7. Weed Management Plans

At present, weed infestations within natural areas in the City of Leduc are a common occurrence, including the presence of several Noxious and Prohibited weed species, as identified under the Provincial Weed Control Act. Without proper management, these infestations can spread, and can seriously jeopardize biodiversity both within and outside of ESAs and other natural areas. For example, common tansy, a Noxious weed that is pervasive throughout the City, aggressively spreads via rhizomes and a single plant can produce approximately 50,000 seeds that are disbursed by wind, water, livestock and pets. Without proper control, this species can easily spread and will invade natural areas where it is currently absent, or only present in low abundance.

Given the threat that invasive species pose to biodiversity in natural areas, there may be a need to develop and employ site-specific natural area weed management plans in areas where weed management is an issue. These plans will ensure that areas of highest concern are targeted, and that the methods used to remove weedy species are appropriate and reflective of the ecological sensitivity of the site. For example, weeds within natural areas that contain wetlands or other aquatic habitats should not be controlled with spraying, but instead should use methods such as hand pulling, clipping of seed heads, mowing, or biological control.

## 8.8. Restoration and Monitoring Plans

In some cases, natural areas or ESAs that are retained by the City may require active restoration to improve their ecological condition. If required, restoration activities should be site-specific, and will likely be tied to other vegetation and weed management activities. Restoration may also include activities such as improvements or enhancements to riparian habitats around wetlands and along streams, or active forest management activities (e.g., under planting of young saplings) in tree stands to ensure their sustainability. Ideally, the condition of natural areas retained within the City should be monitored, evaluated, and reported on a regular basis to ensure their continued health and ecological function.

# 9.0 Conclusion

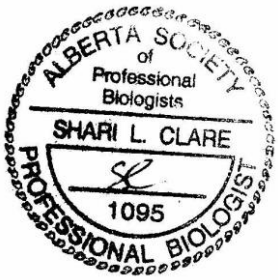
The primary objective of this project was to inventory natural areas in the City of Leduc, and identify a portfolio of Environmentally Significant Areas (ESAs) using an objective, repeatable and scientifically valid framework. To achieve this, we employed a GIS-based multi-criteria decision analysis as the foundation for quantifying and identifying natural areas, which were then assessed in the field to determine habitat condition. In total, 86 natural areas were identified, and the top ten highest-scoring natural areas were identified as Environmentally Significant Areas.

Natural areas identified as Environmentally Significant Areas cover approximately 8% of the City of Leduc, and include aquatic habitats (lake, streams, and wetlands) as well as upland tree stands. Several of the ESAs represent important wildlife corridors through the City (e.g., Deer Creek and the Whitemud Creek tributary), and others (e.g., Telford Lake, ESA 2) are very large habitat patches that likely serve as core habitat at both the local and regional scale. Together, this portfolio of Environmentally Significant Areas represents a range of habitat types that support a diversity of wildlife, and these areas are foundational to the development and conservation of a local and regional network of natural areas that will provide important ecosystem services to local communities.

Moving forward, land-use planning in the City of Leduc must consider environmental values along with the social, economic, cultural considerations that traditionally dominate municipal planning and land use decisions. This ESA study represents scientifically defensible information that can be integrated into future land-use planning decisions; however, the City should also consider developing new environmental policies and tools that can further support land use planning and decision making. These new policies and tools will ensure that important environmental areas in the City are conserved and managed for the benefit and enjoyment of citizens over the long term.

## 9.1. Closure

**This report was written by:**

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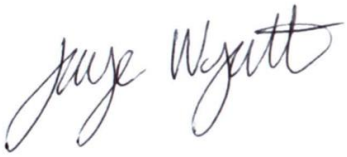

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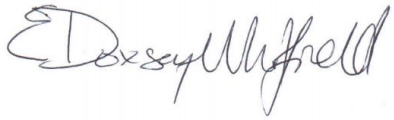

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# Appendix 1: Natural Area Scores

Table A-1. Ecological Significance Scores, Habitat Connectivity Scores, and Habitat Condition Scores for natural areas identified in the City of Leduc. Not all natural areas were assessed for condition in the field; therefore, only those that were visited have a Habitat Condition Score noted.

| Natural Area | Size (ha) | Ecological Significance Score (/100) | Habitat Connectivity Score (/100) | Habitat Condition Score (/100) | Habitat Condition Categories | | |
|---|---|---|---|---|---|---|---|
| | | | | | Plant Naturalness & Diversity | Habitat Quality | Level of Human Impacts |
| 1 | 1.9 | 42 | 59 | 99 | High | High | Minimal |
| 3 | 2.3 | 50 | 59 | 41 | Low | Moderate | Moderate |
| 4 | 4.0 | 48 | 58 | 1 | Moderate | Low | Extensive |
| 5 | 3.3 | 43 | 55 | - | - | - | - |
| 6 | 5.2 | 55 | 67 | 100 | High | High | Minimal |
| 7 | 0.9 | 52 | 75 | - | - | - | - |
| 8 | 2.3 | 44 | 51 | - | - | - | - |
| 9 | 2.4 | 43 | 52 | - | - | - | - |
| 10 | 2.1 | 50 | 57 | - | - | - | - |
| 11 | 1.1 | 36 | 55 | - | - | - | - |
| 12 | 2.7 | 54 | 60 | - | - | - | - |
| 13 | 0.9 | 45 | 62 | - | - | - | - |
| 14 | 0.7 | 46 | 59 | - | - | - | - |
| 15 | 0.9 | 38 | 59 | - | - | - | - |
| 18 | 3.0 | 50 | 60 | - | - | - | - |
| 19 | 2.2 | 52 | 58 | - | - | - | - |
| 20 | 0.8 | 33 | 50 | - | - | - | - |
| 21 | 2.2 | 49 | 52 | - | - | - | - |
| 22 | 1.7 | 48 | 55 | 24 | Moderate | Low | Extensive |
| 23 | 2.4 | 45 | 47 | - | - | - | - |
| 24 | 0.6 | 45 | 52 | - | - | - | - |
| 30 | 0.5 | 43 | 52 | - | - | - | - |
| 31 | 11.7 | 59 | 59 | 99 | High | High | Minimal |
| 32 | 1.0 | 41 | 57 | - | - | - | - |
| 33 | 0.8 | 43 | 57 | - | - | - | - |
| 34 | 1.8 | 40 | 49 | - | - | - | - |
| 35 | 0.6 | 44 | 67 | 75 | Moderate | Moderate | Minimal |
| 36 | 1.1 | 51 | 61 | 65 | Moderate | Moderate | Moderate |
| 38 | 0.6 | 45 | 55 | - | - | - | - |
| 39 | 1.1 | 45 | 52 | - | - | - | - |
| 41 | 2.2 | 42 | 52 | - | - | - | - |
| 42 | 2.4 | 53 | 62 | 44 | Moderate | Low | Moderate |
| 43 | 1.9 | 51 | 44 | - | - | - | - |
| 44 | 0.8 | 45 | 64 | 18 | Low | Low | Moderate |
| 45 | 27.8 | 58 | 71 | - | - | - | - |
| 47 | 7.3 | 59 | 67 | 85 | High | High | Minimal |
| 48 | 0.7 | 38 | 60 | - | - | - | - |
| 50 | 0.6 | 44 | 50 | - | - | - | - |
| 51 | 1.5 | 38 | 50 | - | - | - | - |
| 52 | 49.5 | 74 | 54 | 52 | Moderate | Moderate | Moderate |
| 53 | 0.6 | 36 | 57 | - | - | - | - |
| 54 | 0.9 | 37 | 58 | - | - | - | - |
| 55 | 0.7 | 44 | 50 | - | - | - | - |

*Continued …*

Table A-1 *Continued*. Ecological Significance Scores, Habitat Connectivity Scores, and Habitat Condition Scores for natural areas identified in the City of Leduc. Not all natural areas were assessed for condition in the field; therefore, only those that were visited have a Habitat Condition Score noted.

| Natural Area | Size (ha) | Ecological Significance Score (/100) | Habitat Connectivity Score (/100) | Habitat Condition Score (/100) | Habitat Condition Categories | | |
|---|---|---|---|---|---|---|---|
| | | | | | Plant Naturalness & Diversity | Habitat Quality | Level of Human Impacts |
| 57 | 1.0 | 41 | 54 | - | - | - | - |
| 58 | 0.6 | 39 | 53 | - | - | - | - |
| 60 | 1.2 | 37 | 56 | - | - | - | - |
| 61 | 7.1 | 56 | 61 | 77 | Moderate | High | Moderate |
| 64 | 1.0 | 45 | 56 | - | - | - | - |
| 65 | 2.2 | 45 | 50 | - | - | - | - |
| 66 | 4.3 | 57 | 59 | 88 | Moderate | High | Minimal |
| 67 | 1.3 | 49 | 51 | - | - | - | - |
| 69 | 0.8 | 44 | 67 | 27 | Low | Low | Moderate |
| 70 | 148.0 | 84 | 61 | 63 | Moderate | Moderate | Moderate |
| 72 | 1.0 | 44 | 51 | - | - | - | - |
| 73 | 3.1 | 52 | 58 | 39 | Low | Moderate | Moderate |
| 74 | 0.6 | 49 | 50 | - | - | - | - |
| 75 | 3.9 | 47 | 50 | - | - | - | - |
| 76 | 5.2 | 48 | 57 | - | - | - | - |
| 77 | 1.1 | 45 | 47 | - | - | - | - |
| 78 | 2.3 | 41 | 47 | - | - | - | - |
| 79 | 1.4 | 46 | 65 | 79 | Moderate | Moderate | Minimal |
| 80 | 4.0 | 47 | 47 | - | - | - | - |
| 81 | 2.3 | 48 | 56 | - | - | - | - |
| 82 | 0.6 | 47 | 56 | - | - | - | - |
| 83 | 1.8 | 50 | 61 | - | - | - | - |
| 84 | 64.2 | 60 | 60 | 54 | Moderate | Moderate | Moderate |
| 85 | 6.8 | 50 | 56 | 26 | Low | Low | Extensive |
| 86 | 7.4 | 49 | 48 | - | - | - | - |
| 87 | 2.4 | 43 | 48 | - | - | - | - |
| 88 | 0.8 | 35 | 50 | - | - | - | - |
| 89 | 2.0 | 41 | 48 | - | - | - | - |
| 90 | 2.2 | 34 | 46 | - | - | - | - |
| 91 | 4.2 | 35 | 50 | - | - | - | - |
| 92 | 2.6 | 43 | 53 | - | - | - | - |
| 93 | 1.7 | 44 | 49 | - | - | - | - |
| 94 | 1.1 | 37 | 52 | - | - | - | - |
| 95 | 0.8 | 46 | 49 | 9 | Low | Low | Extensive |
| 96 | 1.4 | 48 | 48 | - | - | - | - |
| 97 | 0.4 | 44 | 53 | - | - | - | - |
| 98 | 0.6 | 33 | 56 | - | - | - | - |
| 99 | 1.5 | 52 | 75 | 64 | Moderate | Moderate | Moderate |
| 100 | 0.9 | 41 | 52 | - | - | - | - |
| 101 | 1.1 | 43 | 72 | 52 | Moderate | Moderate | Moderate |
| 102 | 1.0 | 41 | 48 | - | - | - | - |
| 200 | 0.7 | 49 | 56 | - | - | - | - |
| 249 | 0.9 | 47 | 60 | - | - | - | - |

# Appendix 2: Habitat Condition Rapid Assessment Method

# City of Leduc Natural Area Habitat Condition Rapid Assessment Method

FIELD DATASHEETS

**Prepared for:**
City of Leduc

October 13, 2016

**Prepared by Fiera Biological Consulting**

200, 10318–82 Avenue | Edmonton, AB T6E 1Z8 | Tel: (780) 466.6554 | Fax: (780) 466.9134 | W: fieraconsulting.ca

**Habitat Condition Rapid Assessment Method**
**City of Leduc Natural Areas**

Natural Area ID: _____ Survey Date: _____ Observer: _____

| **General Site Description (Consider land-use, disturbance, nativeness, invasive species, rare** |
|---|
| |
| |
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| |

| **Photos (**Note pic #, gps location, description) |
|---|
| |
| |
| |
| |

| **If forested, record DBH (cm) for 5 representative trees within the natural area** | | | | |
|---|---|---|---|---|
| 1. | 2. | 3. | 4. | 5. |

| **For streams: reccord bankfull width in 3 locations that are representative of the reach (cm)** | | |
|---|---|---|
| 1. | 2. | 3. |

| **Record bankfull depth in 3 locations that are representative of the reach (cm)** | | |
|---|---|---|
| 1. | 2. | 3. |

| **Dominant Trees** | **Dominant Shrubs** | **Dominant Forbs** | **Dominant Grass/Graminoids** |
|---|---|---|---|
| 1. | 1. | 1. | 1. |
| 2. | 2. | 2. | 2. |

**Culverts or bridges?** – Describe the condition of each bridge or culvert in the polygon(s)?

| **Type** | | **Diameter** | **Condition? (perched, damaged, etc.)** | **Wpt** | **Photo #** |
|---|---|---|---|---|---|
| ☐Bridge | ☐Culvert | | | | |
| ☐Bridge | ☐Culvert | | | | |
| ☐Bridge | ☐ Culvert | | | | |

**Plant Species List** – Record all plant species encountered within the natural area

**Wildlife Observations: List and count species heard or observed** (Mammals, birds, herpetiles). For any significant features (e.g., stick nest or den), record waypoint:

**Wildlife Presence and Habitat Features** – Assign a frequency for all of the following within the

| Feature | Absent | Rare | Occasional | Common |
|---|---|---|---|---|
| Snags | ☐ | ☐ | ☐ | ☐ |
| Snags with cavities | ☐ | ☐ | ☐ | ☐ |
| Bedding sites | ☐ | ☐ | ☐ | ☐ |
| Browse by ungulates | ☐ | ☐ | ☐ | ☐ |
| Beaver dam | ☐ | ☐ | ☐ | ☐ |

# UPLAND HABITAT METRICS

☐ Upland not present

IF NO UPLAND PRESENT, SKIP TO RIPARIAN METRICS.

**Nativity** – For each of the following growth form layers present, estimate the proportion of the **canopy aerial cover** that is comprised of **native species.**

| Growth Form | 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% | Not Present |
|---|---|---|---|---|---|---|---|
| Trees | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Shrubs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Forbs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Grasses | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Non-native Grass Species Cover** – Estimate the **canopy aerial cover** of each of the following **non-native grass** found within the grassland habitat:

| Grass Species | 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% | No Grass |
|---|---|---|---|---|---|---|---|
| *Agropyron cristatum* (Crested wheatgrass) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Bromus inermis* (Smooth brome) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Poa pratensis* (Kentucky bluegrass) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |

**Non-native Shrub Cover** – Estimate the **canopy aerial cover** of each of the following **non-native shrubs** found within the forest habitat:

| Shrubs Encountered: | 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% | No Shrubs |
|---|---|---|---|---|---|---|---|
| *Cotoneaster* sp. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Caragana arborescens* (Siberian pea-tree) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Syringa vulgaris* (lilac) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Lonicera tartarica* (Tatarica honeysuckle) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |

## FOREST HABITAT METRICS ***If forested habitat is not present, skip to Human Intrusions section***

**Forest Community Intactness** – Place a check (✓) beside **each** of the species that were observed in forest polygon during the survey:

☐ *Actaea rubra* ☐ *Disporum trachycarpum* ☐ *Lathyrus ochroleucus* ☐ *Pyrola* spp

☐ *Anemone* spp. ☐ *Lathyrus venosus* ☐ *Lonicera dioica*

**Forest Vertical Structure** – Are these **forest layers** (native and non-native) present and have they been impacted by human use or activity?

| Forest Layer | Intact | Partially Intact | Impacted | Absent |
|---|---|---|---|---|
| Overstory | ☐ | ☐ | ☐ | ☐ |
| Understory | ☐ | ☐ | ☐ | ☐ |
| Tall Shrub | ☐ | ☐ | ☐ | ☐ |
| Short Shrub | ☐ | ☐ | ☐ | ☐ |
| Forb | ☐ | ☐ | ☐ | ☐ |
| Grass | ☐ | ☐ | ☐ | ☐ |
| Lichen and Mosses | ☐ | ☐ | ☐ | ☐ |

**Forest Succession** – What is the abundance of the following features in the forest habitat?

| Forest Features | Absent | Rare | Occasional | Common |
|---|---|---|---|---|
| Seedling/young trees (<2m) | ☐ | ☐ | ☐ | ☐ |
| Coarse Woody Debris (CWD) | ☐ | ☐ | ☐ | ☐ |
| Snags | ☐ | ☐ | ☐ | ☐ |

**What is the approximate age of the majority of the treed area?**

☐ Pole/sapling ☐ Young ☐ Mature ☐ Old Forest

**What is the approx. age of oldest trees within the polygon?**

☐ <20 yrs ☐ 20 to 40 yrs ☐ 40 to 60 yrs ☐ 60-80 yrs ☐ >80 yrs

## HUMAN INTRUSIONS

**Anthropogenic Use** – Estimate the combined proportion of the polygon that has been negatively affected by anthropogenic use (e.g. trails, grazing, mowing, tree clearing, draining/ditching, infrastructure, etc):

☐<5% ☐5 to 10% ☐10 to 25% ☐26 to 50% ☐51 to 75% ☐>75%

**Anthropogenic Impact** – Estimate the abundance of the following anthropogenic impacts:

| **Anthropogenic Impacts** | **Absent** | **Rare** | **Occasional** | **Common** |
|---|---|---|---|---|
| Grazing by domestic livestock | ☐ | ☐ | ☐ | ☐ |
| Dumping | ☐ | ☐ | ☐ | ☐ |
| Tree clearing/Vegetation clearing | ☐ | ☐ | ☐ | ☐ |
| Draining/ditching | ☐ | ☐ | ☐ | ☐ |
| Access roads | ☐ | ☐ | ☐ | ☐ |
| Fences | ☐ | ☐ | ☐ | ☐ |
| **Paths** | | | | |
| Paved foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| Gravel foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| Dirt foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| **Structures** | | | | |
| Small structures (e.g., picnic tables, fire pits, etc.) | ☐ | ☐ | ☐ | ☐ |
| Large structures (e.g., foot bridges, parking lot, buildings) | ☐ | ☐ | ☐ | ☐ |
| Utility structures | ☐ | ☐ | ☐ | ☐ |
| Other (specify): | ☐ | ☐ | ☐ | ☐ |
| Other (specify): | ☐ | ☐ | ☐ | ☐ |

**Restoration Potential** – Will changes in management practices improve the overall condition of the natural area (e.g. grazing elimination to allow the understory to regrow; effective weed control measures etc.)?

| | |
|---|---|
| ☐ | No disturbance |
| ☐ | Easy to restore - Minimal impacts |
| ☐ | Difficult to restore - Major impacts |

**Weediness** – **In general**, describe the **OCCURRENCE** of invasive non-native species or noxious/prohibited noxious species detected within the riparian area

☐Absent ☐Rare ☐Occasional ☐Common

**Weediness** – **In general**, describe the **DISTRIBUTION** of invasive non-native species or noxious/prohibited noxious species detected within the riparian area

| | |
|---|---|
| ☐ | Rare or occasional |
| ☐ | Distinct clumps within polygon |
| ☐ | Sparse, uniform distribution |
| ☐ | Dense, continuous distribution |

# STREAM HABITAT METRICS

☐ Stream not present

IF NO STREAM HABITAT PRESENT, SKIP TO LAKE METRICS.

**Stream Characteristics** – Describe the stream within the reach

| | | |
|---|---|---|
| Bed Substrate | ☐ Fine (<2mm)<br>☐ Small gravel (2-16mm) | ☐ Large gravel (17-64mm)<br>☐ Cobble (65-256mm) |

**Bank Stability** – Describe the stability of the banks

| **Bank** | **Unstable**<br>Slumping evident, exposed soils, silt deposition | **Low Stability**<br><50% cover by vegetation or cobble | **Moderate Stability**<br>50-90% cover by veg or cobble | **Stable**<br>>90% cover by veg or cobble |
|---|---|---|---|---|
| Left Bank | ☐ | ☐ | ☐ | ☐ |
| Right Bank | ☐ | ☐ | ☐ | ☐ |

**Bank Undercutting** – Estimate the proportion of undercutting along each bank within the reach

| **Bank** | **None** | **Low**<br>0-24% undercutting | **Moderate**<br>25-50% undercutting | **High**<br>51-100% undercutting |
|---|---|---|---|---|
| Left Bank | ☐ | ☐ | ☐ | ☐ |
| Right Bank | ☐ | ☐ | ☐ | ☐ |

**Stream Vegetation Cover** – Estimate the proportion of the stream that is covered by overhanging vegetation along each bank within the reach

| **Bank** | **None** | **Low**<br>0-24% overhanging vegetation | **Moderate**<br>25-50% overhanging vegetation | **High**<br>51-100% overhanging vegetation |
|---|---|---|---|---|
| Left Bank | ☐ | ☐ | ☐ | ☐ |
| Right Bank | ☐ | ☐ | ☐ | ☐ |

**Riparian Vegetation Stage** – The level of maturity and structure of the **dominant** vegetative cover within 10 m

**Left Bank:**

| | Stage | Description |
|---|---|---|
| ☐ | Initial | Non-vegetated or initial stage following disturbance (< 5% cover) |
| ☐ | Native Graminiod/Forb | Cover by native grass, sedge, rush, forb |
| ☐ | Other Graminiod/Forb | Cover by non-native grass, sedge, rush, forb |
| ☐ | Shrub | Shrub / herb stage, less than 10% tree cover |
| ☐ | Pole-sapling | Trees less than 15 – 20 years old overtopping shrubs |
| ☐ | Young Forest | Self thinning is evident and the forest canopy is differentiated into distinct layers, stand age is 30 – 80 years |
| ☐ | Mature Forest | Forest with canopy gaps and well developed understory |
| ☐ | Crop | |
| ☐ | Pasture | |

**Right Bank:**

| | Stage | Description |
|---|---|---|
| ☐ | Initial | Non-vegetated or initial stage following disturbance (less than 5% cover) |
| ☐ | Native Graminiod/Forb | Cover by native grass, sedge, rush, forb |
| ☐ | Other Graminiod/Forb | Cover by non-native grass, sedge, rush, forb |
| ☐ | Shrub | Shrub / herb stage, less than 10% tree cover |
| ☐ | Pole-sapling | Trees less than 15 – 20 years old overtopping shrubs |
| ☐ | Young Forest | Self thinning is evident and the forest canopy is differentiated into distinct layers, stand age is 30 – 80 years |
| ☐ | Mature Forest | Forest with canopy gaps and well developed understory |
| ☐ | Crop | |
| ☐ | Pasture | |

**Riparian Vegetation Nativity** – For each of the following growth form layers present, estimate the proportion of the **canopy aerial cover** that is comprised of **native species** within 10 m of the stream.

| Growth Form | Growth Form Not Present | 0% native | >0 to 5% native | 6 to 25% native | 26 to 50% native | 51 to 75% native | >75% native |
|---|---|---|---|---|---|---|---|
| Trees | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Shrubs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Forbs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Graminoid | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Non-native Graminoid Species Cover** – Estimate the **canopy aerial cover** of each of the following **non-native grass** found within 10 m of the stream.

| Grass Species | 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% | No Grass |
|---|---|---|---|---|---|---|---|
| *Agropyron cristatum* (Crested wheatgrass) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Bromus inermis* (Smooth brome) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Poa pratensis* (Kentucky bluegrass) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Phalaris spp.* | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |

**Non-native Shrub Cover** – Estimate the **canopy aerial cover** of each of the following **non-native shrubs** found within 10 m of the stream:

| Shrubs Encountered: | 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% | No Shrubs |
|---|---|---|---|---|---|---|---|
| *Cotoneaster* sp. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Caragana arborescens* (Siberian pea-tree) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Syringa vulgaris* (lilac) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Lonicera tartarica* (Tatarica honeysuckle) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |

## TREE COVER

Are there trees present within 10m of the stream? ☐ Yes ☐ ☐ No (if no, skip to Human Intrusions)

**Crown Closure** – Estimate the **canopy aerial cover of all trees present** within 10 m of the stream

| 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Forest Vertical Structure** – Are these **forest layers** (native and non-native) present within 10m of the stream, and have they been impacted by human use or activity?

| Forest Layer | Intact | Partially Intact | Impacted | Absent |
|---|---|---|---|---|
| Overstory | ☐ | ☐ | ☐ | ☐ |
| Understory | ☐ | ☐ | ☐ | ☐ |
| Tall Shrub | ☐ | ☐ | ☐ | ☐ |
| Short Shrub | ☐ | ☐ | ☐ | ☐ |
| Forb | ☐ | ☐ | ☐ | ☐ |
| Grass | ☐ | ☐ | ☐ | ☐ |
| Lichen and Mosses | ☐ | ☐ | ☐ | ☐ |

**Forest Succession** – What is the abundance of the following features within 10 m of the stream?

| Forest Features | Absent | Rare | Occasional | Common |
|---|---|---|---|---|
| Seedling/young trees (<2m) | ☐ | ☐ | ☐ | ☐ |
| Coarse Woody Debris (CWD) | ☐ | ☐ | ☐ | ☐ |
| Snags | ☐ | ☐ | ☐ | ☐ |

**What is the approximate age of the majority of the treed area within 10m of the stream?**

☐ Pole/sapling ☐ Young ☐ Mature ☐ Old

**What is the approx. age of oldest trees within the polygon?**

☐ <20 yrs ☐ 20 to 40 yrs ☐ 40 to 60 yrs ☐ 60-80 yrs ☐ >80 yrs

Does native vegetation cover extend outside the 10 m zone?

☐ Yes ☐ No

## HUMAN INTRUSIONS

**Anthropogenic Use** – Estimate the combined proportion within 10 m that has been negatively affected by anthropogenic use (e.g. trails, grazing, mowing, tree clearing, draining/ditching, infrastructure):

☐ <5% ☐ 5 to 10% ☐ 10 to 25% ☐ 26 to 50% ☐ 51 to 75% ☐ >75%

**Anthropogenic Impact** – Estimate the abundance of the following anthropogenic impacts within 10 m of the stream:

| Anthropogenic Impacts | Absent | Rare | Occasional | Common |
|---|---|---|---|---|
| Grazing by domestic livestock | ☐ | ☐ | ☐ | ☐ |
| Dumping | ☐ | ☐ | ☐ | ☐ |
| Tree clearing/Vegetation clearing | ☐ | ☐ | ☐ | ☐ |
| Draining/ditching | ☐ | ☐ | ☐ | ☐ |
| Access roads | ☐ | ☐ | ☐ | ☐ |
| **Paths** | | | | |
| Paved foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| Gravel foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| Dirt foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| **Structures** | | | | |
| Small structures (e.g., picnic tables, fire pits, etc.) | ☐ | ☐ | ☐ | ☐ |
| Large structures (e.g., foot bridges, parking lot, buildings) | ☐ | ☐ | ☐ | ☐ |
| Utility structures | ☐ | ☐ | ☐ | ☐ |
| Other (specify): | ☐ | ☐ | ☐ | ☐ |
| Other (specify): | ☐ | ☐ | ☐ | ☐ |

**Restoration Potential** – Will changes in management practices improve the overall condition of the natural area (e.g. grazing elimination to allow the understory to regrow; effective weed control measures etc.)?

- ☐ No disturbance
- ☐ Easy to restore - Minimal impacts
- ☐ Difficult to restore - Major impacts

**Weediness** – **In general**, describe the **OCCURRENCE** of invasive non-native species or noxious/prohibited noxious species detected within the riparian area

☐ Absent ☐ Rare ☐ Occasional ☐ Common

**Weediness** – **In general**, describe the **DISTRIBUTION** of invasive non-native species or noxious/prohibited noxious species detected within the riparian area

- ☐ Rare or occasional
- ☐ Distinct clumps within polygon
- ☐ Sparse, uniform distribution
- ☐ Dense, continuous distribution

# LAKE HABITAT METRICS

☐ Lake not present

SKIP IF NO LAKE HABITAT IS PRESENT

**Shore Characteristics** – Describe the shore within the reach

| | | |
|---|---|---|
| Bed Substrate | ☐ Fine (<2mm)<br>☐ Small gravel (2-16mm) | ☐ Large gravel (17-64mm)<br>☐ Cobble (65-256mm)<br>☐ Boulder (>256mm) |
| Vegetation Cover | ☐ None<br>☐ 0-25% | ☐ 25-50%<br>☐ 50-100% |

**Shore Stability** – Describe the stability of the shore

| | | | |
|---|---|---|---|
| ☐ **Unstable**<br>Slumping evident, exposed soils, silt deposition | ☐ **Low Stability**<br><50% cover by vegetation or cobble | ☐ **Moderate Stability**<br>50-90% cover by veg or cobble | ☐ **Stable**<br>>90% cover by veg or cobble |

**Lake Shore Vegetation Cover** – Estimate the proportion of the shore that is covered by overhanging vegetation within the reach

| | | | |
|---|---|---|---|
| ☐ **None** | ☐ **Low**<br>0-24% overhanging vegetation | ☐ **Moderate**<br>25-50% overhanging vegetation | ☐ **High**<br>51-100% overhanging vegetation |

**Riparian Vegetation Stage** – The level of maturity & structure of the **dominant** vegetative cover within 10 m

| | **Stage** | **Description** |
|---|---|---|
| ☐ | Initial | Non-vegetated or initial stage following disturbance (less than 5% cover) |
| ☐ | Native Graminiod/Forb | Cover by native grass, sedge, rush, forb |
| ☐ | Other Graminiod/Forb | Cover by non-native grass, sedge, rush, forb |
| ☐ | Shrub | Shrub / herb stage, less than 10% tree cover |
| ☐ | Pole-sapling | Trees less than 15 – 20 years old overtopping shrubs |
| ☐ | Young Forest | Self thinning is evident and the forest canopy is differentiated into distinct layers, stand age is 30 – 80 years |
| ☐ | Mature Forest | Forest with canopy gaps and well developed understory |
| ☐ | Crop | |
| ☐ | Pasture | |

**Aquatic vegetation cover –** Estimate the aerial cover of open water area covered by each growth form

| Growth Form | Growth Form Not Present | 0% cover | >0 to 5% cover | 6 to 25% cover | 26 to 50% cover | 51 to 75% cover | >75% cover |
|---|---|---|---|---|---|---|---|
| Algae | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Lemna* (duckweed) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Other _____ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Blue-Green Algae** – Are BLUE-GREEN ALGAE present? ☐ Yes ☐ No

**Vegetation Nativity** – For each of the following growth form layers present, estimate the proportion of the **canopy aerial cover** that is comprised of **native species** within 10 m of shore.

| Growth Form | Growth Form Not Present | 0% native | >0 to 5% native | 6 to 25% native | 26 to 50% native | 51 to 75% native | >75% native |
|---|---|---|---|---|---|---|---|
| Trees | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Shrubs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Forbs | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| Graminoid | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Non-native graminoid Species Cover** – Estimate the **canopy aerial cover** of each of the following **non-native grass** found within 10 m of shore.

| Grass Species | 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% | No Grass |
|---|---|---|---|---|---|---|---|
| *Agropyron cristatum* (Crested wheatgrass) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Bromus inermis* (Smooth brome) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Poa pratensis* (Kentucky bluegrass) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Phalaris spp.* | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |

**Non-native Shrub Cover** – Estimate the **canopy aerial cover** of each of the following **non-native shrubs** found within 10 m of the shore:

| Shrubs Encountered: | 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% | No Shrubs |
|---|---|---|---|---|---|---|---|
| *Cotoneaster* sp. | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| *Caragana arborescens* (Siberian pea-tree) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Syringa vulgaris* (lilac) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |
| *Lonicera tartarica* (Tatarica honeysuckle) | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | |

## TREE COVER

Are there trees present within 10m of the shore? ☐ Yes ☐ No (if no, skip to Human Intrusions)

**Crown Closure** – Estimate the **canopy aerial cover of all trees present** within 10 m of the shore.

| 0% | >0 to 5% | 6 to 25% | 26 to 50% | 51 to 75% | >75% |
|---|---|---|---|---|---|
| ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |

**Forest Vertical Structure** – Are these **forest layers** (native and non-native) present within 10m of the stream, and have they been impacted by human use or activity?

| Forest Layer | Intact | Partially Intact | Impacted | Absent |
|---|---|---|---|---|
| Overstory | ☐ | ☐ | ☐ | ☐ |
| Understory | ☐ | ☐ | ☐ | ☐ |
| Tall Shrub | ☐ | ☐ | ☐ | ☐ |
| Short Shrub | ☐ | ☐ | ☐ | ☐ |
| Forb | ☐ | ☐ | ☐ | ☐ |
| Grass | ☐ | ☐ | ☐ | ☐ |
| Lichen and Mosses | ☐ | ☐ | ☐ | ☐ |

**Forest Succession** – What is the abundance of the following features within 10 m of the shore?

| Forest Features | Absent | Rare | Occasional | Common |
|---|---|---|---|---|
| Seedling/young trees (<2m) | ☐ | ☐ | ☐ | ☐ |
| Coarse Woody Debris (CWD) | ☐ | ☐ | ☐ | ☐ |
| Snags | ☐ | ☐ | ☐ | ☐ |

**What is the approximate age of the majority of the treed area within 10m of the shore?**

☐ Pole/sapling ☐ Young ☐ Mature ☐ Old

**What is the approx. age of oldest trees within the polygon?**

☐ <20 yrs ☐ 20 to 40 yrs ☐ 40 to 60 yrs ☐ 60-80 yrs ☐ >80 yrs

**Does native vegetation cover extend outside the 10 m zone?**

☐ Yes ☐ No

## HUMAN INTRUSIONS

**Anthropogenic Use** – Estimate the combined proportion within 10 m that has been negatively affected by anthropogenic use (e.g. trails, grazing, mowing, tree clearing, draining/ditching, infrastructure):

☐<5% ☐5 to 10% ☐10 to 25% ☐26 to 50% ☐51 to 75% ☐>75%

**Anthropogenic Impact** – Estimate the abundance of the following impacts within 10 m of the stream:

| **Anthropogenic Impacts** | **Absent** | **Rare** | **Occasional** | **Common** |
|---|---|---|---|---|
| Grazing by domestic livestock | ☐ | ☐ | ☐ | ☐ |
| Dumping | ☐ | ☐ | ☐ | ☐ |
| Tree clearing/Vegetation clearing | ☐ | ☐ | ☐ | ☐ |
| Draining/ditching | ☐ | ☐ | ☐ | ☐ |
| Access roads | ☐ | ☐ | ☐ | ☐ |
| **Paths** | | | | |
| Paved foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| Gravel foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| Dirt foot and bike paths | ☐ | ☐ | ☐ | ☐ |
| **Structures** | | | | |
| Small structures (e.g., picnic tables, fire pits, etc.) | ☐ | ☐ | ☐ | ☐ |
| Large structures (e.g., docks, foot bridges, parking lot, buildings) | ☐ | ☐ | ☐ | ☐ |
| Utility structures | ☐ | ☐ | ☐ | ☐ |
| Other (specify): | ☐ | ☐ | ☐ | ☐ |
| Other (specify): | ☐ | ☐ | ☐ | ☐ |

**Restoration Potential** – Will changes in management practices improve the overall condition of the natural area (e.g. grazing elimination to allow the understory to regrow; effective weed control measures etc.)?

☐ No disturbance
☐ Easy to restore - Minimal impacts
☐ Difficult to restore - Major impacts

**Weediness** – **In general**, describe the **OCCURRENCE** of invasive non-native species or noxious/prohibited noxious species detected within the riparian area

☐ Absent ☐ Rare ☐ Occasional ☐ Common

**Weediness** – **In general**, describe the **DISTRIBUTION** of invasive non-native species or noxious/prohibited noxious species detected within the shore zone.

☐ Rare or occasional
☐ Distinct clumps
☐ Sparse, uniform distribution
☐ Dense, continuous distribution

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