



## **CHAPTER 2.0**

### **METHODS**



## 2.0 METHODS

### 2.1 Overview

This State of Natural Areas Project has resulted in creation of eight maps. While each map is unique, a generalized approach was common to creation of them all. The general approach included the following:

- Selection of base reference layers and features.
  - For the Edmonton Natural Areas and general resource map series, these included:
    - infrastructure and physical features (roads, railways, towns, waterbodies and the NSRV top-of-bank outside the City limits),
    - political/policy boundaries (municipal boundaries, Indian reserves, the provincial Transportation Utility Corridor (TUC), Lois Hole Centennial Provincial Park, the North Saskatchewan River Valley Area Redevelopment Plan boundary), and
    - a study area boundary extending roughly two miles around the current City limits, approximating the extent of Edmonton's Inter-municipal Planning Boundary.
  - For the regional Natural Areas map, these included:
    - infrastructure and political/policy boundaries as above (except railways),
    - a regional study area boundary defined as the three sub-basins of the NSR watershed that overlap with Edmonton, and
- Incorporation of topical data layers (e.g., map subject) to each map.
- Validation and refinement of data layers.
- Refinement of map content and presentation through client review.
- Additional refinement based on map review by an Internal Focus Group representative of the general public to confirm message presentation and readability of the maps.

A listing of the data, their sources and any licensing restrictions applicable to the set of data used in this project is provided in Appendix A; actual electronic copies of all created GIS datasets are also provided as a deliverable of this Objective.

The specific methods used to develop the topical data layers for each map series are described in the sections below.

### 2.2 *Edmonton Natural Areas Map Series*

The Edmonton Natural Areas map series was created to document the current status of Edmonton's natural areas and to show the natural areas in the river valley in the same context as the tablelands sites. The maps were to specifically answer three questions related to natural areas:



- What natural areas are currently present in the City of Edmonton, including throughout the river valley system?
- How many natural areas previously recognized as Environmentally Sensitive Areas (ESAs) and Significant Natural Areas (SNAs) have been wholly or partially lost since the 1993 inventory?
- To what extent have Edmonton's natural areas been protected? Or conversely, what opportunities for protection still exist? Protection refers to possessing official status as a Natural Area designated to be retained on the landscape within the context of development. Protected status can be achieved through several means that are discussed in subsequent relevant sections.

Three maps were created:

- Edmonton's Natural Areas in 2005
- Environmentally Sensitive Areas (ESAs) and Significant Natural Areas (SNAs) Lost Since 1993
- Protection Status of Edmonton's Natural Areas (2006)

Following are the steps taken to develop the data layers required to answer the above-noted questions in map format.

### *2.2.1 Natural Areas Mapping Review and Update*

As a first step in the analysis, we examined the City's GIS file from the 1993 natural areas inventory (Geowest 1993). That inventory recognized three natural site categories: Significant Natural Areas (SNAs), Environmentally Sensitive Areas (ESAs) and Natural Areas. SNAs and ESAs, were, by definition, larger than 1.0 hectare in size and had been delineated as polygons representative of the sites' physical boundaries. The third category, Natural Areas, had been identified as point features rather than as polygon features. Our analysis, which involved comparing the digital files to April 2005 aerial photography, resulted in three significant findings: in many cases the boundaries of ESAs and SNAs had changed as a result of clearing or filling activities or perhaps vegetation expansion; in some cases several separate Natural Areas (i.e., point features) represented what 2005 aerial photography showed to be a single, larger natural feature (e.g., a woodland); and, some naturally-vegetated areas that were equal to or larger than 1.0 ha (and therefore potentially SNAs or ESAs) had not been included in the original inventory. These findings were deemed to be important for accurate representation of the current inventory and for the upcoming connectivity analysis and overall conservation planning exercise.

With that in mind, the City requested that our current analysis and mapping capture the following: previously identified ESAs and SNAs, and, all other tableland and river valley natural areas (i.e. areas supporting natural vegetation) equal to or larger than 1.0 hectare, including lands within the more central, developed portion of the City (i.e., lands not covered by the 1993 inventory). Furthermore, the City determined that the new natural areas map series should combine the previously identified SNAs, ESAs and the newly digitized Natural Areas greater



than one hectare into one, new, Natural Areas category. While the finer categories created in 1993 were useful in earlier natural site management, recent changes in the City's management approach, including integration of the river valley resources as natural areas, have made the distinctions irrelevant.

The next step was to update the boundaries of previously delineated ESAs and SNAs from the 1993 inventory. By referencing April 2005 aerial photography we redefined the 1993 boundaries. For the most part, refinements reduced the size of those areas. (The reduction was likely a reflection of recent clearing and filling activity). In some cases, sites had been completely developed and those sites were deleted from the dataset. However, in some cases, the refinements lead to slight increases in the size of sites, this appeared to amount to a correction of mapping errors from the initial inventory but may have been the result of vegetation expansion. The next step, the Natural Areas digitizing exercise used April 2005 aerial photography in 1-m resolution digital format as the source for spatial referencing. Wherever possible, previously identified Natural Areas were given the same site code as in the original inventory. When multiple Natural Areas were combined, the site code with the lowest number was used (e.g., NW1 would represent a site previously identified with points labeled NW1, NW13, NW60). The other site codes were retained in the dataset as an original reference. Newly-identified Natural Areas were not given any site code.

To address the integration of tableland and river valley Natural Areas, it was necessary to derive a comparable dataset of Natural Areas within the NSRV. Although the Ribbon of Green categorized river valley lands into three different land use categories, no previous studies had ever specifically delineated natural areas (i.e., areas supporting native, unmanicured vegetation) from other land uses within the river valley. The Ribbon of Green also did not cover the entire river valley and ravine system. As such, it was necessary to create such a layer for this mapping exercise. Rather than simply using the NSRV Area Redevelopment Plan (ARP) to depict the extent of natural lands within the river valley system, we differentiated naturally-vegetated lands from developed areas and manicured parklands within the ARP boundary. While the approach to mapping the tableland Natural Areas was essentially an inclusive process, the approach to mapping similar areas within the NSRV and ravine system was exclusive. We assumed that all land within the river valley and ravines (i.e., within the NSRV ARP boundary) was natural, *then* extracted areas known to be non-natural from the ARP lands. Non-natural areas were defined as built-up areas, areas of manicured parkland, agricultural lands, gravel extraction operations and areas of exposed soils. Following this exclusive process, all lands that remained were deemed to support natural vegetation (and areas smaller than 1.0 ha were eliminated). Extensive referencing with April 2005 aerial photography confirmed that Natural Areas within the NSRV had been correctly identified.

The combination of the updated tableland Natural Areas file and the newly created river valley and ravine system Natural Areas file is displayed as the Edmonton Natural Areas in 2005 map.



### 2.2.2 Depiction of Losses Since 1993

Following the ESA and SNA boundary refinements, we compared the original, 1993 ESA and SNA boundaries to the updated 2005 boundaries to determine the losses that had occurred to the inventoried sites since 1993. Losses were shown by overlapping two data layers: the base layer (shown in red) represents the boundaries of the sites as they were delineated by Geowest in 1993; the second layer (colored in green) shows the refined boundaries interpreted from 2005 aerial photography as described above. When green is overlain on red, areas of red that are not covered by green represent portions of sites that, through various means, have been lost since 1993. Showing both layers results in the losses map: Environmentally Sensitive Areas (ESAs) and Significant Natural Areas (SNAs) Lost Since 1993.

### 2.2.3 Depicting Protection Status

Accurately representing all Natural Areas present on the landscape in 2005 (the most recent available aerial photograph), was considered a critical first step in mapping their current protection status. That newly created map, Edmonton's Natural Areas in 2005, was used as a base to build the map depicting the protection status of Edmonton's Natural Areas. Much information on the protection status of Natural Areas was provided by the City's Office of Natural Areas.. That information was linked to files used within the Natural Areas map. At a very general level, this link made it possible to identify and spatially represent which sites in Edmonton were protected and which sites remain unprotected. However, the protected status information was not associated with any spatial information and, therefore, for sites that were identified as partially protected, it was necessary to determine and digitize the protected portion of sites. Furthermore, because of the inclusion of many additional sites on the Natural Areas in 2005 map for which there was no pre-existing information regarding protection, it was necessary to determine the protection status of all additional sites. This was done by determining which sites existed in areas that, as of 2006, had been planned at the neighbourhood level, then reviewing the relevant planning documents to determine the fate of individual natural areas.

Another objective of the protection status map was to represent the varying levels of protection that exist for natural areas within the North Saskatchewan River Valley and ravine system. Despite all Natural Areas within the river valley being encompassed within the NSRV ARP, the Office of Natural Areas indicated that that alone did not provide full protection. It was determined that, to be considered protected within the river valley, a natural area would have to occur on land zoned Metropolitan Recreation Zone (A). However, the level or certainty of protection for those lands is also dependent on ownership. As such, the map shows three protection status categories within the river valley: zoned A *and* owned by the City (the highest protection status in the river valley); zoned A but under private ownership; and unprotected (i.e., not zoned A; owned by either the City or privately).



In the end, the Protection Status of Edmonton's Natural Areas (2006) map included the following status categories related to protection:

- protected as a Natural Area (NA) under City ownership;
- protected as a NA under private ownership;
- river valley NAs zoned A under City ownership;
- river valley NAs zoned A under private ownership;
- Crown-owned waterbodies;
- NA owned by the City (but not formally recognized by the City for protection);
- unprotected NA;
- NA outside the jurisdiction of the City of Edmonton; and,
- currently existing NAs approved for development in statutory plans as of 2006.

More detailed explanations of these categories are provided in Chapter 3.

### **2.3 Edmonton Region Natural Areas Map**

The Significant Natural Areas of the Edmonton Region map was created to illustrate the relationship of Edmonton's Natural Areas with other natural areas in the broader region. The boundaries of the regional study area were based on the three sub-watersheds of the larger North Saskatchewan watershed basin in which Edmonton lies: the Strawberry, Sturgeon and Beaverhill sub-watershed basins. Many resource managers are now focusing management activities on a watershed basis, an acknowledgement of the interrelationships between natural areas and surface water quality and quantity. This presentation also informs viewers as to which regional natural areas are/could be linked by way of hydrological processes, which can provide insight into the potential for exchange of nutrients, pollutants, animals and seeds through the flow of water.

The map was to include natural areas currently afforded some protection under federal or provincial jurisdiction, as well as Natural Areas within Edmonton and the surrounding municipalities that have been determined to be of regional significance. Through the late 1980's, most municipalities in the province completed inventories of Environmentally Significant Areas (ESAs) within their jurisdictions. In most inventories, ESAs were classified with respect to their ecological significance as either locally, regionally, provincially or nationally significant. At a regional scale, conservation management tends to focus on sites of regional or greater significance, thus, it was these sites that were incorporated into the Regional Natural Areas Map.

The municipalities within the regional study area include the City of Edmonton, the City of St. Albert, Leduc County, Parkland County, Strathcona County, Sturgeon County and a small section of Beaver, Lamont, and Lac St. Anne counties. Only some of the surrounding municipalities had digital data of their regionally significant natural areas available. For municipalities having an inventory but not in digital format, we digitized regionally, provincially and nationally significant natural areas from the original ESA studies. For municipalities with no



inventory at all, we used provincial data from a dataset describing all of the protected areas found across Alberta: provincial parks, natural areas, wildlife areas and other forms of protected landscapes. The sections below outline specific steps taken to obtain digital data, and the sources used to digitize data for those municipalities without such files. Also identified are the dates of the original data sources for digital and published ESAs and any license restrictions that would apply to further distribution of digital data provided by the municipalities.

### 2.3.1 Digital Data Acquisition

As described in the preceding section, Edmonton's Natural Areas inventory was updated to create the new Edmonton Natural Areas map series. Information pertaining to the significance of sites was provided in the City's updated, 2006 Natural Areas database. Edmonton data were thus available in a recent and digital format.

Parkland County, Leduc County and St. Albert also had digital data describing the natural areas within their jurisdiction, but the ages of those data varies considerably. Leduc County's data was a digital representation of an ESA study completed in the 1980s (Westworth and Associates 1991). St. Albert completed a more recent inventory (Spencer Environmental 1999), the results of which were mapped in digital GIS format by the City in 1999. Parkland County updated their natural areas inventory in 2005-06, in both report and digital form (Parkland County 2006). Based on the dates of inventory and the recent rapid development pace in the region, Leduc County's inventory is likely to have changed somewhat, St. Albert's few regionally-significant areas are thought to remain intact (Maslen, *pers. obs.*) and Parkland County data is likely of similar accuracy to Edmonton's updated inventory.

The accompanying database attached to each of those GIS files classified the sites as locally, regionally, provincially or nationally significant, which allowed us to select the sites of regional or greater significance.

Coincidentally, no natural areas inventories were available for the counties only partially located within the study area (Lamont, Beaver and Lac St. Anne), and mapping of such sites in these areas was outside the scope of this project. The provincial protected areas dataset did, however, extend into these areas, and so allowed identification of sites of regional or greater significance. Digital data for Strathcona and Sturgeon counties were not available and were created as described in the next section.

We combined all of the above data with the provincial protected areas dataset to develop a partial coverage of natural and protected areas for the entire regional study area.

Leduc and Parkland counties and the City of St. Albert provided their data under license to Spencer Environmental and the City of Edmonton. The licenses restrict further distribution of the datasets without permission of the data owner. Use of the data within the context of the City



of Edmonton Natural Areas program is permitted, and the licenses will allow these data to be used beyond this State of the Natural Areas Project.

### 2.3.2 Data Creation

Natural areas of Sturgeon and Strathcona counties had been mapped by Infotech Services and Associates Geowest (1989) in a combined inventory of Environmentally Sensitive Areas in the two counties but were not available digitally. The natural areas with regional or greater significance that lay within our regional study area were digitized from scanned and georectified versions of the original maps. This allowed accurate transcription of the published maps, but also included some potential for error. The Geowest data are only accurate to 1989, i.e., on the ground changes in the inventory that may have occurred since 1989 are not reflected in the data. Updating the data to current status was beyond the scope of this project. As a result, the data are not as accurate as the more recently compiled digital data provided by the other municipalities in the regional study area. A brief analysis indicated that the changes are at a scale that should not be discernable at the coarse scale of this regional map.

Because these GIS data were created by the City of Edmonton for this project, the City becomes the owner of the datasets. Providing the data back to Sturgeon and Strathcona counties would reciprocate their sharing of the original ESA report, which is now out of print and difficult to find.

The completed dataset was checked for accuracy and omissions by a separate reviewer, and then combined with the digital natural areas created from the acquired datasets. This provided the final regional Natural Areas file depicted in the map Significant Natural Areas of the Edmonton Region.

## 2.4 General Resource Maps

The general resource map series was intended to provide some environmental context to the Edmonton Natural Areas map series, illustrating the distribution of biophysical resources in Edmonton. These four maps were developed from digital data already available through free sources and from projects recently completed in the Edmonton area. Natural vegetation, special status plant and wildlife observations, surficial geology, and agricultural soil capability are depicted on this map series. Because waterbodies (including wetlands) were included on the map series, these maps also capture aquatic systems within the City. The aquatic network is most evident in the vegetation map, which also illustrates the extent of physical connection between these aquatic and terrestrial natural features. The data sources and some notes on the interpretation and appropriate use of these map products follow below.



### 2.4.1 Vegetation Resources

Two datasets were used to develop the Edmonton Vegetation Map. Biophysical resources of Edmonton's river valley are inventoried in 1981, EPEC (1982). In 2005, the River Valley Alliance (RVA) commissioned a study to update the original EPEC (1982) mapping using the 2005 1-m resolution aerial photography of the City of Edmonton. The RVA provided the resulting GIS dataset to the City of Edmonton State of Natural Areas Project, under a license agreement that entitles the City to continue to use the data in natural areas management work. The data cannot, however, be redistributed to other parties without permission of the RVA.

In 2003, Alberta Sustainable Resource Development (ASRD) mapped native vegetation and wetlands in Edmonton's tablelands. A license agreement with ASRD allows use of the data for the State of Natural Areas Project and the more comprehensive Natural Areas Conservation Plan. Like other licensed data obtained for this project, it cannot be redistributed without permission. This dataset was created for the entire Central Aspen Parkland ecological sub-region using remote sensing technology (i.e., automated interpretation of satellite imagery). This process relies on the GIS operator to group (classify) light reflectance values captured in the satellite image into categories representative of land cover (e.g., aspen and other deciduous trees, grasslands, water). Its accuracy depends on the resolution and clarity of the image, the reflectance classification categories selected, and, ideally, ground-truthing to confirm the classification system. For this dataset, the resolution of the satellite imagery was quite coarse (25 m resolution) and interpretation of 1:30,000 aerial photography was used to confirm the classification process, rather than ground-truthing. As a result, the accuracy of that mapping is inferior to that of the RVA vegetation dataset. It is, however, the only regional vegetation dataset currently available for the Edmonton area, and it does provide some indication of the type and distribution of vegetation in the upland area.

These two datasets and the network of Natural Areas were overlaid on the base features layers to create Mapped Vegetation of the Edmonton Area. Where mapped vegetation communities overlap with identified Natural Areas, they provide information about the vegetation composition of the Natural Areas. However, as a result of the accuracy and extent of that mapping, some Natural Areas did not have such information. In those cases, Natural Areas are shown as unclassified vegetation communities.

The RVA dataset also contains detail regarding manicured or managed greenspace, and the City has datasets of smaller park sites that could be used to create a map of the greenspace in the City. Both of these datasets are provided in the Objective 1 data package, and could be used to produce a greenspace map if such a product is useful later in the project or Natural Areas Conservation Planning process.

### 2.4.2 Special Status Plant and Wildlife Observations

This map was created using provincial and City of Edmonton databases. Alberta Natural Heritage Information Center (ANHIC), and Alberta Fish and Wildlife maintain databases



tracking observations of select plant and wildlife species. ANHIC focuses primarily on plants and the Fish and Wildlife Information Management System (FWIMS) tracks wildlife, including fish. Those two agencies provided Edmonton area data for licensed use by the City during the project. The licenses come with two restrictions: no redistribution without permission and, to protect the resource, presentation of the observations as hazed locations (i.e., the precise location cannot be mapped, instead the locations must be shown as a broader area). ANHIC data was provided already hazed at the quarter section or section level or as buffered point locations. FWMIS data is typically provided as the original point location. At their request we have buffered all reported locations to the quarter section level.

From these datasets, we selected all observations of wildlife species considered by the province to be Sensitive, At Risk, or May Be At Risk, plant and wildlife (including fish) species considered by the federal government to be Endangered, Threatened or Vulnerable, *and*, all plant and butterfly species ranked by ANHIC as provincially rare (S1 to S3).

ANHIC and FWMIS records include observations dating back to the late 1800s. Because the older records likely no longer represent current conditions they did not seem relevant to the current exercise. To provide a more recent context, we selected only data from the past 50 years (i.e., 1956 to 2006).

Using the same criteria, the City of Edmonton, Office of Natural Areas provided us with a list of observations obtained from their library of natural site assessments prepared by consultants under Policy C-467, since 1995. All observation locations obtained from the City are shown as buffered by a 500 m radius.

This final selection of data was overlain on the base map layers to produce Observations of Special Status Species in the Edmonton area over the Past 50 Years.

### 2.4.3 Surficial Geology

Geological processes such as weathering and erosion break bedrock down into smaller particles of sediment such as clay, silt, sand, gravel. These materials are not soils; they are the deeper earth materials. (Soils typically form as a result of weathering of the top layers of the surficial materials.) Surficial geology, therefore, refers to the loose materials situated between the soil zone and bedrock. Geological processes can also result in the re-distribution/deposition of surficial materials. A surficial geology map shows the surface distribution of materials of different textures and origins. Most of the surficial deposits in the Edmonton area were formed by glacial and de-glacial processes during the last stage of continental glaciation. The remainder of surficial deposits are the products of post-glacial geological processes, such as river flood plains, or can be attributed to human activity such as placing of fill for roads.

The Alberta Geological Survey (AGS) has produced a digital version of surficial geology mapping originally prepared by Chao (2002). The dataset is complex, and provides the original



deposition process (e.g., aeolian (wind deposited); or glaciolacustrine (sediments deposited in a glacial lake). The deposition and erosion of materials results in distinct landforms, such as the hills, hummocks, depressions, ridges and river valleys we see today. Landforms per se are not represented on these maps but the data do include a description of the current topological form (e.g., hummocky, level, rolling). Because these map products are meant to be accessible to the general public, as well as technical specialists, the terminology provided in the original data was altered to include more common terms. For example, a rolling, aeolian glacial deposit is referred to as a sand dune landform. We added the common term field to the database for this file to allow application of these more recognizable terms to the map. The file provided as part of the data package includes a database containing the original, technical terminology, plus our additional common terminology field.

AGS provided the data at no charge and applies no licensing restrictions. The data can be redistributed without permission of AGS, however, any maps produced from the data should cite the original author and AGS as the data source.

Contrary to other maps, the surficial geology layer was laid under the base layers to create this map. This was possible because the data are represented in broad polygons covering the entire map extent. The mapped data are identified only in common terms rather than the more precise technical terms to improve the understandability of the map message. The current network of Natural Areas (as of 2005) is shown on this map to indicate the distribution of those features in the context of surficial geology.

#### *2.4.4 Agricultural (Crop) Soil Capability*

In the late 1960s, the federal government sponsored the Canada Land Inventory (CLI) study, which classified lands across the country, at a relatively broad scale (e.g., 1:50, 000) with respect to their capability to sustain certain land uses. The mapping described the potential for wildlife habitat, recreation, and a variety of other land uses to be sustained, given the constraints and opportunities offered by the natural features present at a given location. Agricultural soil capability was one of the maps created in this inventory project. Capability in this context referred to soil fertility, limitations to production and the agricultural production possible given these conditions. The map grouped capability into seven classes in decreasing order. Class 1 soils have few limitations to production and workability in terms of soil texture, soil moisture or rocks and are expected to support a variety of cereal crops at relatively high productivity. Class 7, in contrast, represents organic soils, which were considered to have extremely limited potential for agricultural use. Waterbodies, while identified on the map, were not classified.

These data are provided by Natural Resources Canada (NRCAN) as part of the national database of resource management data. The dataset is freely distributed and has no license restrictions on redistribution. Maps displaying these data should, however, cite the Canada Land Inventory and NRCAN as data sources (see GIS metadata for appropriate citation format).



In the Edmonton area, soils range from Class 1 to 6. The urban areas of the City (circa 1968) were not classified as they were developed lands effectively taken out of agricultural production at the time of that exercise. To reflect more current conditions, we updated this dataset to show the current developed area of the City, so that only the undeveloped lands within and immediately adjacent the City are shown as classified.

Like the surficial geology dataset, the CLI dataset fills the entire map extent and has large map units. The modified dataset was, therefore, mapped underneath the base data layers to create the Agricultural Soil Capability map. The current network of Natural Areas (as of 2005) is also shown on this map to illustrate the spatial relationship between them and the soil classes.