

**Guidebook for Preparing Natural Area Management Plans
For
Edmonton's Environmentally Sensitive and Significant
Natural Areas: A Working Draft Document**

Prepared by:

**Office of the Conservation Coordinator
City of Edmonton**

March 2003

Table of Contents

Section	Page
1.0 INTRODUCTION TO THIS GUIDEBOOK	1
2.0 SUGGESTED OUTLINE FOR MANAGEMENT PLANS	3
2.1 Introduction to Management Plan.....	3
2.1.1 Policy Statement.....	3
2.1.2 Planning History and Summary of Previous Assessments.....	3
2.1.3 Overview of Proposed Development	3
2.1.4 Legislative/Policy Context	4
2.2 Primary Purpose, or Goal, of Site Conservation.....	5
2.3 Baseline Description of Natural Site.....	7
2.3.1 General site description and classification	7
2.3.2 Biophysical Conditions	8
2.3.2.1 Biotic Features.....	8
2.3.2.2 Abiotic Features	10
2.3.3 Significant Natural and Cultural Features	12
2.3.4 Landscape Context	13
2.4 Management Objectives and Strategies	14
2.4.1 Water Resources.....	16
2.4.1.1 Potential Objectives for Water Resources.....	16
2.4.1.2 Potential Strategies Water Resources.....	17
2.4.2 Habitat Quality	17
2.4.2.1 Potential Objectives for Habitat Quality	18
2.4.2.2 Potential Strategies for Habitat Quality	18
2.4.3 Wildlife	18
2.4.3.1 Potential Objectives for Wildlife.....	18
2.4.3.2 Potential Strategies for Wildlife.....	19
2.4.4 Vegetation	19
2.4.4.1 Potential Objectives for Vegetation	19
2.4.4.2 Potential Strategies for Vegetation.....	19
2.4.5 Human Use.....	20
2.4.5.1 Potential Objectives for Human Use.....	20
2.4.5.2 Potential Strategies for Human Use	21
2.4.6 Significant Natural and Cultural Features.....	21
2.4.6.1 Potential Objectives for Significant Features.....	21
2.4.6.2 Potential Strategies for Significant Features	21
2.5 Construction and Post-development Operations and Maintenance.....	23
2.5.1 Construction Phase (if appropriate to site).....	23

2.5.2 Post-development Operations and Maintenance	23
2.6 Monitoring	26
2.7 Public Involvement.....	27
2.8 Summary	28

Supplementary Material

Glossary of Terms	29
Literature Cited	35

List of Appendices

Appendix 1 Natural Site Management Plan Approval Process Flow Chart	37
Appendix 2 Checklist for the Development of Natural Site Management Plans.....	38
Appendix 3 Buffers	40
Appendix 4 Wetland Classification for Natural Site Management Plans	42
Appendix 5 Overview of Wetland Functions and Values.....	44
Appendix 6 Summary Chart of Management Plan Goals, Objectives and Strategies	38
Appendix 7 Table of Responsibilities for the Construction Phase.....	40
Appendix 8 Table of Responsibilities for Post-development Operations and Maintenance	42

1.0 INTRODUCTION TO THIS GUIDEBOOK

This document is designed to assist in the preparation of management plans for City of Edmonton natural sites that are to be conserved. City Policy C-647 (The Conservation of Natural Sites in Edmonton's Table Lands), adopted in 1995, mandates that management plans be developed for sites, in Edmonton, that are to be conserved. At that time, brief guidelines were developed to assist those preparing plans. Since 1995, much progress has been made in Edmonton with respect to natural site conservation and management, and, site integration into developed lands.

In keeping with this, City of Edmonton, Office of the Conservation Coordinator recognized a need for new guidelines that reflected the City's current practices and conservation goals. These new guidelines are intended to facilitate the efficient preparation of management plans, promote timely and effective communication between proponents and City planners, expedite the review, approval, and implementation of the management plan and, ultimately, result in better site management. In addition, this guideline document provides a standardized template to create consistency among management plans prepared for Edmonton's natural sites.

Integral to these guidelines is the concept of site-specific management goals, objectives and strategies. The primary purpose of retaining Edmonton's natural sites is conservation of Edmonton's remaining natural resources and biodiversity. Conservation of a variety of individual sites, each uniquely positioned in the landscape and with its own suite of resources, will lead to establishment of numerous natural landscape features and greater biodiversity in the city as a whole. Because each natural site is unique with respect to setting and resources, identification of a site-specific conservation goal should be the first step in natural site management planning. Once a suitable management goal is established, numerous, specific management objectives can be developed and from there, specific strategies for achieving the objectives. Management goals establish what we are attempting to conserve, objectives provide specific ends, and strategies provide the means by which we will realize the objectives. This hierarchical approach should ensure the development of effective management plans that can be easily implemented. The use and preparation of site-specific management goals, objectives and strategies is further explained in sections 2.2 and 2.4 of this document.

Section 2 of this document represents a suggested outline for management plans. Not all subsections will be relevant to all natural sites. Discretion and expert opinion must be used during plan preparation to ensure that the plan adequately addresses site-specific circumstances and conditions, and incorporates current knowledge regarding urban natural site conservation. Each of the following subsections of this document follows a similar format. In most cases, a rationale for the information requested is provided to enable the user to understand why the information is requested and how it may be used in natural site management. Next, there are notes that specify what must be addressed in that section of the plan. Finally, wherever possible, an example is provided to promote a consistent format among plans and indicate the degree of detail that should be included in

the management plan document. A glossary of terms ensures that all plans are developed using the same definitions.

This document holds the status of an approved working document. As conservation and management of Edmonton's natural sites evolves, so too will the guidelines.

Review of completed management plans is initiated by submission of four printed copies and one electronic copy to Planning and Development. The full review process is outlined in Appendix 1.

2.0 SUGGESTED OUTLINE FOR MANAGEMENT PLANS

2.1 Introduction to Management Plan

2.1.1 Policy Statement

A policy statement should be provided to place the management plan in an administrative context and make it specific to the natural site of interest. The following example can be incorporated into a plan, as is, after providing information specific to the target natural site.

Example:

“This Natural Site Management Plan is written pursuant to City Policy #C467: *Conservation of Natural Sites in Edmonton’s Table Lands* and outlines the management of **(name, reference number of natural site, and legal land description)**. Planning approvals for the development of the area that includes the natural site were obtained on **(date)** and have met the requirements of **(name of applicable municipal approval sections)**.”

2.1.2 Planning History and Summary of Previous Assessments

This section should provide a brief overview of information about the natural site obtained to date and should indicate what information will need to be obtained prior to site development. It is particularly important to note what existing documentation is available with respect to site assessments and environmental evaluations.

Describe all planning and development work completed to date relative to the natural site and any associated development project, including any previous site assessments or environmental evaluation. List all completed reports, with approved dates. Describe any future site assessment or inventory work planned.

2.1.3 Overview of Proposed Development

This section should consist of a general overview of the development project (if the management plan is development-driven). This information will assist in illustrating the post-development condition of the site and the matrix that will surround it.

Briefly indicate:

- the proponent (company name and primary contact)
- the name and nature of the project
- the size of the project (area of land involved and area boundaries)
- development schedule
- future development plans/expansions on these and adjacent lands (i.e. long-term scope of project)
- existing land use on adjacent lands (e.g. residential, agricultural)

2.1.4 Legislative/Policy Context

Some components of the target natural site, or their management, may be governed or influenced by federal, provincial, or municipal legislation or policy, other than City Policy #C467. For example, the presence of fish habitat may involve Department of Fisheries and Oceans Canada, or the presence of a permanent, naturally-occurring wetland could mean that part of the site is, or will be, claimed by the province under Alberta's Public Lands Act.

Outline in detail applicable legislation, policies, or required compensation actions specific to project development that has affected, or might in future affect, site delineation or management. Describe agency involvement. Legislation and policies that might be applicable to specific management plans include (but may not be limited to):

Federal

- Canadian Environmental Assessment Act, 1994
- Canadian Environmental Protection Act, 1999
- Fisheries Act
- Migratory Birds Convention Act, 1994
- Navigable Waters Protection Act
- Federal Wetland Policy

Provincial

- City Transportation Act, 1980
- Environmental Protection and Enhancement Act, 1992
- Municipal Government Act, 1994
- Public Lands Act
- Water Act and Water Crossing Code of Practice (Water Act applies in several ways)
- Weed Control Act
- Wildlife Act, 2000
- Interim Draft Wetland Policy for Alberta

Municipal

- City Policy C-467 (Conservation of Natural Sites in Edmonton's Table Lands), 1995
- Bylaw No. 9199 (Bylaw for Regulating and Controlling Animals Within the City of Edmonton)
- Bylaw No. 12800 (Edmonton Zoning Bylaw)

2.2 Primary Purpose, or Goal, of Site Conservation

conservation: maintenance of environmental quality and resources or a particular balance among the species present in a given area through the management of resources within social and economic constraints while acknowledging the naturally dynamic character of biological systems (adapted from the *Oxford Dictionary of Ecology* 1998)

purpose: an idea or ideal kept before the mind as an end of effort or action; an aim, a particular thing to be effected or attained (Funk and Wagnall's Standard College Dictionary 1974)

goal: something toward which effort or movement is directed (Funk and Wagnall's Standard College Dictionary 1974)

This section should comprise a clear, concise, unambiguous statement as to the purpose for conserving this site (a conservation goal statement). The statement must be site-specific (i.e., it cannot be generalized from statements developed for other sites) and should reflect the City's overall conservation goals. This statement forms the basis of, and sets the tone for, the remainder of the document; therefore, prior to preparing the remainder of the management plan, the conservation goal statement and the rationale for it should be reviewed by the Conservation Coordinator. Appendix 1 provides a schematic for the management plan review process.

Following are three examples of goal statements that indicate the level of detail sought. Each example is preceded by a brief description of a hypothetical natural site to provide context for the example.

EXAMPLE 1

Description of the Natural Site

A development is proposed for a natural site that consists of a 10 ha wetland/woodland complex comprising a 6.0 ha shallow marsh with open water, cattail, wet meadow zones, an aspen/willow fringe, and a 4.0 ha aspen/balsam poplar woodland.

Goal statement:

The primary purpose of retaining Natural Area NW 1234, the Northwest Edmonton Complex, is to integrate it into the _____ neighbourhood, as development progresses, and manage it to promote avian and mammalian diversity, waterfowl productivity, self-sustaining natural communities, and an attractive neighbourhood amenity.

EXAMPLE 2

Description of the Natural Site

*A development is proposed for a natural site that is a 15 ha aspen parkland complex comprising a mosaic of closed-canopy aspen/balsam poplar woodland that contains the rare plant - western blue flag (*Iris missouriensis*), and small pockets of prairie grassland. The area has a high degree of biodiversity and moist soil conditions make it extremely sensitive to human disturbance. It is classified as an Environmentally Sensitive Area.*

Goal statement:

Natural Area NE 9876, the Northeast Edmonton Complex, is to be retained as an environmentally-sensitive area and managed as an area of limited human use to conserve rare plant species, high biodiversity and undisturbed soils.

EXAMPLE 3

Description of the Natural Site

This natural area is a stormwater-influenced wetland and has 3 ha of open water surrounded by a fringe of emergent vegetation (e.g., cattails) and 4 ha of wet meadow zones mixed with second-growth forest. There is an adjacent housing development.

Goal statement:

Natural Area SW 5432, the Southwest Edmonton Complex, is to be integrated into the _____ Industrial Area and managed to function in conjunction with traditional stormwater ponds to provide flood abatement and promote avian and mammalian diversity, waterbird productivity, self-sustaining natural communities, and an attractive, passive recreational amenity.

2.3 Baseline Description of Natural Site

This section should provide a comprehensive description of the post-development natural site (addressing conditions expected after the proposed development, if there is one, is complete). The description will likely differ from that given in the completed Natural Site Assessments because it will account for physical changes that are planned to occur during development (e.g., establishment of a buffer zone, or fragmentation, or reduction in size). Information in completed site assessments can and should be used, but this baseline description must address, to the extent possible, post-development conditions. The baseline description gives important context to the rest of the management plan, provides a good indication of what is known about the site and what additional information might be required for effective management. It will also serve as a baseline for any data gathered during future monitoring. In addition, in conjunction with the conservation goal statement, the information in this section should be used to prepare the objectives and strategies that are critical to the management plan. This section should focus on those site elements determined during the natural site assessments to be of high importance and sustainable after development. To facilitate the subsequent development of site-specific objectives and strategies, the proponent may wish to customize the checklist found in Appendix 2 during the preparation of this section. Inclusion of map, airphotos and drawings in the site description is recommended to facilitate a better understanding of site conditions and provide a record of baseline conditions in additional formats.

2.3.1 General site description and classification

- site name and number
- site size
- location (provide legal land description)
- site classification as indicated in the 1999 inventory of natural sites by Geowest Environmental Consultants Ltd. (i.e., Natural Area, Significant Natural Area, or Environmentally Sensitive Area)
- criteria originally used to classify site
- update class as appropriate, noting differences apparent during the assessment (e.g, site was classed as regionally –significant and is now locally-significant)
- general description of site , i.e., type of natural area – e.g., aspen woodland, riparian-ravine system, upland-wetland complex, forest-wetland complex, etc.
- presence and size of buffers around the natural site (see Appendix 3 for a detailed overview of buffer design). The requirement for buffers and appropriate sizing thereof will vary from site to site according to many factors, including site conditions, adjacent land use, nearby natural areas and available land base. Ideally, a site buffer will have been established prior to preparation of the management plan. If not, this should be undertaken as one of the first steps of the management planning process.

- conceptual description of the ecosystems comprising the site (1 – 2 pages). Describe the functions, values, and ecological processes (chemical, physical, and biological) typically associated with these kinds of viable systems. For example, if an isolated prairie pothole marsh is present, provide a description of the energy nutrient cycling, vegetation zonation, natural succession, and hydrologic regime of a typical marsh exhibiting those characteristics.

2.3.2 Biophysical Conditions

This section should describe, in detail, the biotic and abiotic components of the natural site in the “as-built” stage of development. Information from previous assessments can and should be used. All sources of information and classification schemes must be referenced. Further research or inventory work might be necessary to complete this section and such a requirement is at the discretion of the Conservation Coordinator.

Site elements should be organized into biotic (living) or abiotic (non-living) components. Although they have many biotic characteristics, more complex landscape features, such as wetlands and soils, are here considered abiotic components because of their inherent geomorphological nature.

2.3.2.1 Biotic Features

Biotic features are the living components of an ecosystem (as opposed to the physical and chemical components) and are here represented by vegetation and wildlife. Biotic components often reflect the underlying abiotic features of a site (e.g., soils) and, as such, many plants and animals are used as indicators of broader ecosystem health.

Vegetation

Vegetation often provides critical resources that support many other organisms and ecological processes. Not only do plant species reflect the soil, climate and water properties of a site, vegetation often dictates which animals are able to use an area and for what purposes. Plant communities provide the structure, food and protection required for viable habitats and are often one of the preferred measures of ecosystem health. The maintenance or restoration of the natural vegetation in an area is critical for conserving natural environments and the long-term sustainability of natural processes and wildlife use. Whenever possible, the site should retain its original vegetative communities and any restoration work should reflect the native species that were or are present. Such an approach promotes the maintenance of pre-development wildlife use of the natural site, further reducing restoration or mitigation costs of the project.

The following vegetation information must be provided for the site. Maps and drawings should be included where appropriate.

- Indicate vegetation / forest type(s) present using classifications consistent with those used by Alberta Environment (i.e., Alberta Vegetation Inventory). Provide a vegetation map.
- Indicate any rare or endangered species present (indicate special status plant work done to date).
- Indicate introduced species and species listed in the Alberta Weed Control Act.
- Describe the vegetation functions and values at the site (e.g., function – provision of songbird habitat, value – nature photography)
- Indicate which vegetation features (e.g., species, communities, functions, etc.) will be the focus of management. Justify those selections (this can be done using the checklist provided in Appendix 2).

Wildlife

Traditionally, the term “wildlife”, in both common usage and in legislation, has been understood to refer to larger animals – particularly big game, fur-bearers, birds of prey, and waterfowl. Many jurisdictions are redefining this term to include reptiles, amphibians, fish, insects and other invertebrates, wildlife parts and eggs. Some even include vegetation in the definition of wildlife. For the purpose of this document, wildlife describes organisms in the Kingdom Animalia (animals). This broad definition reflects the important role of all wildlife species in natural ecosystems. Vegetation is treated separately (see above).

In addition to providing viewing and recreational enjoyment for people, animals perform many important ecological roles. Many rodents and invertebrates play a critical part in soil aeration and nutrient cycling. Insects and some birds play a key role in pollinating plants and reducing the impacts of introduced species, thereby contributing to the sustainability of vegetation communities. Larger wildlife species act as key predators and aid in pest control. Some wetland animals, such as beaver, help maintain water on the landscape – even in times of drought. Conversely, some species may be detrimental to the overall ecology of a system or to adjacent human habitation and would require specific management actions to mitigate these effects.

This section should address the wildlife expected to be present once development is complete. The suite of species likely to use the natural site that is to be managed might not be the same as those inventoried during the initial natural site assessment. For example, if the site will be significantly smaller than the one that currently exists, or if one habitat type will be removed, fewer (or perhaps different) wildlife species would be expected to use the site post-development. Conversely, the species observed during inventory work may not be a representative list of species that use, or will use, the area. Using the inventories developed during the Natural Site Assessment(s) and other appropriate information, provide a best estimate of species that are expected to be present at

the managed site. All assessments and inventories must be referenced and dates and effort levels of surveys noted.

The following wildlife information must be provided in the plan. Maps and drawings should be included where appropriate.

Anticipated Wildlife Species

- Indicate species expected to be present at the site (note the basis of conclusions, e.g., previous observations, available habitat, range, surrounding land use etc). Consider mammals, birds, amphibians, reptiles and fish; if possible provide an indication of known or expected population sizes.
- Indicate if species are resident or non-resident species.
- Indicate if species are at risk.
- Identify nuisance wildlife.
- Distinguish between species that were observed and those not observed but considered to be likely to use the natural site.
- Briefly indicate which species or guilds will be the focus of management. Justify those selections.

Anticipated Wildlife Habitat

- Indicate habitat types to be present.
- Describe habitat use by species (e.g., breeding, staging, foraging, lekking areas).
- Indicate location of wildlife travel corridors.
- Identify seasonal habitat uses.
- Identify important wildlife areas within Natural Site (e.g., nesting sites, critical habitats, thermal cover).
- Briefly indicate which habitats will be the focus of management. Justify those selections.

2.3.2.2 Abiotic Features

Abiotic features are the non-living components of an ecosystem and include air, soils (including nutrients), water, topography (the three together forming wetlands), geology, fire, and climate. Abiotic features generally form from long-term processes due to influences such as glaciation, erosion, weathering, climate, and rock and soil formation. Such features can also result from immediate disturbances such as severe or constant flooding, landslides, frost damage, or drought. Regardless of their genesis, abiotic features such as lakes and nutrient-rich soils set the stage for all organisms in an area to establish themselves and further modify the site. The natural site management plan should focus on the abiotic features likely to change (i.e., soils, hydrology and wetlands).

Soils

Soils play a critical role in the ability of other organisms to grow and flourish in an area. Biochemical cycles, such as the cycling of nitrogen from the atmosphere and organic material back into the environment are often critical, but overlooked, functions of soils. Soils also provide groundwater filtration and act as carbon sinks to reduce the impacts of climate change. Management plans should address soil conservation issues as soil is one of the few non-renewable resources on site that has the potential to be permanently impacted by development activities. Both vegetation and wildlife resources depend on soil resources in numerous ways.

Specific classifications have been developed for soils and provide an important understanding of the ecological potential of a site. Soils information in the Natural Site Assessment should provide much of the necessary information to complete the soil section. All assessments and inventories must be referenced.

The following soils information must be provided in the plan. Maps and drawings should be included where appropriate.

- Indicate soil classification for the site following the Canadian System of Soil Classification (1996).
- Indicate any areas of special concern (e.g., future erosion problems, pockets of highly productive soils).

Hydrology

The hydrology of a site will indicate how water (in various states) moves through or is stored on the site. When available, hydrological data should be included to give an overview of the role that water plays at the site. In addition, knowledge of a site's hydrology will help proponents maintain the integrity of water movement, the recharge of ground water resources and the post-development sustainability of the site features (both upland and wetland). This section should be done for all sites, even those that do not have a wetland component. Wetland site hydrology is also discussed in the next section. All assessments and inventories must be referenced.

The following hydrological information should be provided in the plan. Maps and drawings should be included where appropriate.

- Describe the hydrology of the site (including groundwater table elevations).
- Indicate areas of special concern (e.g., recharge and discharge areas).
- Indicate, as best is known, preferred soil moisture regime and flood level and duration tolerances of dominant upland and/or wetland plant species present

Wetlands

In Canada, the National Wetlands Working Group (1997) defines wetlands as “land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to a wet environment.” In the Edmonton area the five wetland classes are: bog, fen, swamp, marsh, and shallow open waters. See Appendix 4 for more detailed wetland classifications. It is important to note that local conditions can result in the presence of complexes containing more than one wetland class.

Wetlands play a critical role in linking aquatic and terrestrial systems and have been called some of the most important ecosystems on Earth. They provide important habitat to ecologically-significant and economically-important plants and animals, and are areas of tremendous recreational and aesthetic value. Wetlands help stabilize water supplies and enhance downstream water quality because of their ability to filter out waste and sediment. Wetlands represent some of the most biologically diverse ecosystems in the Edmonton area. Both the provincial and federal governments have recognized the importance of wetlands by establishing policies and guidelines for wetland management and conservation. Wetlands are also covered under Alberta’s Water Act because they comprise aquatic habitat.

If a wetland is present at the site in question, the following information relative to wetlands must be provided. Maps and drawings should be included where appropriate.

- Indicate the wetland class(es) present as per the *Canadian Wetland Classification System* (1997). It is not necessary to formally indicate the form or type (see Appendix 4), however, some additional descriptors are desirable (e.g., isolated marsh, treed fen, etc.).
- Include a hydrological description and describe wetland linkages present, including but not limited to the following.
 - Discuss the influence of the existing wetland hydroperiod.
 - Discuss the influence of the existing wetland nutrient and water sources.
- Indicate the wetland functions and values of the site (see Appendix 5).

2.3.3 Significant Natural and Cultural Features

Significant features include site features of special conservation concern and can be natural (geological, biological), or anthropogenic (cultural). Significant natural features are features that are either rare for the area or play a key ecological role on the landscape. They can also represent an anomaly of nature that is of human interest and has educational value. (There may be some overlap

between this category and the biotic or abiotic features but restating a feature of particular significance, emphasizing its educational values, may assist in subsequent development of objectives.) In some cases, natural sites have attracted humans for centuries and, as such, the presence of significant cultural features is possible. Cultural features can be both historic and prehistoric (all referred to as historical resources) and may require special consideration with respect to provincial or federal legislation.

The following information relative to natural and cultural features must be provided. Maps and drawings should be included where appropriate.

- Describe any significant natural or cultural features at the site and indicate their educational, ecological or cultural value and their known level of significance (e.g., local, regional or provincial).

Example: Significant features may include sand dunes, mineral springs, salt licks, fossil beds, areas of old growth forest, historic buildings, or teepee rings.

2.3.4 Landscape Context

This section places the natural site into a broader context. This placement allows for the evaluation of the cumulative effects of the proposed development and other nearby developments, and identification of critical linkages to other natural sites (e.g., wildlife corridors and ecological connectivity). Recognition of links between sites will also assist in determining species likely to use the target natural site in future.

- Indicate the natural site's position relative to other natural sites (and other protected areas within Edmonton's Table Lands), the North Saskatchewan River Valley and Ravine System, and protected areas in adjacent municipalities (e.g., ecological reserves). Include estimated distances between the target site and other identified areas.
- Describe the wildlife corridors and ecological connectivity between this Natural Site and other natural sites.
- Describe regional connections (this may be the North Saskatchewan River Valley but there could also be other regional connections).
- Describe continental connections (e.g., migratory pathways).

2.4 Management Objectives and Strategies

This section should present specific management objectives and strategies for the natural site. These should flow directly from the goal statement prepared earlier and the information recorded on the checklist (Appendix 2) developed during preparation of the baseline site description.

objective: end results that will achieve broader goals that describe desired future conditions, and are measurable, time-specific and geographically specific (Government of British Columbia 2000)

strategy: describes how to achieve an objective, and pertains to an activity and how that activity is to be conducted. Strategies may be time-specific and measurable. (Government of British Columbia 2000)

Objectives specify what the proponent wants the natural site to represent ecologically while recognizing the constraints imposed by the proposed development. Objectives provide clear direction for specific management actions (strategies) and have measurable attributes where possible. Ultimately, objectives are tools that help developers organize their management actions and remain on track in accomplishing their site conservation goal(s). Each natural site management plan will have numerous management objectives. These guidelines suggest organizing objectives into six (6) subsections or categories, each addressing very different areas of management: 1) Water Resources, 2) Habitat Quality, 3) Wildlife, 4) Vegetation, 5) Human Use and 6) Significant Features. All six categories may not apply to each natural site. Wherever possible, objectives should be illustrated with plans and diagrams.

Strategies are more specific statements that describe how one will accomplish a given objective. They allow managers to gauge whether the objective has indeed been met. They describe management practices and control measures that will be implemented at the site to meet particular objectives. For each objective put forth, the proponent should develop one or more strategies, thus management strategies will be more numerous than objectives.

The need for strategies to be specific to a particular objective creates potential for development of conflicting strategies. For example, an objective to promote waterfowl nesting might give rise to a strategy to establish shrubby nesting cover along the edge of a wetland. Management objectives for the same site might also include the provision of recreational bird watching opportunities. That objective might give rise to a strategy that calls for installation of a walking trail along the edge of a wetland, adjacent to the area where shrubs were planted. The two strategies will conflict because the presence of people on the walking trail during June and July would discourage waterfowl from nesting in the newly-enhanced area. An important step in the plan preparation will be to

look for and eliminate all conflicting strategies. (In this example, one solution might be to restrict access to the walking trail during the waterfowl nesting period.)

It is critical to determine in the early stages of development whether a strategy is working or not and management of the site must be adapted accordingly. Incorporating some monitoring and a feedback loop into the management plan is key to successful site management. Monitoring is an effective tool for ensuring that your management strategies and objectives are being met. Monitoring is further discussed in Section 6.

*Objectives and strategies should be as detailed as possible to facilitate effective implementation. The parties implementing the management plan may not have the benefit of other documentation available to them. The following examples of objectives and strategies are supplied to indicate the level of detail that should be provided and the direct link that should exist between goals, objectives and strategies. **Their inclusion does not imply that there is a limited number of phrases or that expert judgment is not required to develop objectives and strategies specific to the area being managed.***

EXAMPLE 1

Example Goal: *The primary purpose of retaining Natural Area NW 1234, the Northwest Edmonton Complex, is to integrate it into the _____ neighbourhood, as development progresses, and manage it to promote avian and mammalian diversity, waterfowl productivity, self-sustaining natural communities, and an attractive neighbourhood amenity.*

Example Objective:

To provide upland vegetation that supports passerine nesting and the presence of small mammals.

Example Strategies:

Monitor woodland understory to ensure continued presence of shrubby and herbaceous cover.

Address areas of off-trail disturbance as they occur.

EXAMPLE 2:

Example Goal: *Natural Area NE 9876, the Northeast Edmonton Complex, is to be retained as an environmentally-sensitive area and managed as an area of limited human use to conserve rare plant species, high biodiversity, and undisturbed soils.*

Example Objective:

To retain populations of western blue flag.

Example Strategies:

Conduct annual plant surveys to document the presence of exotic species and map areas of occurrence.

Control detected weeds through hand picking or plant-specific herbicide applications.

Example Objective:

To limit human use to levels that do not adversely affect existing vegetation and soils.

Example Strategies:

Place one walking trail near the outer edge of the established buffer zone.

Erect interpretive signs indicating the primary purpose of site conservation and why human use requires management.

Monitor site and trails annually, looking for evidence of off-trail use.

For each of the above-mentioned categories, a number of potential objective topics are listed for consideration when developing site-specific objectives. The lists are provided to indicate the range of objectives that may be required to achieve the site's conservation goal(s). Not all of the topics provided will apply to each natural site and in some cases additional topics not shown here may be applicable. Immediately after each list of objective topics, an example of a suitable objective is provided. The example is followed by a list of potential strategy topics which follows the same order as that provided for the objectives. Because there can be more than one strategy for a single objective, the strategy list does not match the objective list line-for-line. As with the objectives, an example of a strategy (one linked to the hypothetical objective given for that category) is provided.

2.4.1 Water Resources

Surface water resources in many of Edmonton's Table Land natural sites are restricted to wetlands, therefore, this section includes objectives specific to wetlands. Other water resources such as streams and ponds, both ephemeral and permanent, could also be associated with natural sites and, if so, should also be covered in this section of the management plan.

2.4.1.1 Potential Objectives for Water Resources

- objective(s) to address specific wetland functions and values that will be conserved (see Appendix 4)

- objective(s) to manage hydroperiod, i.e., water level and flooding duration during normal conditions, flood conditions, and drought conditions
- objective(s) to address water quality and quantity requirements in a spatial and temporal context
- objective(s) to manage wetland and riparian vegetation zones (likely done by managing hydroperiod)
- objective(s) to address water accessibility for recreational and agricultural uses
- objective(s) to address beaver/muskrat management

Example Objective for Water Resources: Provide for spring staging and nesting habitat for mallards and other dabbling duck species.

2.4.1.2 Potential Strategies Water Resources

- strategies for monitoring wetland functions and values
- strategies for wetland construction or replacement
- strategies for maintenance or management of water levels in times of normal precipitation, flooding, and drought
- strategies for maintenance of water supply
- strategies for compliance with objectives in the Alberta Water Act
- strategies for wetland/riparian enhancement
- strategies for management of emergent wetland vegetation
- strategies for algal control
- strategies for enhancing recreational and educational appreciation and use of wetland
- strategies for integrating ecologically sustainable agricultural use
- strategies for using wetland species to help maintain and create wetlands

Example Strategies:

In non-drought years, maintain water levels such that a 1 ha area of open water is present during period late April to late June.

Ensure flooding does not occur beyond the interface of the wet meadow/willow zones.

Through use of a control structure, ensure that the drawdown period for the wet meadow zone do not exceed 24 hours.

2.4.2 Habitat Quality

Habitat quality includes habitat for both plants and animals. Management of habitat quality can be passive or active.

2.4.2.1 *Potential Objectives for Habitat Quality*

- objectives to address habitat and wildlife diversity including:
 - food – type, amount, and seasonality
 - cover – type, amount, and seasonality
- specific objectives to address habitat linkages
- specific objectives to address wildlife habitat enhancement

Example Objective for Habitat Quality: *Promote autumn shorebird foraging habitat in the form of mudflats.*

2.4.2.2 *Potential Strategies for Habitat Quality*

- strategies for monitoring habitat quality
- strategies for prescribed burning programs (if applicable)
- strategies for habitat protection
- strategies for wildlife habitat enhancement (including supplemental shelter – nest boxes, buffer management, placement of vegetation, natural cavity/snag development)
- strategies for control of native, exotic, or feral species
- strategies for site stabilization
- strategies for pest and disease control (e.g., avian botulism)

Example Strategy for Habitat Quality: *During August and September, draw water levels down when necessary to ensure the presence of an exposed mudflat approximately 5 m wide.*

2.4.3 **Wildlife**

Wildlife resources will vary from site to site and in some cases require active management.

2.4.3.1 *Potential Objectives for Wildlife*

- objective(s) to address waterfowl management
- objective(s) to address avian species (i.e., landbirds, waterbirds, waterfowl, shorebirds)
- objective(s) to address animal populations (i.e., amphibians, reptiles, invertebrates, fish, large and small mammals)
- objective(s) to address nuisance wildlife management
- objective(s) to manage rare, threatened, or endangered animal species

Example Objective for Wildlife: *Promote disease-free waterfowl populations during the ice-free months.*

2.4.3.2 Potential Strategies for Wildlife

- strategies for monitoring wildlife species
- strategies for nuisance management including:
 - wildlife diseases
 - mosquitoes
 - nuisance animals
 - pets as predators
 - human/wildlife conflicts
- strategies for maintenance of post-development wildlife use
- strategies for special protection and monitoring of rare, threatened, or endangered species populations

Example Strategies for Wildlife:

During times of botulism outbreaks, monitor waterfowl populations weekly to promote the early detection of disease.

Remove carcasses on a weekly basis.

2.4.4 Vegetation

Vegetation communities at Edmonton's natural sites will vary from grasslands to forest to submerged aquatic communities. Each type will require site-specific management and depending on the specific goal, varying degrees of management.

2.4.4.1 Potential Objectives for Vegetation

- objective(s) to address upland forest species
- objective(s) to address non-native plant management (e.g., weed control)
- objective(s) to address site re-vegetation
- objective(s) to address rare, threatened, or endangered plant species
- objective to address wetland vegetation diversity

Example Objective for Vegetation: Manage weedy/non-native plant species to minimize encroachment into the site.

2.4.4.2 Potential Strategies for Vegetation

- strategies for monitoring forest health
- strategies for standing dead tree management including regular risk assessments
- strategies for deadfall management
- strategies for weed control
- strategies for management of vegetation with specific attention to:
 - native species (including vascular and non-vascular plants)

- grass seeding mixtures
- tree and shrub selection
- preparation of planting sites
- site stabilization and planting protection
- control of invasive species
- establishment of permanent markers to delineate buffer limits
- biological pests
- strategies for maintaining wetland vegetation (see Water Resources, Section 2.4.1)
- strategies for monitoring success of replanting initiatives
- strategies for special protection and monitoring of rare, threatened, or endangered species

Example Strategy for Vegetation: Monitor weeds on an annual basis and remove, by digging, any observed weeds.

2.4.5 Human Use

Human use can significantly affect natural site resources and functions. This section should address how human use will be managed such that public use of the site is balanced with site sustainability and public safety.

In addition, although a proposed development is specific to a given time frame, the potential exists for changes in use patterns, particularly as a result of the establishment of development on adjacent lands.

2.4.5.1 Potential Objectives for Human Use

- objective(s) to address restricted or prescribed uses
- objective(s) to address control of access and associated enforcement
- objective(s) to address interpretive uses and educational values (if applicable)
- objective(s) to address additional recreational uses or constraints
- objective(s) to address undesirable uses
- objective(s) to address facility requirements and maintenance (e.g., pathways, docks, signage)
- objective(s) to address parking considerations and restrictions
- objective(s) to address public health (e.g., West Nile Virus)

Example Objective for Human Use: Provide infrastructure for passive recreation in a manner that minimizes site disturbance.

2.4.5.2 Potential Strategies for Human Use

- strategies for when overuse of site (recreational or otherwise) is evident
- strategies for fire preparedness and burning restrictions on adjacent lands
- strategies for noise management
- strategies for access management (including snowmobiles, all terrain vehicles, and horse use)
- strategies for enhancing public appreciation of the site through educational and interpretive experiences
- strategies for monitoring human use and potential changes
- strategies for management of cumulative effects resulting from future development(s) adjacent to the one driving this management plan.
- strategies for litter and viewscape management
- strategies for maintaining access for emergency vehicles (outline types of vehicles and seasonal requirements)
- strategies to address parking concerns
- strategies for monitoring both biotic and abiotic risks to public health and safety

Example Strategies for Human Use:

Develop one walking trail through the woodland (as shown on Figure X) and one along a portion of the aspen/willow/wet meadow interface.

Develop one wetland viewing point at the height of land in location X on Figure X.

2.4.6 Significant Natural and Cultural Features

2.4.6.1 Potential Objectives for Significant Features

- objective(s) to address control of access and associated enforcement
- objective(s) to address interpretive uses and educational values (if applicable)
- objective(s) to address additional recreational uses or constraints
- objective(s) to address undesirable uses

Example Objective for Significant Features: Provide infrastructure for interpretive opportunities in a manner that ensures sustainability of feature.

2.4.6.2 Potential Strategies for Significant Features

- strategies for monitoring human use and potential changes
- strategies for when overuse of site is evident

- strategies for access management (including snowmobiles, all terrain vehicles, and horse use)
- strategies for enhancing public appreciation of the site through educational and interpretive experiences

Example Strategies for Significant Features:

Develop appropriate interpretive material and deploy at site that minimizes disturbance.

Note:

To assist implementation of the management plan and its efficient, long-term use, provide a chart that briefly summarizes the site goals, objectives and strategies. Appendix 6 provides an example of a possible format for a summary chart, listing the management plan's goal(s), objectives and strategies in a manner that indicates their hierarchical relationship.

2.5 Construction and Post-development Operations and Maintenance

This section must contain plans and diagrams of the post-development natural site and infrastructure proposed in previous sections. This section of the plan provides measures that pertain to the day-to-day activities required to implement the proposed management strategies. It also indicates what resources are needed, assigns responsibilities to specific parties, identifies timing and other critical details required to implement the plan. This section should be organized according to construction and operation phases.

2.5.1 Construction Phase (if appropriate to site)

This section of the plan should indicate how the site will be managed during the construction of the proposed development. While such management actions are specific to construction actions, they may also have broader applications to future management of the site. It is critical that this section clearly identify the parties responsible for the required activities. Appendix 7 provides a template of a table indicating responsibilities during the construction phase.

- Provide erosion control designs and specify what construction monitoring and maintenance will occur. (These measures should include those taken to address erosion sources on site *and* any measures that should be taken to address erosion occurring on site as a result of activities on adjacent lands that are not part of the proposed development. In the latter case, the action may be limited to reporting a problem to the appropriate authority).
- Indicate "best management practices" that will be employed (e.g., locate refueling stations greater than 100 m from a water body).
- Prepare contract clauses to ensure that management objectives are met in a timely way.
- Manage construction to minimize cumulative effects of other adjacent projects or on-site expansions or recreational developments.
- Specify how effects of construction on natural features will be monitored and be prepared to implement adaptive management techniques to ensure the integrity of the site during construction.

2.5.2 Post-development Operations and Maintenance

This section should provide details regarding specific post-development operations and maintenance activities. Include detailed photographs and diagrams as required. Be specific to applicable guidelines or legislation. Once the site is developed, City of Edmonton department standards apply (e.g., Community Services, Drainage Services) and they must be reflected in this section of the management plan. It is critical that this section clearly identify the parties responsible for the required activities. Appendix 8 provides a template of a table indicating responsibilities during operations. Preparation of this information should serve as a final check to ensure that no conflicting strategies or measures have been prescribed.

The following information should be included in this section:

- Specify which "best management practices" will be used.
- Provide a schedule of required inspections and criteria (e.g., indicate specific legislation or directives, where appropriate).
- Outline fertilizer requirements and limitations (e.g., indicate what fertilizers will be used and where their application would not be recommended).
- Outline ongoing vegetation maintenance, this includes in the established buffer and in the natural site itself (e.g., where informal hiking trails are resulting in soil compaction and vegetation loss erect fencing or signage to discourage off-trail wandering and where required, disk compacted soil, correct drainage and replant with native plant species).
- Detail rehabilitative planting requirements, seed and plant specifications and sources (e.g., Indicate what type of seed [native or non-native] will be used on site, planting and watering schedules).
- Specify drought mitigation measures/management (e.g., distribute information papers to adjacent residents in spring to provide water conservation tips to reduce water consumption).
- Describe restrictions to timing of maintenance with respect to project objectives (e.g., do not undertake major vegetation and trail maintenance activities, such as pruning, during the period 01 May to July 15, to avoid disturbing migratory bird nests).
- Outline snow removal and ice management procedures (e.g., indicate chemicals to be used for treatment of icy trails, roads, and walkways).
- Indicate approach for management of vegetation pests (e.g., indicate what if any pesticides will be used and how provincial guidelines will be met).
- Describe the operation of water control structures (e.g., indicate levels and timing for establishment of desired hydrologic conditions or vegetation management).
- Describe the management and maintenance of water control structures (e.g., conduct regular inspections of all water structures to repair leaks).
- Provide inspection schedules for damage and risk assessments (e.g., danger trees will be identified and removed as part of general site maintenance).
- Identify criteria for sediment removal (e.g., outline acceptable accumulation depths and indicate appropriate timing for sediment removal).
- Detail the required management for maintenance of vegetation and methods for the control of unwanted vegetation (e.g., indicate mowing or burning schedules, dumping locations for hand-picked weed species).
- Outline actions required for the development, maintenance, and enforcement of access management infrastructure.
- Provide detailed operational procedures for:
 - noxious weed control
 - handling and disposal of dead vegetation, prolific weeds
 - monitoring of plant health
 - replanting guidelines
 - water level controls

- erosion controls
- flood and drought management
- sediment removal
- algal bloom management
- sediment removal
- insect infestations (e.g., mosquito control)
- removal of litter and debris
- ecological monitoring (see section 6).
- Provide an organizational chart (e.g., include names and contact information).
- Outline financial implications – capital costs and operating costs.
- Indicate education strategies to enhance management objectives.

2.6 Monitoring

Monitoring is mentioned frequently throughout this document and is an important site management tool. It is through monitoring that the proponent and City can ensure that the site-specific management strategies, objectives, and conservation goals are being met. Natural site management plans are relatively new to the City and monitoring data serve as one means of improving site management in the long time. Such a database also leads to more effective natural site assessments in the future.

Monitoring should occur during construction and during post-development operations. Monitoring programs need not be elaborate. They should focus on obtaining measurable data (preferably quantitative) that enable managers to easily identify when corrective or adaptive action is required and contribute to a useful, long-term database. The Conservation Coordinator is a valuable resource for developing effective, consistent monitoring programs. Ultimately, consistent monitoring programs among sites would be most useful to the City's overall natural site conservation program.

- Establish a monitoring program that meets all of the requirements noted in earlier sections of the document. Be prepared to implement adaptive management techniques when required to realize the conservation goal(s) and ensure the integrity of the site. Ensure that the monitoring program includes criteria that clearly indicate when adaptive management would be required (e.g., where intermittent flooding of a trail is resulting in side trails, modify drainage patterns to eliminate trail flooding).
- Provide a wetland inspection checklist (where appropriate) to be used by field staff during monitoring to aid in reporting efficiency and consistency.

2.7 Public Involvement

Where applicable, outline the process for public involvement in the development or management of the site. Potential specific groups of interest include community leagues, established public stewardship programs, and naturalist organizations.

2.8 Summary

Provide a brief synopsis of how the management plan meets the goals and objectives for the natural site. This synopsis must include an overview of monitoring and research requirements (with a schedule indicating future activities) and a list of the values and functions of the natural site and how they are specifically addressed by management activities.

Glossary of Terms

This glossary focuses on terms that are specific to natural site conservation and ecology as well as terms that might be used in more than one discipline (e.g., engineering and biology). When definitions have been taken from specific sources, those sources are indicated in the annotation.

adaptive management: "a formal, systematic, and rigorous approach to learning from the outcomes of management actions, accommodating change and improving management. It involves synthesizing existing knowledge, exploring alternative actions, and making explicit forecasts about their outcomes." (British Columbia Forest Service 1999, January)

Alberta Vegetation Inventory (AVI): a system for describing the quantity and quality of vegetation present. It involves the stratification and mapping of the vegetation to create digital data according to the AVI Standards Manual (Alberta Environmental Protection 1991)

anthropogenic: human made

biodiversity (biological diversity) : the variability among living organisms from all sources including inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Convention on Biological Diversity, 1992; www.biodiv.org)

bog: peat covered wetlands in which the vegetation shows the effects of a high water table and a general lack of nutrients. Surface water bodies are strongly acidic and are dominated by sphagnum mosses and heath shrub vegetation – both with and without trees (Canadian Wetlands Conservation Task Force 1993)

buffer: a band of vegetation or relatively undisturbed land around or along a core area intended to act as a natural barrier that moderates negative effects from outside activities before they can impact the area of interest

community (ecological context): any grouping of populations of different organisms that live together in a particular environment (Allaby 1998)

conservation: maintenance of environmental quality and resources or a particular balance among the species present in a given area through the management of resources within social and economic constraints while acknowledging the naturally dynamic character of biological systems (adapted from Allaby 1998)

Conservation Coordinator: the person responsible for the implementation of City Policy C-467 (Conservation of Natural Sites in Edmonton's Tablelands)

cumulative effects: changes to the environment that are caused by an action in combination with other past, present and future human actions (Government of Canada 1994)

Edmonton's Table Lands: the suburban and agricultural lands, outside of the North Saskatchewan River Valley that were annexed to the City in 1982 (City of Edmonton 1992)

endangered species: a species whose present existence in Alberta is in danger of extinction within the next decade (Government of Alberta 2000b)

Environmentally Sensitive Area: a natural site in Edmonton that is larger than 1.0 ha (wetlands) or 2.0 ha (forested areas) and is “undisturbed or relatively undisturbed” and which “because of its natural features has value to society and ecosystems worth protecting, but are susceptible to further disturbance”. These sites might provide habitat for rare species, exhibit high diversity, contain unique or sensitive landforms, or provide critical hydrological functions (Alberta Environmental Network and City of Edmonton 2001)

exotic: from elsewhere; introduced into an area; non-native

extirpated: locally extinct, but still present in one or more locations elsewhere

fen: peat covered wetland characterized by a high water table, slow internal drainage by seepage down low gradients, may exhibit low to moderate nutrient content and may contain shrubs, trees or neither (Canadian Wetlands Conservation Task Force 1993)

feral animal: a domesticated animal or their progeny that is no longer or never has been under the care of humans and lives in the wild

forb: a broad-leaved, non-woody plant that dies back to the ground after each growing season (Johnson *et al.* 1995)

function: describes what the natural feature (e.g., wetland) does in ecological terms without any reference to any monetary or social values that society places upon that function

goal: a broad, long-term projection of desired outcomes relative to the overall purpose of the project and nature of the natural site

guild: avian species in an area that exploit similar resources in similar ways

habitat: a place where an organism lives that provides resources necessary for that organism's survival

herb: a plant without woody above-ground parts, the stems dying back to the ground each year (e.g., forbs, grasses, sedges, rushes, ferns; Johnson *et al* 1995)

herbaceous: herb-like, pertaining to an herb

hydrology: the study of the flow of water in various states through terrestrial and atmospheric environments (Allaby 1998)

hydroperiod: depth, duration, frequency and pattern of flooding (within a wetland)

important wildlife area: an area that provides an important or critical resource to an animal either seasonally or year-round.

introduced species: a species that is not native to an area, but was established in the area because of human activity

lekking: act of males of specific bird species (e.g., grouse) aggregating at one location where they perform displays to attract females.

management plan: a document formulated to ensure that all responsibilities and actions necessary to support a natural site's conservation are considered and understood, once a landowner(s) has decided to conserve a site (City of Edmonton 1995)

marsh: nutrient-rich wetlands that are periodically or permanently inundated by standing or slow moving water mainly possessing wet mineral soils; they, are subject to a gravitational water table but water remains within the rooting zone of plants for most of the growing season; emergent vegetation consists of reeds, cattails and sedges (Canadian Wetlands Conservation Task Force 1993)

migratory species: a species that is at least annually required to travel large distances to link seasonally important habitats that are critical to some part of their life cycle

Natural Area: a site that is 0.1-1.0 ha (wetlands) or 1.0-2.0 ha (forested areas) that do not necessarily contain any special or unusual features (Alberta Environmental Network and City of Edmonton 2001)

Natural Areas Policy Implementation Committee: an in-house committee that evaluates the natural site management plan and determines whether it is sufficient for the management of the natural site.

natural site: any environmentally sensitive area, significant natural area or natural area that was identified by, and/or meets the criteria outlined in, the *Inventory of Environmentally Sensitive and Significant Natural Areas, City of Edmonton: Consolidated Technical Report*, (Geowest Environmental Consultants 1998), or is subsequently identified by the Office of Conservation Coordinator as meeting the intent of that inventory.

non-resident species: a species that does not live in the area of interest, but might use it to facilitate its movement from one habitat to another

non-vascular plant: plants that do not possess vascular tissue (xylem and phloem); includes mosses, liverworts, and hornworts

normal water level: the design level of water in a facility associated with dry weather periods or periods of low stormwater flows (Lilley Environmental Consulting 2000)

nuisance wildlife: wild animals whose activities or presence create a hazard or inconvenience for humans (the list of animals fitting this definition may change over time)

objective: end results that will achieve broader goals. They describe desired future conditions, and are measurable, time-specific and geographically specific.

peatland: vegetated wetlands with a minimum of organic soil depth of 40cm resulting from the accumulation of peat (decomposing plant material)

policy statement: a statement that puts the management plan into an administrative context and makes it specific to the natural site of interest (Government of British Columbia 2000)

proponent: the person, company, or governmental body proposing the project (adapted from the Canadian Environmental Assessment Agency 1994)

rare species: for plants, where they are few in number or found only in a limited number of areas (often 5 or fewer in the province); they are not in immediate danger of extinction but could be at risk due to their numbers and or distribution, these species may be widespread in other geographic locations outside of Alberta (Argus and White 1978)

resident species: a species that is continuously present in an area for most or all of its lifespan; does not include animals that only use the habitat on a seasonal basis

seasonal habitat: habitat that provides a seasonal requirement for a species (e.g., nesting areas, waterfowl staging areas)

shallow open water: potholes, sloughs or ponds as well as waters along river and lakeshore areas, usually relatively small bodies of standing or flowing water commonly representing a transitional stage between lakes and marshes, surface water open and generally free of emergent vegetation, water depth usually < 2 m at mid-summer levels (Canadian Wetlands Conservation Task Force 1993)

Significant Natural Area: a site larger than 1.0 ha (wetlands) and 2.0 ha (forested areas) that “has the potential to remain sustainable within an urban environment and is

significant from an environmental perspective to the community of Edmonton because of its size or features of the site” (Alberta Environmental Network and City of Edmonton 2001)

snag: a dead standing tree

species at risk: an extirpated, endangered, or threatened species or a species of special concern (Government of Canada 2002)

strategy: describes how to achieve an objective, and pertains to an activity and how that activity is to be conducted. Strategies may be time-specific and measurable. (Government of British Columbia 2000)

swamp: a nutrient-rich, productive wetland where standing or gently moving water occurs seasonally or persists for long periods, leaving the sub-surface continuously waterlogged; they consist of dense coniferous or deciduous forest, or tall shrub thickets (Canadian Wetlands Conservation Task Force 1993)

threatened species: a species that is likely to become endangered if the factors causing its vulnerability are not reversed (Government of Alberta 2000b)

value: the benefit that a specific ecological function provides to society

vascular plant: a plant that contains vascular tissue (xylem and phloem) that allows movement of water, sugars, and nutrients through the plant (e.g., flowering plants, trees, ferns)

viewscape: the view of the horizon or landscape features that can be seen from a specific point of land; often considered as an aesthetic value to be considered during development or recreational planning

weed: a plant that grows where it is not wanted (Royer and Dickinson 1999); as per the Alberta Weed Control Act there are 3 kinds of weeds: 1) “noxious weed” means a plant that has the ability to spread rapidly and cause severe crop losses and economic hardship; 2) “nuisance weed” means plants that are common to the Province and in many cases are native species, they can cause significant economic losses, but are so biologically suited that they can never be eradicated; and 3) “restricted weed” means plants that pose a serious threat and as such must be eradicated due to their ability to spread rapidly and be successful competitors (Government of Alberta 2000a)

wetland: land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic vegetation, and various kinds of biological activity that are adapted to a wet environment (*Canadian Wetlands Conservation Task Force*).

wildlife: organisms in the Kingdom *Animalia* (animals), including big game, fur-bearers, birds of prey, insects and other invertebrates, reptiles, amphibians, fish, wildlife parts, eggs and young.

wildlife travel corridor: an area, usually one providing vegetated or terrain cover that reduces wildlife exposure to predators and weather, that is used by wildlife to travel from one habitat area to another

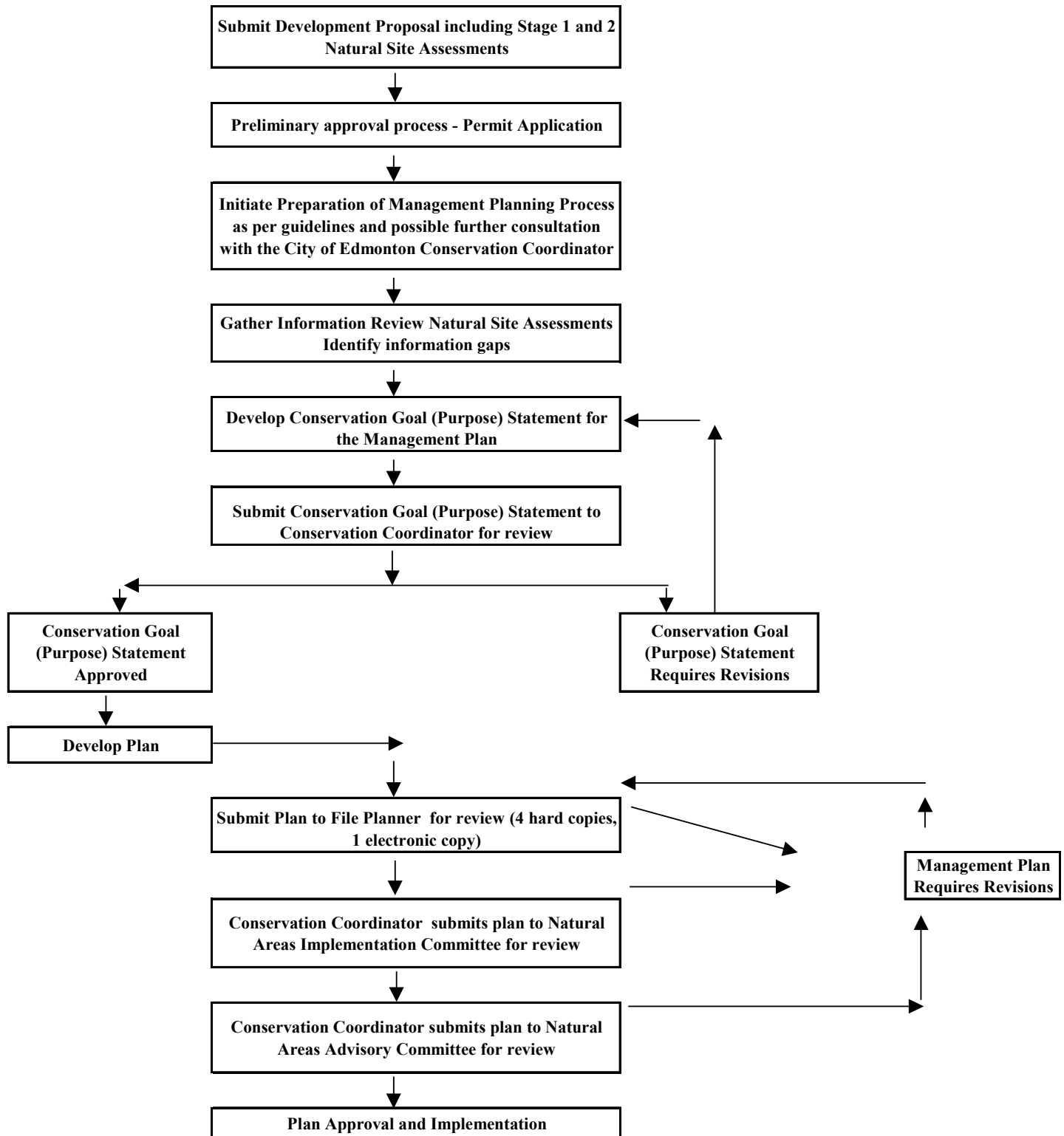
woodland: an area dominated by trees

Literature Cited

- Alberta Environmental Network and City of Edmonton. 2001. Conserving Edmonton's natural areas: a framework for conservation planning in an urban landscape. City of Edmonton. Edmonton, Alberta, Canada. 174 pp.
- Alberta Environmental Protection. 1991. Alberta Vegetation Inventory standards manual version 2.1. Government of Alberta. Edmonton, Alberta, Canada. 53 pp.
- Allaby, M. (ed.). 1998. A dictionary of ecology 2ed. Oxford, United Kingdom. 446 pp.
- Argus, G. W. and D. J. White. 1978. The rare vascular plants of Alberta. Syllogeus No. 17, National Museums of Canada, Ottawa, Ontario, Canada. 46 pp.
- British Columbia Forest Service (1999, January) An Introductory guide to adaptive management for project leaders and participants. Retrieved January 16, 2003 from <http://www.for.gov.bc.ca/hfp/amhome/INTROGD/Toc.htm>
- Canadian Wetlands Conservation Task Force. 1993. Wetlands, a celebration of life: final report of the Canadian Wetlands Conservation Task Force. Issues Paper NO. 1993-1. 67 pp.
- City of Edmonton. 1992. Environmentally sensitive and natural area protection within Edmonton's table lands: policy and implementation background study. City of Edmonton. Edmonton, Alberta, Canada. 32 pp.
- Funk and Wagnalls Standard College Dictionary. 1978. Fitzhenry and Whiteside Limited. Toronto, Ontario, Canada.
- Geowest Environmental Consultants (1998). Inventory of Environmentally Sensitive and Significant Natural Areas, City of Edmonton: Consolidated Technical Report.
- Government of Alberta. 2000a. Weed Control Act R.S.A. 2000, C.W. -5. Alberta Queen's Printer. Edmonton, Alberta, Canada.
- Government of Alberta. 2000b. Wildlife Act R.S.A. 2000, C. W-10. Alberta Queen's Printer. Edmonton. Alberta, Canada
- Government of British Columbia. 2000. Range use plan guidebook. British Columbia Queen's Printer. Victoria, British Columbia, Canada
- Government of Canada. 1994 Chapter 46, an Act to amend the Canadian Environmental Assessment Act. Queen's Printer. Ottawa, Ontario, Canada.
- Government of Canada. 2000. Species at Risk Act. Queen's Printer, Ottawa, Ontario, Canada.

- Johnson, D., L. Kershaw, A. MacKinnon, and J. Pojar. 1995. Plants of the Western Boreal Forest and Aspen Parkland. Lone Pine Publishing. Edmonton, Alberta, Canada. 392 pp.
- Lilley Environmental Consulting. 2000. Draft Guidelines for Constructed Stormwater Wetlands. City of Edmonton. Edmonton, Alberta, Canada. 28 pp.
- National Wetlands Working Group. 1997. The Canadian wetland classification system, 2nd ed. Wetlands Research Center, University of Waterloo. Waterloo, Ontario, Canada. 68pp.

Appendix 1 Natural Site Management Plan Approval Process Flow Chart



Appendix 2 Checklist for the Development of Natural Site Management Plans

Site Feature		Site Assessment Importance Rating*	Post-development Sustainability*	Specific Objective Required? Y/N	Reason for not Addressing
Vegetation	upland forest species				
	non-native species/weed control				
	native species				
	rare, threatened, or endangered plants				
	tree and shrub selection				
	preparation of planting sites				
	site stabilization and planting protection				
	establishment of buffers				
	biological pests				
	dead tree management				
	monitoring of vegetation				
Wildlife	species present				
	non-native species, nuisance wildlife				
	rare, threatened, or endangered wildlife				
	resident species				
	non-resident species				
	pest management				
	human/wildlife conflicts				
	wildlife disease				
Habitat Quality	food - type, amount, seasonality				
	cover - type, amount and seasonality				
	habitat linkages				
	habitat enhancement				
	habitat protection				
	control of native, exotic or feral species				
	site stabilization				
	pest and disease control				
	prescribed burning programs				
	monitoring of habitat quality				
Soils	soil types				
	areas of special concern				

Checklist for the Development of Natural Site Management Plans					
Site Feature		Assessment Importance Rating*	Post-development Sustainability*	Specific Objective Required? Y/N	Reason for not Addressing
Hydrology	site hydrology				
	areas of special concern				
Water & Wetlands	function and values				
	water levels				
	water quality				
	accessibility				
	beaver management				
	emergent wetland vegetation				
	Alberta Water Act				
	wetland construction/replacement				
	algal control				
	wetland/riparian enhancement				
Landscape Context	distance to adjacent natural areas				
	connectivity with adjacent natural areas				
Human Use	restricted or prescribed uses				
	access control and enforcement				
	interpretive and educational uses				
	recreational uses or constraints				
	undesirable uses				
	facility requirements and maintenance				
	parking considerations and restrictions				
	public health and risk management (e.g., fire, disease)				
	cultural/historic resources				
	cumulative effects				
	monitoring of human use				

* As taken from the Stage 1 or Stage 2 Natural Site Assessment prepared for the site.

Appendix 3 Buffers

*Design Recommendation for Riparian Corridors and
Vegetated Buffer Strips (Fischer and Fischenich 2000)*



Buffers

buffer: a band of vegetation or relatively undisturbed land around or along a core area intended to act as a natural barrier that moderates negative effects from outside activities before they can impact the area of interest

The establishment of buffers will often be on a site-by-site basis depending on the nature and sensitivity of the target natural site's features and the nature of the proposed development or adjacent land use. Fischer and Fischenich (2000) is an example of a state-of-the-art guideline for the creation and management of buffers in riparian areas in the USA. While recognizing that natural site conditions in Edmonton differ from those presented in the document, much of the document's discussion of riparian buffers can be applied to natural site buffers, particularly wetland sites, in Edmonton. We include the reference here to serve as a primer for the subject of buffer establishment and management.

Fischer, R.A. and J.C. Fischenich (2000) Design Recommendations for Riparian Corridors and Vegetated Buffer Strips. EMRRP Technical Notes Collection (ERDC TN-EMRRP-SR-24), U.S. Army Engineer Research and Development Center, Vicksburg M.S.

www.wes.army.mil/el/emrrp

Appendix 4 Wetland Classification for Natural Site Management Plans

Wetland Classification

In Canada, the National Wetlands Working Group (1997) defines wetlands as “land that is saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophilic vegetation, and various kinds of biological activity that are adapted to a wet environment.” In the Edmonton area five wetland classes are found: bog, fen, swamp, marsh, and shallow open waters. Within the Canadian Wetland Classification System there are 3 basic levels of wetland classification with "class" being the first level of classification, form (and subform) being the next level, and "type" being the third level. All three levels combine to provide the best overall classification for a wetland.

A wetland "class" is assigned on the basis of properties of the wetland that reflect the overall generic origin of the ecosystem and environment comprising the wetland. Examples include bog, fens, marsh, swamp, and shallow water.

A wetland "form" is a subdivision of each wetland class and is classified on the basis of surface morphology, surface pattern, water type, and morphological characteristics of the underlying mineral soil. There are 49 forms and 72 subforms in the Canadian Wetland Classification System. Examples include riverine, seepage, peat mound, lagoon, estuarine, and basin.

The third and most useful level of classification is the wetland "type". This level is classified based on the structure of the vegetation cover, rather than on the species present. Wetland types are used in conjunction with wetland forms. Examples include aquatic, floating, moss, submerged, treed, reed, and low shrub.

Following the *Canadian Wetland Classification System* (1997), the 5 major classes of wetlands are:

1. shallow open water: intermittently or permanently flooded areas, open expanses of water that are up to 2 meters deep, no emergent vegetation on $\geq 75\%$ of the wetland surface
2. marsh: wetlands with mineral (and sometimes well decomposed peat) soils, nutrient rich water, neutral to basic pH, emergent vegetation that covers $>25\%$ of the wetland surface
3. swamp: wetlands with mineral (and occasionally peat soils), water at or near the surface, nutrient-rich water, typically dominated by trees and herbaceous species
4. fen: wetlands with organic soils, water table at or above the surface, organic soils, nutrient-rich water, neutral to slightly acid pH, vegetation generally sedges, grasses, reeds, mosses, and shrubs
5. bog: wetlands with organic soils, water table at or near the surface, sphagnum moss peat, generally unaffected by ground water, water generally acid pH and nutrient-poor

Appendix 5 Overview of Wetland Functions and Values

Wetland Functions and Values

Wetlands are often highly productive environments that play an integral role in many ecosystems and comprise the interface between terrestrial and aquatic habitats. The functions and values of wetlands reflect this critical importance of wetlands on the landscape, yet are often overlooked during the course of development. A wetland function is best described as a chemical, physical, or biological process unique to wetland ecosystems that drives larger landscape-level processes. Values are benefits provided to humans by the ecological functions of wetlands. The following table presents many of the functions of wetlands and their associated values.

Wetland Functions	Wetland Values
Surface water storage	<ul style="list-style-type: none"> • flood control • recreational uses • mitigation of storm water run-off • increased agricultural water supplies • drought mitigation
Nutrient cycling	<ul style="list-style-type: none"> • contributions to the stability of global levels of available nitrogen, atmospheric sulfur, carbon dioxide, and methane • mitigation of causes of global warming • improved drinking water • removal of nitrogen, phosphorous and pesticides from crops and feedlots
Particulate removal	<ul style="list-style-type: none"> • improved water quality • pollution mitigation / treatment • reduced downstream sediment loading • trapping of eroded top-soils for future recovery
Provision of animal and plant habitat	<ul style="list-style-type: none"> • wildlife viewing • medicinal plants • education and interpretation • recreation and ecotourism • provision of forage for wildlife and domestic animals (including wetland hay and wild rice) • role in timber production for some forested wetlands • food production • nature-based tourism • trapping, fishing, and hunting
Water filtration or purification	<ul style="list-style-type: none"> • improved water quality • reduced costs of water filtration • microbial action to reduce algal blooms • reduced pathogens
Groundwater recharge	<ul style="list-style-type: none"> • maintenance of regional water resources • drought mitigation • reduced water-logging of agricultural lands

Appendix 6 Summary Chart of Management Plan Goals, Objectives and Strategies

NATURAL SITE:	TYPE:
Management Goal:	
OBJECTIVES	STRATEGIES
WATER RESOURCES	
Objective 1:	Strategy 1a:
Objective 2:	Strategy 2a:
	Strategy 2b:
	Strategy 2c:
HABITAT QUALITY	
Objective 1:	Strategy 1a:
	Strategy 1b:
Objective 2:	Strategy 2a:
	Strategy 2b:
	Strategy 2c:
	Strategy 2d:

OBJECTIVES	STRATEGIES
WILDLIFE	
Objective 1:	Strategy 1a:
VEGETATION	
Objective 1:	Strategy 1a:
	Strategy 1b:
Objective 2:	Strategy 2a:
	Strategy 2b:
Objective 3:	Strategy 3a:
	Strategy 3b:
	Strategy 3c:
HUMAN USE	
Objective 1:	Strategy 1a:
	Strategy 1b:
SIGNIFICANT FEATURES	
Objective 1:	Strategy 1a:

Appendix 7 Table of Responsibilities for the Construction Phase

[illegible]

* “Base” indicates the first stage of development, while “enhancement” indicates additional work after the main stage of development is complete.

Appendix 8 Table of Responsibilities for Post-development Operations and Maintenance

Responsibilities for Post-development Operations and Maintenance

Task Description	Maintenance Responsibility				
	Transportation	Community Services	Drainage	Resident	Third Party
Buffer Area Turf Pathways Fencing back lots	X	X		X	