7 SIGNIFICANT FEATURES AND HABITAT ASSOCIATIONS

7.1 Lake and Wetland Habitats

Wetlands are generally acknowledged as some of the most productive ecosystems in the world today. With a total of 13,740,000 hectares of wetlands, Alberta comprises approximately 11 percent of Canada's total wetland area (Environment Canada 1986). Wetlands such as those found in the Strathcona County region play a significant role in maintaining structure and functionality of the ecosystem. Aside from providing habitat for a diversity of wildlife, wetlands also attenuate flood peaks and storm flow, modify water quality, control sedimentation, and provide recreational and aesthetic resources for public use. Due in part to significant variances in size, location, and structure, the term wetland has been difficult to define and remains biased by its intended utility. The National Wetlands Working Group (1988) refined a definition proposed by Tarnocai (1979) and has presented it as follows:

> *Wetland is defined as land having the water table at, near, or above the land surface or which is saturated for a long enough period to promote wetland or aquatic processes as indicated by hydric soils, hydrophytic vegetation, and various kinds of biological activity which are adapted to the wet environment.*

Although it has a very broad scope, this definition adequately defines the wetlands of Strathcona County, as it encompasses both larger waterbodies such as Cooking Lake and Trappers Lake and the smaller non-permanent sloughs scattered throughout the study area.

Wetland ecosystems have been classified in a number of ways. The bases for these wetland classifications are varied and include floristic composition, topographic location, geomorphologic basin configuration, and other environmental parameters. In Alberta, detailed wetland classification schemes have been developed by Intera Technologies (1985), however the informal classification criteria adopted by the Alberta Water Resources Commission (1987) provides a suitable context for the discussion of priority wetland habitats in Strathcona County. According to the system developed by the Alberta Water Resources Commission, the province’s wetlands have been classified into the following categories on the basis of type and permanency:

NON-PERMANENT WETLANDS

Non-permanent Slough/Marsh - wetland in a depression where surface drainage is obstructed, with less than 50 percent of the area is open water. Surface water is not always present; the area is usually dry for the growing season, especially in the late summer and fall

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Sheetwater - areas of relatively flat, level terrain that are periodically inundated by shallow, open water that persists for short periods

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Seep - wet areas resulting from groundwater discharge at the soil surface

PERMANENT WETLANDS

Permanent Slough/Marsh - same description as for non-permanent sloughs/marsh except that surface water is present year round or climax vegetation is present.

Lake/Pond - permanent body of open water

Bog/Fen - areas composed mainly of peat derived from moss or sedge and other organic materials. Surface water in bogs is acidic. Mosses, black spruce or tamarack, and shrubs are present. Water in fens is slightly acidic to neutral in pH and rich in nutrients. Cover includes mosses, sedges, reeds, grasses, and shrubs.

Watercourse - channel for running water and adjacent floodplain

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The classification system used for this project is a derivative of this national classification. Griffiths (1992) originally used the classification for habitats in the southern portion of the County. Griffiths' (1992) methodology is further detailed in section 8.0. All of the aforementioned wetland types provide critical input toward maintaining the ecological stability of ecosystems in the County. The conservation of priority wetlands is, therefore, an essential step toward the maintenance of ecological integrity. The functional attributes of wetlands are a result of interactions between and among biotic and abiotic ecosystem components. These wetland functions, although loosely defined here, emphasize the important role of wetlands in conserving diversity and stability. Wetlands provide:

- hydrologic functions;
- water quality control functions; and
- life-support functions.

The hydrologic functions associated with wetlands are the most basic natural values from which all others stem. Primary productivity, wildlife habitat, and nutrient cycling in a wetland or wetland complex are all dependent upon the presence and movement of water through the system. The water budgets of most wetlands are relatively stable, that is, inflow equals outflow. The principal flow components in the wetland water budget are:

INPUTS	OUTPUTS
precipitation surface water inflow (includes overland flow) groundwater inflow	evapotranspiration surface water outflow groundwater outflow

Wetlands function in attenuating flood peaks and storm flows by temporarily storing surface water and releasing it during drier periods. The level to which wetlands perform such functions varies with the type of wetland and its physical characteristics. Following a hydrological classification of wetlands developed by Novitzki (1979), wetlands in Strathcona County are dominated by surface water depressional wetlands, which are larger, more permanent lakes and ponds which receive only precipitation and overland flow. Ground water depressional wetlands are also fairly common in the study area in the form of bogs. These wetland areas are characterized by close contact with the water table and little or no surface drainage. As such, ground water depressional wetlands are commonly associated with black spruce and tamarack bogs within the County.

Wetlands affect water quality by acting as sinks for chemicals, sediments, and nutrients and as sources of nutrients to adjacent water bodies. The process of nutrient cycling is the primary agent of water quality control. Nutrients are brought into wetlands by hydrologic inputs of precipitation and surface and groundwater inflows while they leave the system primarily by surface and groundwater outflows. During their time in the system, however, the role of nutrients and their use is dependent upon intrasystem pathways such as primary productivity and decomposition (Mitsch and Gosselink 1993). Since production and decomposition rates vary with the type of wetland, rates of nutrient cycling also vary. Riparian streams and watercourses, for example, have higher rates of nutrient cycling than do forested bogs where water flow energy is minimal.

The functional value most often associated with wetlands is the provision of fish and wildlife habitats. Sather and Smith (1984) list several factors which determine the value of wetlands as habitat: vegetation structure and diversity, surrounding land use, spatial dispersion of wetlands, vertical and horizontal zonation, size, and water chemistry. In Alberta, 45 species of waterfowl, 81 species of non-game birds, and 30 species of mammals are dependent upon wetlands or wetland margins for all or a portion of their life cycles (Alberta Water Resources Commission 1987). Some of these species are obligately dependent on wetlands while others facultatively use wetlands due to the associated higher productivity of such ecosystems.

A great deal of attention has been given to waterfowl use of wetlands for various life stages, including breeding, moulting, staging, migration, and wintering (Bellrose 1976, Greeson et al. 1979, Windell et al. 1986, Weller 1987, Poston et al. 1990 and others). Both dabbling and diving ducks have been shown by these authors and others to utilize a diversity of wetland types during breeding and non-breeding periods.

Conversely, there has been a relative lack of attention given to the use and importance of wetlands to invertebrates and cold-blooded vertebrates. A description of the full range of invertebrates inhabiting wetlands is beyond the scope of this report, however even the least conspicuous forms of invertebrates are extremely important for converting plant energy into animal food chains. Crustaceans, the most abundant of wetland invertebrates, are almost exclusively aquatic yet their habitat preferences within an individual wetland vary greatly. Amphipods and isopods occur in dense populations in submerged vegetation and, among the Cladocerans, some frequent submerged vegetation, some may be littoral or benthic, while still others are limnetic, or free-swimming (Quade 1969, Martien and Benke 1977, Weller 1979). Mollusks can also be a dominant group in a variety of wetland types ranging from wet riparian margins to deeper permanent lakes. Aquatic snails (Gastropoda) are fairly widespread and are favored forage resources of larger species. Clams and mussels (Pelecypoda) are also important forage items for muskrat, mink, river otter, long-toed salamander, and numerous fish and waterfowl.

Fish species presence in Strathcona County is varied due to (1) habitat specificity and (2) seasonal fluctuations in habitat suitability. For example, dissolved oxygen levels are critical habitat parameters for many Alberta fish species, such as rainbow trout. Long periods of ice cover, high summer temperatures, reduced water levels, snow cover on ice, and wind movement are all natural phenomena that influence oxygen availability. Spawning migrations also occur from deeper waters of lakes and larger rivers to inshore waters and tributaries. Many fish species are, thus, vulnerable to disturbance in a wide variety of habitats and disruption of any one life cycle stage can impair survivorship.

One of the least acknowledged components of wetland-supported biota is the mammalian fauna that are dependent to some extent on aquatic ecosystems. Numerous mammals found in Strathcona County use wetlands facultatively while some, such as beaver and muskrat, are clearly obligate users of such ecosystems. Aquatic or semi-aquatic mammals range from small microtines such as voles and shrews through predators such as river otter to large ungulates. White-tailed deer utilize the County's wetland habitats all year round and moose are common inhabitants of these forested wetlands during the summer season, at which time aquatic vegetation composes a large proportion of their diet. Moose regularly utilize aquatic vegetation as a major source of sodium, as ungulates are particularly sodium - stressed in the spring when, over winter, they have had to rely on low-sodium woody browse and then have additional sodium requirements during pregnancy, lactation, fur moult, and antler development (Best et al. 1977).

No species, however, has as profound an impact on wetland ecosystem development as does the beaver. Beaver impoundment is very common in marsh-sedge wetlands and shrubby wetlands wherever deciduous forest margins occur in Strathcona County and throughout forested regions of Alberta. In areas where beavers are found, dams and lodges can control erosion, retain water, and create favorable wildlife habitat for other species. Trottier (1973) states that:

> *the ability of the beaver to modify their habitat has far-reaching implications related to ecosystem diversity. The cycle of occupation and abandonment of habitat sites, resulting in flooding followed by a drop in impounded water eliminates some ecological niches and creates others. There is a constant turnover of biotic communities since the behavior creates both terrestrial and aquatic seral stages.*

The structural heterogeneity of beaver ponds is significantly higher than that in surrounding terrestrial habitats and, thus, provides an increased number of microhabitats for a variety of species including mink, muskrat, waterfowl, shorebirds, and raptors. These types of biota - controlled wetlands are significant features of the landscape and warrant recognition and protection, particularly if they are already sufficiently removed from anthropogenic activity.

7.2 Riparian Habitats

Riparian ecosystems are well-defined landscape features that share many of the same values as wetlands but are distinct enough to warrant consideration on their own merit. Like the term "wetland", there is no universally accepted definition of a "riparian zone" however the following definition suits our purposes for consideration within Strathcona County (Johnson and McCormick 1979):

> *Riparian ecosystems are ecosystems with a high water table because of proximity to an aquatic system or subsurface water. Riparian ecosystems usually occur as an ecotone between aquatic and upland ecosystems but have distinct vegetation and soil characteristics ... Riparian ecosystems are uniquely characterized by the combination of high species diversity, high species densities, and high productivity. Continuous interactions occur between riparian, aquatic terrestrial ecosystems through exchanges of energy, nutrients, and species.*

Other definitions have stressed wetland characteristics (Minshall et al. 1989), transitional phases (Kovalchik 1987), and landscape pattern (Gregory et al. 1991) in describing riparian zones. Regardless of which definition is applied, however, riparian ecosystems are generally found wherever streams and rivers cause flooding beyond the confines of their channels. In Strathcona County, riparian ecosystems can be found in association with broad alluvial valleys of major rivers such as the North Saskatchewan. However, the vast majority of riparian zone within the County lies in association with the more numerous drainage nets characterized by smaller streams and creeks.

How, then, do riparian ecosystems differ from upland and wetland ecosystems? Three unique characteristics of riparian ecosystems are integral to an understanding of their significance (Brinson et al. 1981, Mitsch and Gosselink 1993):

1. Riparian ecosystems generally have a linear form as a consequence of their proximity to and close association with rivers and streams.

2. Energy and material from the surrounding landscape converge and pass through riparian systems in much greater amounts than those of any other wetland ecosystem; that is; riparian systems are open systems.

3. Riparian ecosystems are functionally connected to upstream and downstream ecosystems and are laterally connected to upland and aquatic ecosystems.

Within any given drainage in Strathcona County, most of the overall channel lengths consist of low-order streams, as characterized on the basis of Strahler's (1957) method of classification. These smaller first, second, and third order channels are often the most directly impacted by land-use activities such as residential development, road construction, and livestock grazing and they must be acknowledged as priority wildlife habitats. In doing so, their value for fisheries and wildlife, aesthetics and recreation, forage production, and water quality both on-site and downstream will be recognized.

Apart from the broader watershed-level functions of nutrient cycling and energy transfer, riparian ecosystems also play a critical role in maintaining fish and wildlife productivity. Organisms of all trophic levels benefit from the interactions between biological, physical, and chemical components of the system, creating complex food webs that support productive and diverse wildlife populations. While some species are dependent upon riparian zones for all of their life requirements, others simply make extensive use of these areas even though they are not dependent upon them. One of the most significant facultative uses of riparian habitats in Strathcona County is the provision of migratory or dispersion corridors for ungulates.

The morphology of small stream channels such as Point-Aux Pins Creek and Astotin Creek are characterized by shallow riffle sections interspersed with deep pools and overhanging banks. In contrast to streams of uniform depths and widths, which usually provide insignificant amounts of fish spawning habitat, small heterogenous streams provide abundant spawning and rearing habitat. Pools form the major microhabitat for fish inhabiting stream environments. Although pools are present along the straight reaches of some streams, they are more commonly formed at bends and oxbows where flows are deflected by channel banks, turbulence is relatively intense, and the bed is erodible (Beschta and Platts 1986).

It has been suggested that wetlands may be viewed as habitat islands in a sea of terrestrial vegetation and that they follow the rules of island biogeography theory (Weller 1988). Therefore, while the shape or edge-effect of a wetland is important in defining significant wildlife habitat values, the size of wetlands and distance between them may be more important. Wetland complexes, then, become quite significant due to increased structural habitat availability and increased species richness as compared to isolated wetlands of equal or greater size.

The diversity and productivity of riparian and wetland systems are ascribable to biotic and nutrient exchanges with upland and aquatic ecosystems. Therefore, aquatic, wetland, and upland areas generally form integrated ecosystems. The degradation or fragmentation of one affects the quality and functions of the others, which, in turn, affects associated plant and wildlife communities. Inclusion of representative riparian/wetland complexes in a priority wildlife habitat network can prevent the exploitation of these resources and ensure that the productivity and value of these systems are realized to their full potential.

7.3 Woodland Habitats

The occurrence of forested communities in central Alberta is characterized by gradually more continuous deciduous and mixedwood cover moving north through the Parkland Natural Region. Prior to European settlement, much of what is now the Central Parkland Subregion was likely dominated by grassland vegetation (Strong 1977). However, settlement reduced the frequency of fire throughout the area and allowed the southward and eastward advance of aspen into the grasslands. The resultant vegetation regime of central Alberta is transitional in nature, dominated by grasslands in the extreme south and shifting to closed deciduous forests and boreal mixedwood forests in the north.

The Parkland Natural Region is described by Achuff (1992) as forming a broad transition zone between the drier grasslands of the plains and the coniferous forests of the Boreal Forest. This transitional relationship has long been recognized as Bird (1930) also regarded the aspen parkland as a subclimax ecotone between the coniferous forest and the prairie. However, recognition of the aspen parkland as one of the most productive agricultural zones in Alberta has resulted in an immense loss of native parkland vegetation. True parkland vegetation, with continuous aspen forest broken by grassland openings, is now increasingly rare due to large-scale clearing activity (Achuff 1992).

The boreal mixedwood forest has been described as a disturbance forest with its composition and structure governed primarily by the ability of species to adapt to disturbance rather than as a result of the gradual process of autogenic succession. Some researchers have suggested that aspen mixedwood forests exhibit a pulse strategy which maintains forest composition in relatively early and productive stages of succession. As a result, forest stands in Strathcona County tend to be relatively young in age; succession is restricted to a relatively short interval following disturbance and its prominence in determining forest composition is also reduced accordingly. Odum (1975) referred to such phenomena as “allogenic succession”, or succession governed by external influences.

Where these forested stands occur within the County, their composition tends to be controlled by the general physiographic conditions prevalent at different locations. Therefore, the vegetation of a single site has the potential to follow many different successional pathways, as are described by Russell et al. (1984). The type of tree species which develops on a given site after disturbance is strongly influenced by:

(1) the pre-disturbance vegetation;

(2) the type and severity of disturbance;

(3) the initial site conditions following disturbance;

(4) the availability of a viable seed source;

(5) the suitability of weather for germination and growth of seedings;

(6) the influence of browsing mammals; and

(7) the physical characteristics of the site itself.

Local composition of forest stands is, therefore, an expression of both species' tolerance to general physiographic conditions and the change in local conditions accompanying the disturbance. High levels of heterogeneity in boreal landscapes are attributed to natural disturbances such as flooding, insect epidemics, windstorms, and fire (Pickett and White 1985, Johnson 1992), with lightning- and human-induced fires being the primary disturbance that has shaped these communities in the past. The dominant boreal mixedwood tree species - aspen, jack pine, white spruce, and black spruce - all have wide ecological amplitudes and can reproduce prolifically after fire given proper growing conditions. The suckering capacity of aspen, the serotinous cones of jack pine, and the semi-serotinous cones of black spruce are obvious adaptations to a fire-dependent system.

The mixedwood forests which are encountered in the area of Strathcona County are mosaic landscapes comprised of stands that vary in tree composition, age, size, shape, and dispersion (Peterson and Peterson 1992). Throughout the mixedwood forests, aspen has traditionally been regarded as a seral stage for conifer-dominated climax communities; this is often the case in the Strathcona County study area, as mixed stands of both aspen and white spruce are the dominant forest community type. However, Kabzems et al. (1976) and Fairbarns (1992) have also described aspen to occur as a climax community in the area of the Boreal Dry Mixedwood Subregion. Therefore, pure stands of aspen and pure stands of white spruce also occur in suitable conditions.

Wildlife use of forested habitats in Strathcona County is closely related to stand age and, thus, stand structure. Species that require dead trees (snags) for nesting and/or foraging (e.g., woodpeckers) or which nest or feed in the canopy (e.g., least flycatcher, bats) are commonly found in old stands where canopy height and snag density are highest. On the other hand, species that forage on shrubs or saplings (e.g., snowshoe hare) are generally more common in young stands where the density of shrubs and saplings is highest. Obviously, wildlife species inhabiting forests in the County have adapted to the various habitats provided by different stages in the life cycle of aspen and mixedwood forests (Table 10).

Table 10: WILDLIFE INDICATOR SPECIES FOR DIFFERENT AGE CLASSES OF ASPEN (from: Wollis 1991)

Indicator species	No. of species represented	Habitat type a							
		1	2	3	4	5	6	7	8
savannah sparrow	14								
clay-colored sparrow	13								
chipping sparrow	30								
warbling vireo	24								
hermit thrush	24								
ovenbird	26								
ruffed grouse	31								
hairy woodpecker	33								
great gray owl	30								
Tennessee warbler	9								
pileated woodpecker	48							●	●

[a] Habitat types: **1** = grasses/forbs, **2** = upland shrubs/saplings, **3** = edge, **4** = immature (25-50 yr), **5** = mature mixedwood forest (50-80 yr), **6** = mature deciduous, **7** = old growth mixedwood (>80 yr), **8** = old growth deciduous (>80 yr).

In a study of the relationship between stand age, stand structure, and vertebrate biodiversity in aspen mixedwoods, Stelfox (1995) reported greater diversity and abundance of organisms found in young and old stands in comparison to mature stands. This pattern has been exhibited by numerous taxa, including birds, flying squirrels, bats, and ungulates. Relative to young and old stands, mature stands are structurally simpler and characterized by an even-aged canopy and a forest floor devoid of coarse woody debris.

The principles of island biogeography (*sensu* MacArthur and Wilson 1967) indicate that a strong relationship should exist between the size of mixedwood forest stands and their biodiversity. Fragmentation of these stands has the potential to affect wildlife species extinction rates through mechanisms such as radical changes in biophysical characteristics, increased interspecific competition, violation of minimum viable area requirements, and increased importance of random extinction events (Nietfeld and Stelfox 1993).