



Chapter 3.0

The North Saskatchewan in Alberta



3.0 THE NORTH SASKATCHEWAN IN ALBERTA

3.1 WATERSHED OVERVIEW

Wherever you are on earth, you are in a watershed. Most of the rain and snow falling outside your window will eventually find its way to a local waterbody - rolling downhill across the land, forming rivulets and joining small streams, and finally emptying into a river or lake. That area of land or “gathering ground” from which water drains to your local waterbody is *your watershed*.

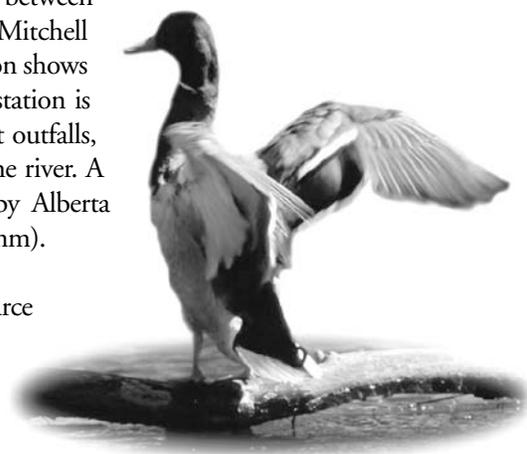
In 2001, the North Saskatchewan Watershed Alliance (NSWA) prepared a background report that described the North Saskatchewan Watershed (Perrin 2001). The following overview of the watershed uses information from that report as well as other material as referenced. For a more detailed description of subwatershed land use refer to Perrin (2001).

The North Saskatchewan Watershed in Alberta drains 80,000 km², approximately 12.5% of Alberta’s landmass. The river has its origin at the Saskatchewan Glacier in the Columbia Icefields in Banff National Park and flows over 1,000 kilometres from its headwaters to the Alberta/Saskatchewan border. The elevation of the North Saskatchewan River is 1,390 m above sea level at the Saskatchewan Crossing near the park boundary, and slopes to just 500 m above sea level at the border with Saskatchewan. It joins with the South Saskatchewan River in Saskatchewan east of Prince Albert, flows into Lake Winnipeg in Manitoba and eventually empties into the Hudson Bay via the Nelson River. As part of the Saskatchewan River Basin, the North Saskatchewan River is subject to the 1969 Master Agreement on Apportionment, which states that Alberta must allow 50% of the natural flow of rivers to flow into Saskatchewan, must meet a minimum flow requirement whenever flow is above that minimum and can account for this on an annual basis.

Water quality in a river system tends to change as you move downstream due to inputs from both natural and human-caused point and non-point sources. Nutrients (notably phosphorus), bacteria and pesticides typically increase while dissolved oxygen decreases downstream of larger urban populations.

Flow in the North Saskatchewan River is regulated by two headwater dams, the Bighorn on the main stem near the mouth of the Bighorn River, and the Brazeau on the Brazeau River. The net effect of these impoundments is to redistribute flow to a higher average flow in the winter and lower average flow in the summer. Without these dams, the City of Edmonton would face water shortages for consumption and waste assimilation at certain times of the year. Three tributaries contribute 66% of the increase in flow between Whirlpool Point and the Saskatchewan border—the Ram, Clearwater and Brazeau Rivers (Mitchell 1994). An analysis of recorded river flow at Hydat Station 05df001 at the City of Edmonton shows a trend of decreasing flow in the river main stem over the past century (Figure 2). This station is downstream of water treatment plant intakes and upstream of wastewater treatment plant outfalls, so it shows increased water use, but doesn’t show that most of this water is returned to the river. A naturalized flow study of the North Saskatchewan River is currently being prepared by Alberta Environment, which is due to be published in December 2004 (Doug Thrussell pers. comm).

Land use in the North Saskatchewan Watershed in Alberta includes agriculture, resource exploration and extraction, forestry, recreation, and urban centres. The upper part of the watershed is sparsely populated and remains in a primarily natural state within National Parks. The vast majority of human population in the watershed lives in the greater Edmonton area.



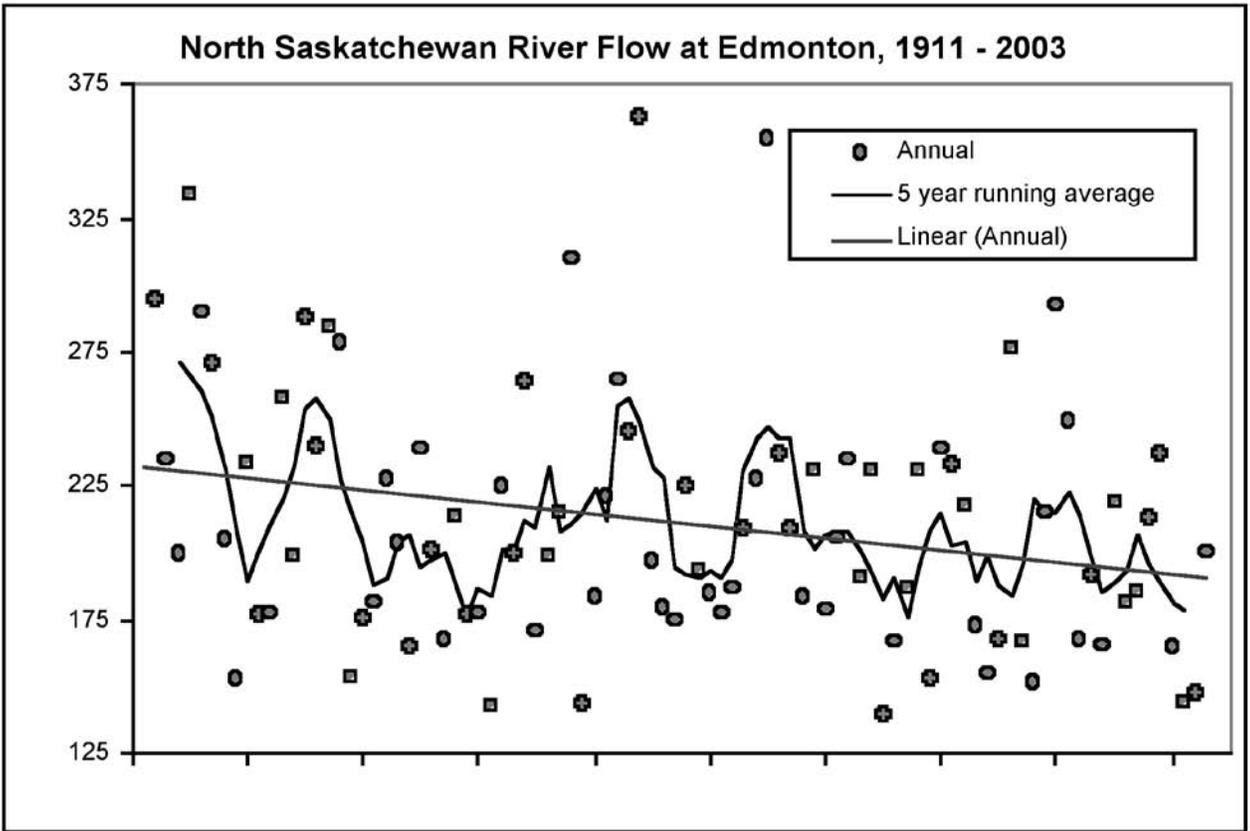


Figure 2: North Saskatchewan River flows at the City of Edmonton (HYDAT Station 05DF001) for 1911 to 2003 as recorded by EPCOR Water Services.

Water use along the North Saskatchewan River and its tributaries includes human consumption, hydro-electric generation, oil and gas extraction, mining, and agricultural uses such as livestock watering and some irrigation. Several villages, towns, and cities in the watershed have either wastewater treatment plants or wastewater lagoons that discharge their treated effluent into either the North Saskatchewan River or tributaries to the river.

The Battle River originates at Battle Lake, traverses central Alberta and flows 1,100 kilometres to enter the North Saskatchewan River near the Battlefords in Saskatchewan. The Battle River drains approximately 40% of the North Saskatchewan River watershed in Alberta. Because the Battle River is fed by groundwater and surface runoff from local snowmelt and rain rather than from glacial meltwater, it only contributes 3% of the water that flows into the North Saskatchewan River. Land use in most of the Battle River watershed is agriculture-intensive and there is a significant amount of coal mining for locally produced power.



There are eight provincial Grazing Reserves in the North Saskatchewan Watershed. These reserves are public lands that provide summer pasture for Alberta’s farmers and ranchers. The reserves also are used for recreational activities, oil and gas production, and firewood cutters. The North Saskatchewan Watershed has ten provincial parks, three national parks, three ecological reserves, two wilderness areas, eighteen First Nation’s reserves, and one Métis settlement.



The North Saskatchewan Watershed, including the drainage basins of the Ram, Clearwater, Brazeau and Battle Rivers, has an estimated 3,600 kilometres of streams. Approximately one-half are suitable for trout and other cold water species. The cold water habitat is located mainly above the junction of the Clearwater and North Saskatchewan Rivers and in the upper half of the Brazeau drainage. Downstream of this area, the river gradually becomes warmer and the fish community shifts towards cool water and warm water game fish such as sturgeon, walleye, pike, goldeye, mooneye and sauger.

Lakes are not plentiful in the watershed and lake fishing opportunities are somewhat limited. Stocked cold water lakes in the headwaters and numerous pothole lakes in the central part of the watershed provide the best opportunities for trout fishing. The larger cool water lakes primarily contain pike, perch, lake whitefish, and walleye.

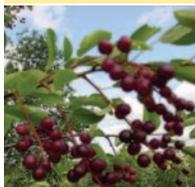
3.2 NATURAL REGIONS IN THE NORTH SASKATCHEWAN WATERSHED

The North Saskatchewan and Battle Rivers traverse five natural regions within Alberta – the Rocky Mountain, Foothills, Boreal Forest, Parkland and Grassland natural regions (Figure 3). The natural regions classification was adopted by the government of Alberta to represent ecosystem and biodiversity elements of importance to protected areas. The classification system emphasizes the overall landscape pattern, which mainly reflects climate, but in others cases reflects the predominance of geological and soil factors. The purpose of the Natural Regions classification is to account for the entire range of natural landscapes and ecosystem diversity and is related primarily to ecosystem and biodiversity conservation.

Brief descriptions of the five natural regions and relevant sub-regions are given below. For more detail, the reader should refer to Achuff (1994).

3.2.1 Rocky Mountain Natural Region

The Rocky Mountain Natural Region is underlain primarily by upthrust and folded bedrock. This region is the most rugged topographically. Elevations drop from west to east, from 3700 m along the Continental Divide to 1500 to 1000 m in river valleys. Three natural sub-regions reflect changes in environmental conditions dues to changes in altitude.





Alberta
COMMUNITY DEVELOPMENT
Parks and Protected Areas Division

Natural Subregions

BOREAL FOREST

- Central Mixedwood 
- Dry Mixedwood 
- Wetland Mixedwood 
- Sub-Arctic 
- Peace River Lowlands 
- Boreal Highlands 

ROCKY MOUNTAIN

- Alpine 
- Subalpine 
- Montane 

FOOTHILLS

- Upper Foothills 
- Lower Foothills 

CANADIAN SHIELD

- Athabasca Plain 
- Kazan Upland 

PARKLAND

- Foothills Parkland 
- Peace River Parkland 
- Central Parkland 

GRASSLAND

- Dry Mixedgrass 
- Foothills Fescue 
- Northern Fescue 
- Mixedgrass 

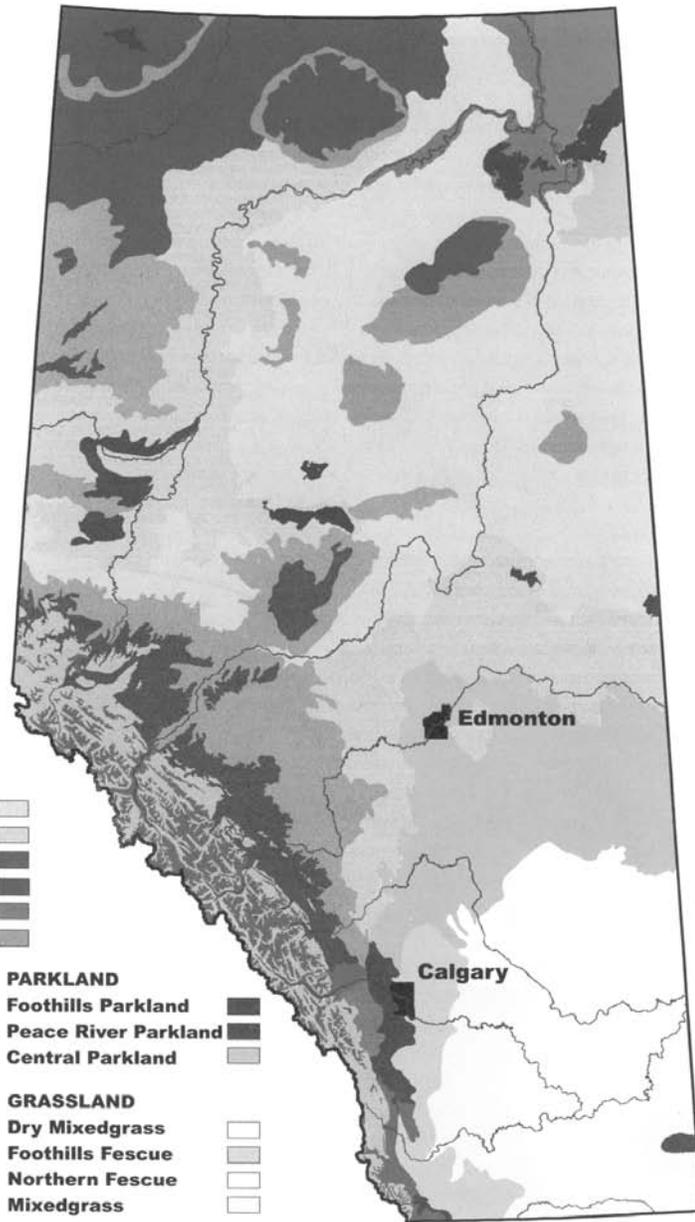


Figure 3: Natural Subregions map of Alberta. Figure courtesy of Alberta Community Development Parks and Protected Areas Division.

3.2.1.1 Alpine Subregion

The Alpine Subregion includes all areas above the tree line. Materials generally are residual bedrock and colluvium often on steep slopes. Extensive areas of unvegetated bedrock occur. The mean May to September temperatures is approximately 6°C and frost-free periods are rare. Mean annual precipitation ranges from 420 to 850 mm. Much of this subregion has no soil. Alpine vegetation typically forms a complex mosaic in which microclimatic variations are reflected in marked changes in dominant species.

3.2.1.2 Subalpine Subregion

The evaluation of the Subalpine Subregion ranges from about 2300 m to around 1600 m. Morainal materials occupy the majority of the subregion with colluvial and residual bedrock materials frequent at higher elevations. Fluvial and glaciofluvial deposits are common along stream valleys. The mean annual temperature ranges from -1°C to 3°C with a mean July temperature of about 15°C. Below freezing temperatures occur in all months. Total annual precipitation ranges from 460 mm to more than 1400 mm. Winter precipitation is higher in this subregion than in any other with often more than 200 cm of snowfall. Soils vary widely, reflecting the great diversity in parent materials and ecological conditions. The Subalpine Subregion is often divided into two portions: a Lower Subalpine characterized by closed forests of lodgepole pine, Engelmann spruce and subalpine fir and an Upper Subalpine with spruce-fir closed forests and open forests near the tree line. At lower elevations, lodgepole forests cover extensive areas following fire. Engelmann spruce and subalpine fir forests typically occur on higher, moister sites that have not been subject to fire. Open forests in the Upper Subalpine are transitional to the treeless Alpine Subregion above. Dominant trees include Engelmann spruce, subalpine fir, and whitebark pine. High elevation grasslands occur in the Subalpine Subregion.

3.2.1.3 Montane Subregion

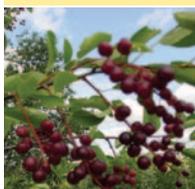
The Montane Subregion occurs primarily in the major river valleys. The landforms of the major valleys are primarily fluvial and glaciofluvial terrace and fans with smaller areas of glaciolacustrine, aeolian and morainal deposits. Sandstone outcrops are typical. Elevations range from 1000 to 1350 m. Chinooks are characteristic of this subregion. The mean temperature for May to September is approximately about 12°C, with a mean July temperature of 15°C. There are approximately 70 frost-free days per year and the mean annual precipitation is approximately 600 mm with a range of 300 to 1280 mm. The landscape is characterized by a pattern of open forests and grasslands. Characteristic tree species include Douglas fir, limber pine and white spruce.

3.2.2 Foothills Natural Region

The Foothills Natural Region is transitional between the Rocky Mountains Natural Region and the Boreal Forest Natural Region. It consists of two Subregions, the Upper Foothills and the Lower Foothills.

3.2.2.1 Upper Foothills Subregion

The Upper Foothills Subregion occurs on strongly rolling topography along the eastern edge of the Rocky Mountains. The upper elevation limit is about 1500 m. Bedrock outcrops of marine shales and non-marine sandstones are frequent. Morainal deposits are common over bedrock throughout much of the area. The subregion has a mean annual precipitation of approximately 540 mm, with approximately 340 mm occurring between May



and September. The mean May to September temperature is 10°C to 12°C. Upland forests are nearly all coniferous and dominated by white spruce, black spruce, lodgepole pine, and occasionally subalpine fir. Lodgepole pine forests occupy large portions of upland sites and black spruce dominates on wet sites.

3.2.2.2 Lower Foothills Subregion

The Lower Foothills Subregion is generally rolling topography created by deformed bedrock along the edge of the Rocky Mountains. Elevations range from approximately 1250 m to 1450 m. Surficial materials are commonly morainal veneer over bedrock. Extensive organic deposits occur in valleys and wet depressions. Mean annual precipitation averages 465 mm, of which two-thirds falls between May and September. The mean May to September temperature is 11°C to 13°C. The forests reflect the transitional nature of the subregion in which mixed forests of white spruce, black spruce, lodgepole pine, balsam fir, aspen, balsam poplar and paper birch occur. Lodgepole pine communities are perhaps the best indication of the lower boundary of the Lower Foothills Subregion. The upper boundary is marked by the occurrence of nearly pure coniferous forest cover. Black spruce forests occur on moist upland sites and fens are common in much of the subregion.

3.2.3 Boreal Forest Natural Region

The Boreal Forest Natural Region is the largest in Alberta; however, most of this natural region occurs north of the North Saskatchewan Watershed. The region consists of broad lowland plains and discontinuous but locally extensive hill systems. The presence of extensive wetlands is a major characteristic of the Boreal Forest Natural Region. Bogs, fens and swamps are abundant and marshes are locally prevalent. The region has been divided into six subregions, but only the Dry Mixedwood Subregion occurs in the North Saskatchewan Watershed.

3.2.3.1 Dry Mixedwood Subregion

The Dry Mixedwood Subregion is characterized by low relief and level to undulating terrain. Surficial materials are mostly till with some areas of aeolian dunes and sandy outwash plains. The Cooking Lake moraine east of Edmonton is a separate portion of the subregion. The climate of the subregion is subhumid, continental with short, cool summers and long, cold winters. The mean May to September temperature is approximately 13°C and the growing season 90 days. Annual precipitation averages 350 mm, with June and July being the wettest months. Winters are relatively dry with approximately 60 mm of precipitation. Aspen is an important tree species in the subregion, occurring in both pure and mixed stands. Balsam poplar frequently occurs with aspen on the moister sites. Over time, white spruce and, in some areas, balsam fir can be expected to increase or replace aspen and balsam poplar as the dominant species; however, frequent fire seldom permits this to occur and pure deciduous stands are common in the southern part of the subregion. Dry, sandy sites are usually occupied by jack pine forests. Peatlands are common and may be extensive.

3.2.4 Parkland Natural Region

The Parkland Natural Region forms a broad transition between the drier grasslands of the plains and the coniferous forests of the Boreal Forest and Rocky Mountain natural regions. The Parkland Natural Region consists of three subregions; Central, Peace River, and Foothills, the latter of these does not occur in the North Saskatchewan Watershed. The subregions are separated on the basis of geographical location and major floristic differences. The Parkland Natural Region is the most densely populated region in Alberta and settlement has changed much of the native vegetation from aspen groves and grasslands to cultivated land.



3.2.4.1 Central Parkland Subregion

Surficial deposits in the Central Parkland Subregion range from intermediate-textured hummocky and ground moraines to fine-textured glaciolacustrine deposits and coarse outwash. Elevations range from just over 500 m to around 1100 m. Numerous permanent streams cut across the subregion, and lakes and permanent wetlands are scattered throughout. Many of the lakes and wetlands naturally are slightly to strongly alkaline. The mean annual temperature is 2°C with a May to September average of 13°C. The frost-free period averages 95 days. The mean annual precipitation is 350 to 450 mm, with the May to September precipitation averaging 300 mm. Within the Central Parkland Subregion, the vegetation changes from grassland with groves of aspen in the south to aspen parkland to closed aspen forest in the north. The two major forest types in the subregion are trembling aspen and balsam poplar on moister sites in depressions and in the northern part of the subregion. Both are characterized by a dense, lush, species-rich understory. The grassland vegetation of the ‘parks’ is the same as that of the Northern Fescue Subregion described below.

In Alberta, the Central Parkland Subregion is one of the most productive waterfowl areas; however, only about 2% of this landscape is formally protected in parks or other conservation areas. The area’s deep, rich soils and reliable moisture have largely been converted to productive farmland. It is now the most heavily impacted and fragmented ecoregion in Alberta, with only 5 - 8% remaining in its natural state (Nature Conservancy of Canada 2004).

3.2.5 Grassland Natural Region

The Grassland Natural Region is a flat to gently rolling plain with a few major hill systems. Most of the bedrock is covered with extensive, thick glacial till deposits. The Grassland Natural Region contains four subregions: Dry Mixedgrass, Mixedgrass, Northern Fescue, and Foothills Fescue, separated primarily on the basis of climatic, soils and vegetation. Only the Northern Fescue and Foothills Fescue subregions occur in the North Saskatchewan Watershed.

3.2.5.1 Northern Fescue Subregion

The Northern Fescue Subregion is characterized by gently rolling terrain, commonly low-relief ground moraine and hummocky moraine. The mean May to September temperature is 14°C and the frost-free period is about 90 days. Mean annual precipitation is approximately 400 mm, with mean May to September precipitation of approximately 280 mm. The vegetation is dominated by rough fescue.

3.2.5.2 Foothills Fescue Subregion

The Foothills Fescue Subregion occurs largely on the outwash deposits of the foothills. Elevations are higher in this subregion than in the Northern Fescue Subregion. The climate differs from the Northern Fescue Subregion in having a greater frequency of Chinooks and thus, a milder winter climate. There also is more snowfall in later winter and early spring with the majority of precipitation falling during the growing season. The mean annual precipitation is approximately 500 mm with 290 mm falling between May to September. The mean May to September temperature is 11 to 13°C and the mean annual temperature is 3°C. The average frost-free period is 90 days. Grasslands are dominated by rough fescue, Idaho fescue, and oat grass.

