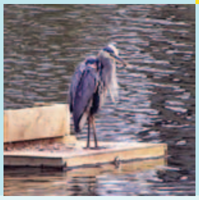


Chapter 7.0
Conclusion




7.0 CONCLUSION

7.1 DISCUSSION OF INDICATORS

7.1.1 Land Use

7.1.1.1 Riparian Health

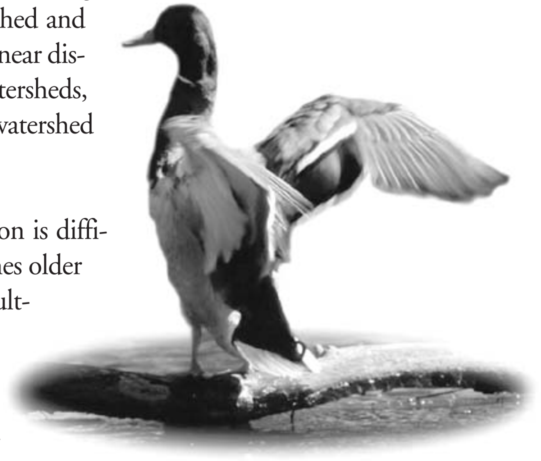
There have been no comprehensive assessments undertaken for riparian habitat in any Subwatershed; although small-scale assessments have been completed along several lakes, streams and creeks. To gain a better understanding of the impact that linear developments, agriculture and municipal land uses may have on a Subwatershed, comprehensive assessments of riparian health are needed within all 18 Subwatersheds. Such a study was recently completed for the South Saskatchewan Basin (Red Deer, Bow and South Saskatchewan Rivers) by Cows & Fish (ARHMP Cows & Fish 2004). At a minimum, the City of Edmonton and other larger municipalities should undertake a comprehensive assessment and inventory of riparian areas within their jurisdictions.

The assessments completed to date suggest that a significant portion of the riparian habitat has been damaged in Subwatersheds that have a higher proportion of agricultural development. However, this finding may be biased by a tendency to conduct assessments in agricultural areas (the "white zone" of Alberta) of most concern (i.e. those that are more likely to have been impacted). The riparian health assessments that have been completed by Cows & Fish may not be representative of other sites outside of the white zone within the North Saskatchewan Watershed. Sites completed also include those where specific requests have been made to undertake assessment work.

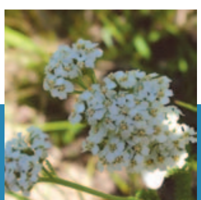
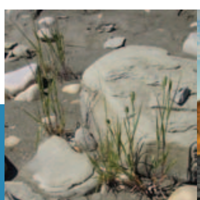
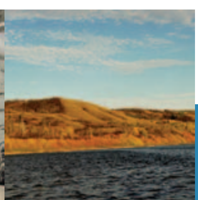
7.1.1.2 Linear Development

The least amount of linear development occurs in the headwaters of the Cline (0.1%), Brazeau (1.4%) and the Ram (1.6%) Subwatersheds. There is also relatively little linear disturbance in the Sounding Subwatershed (1.0%). The greatest amount of linear disturbance occurs in the Subwatersheds within the Foothills Natural region. Linear developments have affect 4% of the Strawberry Subwatershed area and 3.5% of the Modeste Subwatershed area.

The type of disturbance varies among the Subwatersheds. Among those with the least amount of linear disturbance are the Brazeau, Sounding and Cline Subwatersheds. In the Brazeau and Sounding Subwatersheds, 63% and 51% of the linear disturbance is due to cutlines, respectively. In the Cline and Sounding Subwatersheds, the majority of the disturbance is due to roads, 63% in the Cline Subwatershed and 55% in the Sounding Subwatershed. Among the Subwatersheds with the greatest amount of linear disturbance, pipelines account for most of the disturbance in the Modeste and Strawberry Subwatersheds, 33% and 25% respectively. Roads account for 31% of the disturbance in the Modeste Subwatershed and 55% in the Strawberry Subwatershed.



Seismic cutlines are particularly damaging because of their multitude of impacts. Regeneration is difficult due to soil and root disturbance, grass competition and access use. As many as 88% of lines older than 20 years have still not regenerated (AB Centre for Boreal Studies, November 2001), resulting in progressive loss of mature forest and alteration of forest structure. Forest fragmentation reduces habitat effectiveness, and can lead to avoidance of habitat by certain species. Damage to aquatic systems increases sedimentation, bank erosion, alteration of drainage patterns and destruction of aquatic habitat (AB Centre for Boreal Studies, Nov 2001). Groundwater sources (aquifers) can also be negatively impacted by seismic activities including blasting.

7.1.1.3 Land Use Inventory

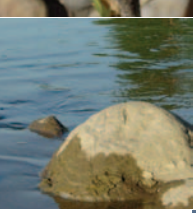
The land use inventory information is based on the PFRA Land Classification as well as information related to forest management agreements and protected areas. As one travels from west to east, progressively more land is in grasslands and agricultural land uses and less in forests. Grasslands mainly cover several Subwatersheds but most notably in Paintearth, 55% of the land area; Blackfoot, 55%; Sounding, 61% and Ribstone, 65%. Cropland covers more than half of the land area of the following Subwatersheds: Vermilion, 51%; and almost half in the Iron, 44%, and Blackfoot, 41%. In the central part of the North Saskatchewan Watershed, forage is more dominant with 54% of Strawberry Subwatershed being in forage, 43% of the Modeste Subwatershed and 37% of the Bigstone Subwatershed. With an increase in lands converted to cropland comes a loss of biodiversity (Tilman et al. 2002). Ideally, agricultural practices need to encourage biodiversity, such as on marginal lands.

In addition to the linear disturbances noted above, the Subwatersheds with the most disturbance in the form of well sites and other facilities, urban development and reserve lands are the Sturgeon Subwatershed, 68%; which is affected mainly by urban development in and around Edmonton; the Strawberry Subwatershed, 15%, and the Frog Subwatershed, 12.3%. The Subwatersheds with the least amount of land disturbance are the Cline, no disturbance noted; Brazeau, 0.2%; and the Ram, 2.3%. Continued efforts should strive to maintain the low disturbance of these areas as headwaters source protection. In those areas that are already significantly impacted, best management practices (agriculture, oil and gas, stormwater, etc.) can be utilized to manage the impacts of these activities in the watershed.

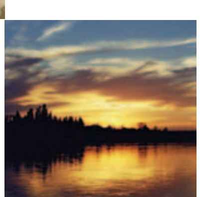
7.1.1.4 Livestock Density

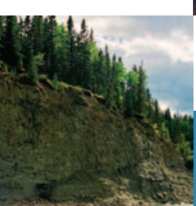
Manure production was used as a surrogate for livestock density. Manure production information was available only on the basis of soil polygons. These polygons provide only a rough estimate of manure production in a Subwatershed area. Based on the available information, livestock densities were greatest in the Bigstone, Beaverhill and Sturgeon Subwatersheds and least in the Cline, Ram and Brazeau Subwatersheds. Because of the impacts that agriculture can have on surface water quality, it is recommended that intensive agriculture be minimized in the headwater Subwatersheds (Cline, Ram, Brazeau and Clearwater) as a source water protection measure. The high agricultural intensity in headwater Battle River Subwatersheds (such as the Bigstone) may be cause for some concern for surface waters in those Subwatersheds and for downstream users.

7.1.1.5 Wetland Inventory



The most detailed information on wetlands is provided by Ducks Unlimited Canada. Based on their information, the Subwatersheds with the largest percentage of the land area covered in wetlands are Strawberry, 23.5%; Ribstone, 12.9%; Sounding, 8.5%; and Beaverhill, 8.5%. Quite clearly, much more data is required for a detailed wetland inventory of the North Saskatchewan Watershed. This would help to more accurately assess watershed health. While the former will quantify existing wetlands, a drained wetland inventory would be useful to help assess how much wetland area has been lost. A comprehensive wetland resource inventory, including drained wetlands, is a key component of a complete land use inventory. By identifying areas of wetland loss, land management planners can effectively implement watershed management plans that develop and prioritize restoration goals which will address this fundamental element of source water protection and restoration. Establishing more active partnerships between agencies (Alberta Environment, Ducks Unlimited Canada, Alberta Agriculture, Agriculture and Agri-Food Canada and municipalities) will help provide necessary data to support the integrated watershed management planning.








7.1.2 Water Quality

7.1.2.1 Alberta Surface Water Quality Index

Data on the Alberta Surface Water Quality Index (ASWQI) calculated at sites on the North Saskatchewan River, was available for two Subwatersheds, the Strawberry – calculated at Devon upstream of Edmonton – and the Beaverhill – calculated at the Pakan Bridge downstream of Edmonton. The index shows the impact of inputs to the river from the City of Edmonton, industrial discharges in the Edmonton region and the Edmonton regional municipalities. In general, water quality for metals was rated as “excellent” to “good” at Devon and “excellent” to “fair” at Pakan. For nutrients, the index was “good” to “fair” at Devon and “fair” at Pakan. For bacteria, the index was “excellent” to “good” at Devon and “good” to “poor” at Pakan. The index for pesticides was “excellent” to “good” at Devon and “good” to “fair” at Pakan. The impact of the capital region’s population, wastewater, stormwater, development and land use all contribute to decreased water quality seen immediately downstream of Edmonton.

7.1.2.2 *Escherichia coli (E. coli)*

Little information was found for *E. coli* counts in the watershed. The Tomahawk Creek (in an area of moderate agricultural intensity) in the Modeste Subwatershed was found to have very high coliform counts (CAESA 1998). This result was typical of other moderate intensity agricultural sites. It is not known why moderate agricultural intensity streams have higher fecal coliform counts than high agricultural intensity streams. The North Saskatchewan River downstream of Edmonton (Strawberry Subwatershed) also has elevated fecal coliform counts, and with the source being treated wastewater and untreated stormwater runoff inputs (Alberta Environment 2004). Coliform counts have been reduced since the addition of UV treatment at the Gold Bar Wastewater Treatment Plant (City of Edmonton 2003).

7.1.2.3 Phosphorus

Data on phosphorus concentrations were found for relatively few lakes, rivers, streams and creeks in the North Saskatchewan Watershed. High phosphorus concentrations are a problem at several lakes within the North Saskatchewan Watershed (Alberta Lake Management Society 2004), due to the deep, phosphorus-rich soils found throughout the watershed. Lakes throughout the watershed report phosphorus related problems with algal blooms, fish kills, aesthetics, and impairment of recreational use.

Work by Alberta Agriculture, Food and Rural Development continues to demonstrate the strong positive correlation between intensity of agriculture and phosphorus concentrations in Alberta streams in agricultural watersheds (Anderson *et al.* 1998, Anderson 1998, Anderson 2000, Carle 2001, Donahue 2001, Depoe and Westbrook 2003). In addition, streams with greater agricultural intensity had increased peak, median and flow weighted mean phosphorus concentrations, and had higher frequencies and degree of non-compliance with phosphorus guidelines for the protection of aquatic life.

The Strawberry Subwatershed and the capital region are major sources of phosphorus and other nutrient loadings into the North Saskatchewan River. However, recent treatment improvements have been made at both Gold Bar and the Alberta Capital Region Wastewater Commission wastewater treatment plants. Biological nutrient removal was retrofitted at the Gold Bar wastewater treatment plant in 1997, and has reduced final effluent total phosphorus concentrations by 40% between 1996 and 2003 (Grace Nowak *pers. comm.*).



7.1.2.4 Pesticides

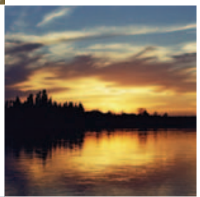
Summarized data on pesticides were available for two Subwatersheds; the Strawberry – measured in the North Saskatchewan River at Devon upstream of Edmonton – and the Beaverhill – measured at the Pakan Bridge on the North Saskatchewan River downstream of Edmonton. The Surface Water Quality Index for pesticides was “excellent” to “good” at Devon and “good” to “fair” at Pakan. More Alberta Environment sites in the Long Term River Network (LTRN) would give a better understanding of pesticide concentrations throughout the North Saskatchewan Watershed. Limited datasets from Alberta Agriculture, Food and Rural Development exist for their study streams within the North Saskatchewan Watershed. Streams draining high (Amisk Creek, Atim Creek, Buffalo Creek, Stretton Creek) and moderate (Lloyd Creek, Strawberry Creek) intensity agricultural areas all have detectable levels of several pesticides used in Alberta.

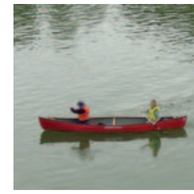
A recent study on pesticides in 32 semi-permanent wetlands of the Aspen Parkland eco-region in 2000 detected pesticides in 92% of the wetlands sampled (Anderson *et al.* 2002). Detections of 2,4-D and MCPA were most frequent, but glyphosate and picloram occurred at higher concentrations. Rainwater was also sampled during this survey, and 2,4-D, MCPA and glyphosate were encountered frequently in precipitation samples (65%, 53% and 57% of the samples, respectively). The authors recommended further research on the implications of chronic, low levels of multiple pesticide residues in air, precipitation, water and aquatic organisms (Anderson *et al.* 2002). Subwatersheds within the Aspen Parkland include the Beaverhill, Frog, Sounding and Battle Subwatersheds (Bigstone, Iron, Paintearth, Iron, Ribstone, and Blackfoot).

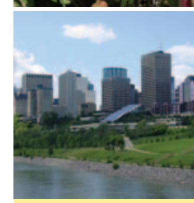
7.1.3 Water Quantity

Water quantity in Alberta, and therefore the North Saskatchewan Watershed, is directly affected by yearly and seasonal differences in weather. Total annual runoff from the high mountain regions varies little from year to year. The Bow River discharge at Banff shows a range from about 900 000 dam^3 in 1949 to 160 000 dam^3 in 1954. In contrast, total annual flow in the Battle River at Ponoka, a central plain stream, has ranged from 15 000 dam^3 in 1976 to 260 000 dam^3 in 1927. Seasonal variations also affect water supply. Spring melt and summer rains produce the greatest volumes of flow while drier fall weather and temporary storage of water in snow and ice during winter are reflected in low runoff patterns. This seasonal change in surface water flow varies across the province. Mountain-fed streams such as the North Saskatchewan River generally experience greatest flows in June or July during the mountain snow melting period, while streams located in the plains, such as the Battle, usually peak in April. Sounding Creek responds almost entirely to an early spring melt (Alberta Environment 2004).

Where surface water sources are not readily accessible, groundwater resources are of particular importance. It is estimated that the total volume of potable groundwater in Alberta may approach 5.5 billion dam^3 with a recoverable, sustainable volume of 16 million dam^3, an amount nearly equal to the total volume of Cold Lake. Groundwater is retrieved from permeable deposits such as sand, gravel or sandstone. Some groundwater can be found in practically every part of the province but aquifer depths, yields and water potability vary. Alberta’s groundwater resource is not as well-defined as its surface water. Documentation of water quality, water volumes and depths of producing zones is a slow process because of the high cost of exploration. The locations of a number of major aquifers in the province are reasonably well known, and regional data are being accumulated and compiled into hydrogeologic maps and reports as the number of water wells and exploration programs expands (Alberta Environment 2004).






Groundwater is an integral part of the hydrological environment. It is a dynamic component subject to sub-surface flow and eventual discharge to surface water systems. Aquifer discharge is the base flow of many rivers and streams, sustaining them during winter and rainless periods. Over-development of groundwater resources could result in reduced flow from groundwater discharge areas. Such change could lead to the degradation of wetlands and alteration of surface runoff characteristics. Surface water developments such as reservoirs have the potential to add additional water to aquifer systems, thus contributing to higher water tables beyond their immediate vicinity (Alberta Environment 2004).

7.1.3.1 Surface Water Allocation by Sector

The ten largest surface water allocations in the North Saskatchewan Watershed are given to TransAlta Utilities Corporation, ATCO Electric Ltd., EPCOR Generation Inc., the City of Edmonton and Alberta Environment (Table 8). With the exception of the City of Edmonton and Alberta Environment, the water is used for industrial cooling or hydropower generation. Edmonton's allocation is for municipal (household) use. A full listing of all licensed users appears on the report CD-ROM as additional information. Alberta Environment reports surface consumptive allocations by major Subwatershed (Figure 29).

Table 8: The ten largest active surface water allocations in the North Saskatchewan Watershed.

Allocation (dam^3)	Applicant	Project	Source	Priority
660,190	TransAlta Utilities Corporation	Keephills/Industrial	Wabamun Lake	1954
456, 388	ATCO Electric Ltd.	Alta Power Ltd.	Battle River	1955
234, 568	TransAlta Utilities Corporation	Keephills/Industrial	Wabamun Lake	1994
234, 373	ATCO Electric Ltd.	Alta Power Ltd.	Battle River	1976
234, 361	EPCOR Generation Inc.	Edmonton Power Inc.	North Saskatchewan River	1967
215, 859	EPCOR Generation Inc.	Edmonton Power Inc.	North Saskatchewan River	1971
149, 382	EPCOR Generation Inc.	Edmonton Power Inc.	North Saskatchewan River	1975
73, 023	TransAlta Utilities Corporation	Keephills/Industrial	North Saskatchewan River	1998
53, 017	EPCOR Generation Inc.	Edmonton/Power	North Saskatchewan River	1937
52, 546	Alberta Environment	Environmental Protection WR	Wabamun Lake	1997

The mean annual North Saskatchewan River discharge is 7,154,200 dam^3, of which approximately 32% of main stem natural flow is allocated. Of this, 70% (248,848 dam^3) is used for commercial/industrial use and 12% (41,771 dam^3) is used for municipal use.

The mean annual Battle River discharge is 310,800 dam^3, of which over 100% of main stem natural flow is allocated. Of this, 27% (15,546 dam^3) is used for commercial/industrial use and 19% (10,485 dam^3) is used for irrigation use.

The total annual surface water allocation for the Sounding Watershed is 25,416 dam^3. Of the allocated portion, 57% (14,560 dam^3) is for habitat enhancement use and 15% (3,912 dam^3) is for agricultural use.



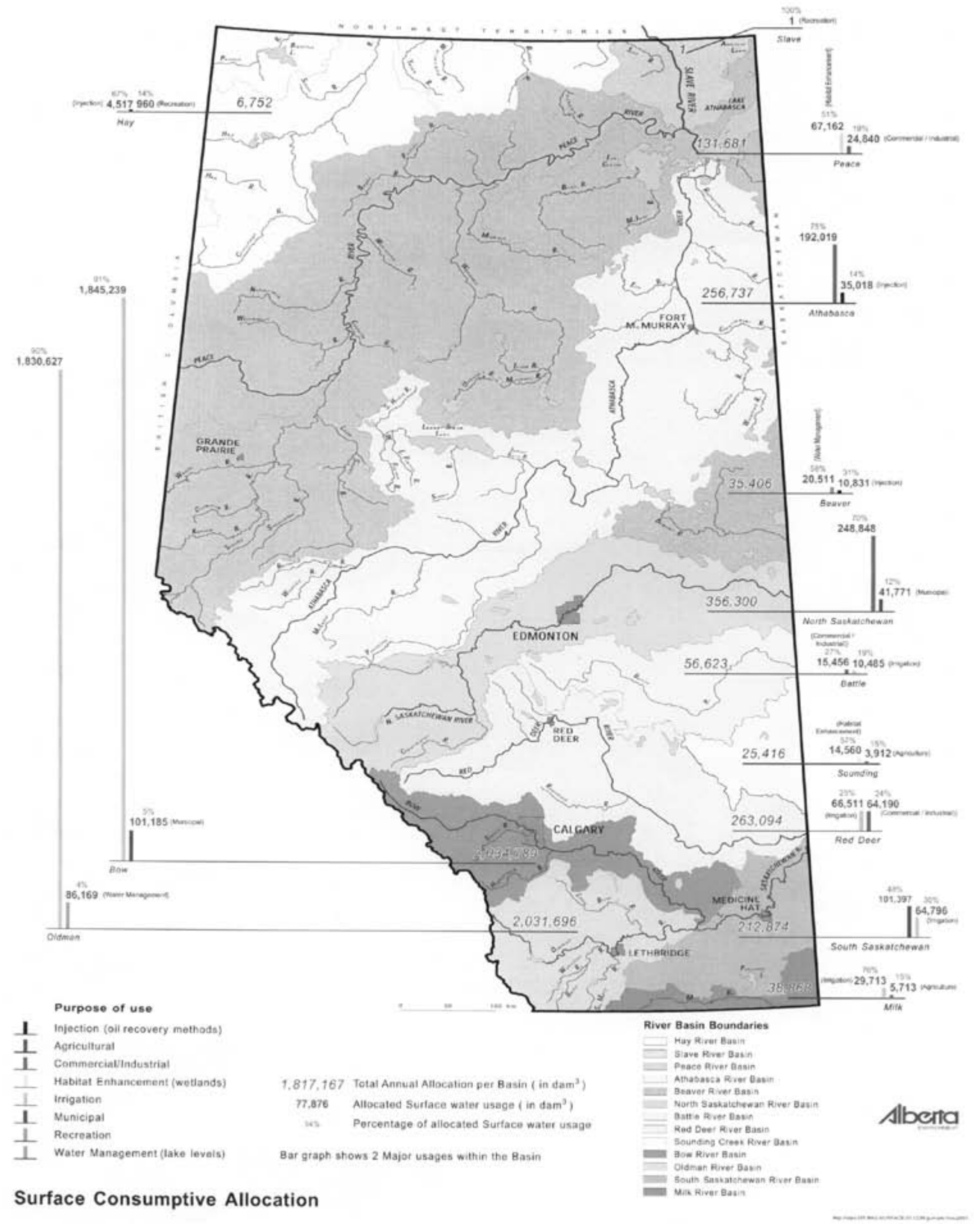
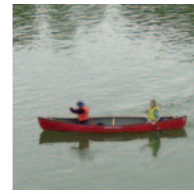
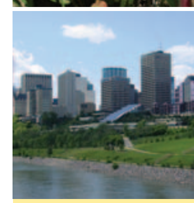


Figure 29: Surface water consumptive allocation in Alberta by major watershed.



7.1.3.2 Groundwater Extraction by Sector

The ten largest groundwater allocations in the North Saskatchewan Watershed are held by Lafarge Construction Materials, the Town of Stony Plain, Petro-Canada, the Town of Lacombe and the City of Edmonton (Table 9). The water is used primarily for drainage, well injection or municipal use (Town of Lacombe). A full listing of all licensed groundwater users appears on the CD-ROM.

Table 9: The ten largest active groundwater allocations in the North Saskatchewan Watershed as of January 8, 2004.

Allocation (dam^3)	Applicant	Project	Use	Priority
986,790	Lafarge Construction Materials	Lafarge Construction Materials	DRAINAGE	1988
954,720	Town of Stony Plain	Town of Stony Plain	DRAINAGE	1977
740,090	Lafarge Construction Materials	Lafarge Construction Materials	DRAINAGE	1984
595,770	Town of Stony Plain	Town of Stony Plain	DRAINAGE	1977
595,770	Town of Stony Plain	Town of Stony Plain	DRAINAGE	1977
534,050	Town of Lacombe	Town of Lacombe	URBAN	2001
534,050	Town of Lacombe	Town of Lacombe	URBAN	2001
431,720	City of Edmonton	City of Edmonton	DRAINAGE	1979
339,210	Town of Vermilion	Town of Vermilion	URBAN	1979
336,740	Town of Ponoka	Town of Ponoka	URBAN	1980

Alberta Environment reports groundwater consumptive allocations by major Subwatershed (Figure 30).

The total annual groundwater consumptive allocation for the North Saskatchewan Watershed is 11,714 dam^3. Of this, 56% (6,604 dam^3) is for commercial/industrial use and 29% (3,343 dam^3) is for agricultural use.

The total annual groundwater consumptive allocation for the Battle River Watershed is 10,022 dam^3. Of this, 50% (4,986 dam^3) is for agricultural use and 26% (2,600 dam^3) is for commercial/industrial use.

The total annual groundwater consumptive allocation for the Sounding Watershed is 1,810 dam^3. Of this, 50% (908 dam^3) is for habitat enhancement use and 37% (677 dam^3) is for municipal use.



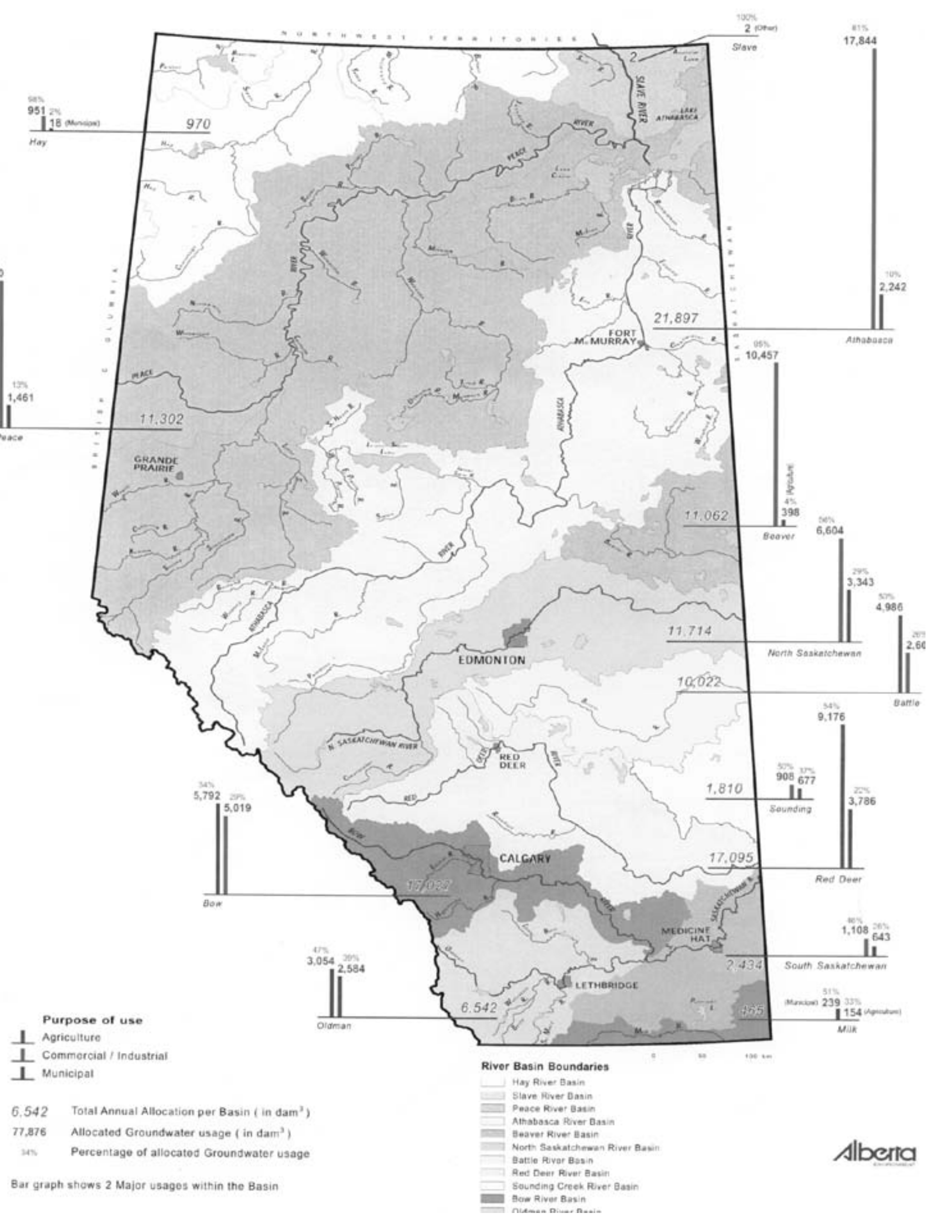
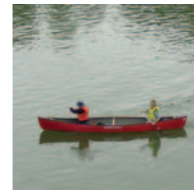
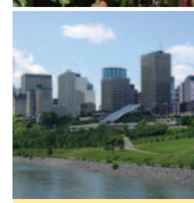


Figure 30: Groundwater consumptive allocation in Alberta by major watershed.



7.1.4 Biological Indicators

7.1.4.1 Aquatic Macrophytes

A systematic examination of aquatic macrophytes and changes in their populations and distribution has not been completed in any Subwatershed, so an indication of watershed health cannot be predicted using this indicator. This data gap should be addressed in future research in the watershed.

Inventories in lakes in the Modeste Subwatershed found that the main species of emergent vegetation were greater bulrush, common cattail, reed grass, sedge, and arrowhead. The most abundant submerged macrophytes were northern watermilfoil, Richardson pondweed, stonewort, large-sheath pondweed, and sago pondweed.

Inventories in lakes in the Sturgeon Subwatershed found similar species. Greater bulrush, common cattail, reed grass, sedge, and arrowhead were the most abundant emergent species. Northern watermilfoil, Richardson pondweed, stonewort, large-sheath pondweed, sago pondweed, and coontail were the most abundant submergent species.

7.1.4.2 Fish Population Estimates

A systematic estimate of fish populations has not been undertaken in any Subwatershed, so an indication of watershed health cannot be predicted using this indicator. This data gap should be addressed in future research in the watershed. However, in general, the most abundant fish species change from cold water and cool water species in the more western, higher elevation Subwatersheds to cool water and warm water species as one proceeds to Subwatersheds downstream where the water is warmer and, in the case of flowing water, generally slower moving.

Fish species occurring in the watershed include mountain whitefish, bull trout, cutthroat trout, rainbow trout, brook trout, lake trout, brown trout, lake whitefish, northern pike, yellow perch, walleye, sauger, goldeye, mooneye, lake sturgeon, longnose sucker, white sucker, Northern redhorse sucker and burbot (Nelson and Paetz 1992).

7.1.4.3 Vegetation Types

In general terms, coniferous forests of white spruce and lodgepole pine dominate the vegetation in the higher elevations. Lodgepole pine is especially dominant where fire occurs and white spruce is dominant where there has been no recent fire. As one moves to lower elevations, the forest cover is lodgepole pine, Douglas fir, and Engelmann spruce. At still lower elevations, there is a co-dominance of trembling aspen, balsam poplar, lodgepole pine and white spruce. In the Boreal Forest Region, species such as trembling aspen and balsam poplar dominate.

7.1.4.4 Benthic Invertebrates

There has been no systematic assessment of benthic invertebrates in the watershed, so an indication of watershed health cannot be predicted using this indicator. This data gap should be addressed in future research in the watershed. However, benthic invertebrates have been studied in specific locations. For example, Alberta Environment surveyed benthic invertebrates in the North Saskatchewan River between 1973 and 1977 (Reynoldson and Exner 1978). The study found changes in the main invertebrate groups between sites sampled upstream of



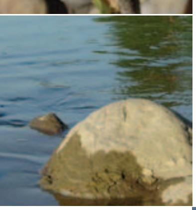
Edmonton and those sampled downstream. The main invertebrate groups upstream of Edmonton were Chironomidae, Ephemeroptera and Plecoptera. Downstream of Edmonton, there was a major increase in numbers and a decline of species diversity. At sites downstream of Edmonton, Oligochaeta and Chironomidae were the most abundant groups of benthic invertebrates. The nature of the change in the benthic invertebrate communities suggested the major impact was due to organic rather than inorganic or toxic effluents. Stormwater management and wastewater treatment in the City of Edmonton have been improved significantly since the study was conducted. Follow-up sampling should be undertaken at these sites to see how the benthic invertebrate communities have responded to these changes.

A benthic invertebrate survey was conducted in Wabamun Lake in November 2002. The results indicated some effects in the areas of the wastewater and power plant discharges when compared to background areas in the lake. Overall the differences were slight; however, signs of mild enrichment were apparent.

7.2 CONCLUSION SUMMARY

Fifteen indicators of watershed health were selected and ranked by a panel of experts and members of the NSWA for each of the 18 subwatersheds. These indicators were summarized and have yielded a subjective health rating. The overall health of the entire North Saskatchewan Watershed is generally fair, and includes some subwatersheds where ecosystem function is significantly impaired by human activity. Through an adaptive process, the NSWA should re-evaluate these indicators based on the current report for relevance, and focus future data collection efforts and state of the watershed reporting where data gaps have been identified and indicators refined. This report did not evaluate other industries such as forestry and oil and gas in any great detail – so it is unknown as to the degree of impairment caused by these and other industries.

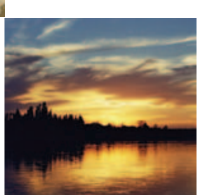
On a watershed scale, for the indicators where data were available, watershed health tends to decrease as you move towards the Modeste, Sturgeon and Strawberry subwatersheds, where livestock density, human activity and populations are greatest. Linear development, intensive land uses, and livestock densities are highest in these watersheds, while riparian health scores and wetland cover based on the maps generated, are lowest.

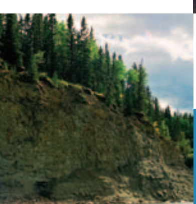


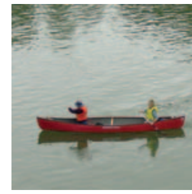
Disturbances of note include the Capital Region's impacts on the river main stem from treated wastewater and stormwater outfalls. For example, the Surface Water Quality Index drops downstream of Edmonton due to increases in both *E. coli* counts and phosphorus concentrations. However, the impact of the City has been lessened considerably by the recent improvements in wastewater treatment technology (tertiary treatment including biological nutrient removal) and should continue to improve as the City of Edmonton moves forward with proposed stormwater treatment strategies.

The impacts of high agricultural intensity in the Bigstone, Iron, Ribstone, Blackfoot, and Paintearth subwatersheds may be reflected in higher phosphorus and lowered riparian health scores and wetland densities. In these Battle River subwatersheds, water quantity will continue to be an issue, as will water quality.

Pesticides did not appear to be a major concern anywhere within the watershed. Pesticides were detected in several subwatersheds, but concentrations never exceeded the CCME Surface Water Quality Guidelines for the Protection of Aquatic Life. "Based on the research and monitoring work conducted, the risk of water quality degradation appears to be significant for areas of the province where intensive agriculture is practised, as measured by fertilizer or herbicide inputs or by animal unit density" (CAESA, 1998). However, several types of pesticides identified do not have guidelines established.








Biological indicators and water quantity were most poorly represented in this study, and available data were not adequate to properly address these indicators. For example, none of the biological indicators (aquatic macrophytes, fish population estimates, vegetation types and benthic invertebrates) were comprehensive enough to allow for a prediction of watershed health. Pharmaceuticals (animal and human) were found to be of concern to watershed residents. Effects on humans and aquatic life are not well known or documented in the watershed and this presents a data gap of interest to the public.

The NSWA, as Watershed Planning and Advisory Council for the North Saskatchewan River Watershed in Alberta, will continue to lead State of the Watershed reporting in this watershed. It will also undertake integrated watershed planning by involving its members and stakeholders in an ongoing, adaptive assessment and planning process. This State of the Watershed Report is a foundational document to be used by the NSWA to initially characterize and evaluate the overall health and issues of concern in this watershed.

As all major watersheds in this province are unique, this new approach to planning and growth while considering the limitations of watersheds creates an opportunity. The North Saskatchewan Watershed, with a relative abundance of water quantity, can consider the needs of the aquatic, riparian and other hydrological systems as part of its future. The Watershed Planning and Advisory Council for the North Saskatchewan (the NSWA) can choose to restore and plan to incorporate not just society's needs, but the needs of the natural systems which support social, environmental and economic health. It is hoped that this document and future reports of this kind will provide an assessment of just how well planning, implementation and actions improve the 'state of the watershed'.