6.0 Discussion and Conclusions

6.1 Land Use

6.1.1 Wetland Loss

Current evidence suggests that wetland loss throughout the settled area of Alberta has been extensive. By the early 1970s, the Aspen Parkland ecoregion of Alberta had already lost an estimated 61% of its original wetland area (Schick, 1972). Similarly, a more recent study (Strong et al., 1993) estimated that the settled area of Alberta had lost at least 63% of its original wetland area by 1990. Ongoing rates of wetland loss in the settled area of Alberta range from 0.3-0.5% of the remaining wetland area per year (Turner et al., 1987; Watmough et al., 2002). Environment Canada habitat monitoring data specifically from the Red Deer River watersheds suggest that the rate of wetland loss in this watershed is about 0.5% of the remaining wetland area per year indicating a relatively high rate of ongoing wetland loss in this watershed. These watershed-specific wetland loss data were derived from 17 habitat monitoring transects that cover about 25,276 ha in the Red Deer River watershed (Environment Canada, unpubl. data). Cumulatively, all existing studies indicate that both historical and ongoing rates of wetland loss should be of concern within the Red Deer River watershed and must be addressed in future land use plans to ensure watershed health. Furthermore, there are currently at least two wetland inventories underway in the province that will cover most, if not all, of the Red Deer River watershed. These wetland inventories should be completed as soon as possible to provide critical data for the IWMP phase.

Ducks Unlimited Canada has invested about $33.5 Million and is currently involved in 424 projects that conserve/restore about 78,500 ha of land that directly benefits watershed health and function, including wetlands, in the Red Deer River watershed (Figure 397).

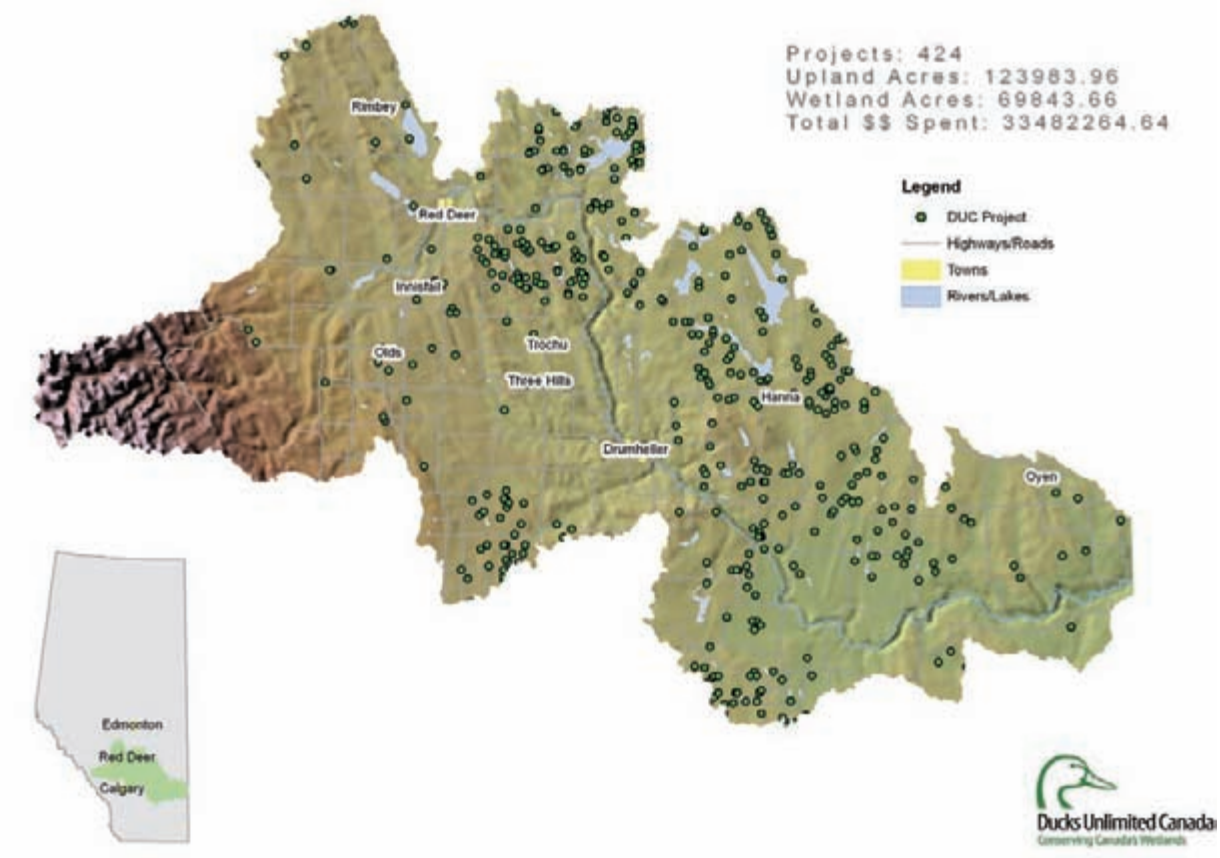

Figure 397. Ducks Unlimited Canada projects in the Red Deer River watershed.

6.1.2 Riparian Health

Riparian health assessments and ratings are currently limited within the watershed. Assessments have been completed in the Little Red Deer, Medicine, Blindman, Kneehills and Rosebud watersheds, but only in limited areas, so the data cannot be considered indicative of the riparian health of the entire watershed. Overall, the ratings of health were fair, with common problems including damage to streambanks, invasive plant species and lack of successfully established healthy riparian plant communities. Anthropogenic disturbances and encroaching cattle populations are the main sources of impacts to riparian areas and consequently to their health and functionality.

6.1.3 Livestock Manure Production

Livestock manure production is rated as being generally low in most subwatersheds with medium risk levels occurring in the Blindman, Waskasoo and Kneehills subwatersheds. This is of particular concern especially considering the high vulnerability to contamination for both surface and groundwater in these areas (Figures 398, 399, 400). The majority of the feedlots in these watersheds are cattle and swine operations and many are focused in clusters

within the respective watersheds. Future planning initiatives can examine the placement of these operations within the watershed to prevent clustering and address the carrying capacity of the soils for manure content. Many areas are on the verge of being rated as medium and some to high risk, so these areas need to be addressed in the future to prevent degradation of surface and groundwater resources.

6.1.4 Urban, Rural, Agricultural and Recreational Developments

The "middle" portions of the watershed are of concern with respect to developments as well. The Raven, Medicine, Blindman, Waskasoo, Buffalo, Threehills, Kneehills, Michichi and Rosebud subwatersheds are all rated as medium risk for this indicator; all others received a good rating. There is a high rate of development in these watersheds most likely due to the proximity to the Queen Elizabeth II Highway corridor. Some of these subwatersheds are completely lacking provincial parks or recreational areas, while others have numerous high use campground areas.

6.1.5 Linear Developments

Linear developments are of concern in the James, Raven, Little Red Deer, Medicine, Blindman and Waskasoo subwatersheds, which all received a "poor" ranking with respect to this indicator. Only two subwatersheds, Alkali and Panther, were rated as good, while the remaining subwatersheds were considered fair. This is cause for some concern, particularly in the areas most sensitive to water erosion on bare mineral soil (Figure 398). Many of the areas with high linear developments are at high to severe risk for water erosion due to the removal of vegetation and rutting and compaction of soils in many linear developments, e.g., seismic lines and cut lines.

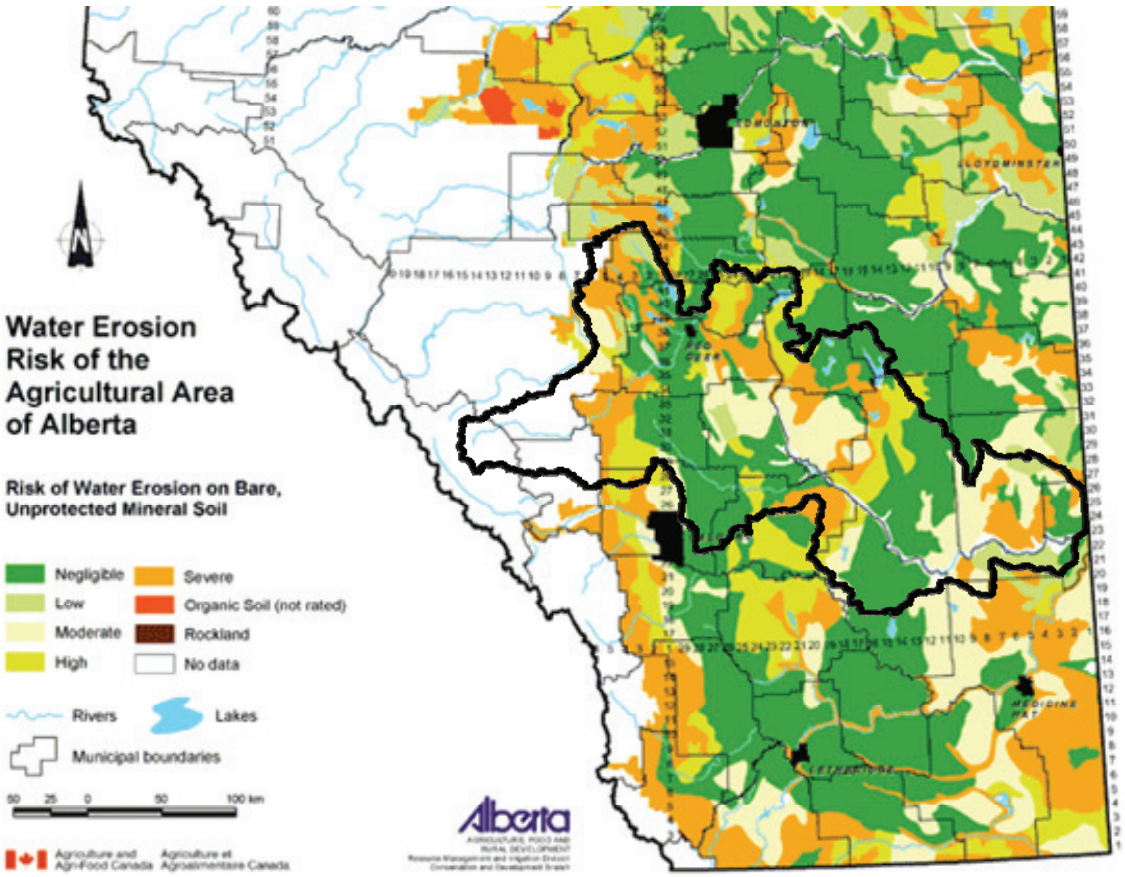

Figure 398. Water erosion risk in the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

6.1.6 Oil and Gas Activities

Oil and gas activity is rated as being low risk in the western portion of the watershed (Panther, James, Raven and Little Red Deer subwatersheds) as well as in the Michichi subwatershed, and medium to high risk in the remaining subwatersheds. Of particular concern are the oil and gas well densities in the Medicine, Buffalo, Kneehills, Berry and Matzhiwin subwatersheds, which are all rated as high risk.

6.2 Water Quality

6.2.1 Nutrients

Water quality nutrient variables are poorest in the central region of the Red Deer River watershed, with the Blindman, Buffalo, Threehills, Kneehills and Michichi subwatersheds exhibiting the lowest rankings. Berry, Rosebud and Medicine are on the brink of receiving an overall poor rating for nutrient levels, while the best nutrient levels occur in the Raven and Alkali subwatersheds. Some data gaps exist

in the Little Red Deer and Waskasoo subwatersheds. The risk for surface and groundwater contamination is high in the subwatersheds exhibiting the poorest water quality (Figures 399, 400, 401).

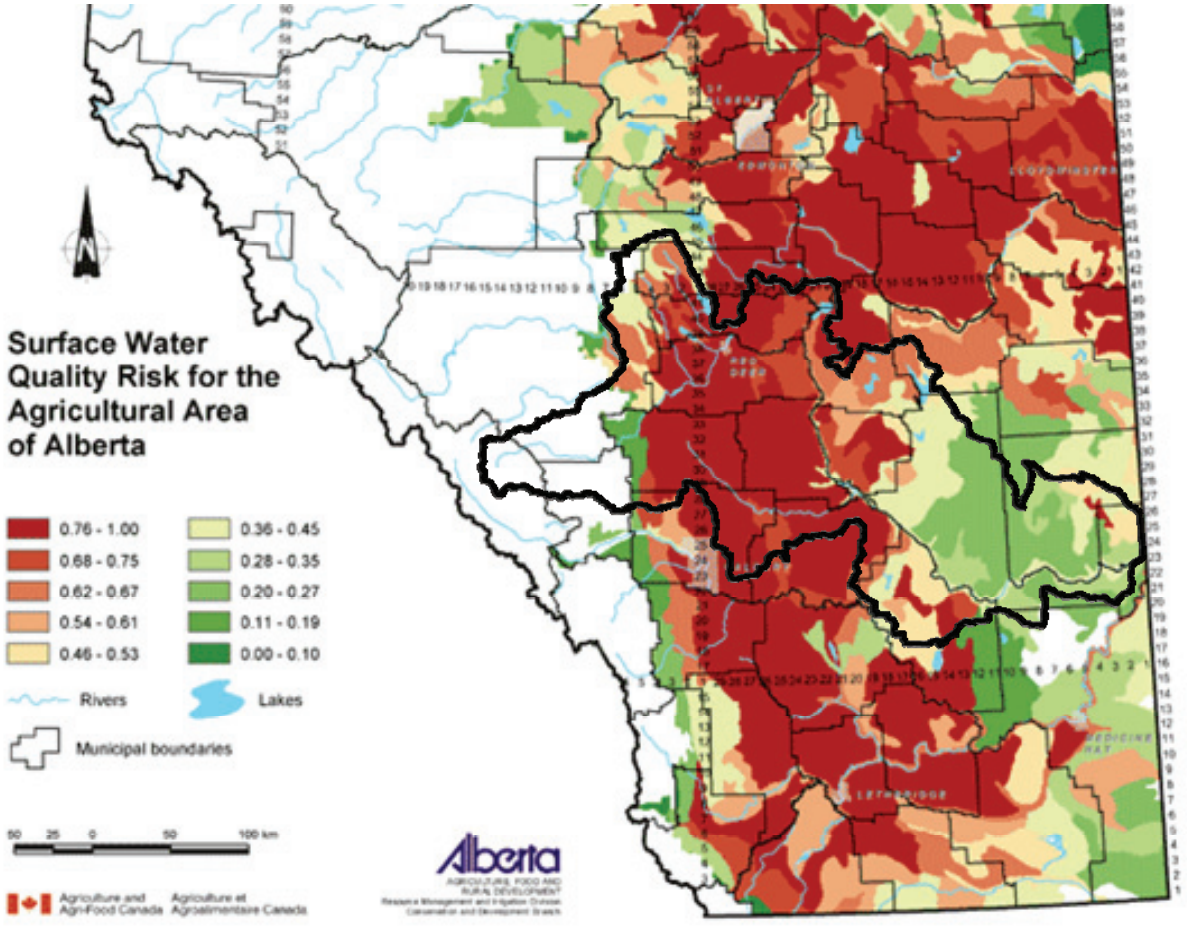

Figure 399. Surface water quality risk in the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

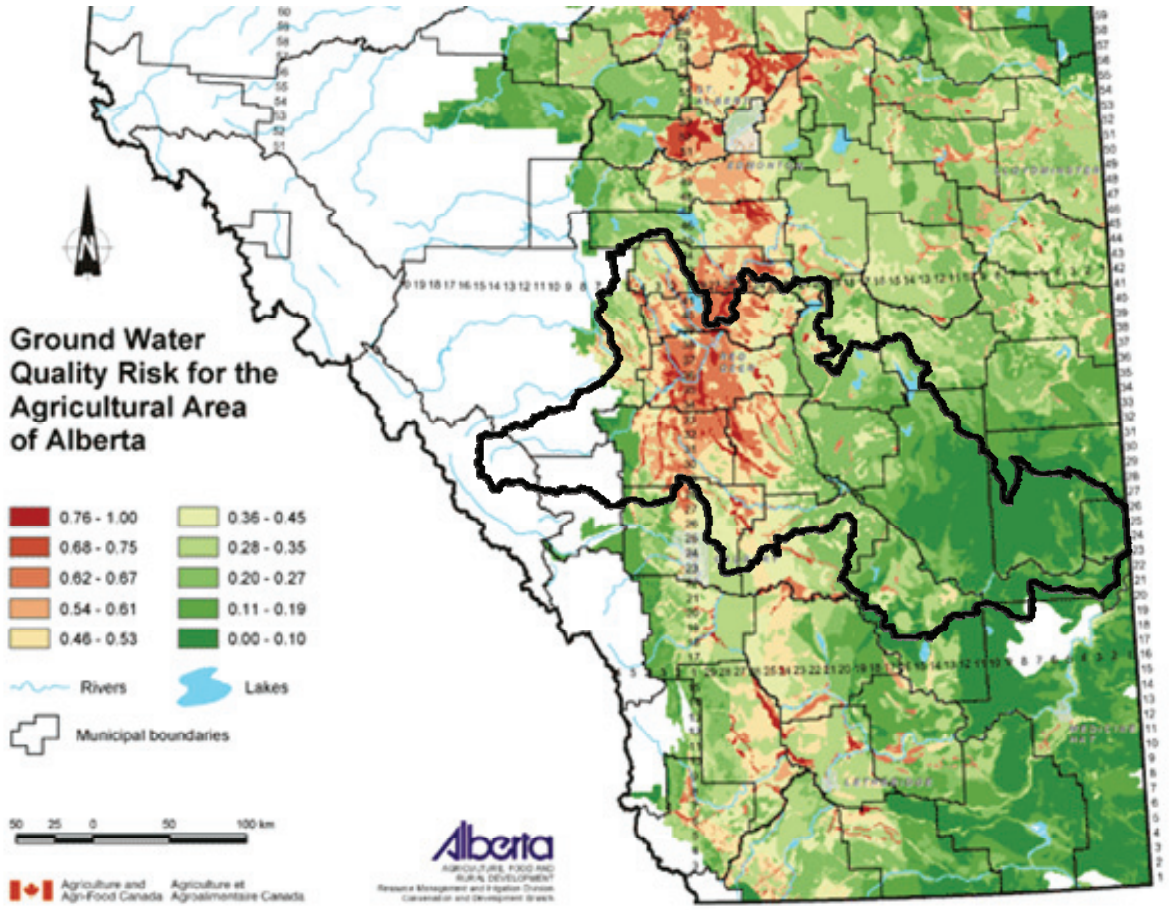

Figure 400. Groundwater quality risk in the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

6.2.2 Bacteria

Bacterial data are limited at this time; data gaps exist in the Panther, Raven, Waskasoo and Michichi subwatersheds. Bacterial levels in the Little Red Deer, Blindman and Matzhiwin subwatersheds are rated as poor, while the remaining subwatersheds received a good rating. These ratings must be taken with caution due to the limited data sets; conditions may not be indicative of the entire subwatershed, and future monitoring and testing is warranted to accurately determine the condition of each subwatershed. Lack of bacterial data could have detrimental effects on water users who rely on groundwater supplies for drinking water.

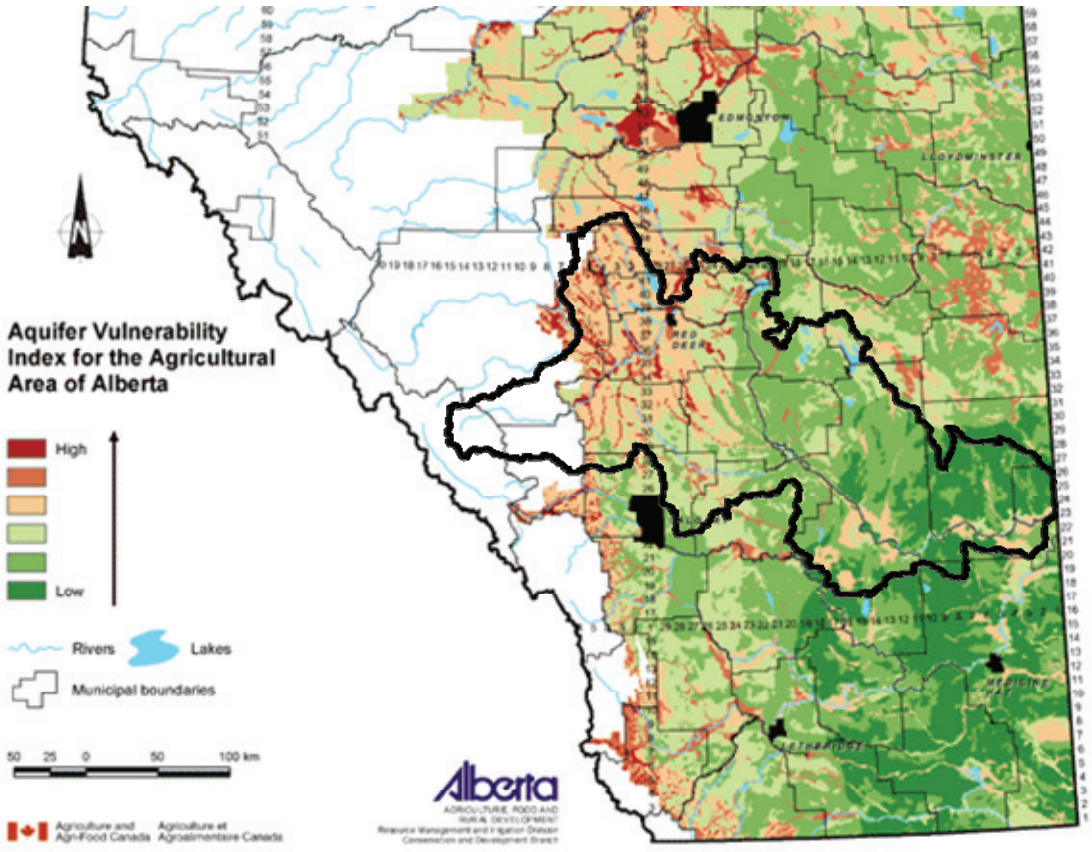

Figure 401. Aquifer vulnerability index for the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

6.2.3 Parasites

Parasite data appear to be extremely limited and were only located for the Medicine River. The presence of parasites in this river results in a rating of poor, with the same consideration that this may not be indicative of the condition of the entire subwatershed. The poor rating would also vary based on the species of parasites present in the surface water, as certain species do not pose a risk to human health.

6.2.4 Pesticides

Pesticide data are limited, with sampling completed in the Little Red Deer, Medicine, Blindman, Buffalo, Threehills, Michichi and Rosebud subwatersheds; all of these locations received a ranking of good. This can be misleading, because guidelines do not exist for many of the detected compounds, and consequently these compounds were not included in the rating. The rating also did not take into consideration the number of different compounds detected in each subwatershed, which varied from 2-20.

6.3 Water Quantity

6.3.1 Minimum Flows to Maintain Ecological Integrity

Instream flow needs have been determined only for the Red Deer River mainstem, indicating that flow rates should not drop below 16-18 m^3/sec during the winter months and below 17-40 m^3/sec during the summer months, depending on location. Similar assessments have not been conducted for any of the tributaries of the Red Deer River or lakes in the Red Deer River watershed.

6.4 Biologicals

6.4.1 Wildlife Biodiversity

Wildlife diversity is an identified data gap in the Red Deer River watershed; however, there are large areas of the watershed at risk for loss of wildlife biodiversity, e.g., in the Medicine, Blindman, Waskasoo, Little Red Deer, Buffalo, Threehills, Matzhiwin and Kneehills subwatersheds (Figure 402). This knowledge, coupled with the extent of linear developments and urban/rural/agricultural developments, indicates the need for immediate protection of wildlife populations in these areas.

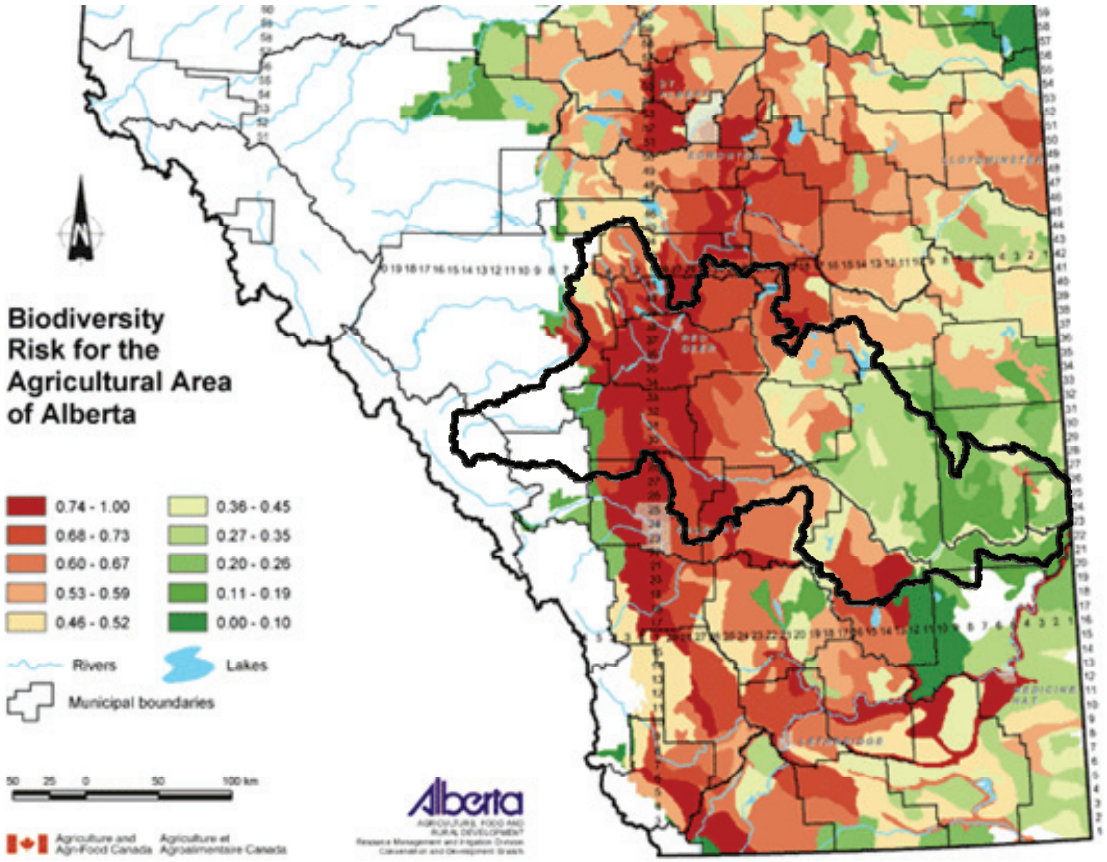

Figure 402. Biodiversity risk in the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

Moreover, several species at risk occur in the Red Deer River watershed, particularly in the southeast portion of the watershed (Figure 403). Species at risk may face extirpation or extinction if their habitat is not suitably protected from disturbance.

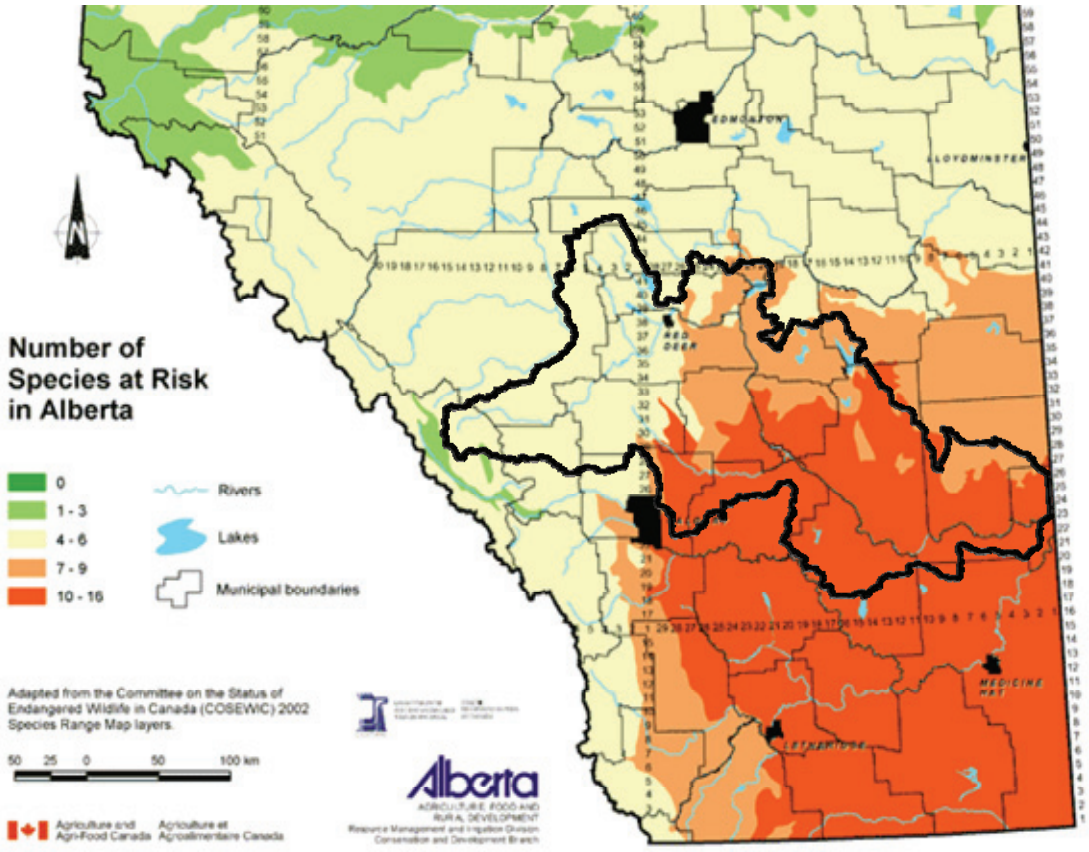

Figure 403. Number of species at risk in the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

6.4.2 Land Cover

Land cover condition is rated as poor throughout the majority of subwatersheds in the central area of the Red Deer River watershed. It is the central region of the watershed that is rated the most poorly with respect to this indicator, which coincides with the high levels of linear developments and urban/rural/agricultural/recreational developments seen in these areas. Wetland cover is low in this central region (Figure 404), and peatlands occur only in the Medicine, Blindman and Raven subwatersheds (Figure 405). Peatlands are rare in the Red Deer River watershed and as such are worthy of protection and conservation efforts, particularly in light of their potential impacts on the global carbon cycle under a changing climate.

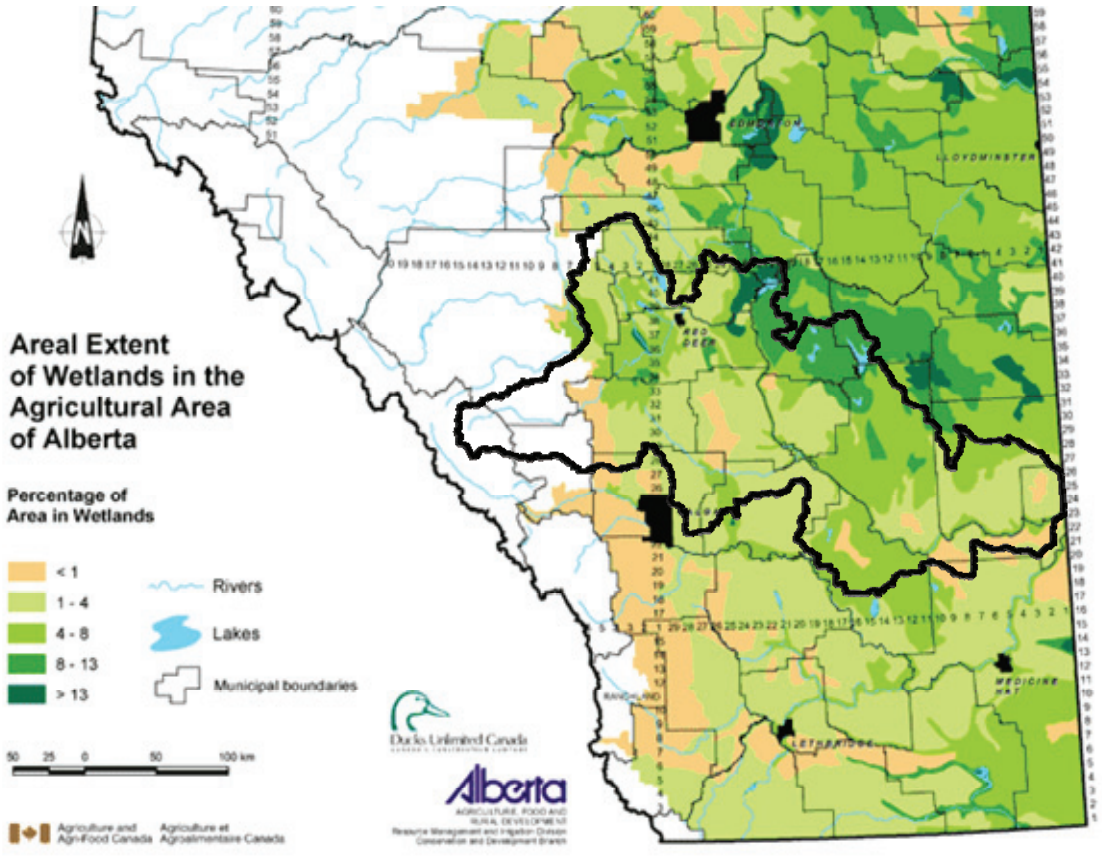

Figure 404. Aerial extent of wetlands in the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

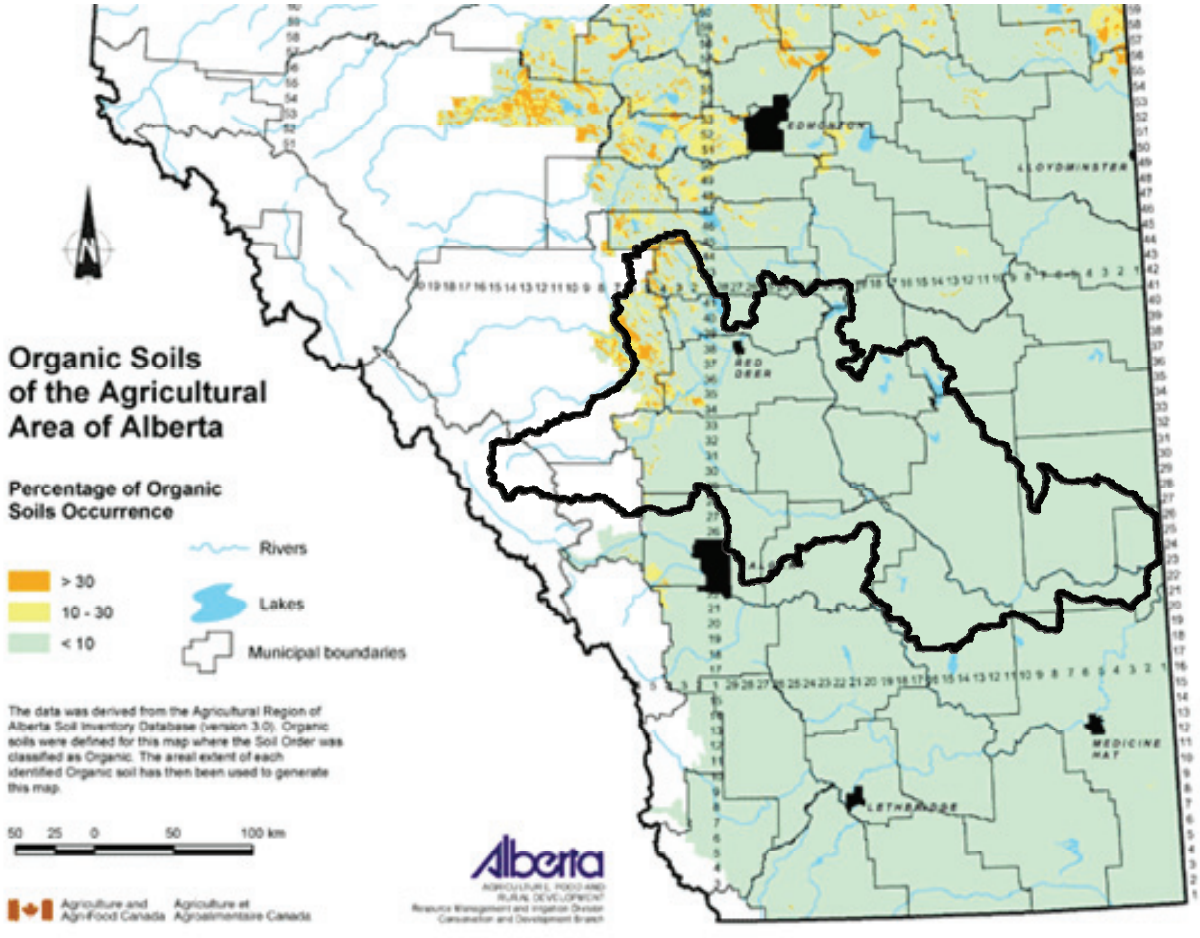

Figure 405. Percent organic soils in the Red Deer River watershed (outlined in black) (base map: Alberta Agriculture and Rural Development, 2005).

6.5 Cultural and Historical Considerations

Figure 406 outlines the numerous historical resources in the Red Deer River watershed. There are many sites classified as Provincial and Registered Historic Resources which require avoidance. Many of these sites occur in the Rosebud subwatershed, while the Alkali and Berry subwatersheds show the highest density of historic resources per township. A complete listing of all archaeological/historic resources in Alberta can be found on the Alberta Culture and Community website (http://culture.alberta.ca/heritage/resourcemanagement/landuseplanning).

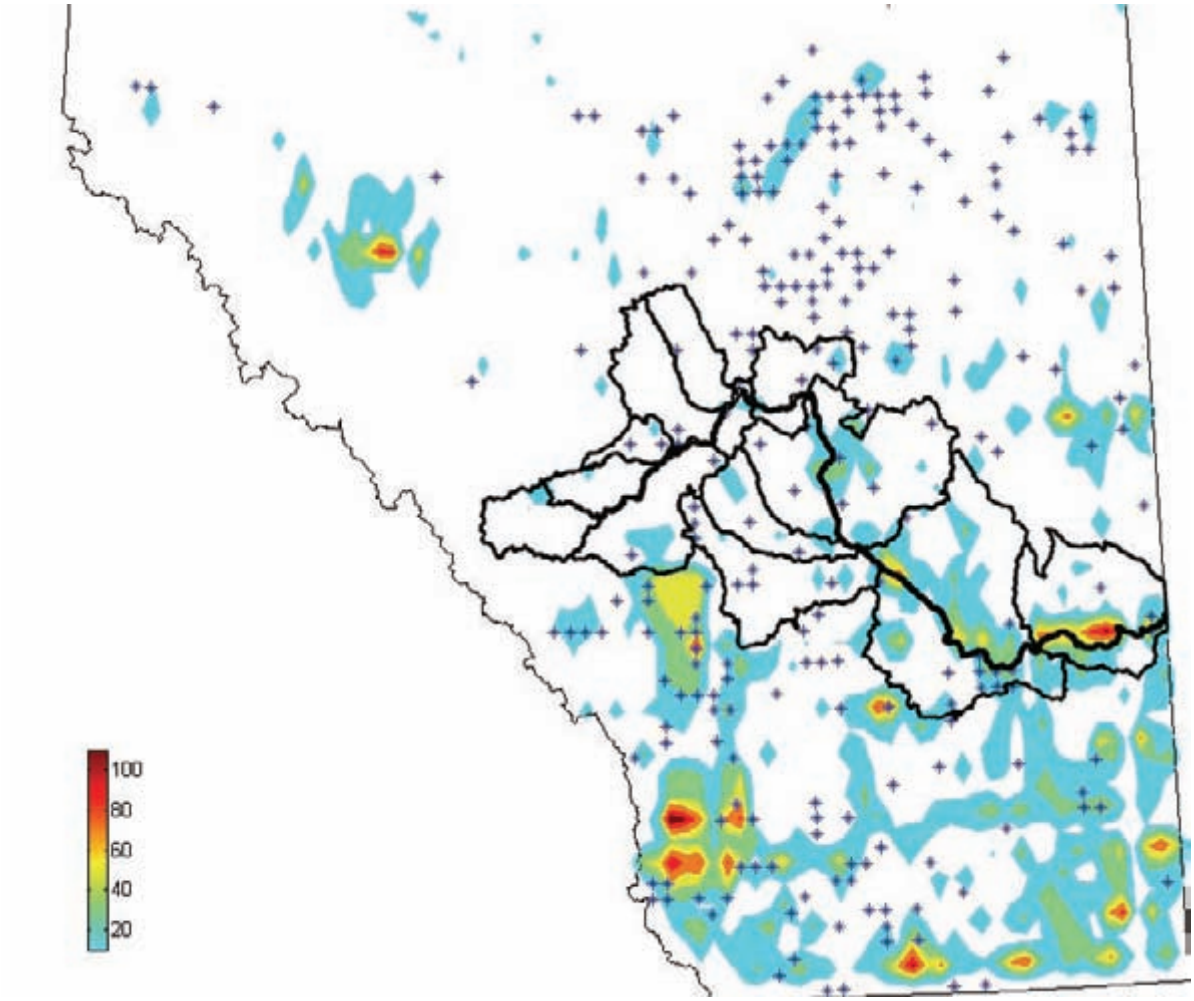

Figure 406. Historic resource densities in the Red Deer River watershed. Points are sites of historic resources classified at levels 1 and 2 under the Listing of Historic Resources (Alberta Culture and Community Spirit, 2008), indicating either protection or registration under the *Historic Resources Act*. Filled contours indicate density of historic resources per township, for all levels (1-5) of resources under the listing.

6.6 Red Deer River Watershed Health Assessment

Each subwatershed received an overall risk indicator and condition indicator rating, which together were used to determine an overall rating of each subwatershed. Based on the risk indicators, four subwatersheds received a rating of low (Panther, James, Raven and Little Red Deer), while the remaining 11 subwatersheds received a rating of medium (Figure 407). The four subwatersheds with a low rating are all located in the upper reaches of the Red Deer, i.e., in the Rocky Mountains or foothills, and are characterized by low population density and accessibility, and consequently low anthropogenic disturbances relative to the subwatersheds in the middle and lower reaches of the Red Deer River.

Consideration of the condition indicators is somewhat more complex, with two subwatersheds receiving a good rating (Panther and Alkali), eight subwatersheds receiving a fair rating (James, Raven Little Red Deer, Buffalo, Threehills, Rosebud, Berry and Matzhiwin), and the remaining five subwatersheds receiving a poor rating (Medicine, Blindman, Waskasoo, Kneehills and Michichi) (Figure 408).

The combined rating of risk and condition indicators was similar to the condition indicator assessment alone. Two subwatersheds received a rating of "A" (Panther and Alkali), eight subwatersheds received a rating of "B" (James, Raven Little Red Deer, Waskasoo, Threehills, Rosebud, Berry and Matzhiwin), and the remaining five subwatersheds received a rating of "C" (Medicine, Blindman, Buffalo, Kneehills and Michichi) (Figure 409). The main characters contributing to a subwatershed's poor rating were linear development densities, resource exploration and extraction activities, nutrient concentrations in surface waters and land conversion activities. Table 165 summarizes the condition and risk indicator ratings for each of the 15 subwatersheds in the Red Deer River watershed.

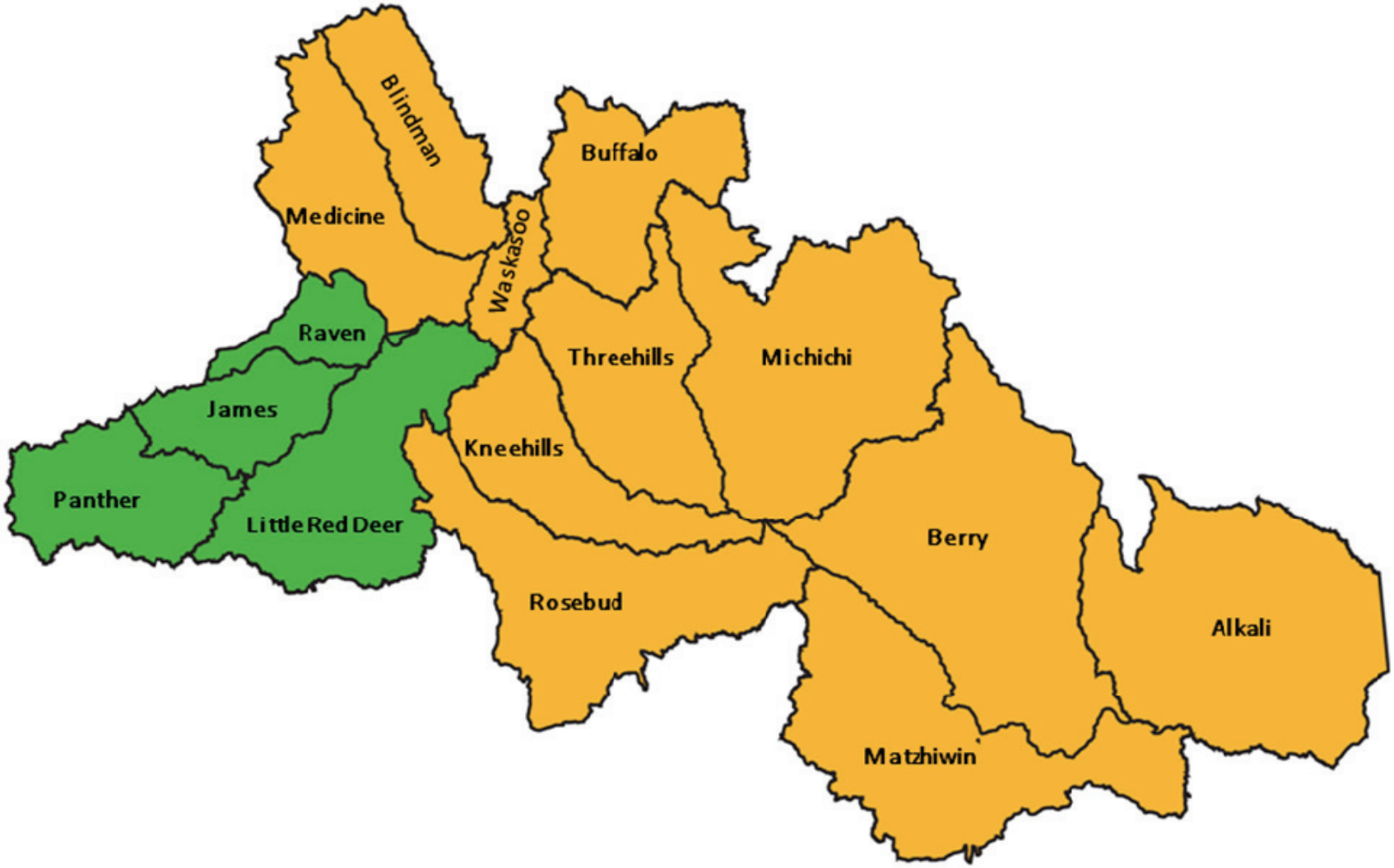

Figure 407. Risk indicator ranking summary of the 15 subwatersheds that comprise the Red Deer River watershed (green = low, orange = medium, red = high).

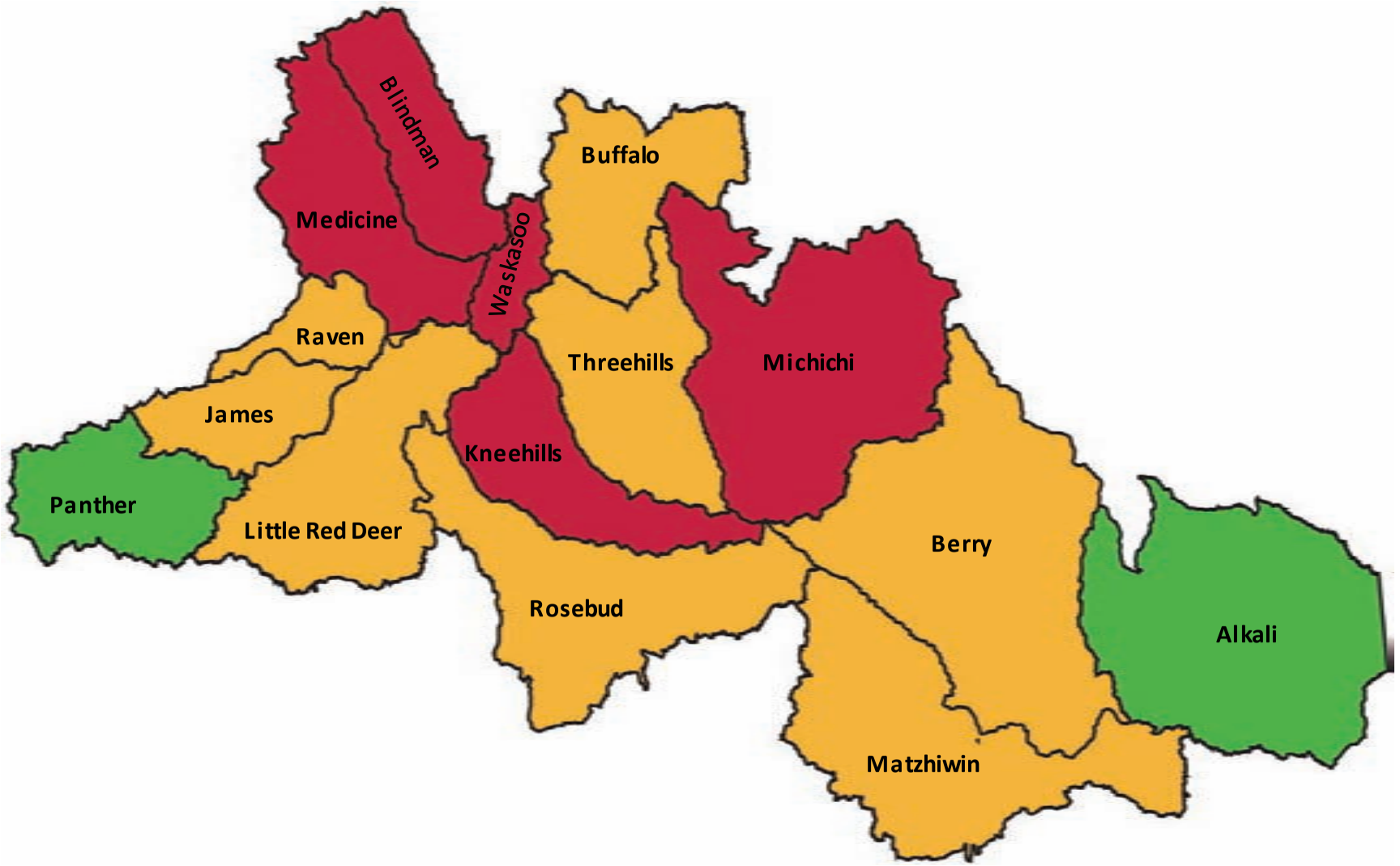

Figure 408. Condition indicator ranking summary of the 15 subwatersheds that comprise the Red Deer River watershed (green = good, orange = fair, red = poor).

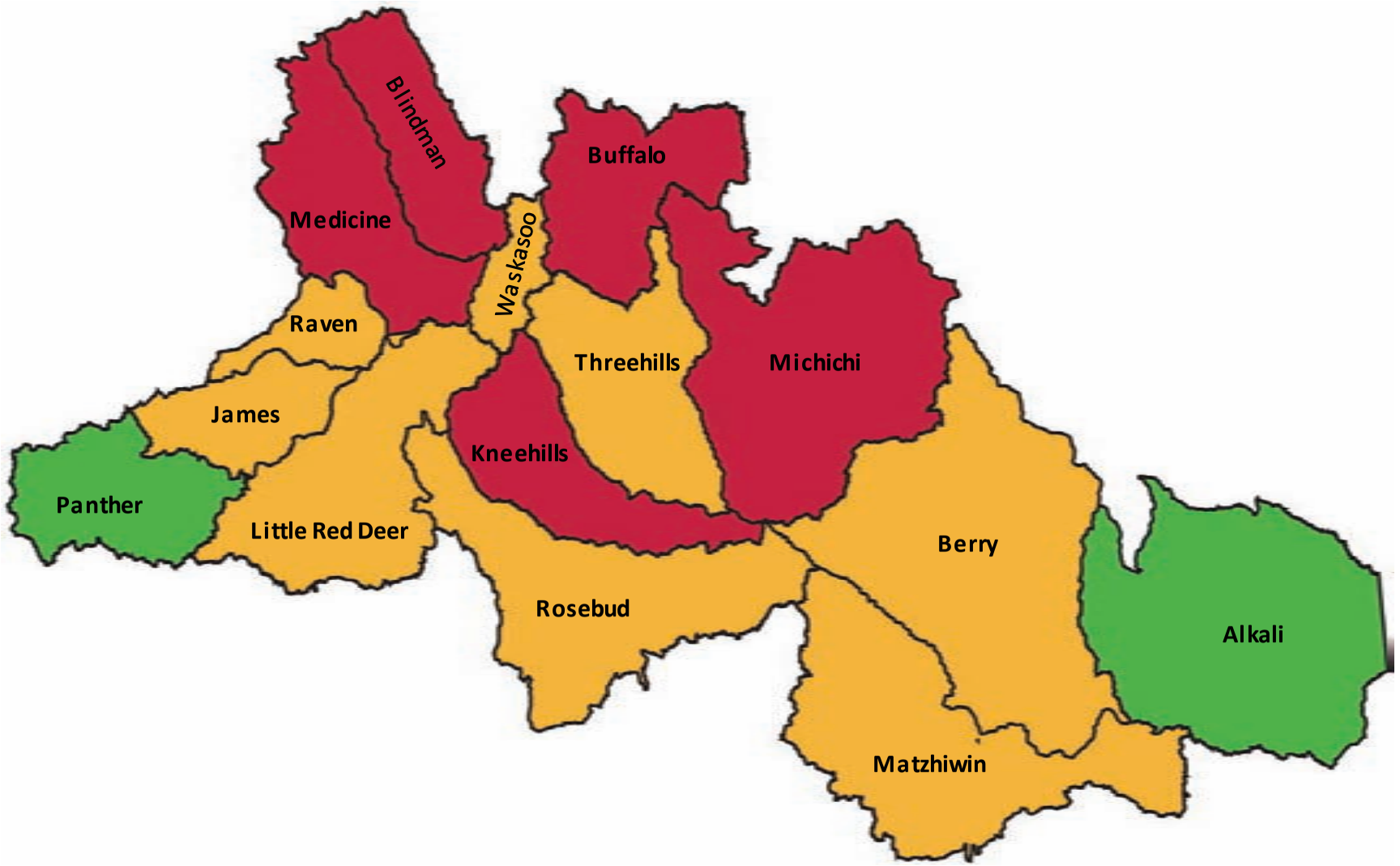

Figure 409. Overall rankings of the Red Deer River watershed, based on the combined rating of risk and condition indicators (green = A+ to A-, orange = B+ to B-, red = C+ to C-).

Table 165. Indicator rating summary (condition and risk) for all subwatersheds (icon meanings can be found in Sections 6.1-6.4). Gray logos indicate data gaps.

Subwatersheds	Condition Indicators	Risk Indicators
Panther		
James		
Raven		

Little Red Deer

Medicine

Blindman

Waskasoo

Buffalo

Threehills

Kneehills

Michichi

Rosebud

Berry

Matzhiwin

Alkali

* Green symbols represent low risk or good condition, orange icons represent medium risk or fair condition and red icons represent high risk or poor condition.