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# **Aquatic Ecosystem Health of the Peace Watershed Project**

Final Report, June 2012

prepared for the



by

**CharettePelPoscente Environmental Corp**

*in partnership with*

**Hutchinson Environmental Sciences Ltd**

## EXECUTIVE SUMMARY

The Mighty Peace Watershed Alliance (MPWA), a watershed planning advisory council created in 2011 under Alberta's Water for Life Strategy, is seeking to develop a thorough understanding of information available on all aspects of water in the Peace River watershed. As part of this effort, the MPWA retained the team of CharettePellPoscente Environmental Corp. and Hutchinson Environmental Sciences Ltd. to provide an integrated overview of the current state of knowledge with respect to Aquatic Ecosystem Health (AEH) in the Alberta portion of the watershed. The objective of this report is to present issues affecting aquatic health, to identify key information gaps and to suggest strategies to resolve these, in preparation of the State of the Watershed report.

The Peace River basin is the largest and one of the northernmost watersheds in Alberta, covering approximately one-third of Alberta. Predominant natural regions in this basin are dry and central mixed woods, but also include Rocky Mountains, foothills, boreal, parkland and parts of the Peace-Athabasca Delta. The largest rivers in the basin are the Peace River mainstem and its tributary the Smoky River. A large number of smaller rivers and streams drain the watershed and the landscape is dotted with hundreds of lakes and wetlands. For the purpose of this review, rivers and lakes in the six sub-basins were assessed individually in order to accommodate regional differences in natural features, human activities and therefore major stressors, and the state of knowledge of aquatic ecosystems.

The main anthropogenic activities that affect AEH in the Peace River basin are urban development, agriculture, forestry, mining, oil and gas operations, hydroelectric development and fisheries, along with linear features, such as roads and cutlines, that result from a number of these activities. Most of the human population is concentrated in the Smoky/Wapiti and Upper and Central Peace River sub-basins, where naturally rich soils support an active agriculture. This leads to cumulative pressures on surface waters, such as excess nutrient loading, pathogens, changes in hydrology and instream barriers, resulting in eutrophication, oxygen deficits and reduced or extirpated fish populations.

There is coal mining in the north-eastern slopes, locally affecting fish health. Forestry and oil and gas operations in the vast forests across the basin represent another land disturbance. Hydroelectric development in British Columbia has changed flow patterns in the mainstem of the Peace River, altering sediment patterns and channel morphology and thereby aquatic habitat. A combination of domestic, recreational and commercial fisheries put pressure on fish populations, which have been particularly affected in lakes.

The status of AEH and associated data quality can be summarized as follows:

- 1) The AEH of the Peace River mainstem is relatively well known, with generally good water quality, healthy fish populations and benthic biota that are mainly controlled by habitat characteristics. The main human impact is that of flow regulation from the upstream Bennett Dam that has changed flow and sedimentation patterns.

- 2) The northern part of the Wapiti/Smoky River system has the highest concentration and diversity of human impact from land clearance, municipal and industrial effluent discharges, agriculture, and water withdrawals. Impacts of these activities on rivers and streams have been well defined as eutrophication (increased algae growth due to nutrient enrichment) in small and large rivers, while small streams suffered, in addition, low oxygen levels, decreased fish habitat quality and resulting declines or extirpations of local fish populations. While the effects of point discharges in the lower Wapiti River are well studied and major upgrades are being implemented to improve effluent quality, diffuse sources of nutrients and other pollutants to smaller agricultural streams and their cumulative downstream effects are not well quantified and it is uncertain what efforts have been made to mitigate agricultural non-point-source effects.
- 3) Medium-to small sized streams and tributaries of the Peace River are relatively poorly known in terms of biotic communities, with limited information on water quality and fish populations. It is these tributaries, however, that are most exposed and likely susceptible to the cumulative effects of land use and population patterns, in particular in the settled and cleared zone ("White Zone") in the Smoky/Wapiti, Upper and Central Peace sub-basins, and to some extent the western Wabasca sub-basin.
- 4) Lakes in the Peace River Basin are also enriched in nutrient concentrations, leading to algae blooms and low oxygen concentrations that in turn result in fish kills. Many of these lakes are naturally nutrient rich and it is unknown to what extent human activities in the watersheds have contributed to the high lake nutrient status. Fish harvest from commercial, domestic and recreational fisheries also have had significant detrimental effects on lake fish populations.

We identified eleven high-priority data and knowledge gaps for the assessment and management of AEH in the Peace River Basin. Five data gaps address aquatic ecosystem structure and function, e.g. tributary water quality, fish populations, fish contaminants, wetland coverage and health and instream flow needs. The remaining six data gaps address stressor-effect relationships, such as impacts of agricultural non-point sources on AEH, cumulative effect of linear features on stream water quality and fish habitat and risk from agricultural practices to drinking water resources, as well as the quantification of stressors, such as calculating the non-point nutrient loads to rivers, the relative importance of water allocations on flows and fishing pressure.

Strategies to address these data gaps include literature reviews, data collection from existing sources, monitoring programs, spatial data analysis including GIS and modeling approaches. Conducting any of the recommended studies and combining them with the results of other ongoing projects will further increase the knowledge base required to prepare a State of the watershed Report. The MPWA may, however, choose to prepare a State of the Basin Report at anytime, with the recognition that collecting information on the state of the watershed is an ongoing effort. Collecting more knowledge and developing and implementing management strategies will always be parallel activities of the MPWA that affect each other and together with periodic reporting on progress, these activities will serve the goal of protecting a sustainable, healthy watershed.