HEART RIVER WATERSHED RESTORATION PLAN

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Executive Summary

In 2014, the Heart River Watershed Restoration Project was initiated with the primary objective of producing a plan to restore fish habitat in the Heart River watershed with the development of a Heart River Watershed Restoration Plan.

A localized watershed-specific restoration plan can provide guidance in achieving desired restoration outcomes for multiple stakeholders. The purpose of the Heart River Watershed Restoration Plan is to provide a framework for restoration, along with the actions required to conserve and restore fish habitat. Future actions should be focused on restoration activities with strategic focus on fish habitat components and monitoring measurable outcomes.

The Heart River Watershed Restoration Plan outlines six activities that have been collaboratively chosen by the Heart River Watershed Restoration Project team as restoration initiatives.

1. **Riparian Vegetation.** Goal: Increase in the percentage of riparian area that is vegetated and an increase in Cows and Fish Riparian Health score.
2. **Farm water planning.** Goal: Increase in water retention on the landscape and an increase in the distribution of nutrients over the watershed.
3. **Culvert improvement**. Goal: Reduction in sediment loading in Heart River and tributaries as well as the mitigation of one fish passage barrier.
4. **Stream bank fencing/bank erosion.** Goal: Reduction of sediment loading in the Heart River and tributaries and increase the area of bank stabilized.
5. **Livestock management.** Goal: Increase the number of off-site watering points installed and increase the Cows and Fish Riparian Health score.
6. **Cropper setbacks.** Goal: Increase the number of hectares put back into permanent vegetation, the number of hectares put back into native vegetation and an increase in Cows and Fish Riparian health score if it is in riparian zone.

The value of restoration projects includes more than just the physical changes on a landscape. Improved understanding of land use practices and the resulting effects on fish or fish habitat is important to encourage change in behaviors and practices occurring on the landscape. Restoration efforts and outreach activities focused on restoration within the watershed can also provide momentum for community participation and additional restoration efforts in the future. The development of community relationships and partnerships between agencies are also recognized as positive outcomes.

Successful watershed restoration requires plans that are realistic, address stakeholder priorities and are practical to implement. Ensuring a restoration plan meets these conditions allows it to be more easily used by various agencies and individuals to combine efforts in fish habitat restoration and enhancement

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1.0 Introduction

Recognizing impairments with fish populations and fish habitat in the Heart River watershed has prompted the need for a watershed restoration plan. Even with application of federal and provincial legislation, development guidelines and best management practices focused on reducing impacts to fish and fish habitat, declines in fish populations and impacts to fish habitat has occurred in the Heart River watershed.

The Mighty Peace Watershed Alliance (MPWA), in conjunction with Alberta Environmental and Sustainable Resource Development (AESRD), Northern Sunrise County (NSC) Smoky Applied Research and Demonstration Association (SARDA), Alberta Riparian Habitat Management Society (Cows and Fish), Heart River Watershed Advisory Council (HR WAC) and Peace Country Beef and Forage Association (PCBFA) have initiated the development of the Heart River Watershed Restoration Plan. The primary focus of this watershed restoration plan is to provide guidance on restoring fish habitat within the watershed. Environment Canada's Environmental Damages Fund provided funding for this project with in-kind contributions from all partners listed.

2.0 Background

Changes within the watershed in the last few decades have not gone unnoticed and work has been underway to address issues and concerns related to aquatic health. This restoration plan is intended to build on previous efforts of other stakeholder efforts, as well as work undertaken by the HR WAC, NSC, MWPA and AESRD.

The Heart River Watershed Management Plan completed in 2008 (Wyngaarden *et al.*) was developed as a result of concerns with declining water quality in the Heart River watershed and provides a number of recommendations for action within the watershed. The Heart River Watershed Restoration Plan differs in that it focuses primarily on fish and fish habitat with an overarching goal to restore and enhance fish habitat in the Heart River. This fish habitat centric plan works within the framework of the Heart River Watershed Management Plan and also complements other management strategies employed by various levels of governments in the watershed (See Figure 1).

Water for Life: Alberta's Strategy for Sustainability: this program was created in 2003 to address the need to manage the quantity and quality of the Province's water supply and systems. The program's main three goals: (1) a safe, secure drinking water supply, (2) a healthy aquatic environment, and (3) reliable, quality water supplies for a sustainable economy.

Government of Alberta – Alberta Environment and Sustainable Resource Development's Fisheries Management Objectives: fish species of priority focus for the Heart River watershed is Arctic grayling, followed by walleye, northern pike, yellow perch, burbot and goldeye.

Frank Lake Important Bird Area (IBA): Frank Lake has been recognized as an important staging area for tundra swans and a nesting area for trumpeter swans as well as supporting over 120 species of birds. Alberta Parks, Tourism and Recreation have provided a protection strategy for Frank Lake and it is managed and recognized as an Important Bird Area with special conservation initiatives (awareness, research and monitoring, and enforcement and regulations) to protect the lake and surrounding area.

Greene Valley Provincial Park Management Plan: extends 26km along the Heart River starting at the town of Peace River to northwest of the Village of Nampa. Officially designated as a provincial park in June 2000, a draft management plan was created in 2006 to provide direction for the future protection and use of the Park.

Figure 1. Regional management strategies

2.1 Study Area

Located in northern Alberta, the Heart River watershed falls primarily within NSC, with small portions in the MD of Big Lakes and the MD of Smoky River No. 130.

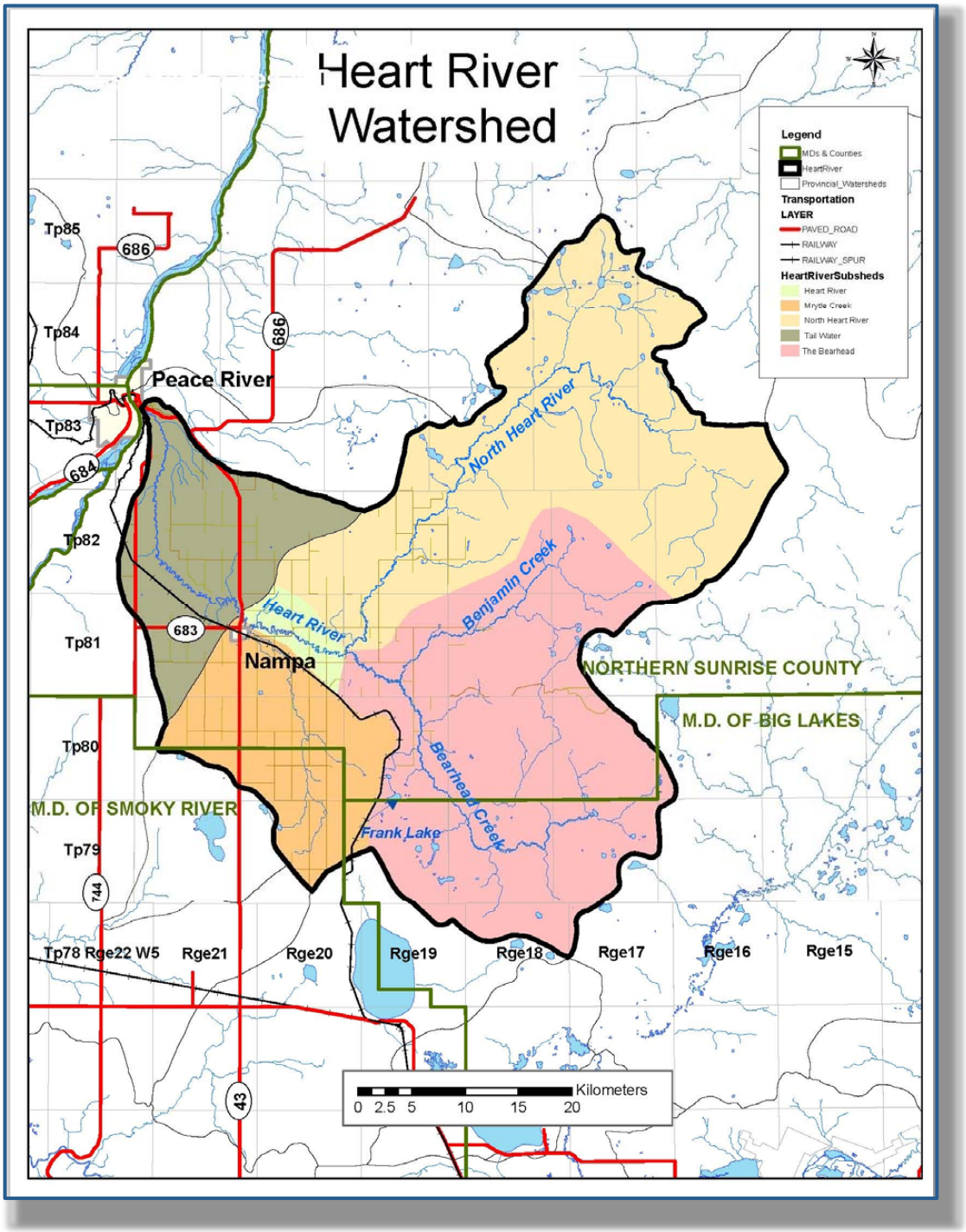


Figure 2: Heart River Watershed and Planning Area (PFRA, 2007)

2.2 Watershed Overview

The Heart River originates at an elevation of 745 m (2,444 ft) and latitude of 56° and drains an area of approximately 1,804 km^2. The watershed can be categorized into three major sub-basins: the North Heart River (830 km$^{2)}$; Bearhead Creek, including Benjamin Creek (773 km^2) and Myrtle Creek including the Nampa South Drainage Project (201 km^2). The headwaters of Bearhead Creek are located within the MD of Big Lakes and the headwaters of Myrtle Creek are located within the MD of Smoky River No. 130 (Wyngaarden et. al., 2008). At an elevation of 320 meters (1,050 ft), the Heart River empties into the Peace River within the Town of Peace River (Figure 3).

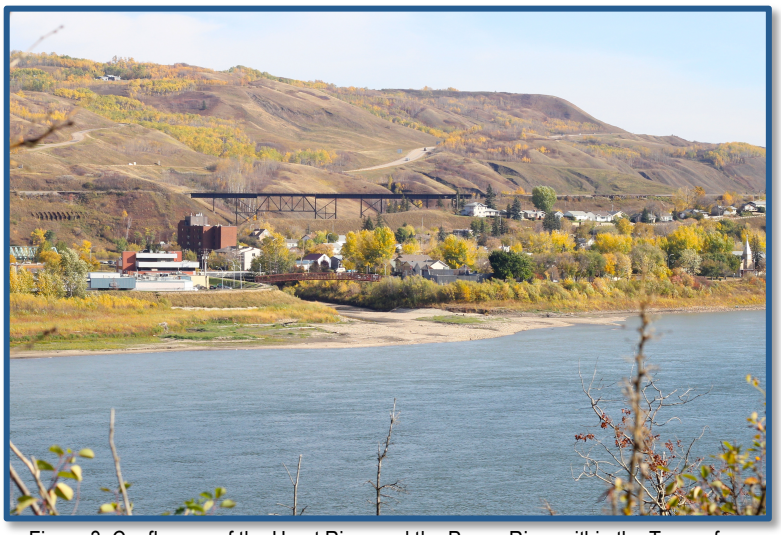


Figure 3. Confluence of the Heart River and the Peace River within the Town of Peace River. Photo credit: Wanda Watts

2.3 Weather and Climate

The weather in the Heart River watershed is typically cold in the winter, with a daily average temperature of -13.7°C (November-February) and warm in the summer with a daily average temperature of 14.5°C (June-August). The average annual temperature for Nampa is 0.5 °C and the area receives an average of 427 mm of rainfall annually. In comparison to other areas in the region, it experiences similar temperature ranges and similar amounts of rainfall. Manning has an average annual temperature of 0.6°C and receives 407 mm of rainfall annually while Eaglesham has an average annual temperature of 1.4°C and receives 441mm of rainfall annually (Climate Data, 2014).

In comparison to the Nampa area other localities in Alberta were considered to identify any unusual weather or climate trends. In central Alberta, Rocky Mountain House is generally warmer than Nampa with an average annual temperature of 1.9 °C and it receives an average rainfall amount of 521 mm. Medicine Hat, located in southern Alberta has a higher average annual temperature of 5.1°C, however, experiences less rainfall with only 329 mm annually (Climate Data 2014). While the Nampa area may experience lower than average seasonal temperatures, there does not appear to be any weather conditions that cause unusual weather trends in the watershed.

2.4 Natural Regions

The Heart River watershed is located within the Boreal Plain Natural Region and Dry Mixedwood Natural Sub Region (Natural Regions Committee, 2006). Wetlands, including bogs, swamps, marshes, fens and open water are common across the Heart River watershed. The soils are typically moderately weathered and belong to the group of soils called Brunisols and Luvisols. Soils are deep and fairly productive for both tree growth and agriculture.

2.5 Biodiversity

The Key Wildlife and Biodiversity Zone (KWBZ) are areas designated by the Alberta Government identifying key wildlife habitats in the uplands and major watercourse valleys (Government of Alberta, 2014). These areas contain significant features for wildlife and helps ensure biodiversity within the Province. The KWBZ is intended to prevent loss and fragmentation of habitat; prevent short and long-term all-weather public vehicle access; prevent sensory disturbance during periods of thermal or nutritional stress on wildlife; and prevent the development of barriers to wildlife corridors (e.g. stream crossings).

Figure 4. Green Valley Provincial Park. Photo credit: Kerri O'Shaunessy, Cows and Fish.

In addition to KWBZ, there are additional protected areas in the Heart River watershed. Green Valley Provincial Park is a protected area located between the Town of Peace River and the Village of Nampa (Figure 4). Harmon Valley Park is located adjacent to portions of the North Heart River. Both of these parks provide valuable wildlife habitat and acts as a wildlife corridor between upland areas in NSC and the Peace River Valley. The Heart River watershed is a blend of areas that have land use management controls, protected areas and areas that have limited or no land use strategies.

2.6 Land use and Human Occupancy

The Heart River watershed is a blend of Crown land (green zone) and settled area (white zone). The green zone covers approximately 84% of the watershed, is largely forested and generally describes the upper reaches. The remaining 16% of the watershed is considered white zone and is primarily located in the lower reaches of the watershed. The settled areas in the white zone are a mix of public and private lands that are largely managed for agricultural use (Wyngaarden *et. al.,* 2008).

Within the watershed there are traditional lands and reserve lands of the Woodland Cree First Nation, the Lubicon Lake Indian Nation, the Duncan First Nation and the Cadotte Metis Nation Local 1994. The western portion of Cadotte Lake is known as the Cadotte Lake Indian Settlement and the eastern portion is an unincorporated community between the Woodland Cree First Nation Reserve and NSC. The Lubicon Lake Indian Band (AANDC, 2011) has lands surrounding the hamlet of Little Buffalo. First Nations and Métis groups historically used the area for hunting, trapping and fishing. Impacts of traditional fishing on the current state of the fish populations in the Heart River are unknown.

NSC's census of 2013, counted 1933 permanent residents and 592 non-permanent residents, reflecting the relatively low population density (0.1 /km2 (0.26 /sq. mi) of human occupancy within the Heart River watershed (Statistics Canada, 2011). Communities within the watershed include the Village of Nampa, Three Creeks, St. Isidore, Marie Reine, Harmon Valley, Reno and the Town of Peace River. Historical activities and various urban and resource developments have negatively affected fish and fish habitat in the Heart River.

3.0 Fish and Fish Habitat

3.1 Fish

Sport fish are those species of fish sought by anglers, domestic and/or commercial fishers (AESRD, 2002). Sport fish historically found in the Heart River watershed include: Arctic grayling (*Thymallus arcticus*), walleye (*Sander vitreus*), northern pike (*Esox luscious*), yellow perch (*Perca flavescens*), burbot (*Lota lota*), and goldeye (*Hiodon alosoides*) (AESRD, 2014).

The Heart River watershed supports eleven non-sport fish species: white sucker (*Catostomus commersoni*), redside shiner (*Richardsonius balteatus*), brook stickleback (*Culaea inconstans*), lake chub (*Couesius plumbeus*), longnose sucker (*Catostomus catostomus*), pearl dace (*Semotilus margarita*), longnose dace (*Rhinichthys cataractae*), spottail shiner (*Notropis hudsonius*), trout-perch (*Percopsis omiscomaycus*), slimy sculpin (*Cottus cognatus*), flathead chub (*Platygobio gracilis*) and northern pike-minnow (*Ptychocheilus oregonensis*) (AESRD 2014).

Figure 5. Arctic Grayling. Photo credit: Gary Braithwaite.

Not all fish species can carry out their life processes in the same type of environment. For example, Arctic grayling are considered to be a 'cold-water' fish, preferring water temperatures between 5 and 18 degrees Celsius (Scott and Crossman, 1998) and are sensitive to chemical pollutants and increased turbidity (Stewart *et al*., 2007). Walleye, northern pike, yellow perch, goldeye and burbot are considered 'cool-water' fish species and can tolerate temperatures warmer than 18 degrees Celsius. These species are generally more tolerant of changes to water quality than Arctic grayling.

Fisheries inventories were conducted in 1981/82 with recommendations to limit further development of the upper sections to protect the resident grayling population from angling pressure (Schwanke, 1983). Recent efforts to capture Arctic grayling within the drainage have not been successful despite varied inventory methods. It is suspected that this species has been extirpated from the system or in such low densities as to not be detected (Lyttle and Wilcox, 2012). This information supports the assertion that water quality has declined over time and could no longer provide suitable water quality for Arctic grayling. However, the Heart River watershed is expected to provide suitable conditions for other sport fish species. Angling surveys conducted in 2014 by the Alberta Conservation Association (ACA) at the confluence of the Heart River confirmed the presence of walleye, northern pike, goldeye and burbot (Buskas and Patterson) although the population densities remain unknown.

Over time, there has been a diverse range of development activities within the watershed that has resulted in changes to the fish populations in the Heart River watershed. In addition to anthropogenic changes, recreational fishing has likely impacted fish populations from harvesting fish during sensitive periods of their life stages, including spawning periods.

3.2 Fish Habitat

Fish habitat assessments as early as the 1970's indicated that future development of the upper portions of the river should be limited in order to maintain the habitat and that land clearing and agricultural practices were likely contributing to increased mobilization of silt and sediments, resulting in degradation to water quality (Schroeder 1973). A stream bank evaluation was conducted in the 1980's to prioritize its suitability for the government streambank fencing program. This assessment found the banks within the study area were 'inherently unstable owing to the loose, sandy soil substrate and active erosion of the stream flow' (Cooke, 1981) and areas were agriculture activity was present, further aggravated this streambank instability and corresponding increased silt load in the drainage.

Productive capacity is defined as "the maximum natural capability of habitats to produce healthy fish, safe for human consumption, or to support or produce aquatic organisms upon which fish depend" (DFO, 1986).

Generally, fish habitat assessments use terminology such as 'productive capacity', which refers to the status of fish habitat as well as its potential to support fish in the future. This definition aligns with policy developed by the federal government's Fisheries Protection Program and the provincial government's Fisheries Management Objectives (FMO's). FMO's outline the goals and indicators of success in provincial management strategies for a particular fish species or an area of concern (AESRD, 2012). FMO's have been developed for the North Heart River watershed and include a priority focus on sport fish species. Primary management objective is for Arctic grayling followed by walleye as a secondary priority. Northern pike is the third priority focus for the watershed followed (in equal concern) by yellow perch, burbot and goldeye (AESRD, 2012.)

3.3 Fish Habitat Status

Fish habitat is comprised of a variety of components that when functioning together, provide valuable areas in which fish live. Riparian areas, water quality and water quantity provide essential habitat features and help to maintain the productive capacity of fish habitat. In addition to functional fish habitat areas, fish need the ability to move upstream and downstream between different habitats to meet the needs of their various life stages.

3.3.1 Riparian Areas

Riparian areas are often some of the most productive areas on a landscape. Alterations or destruction of the riparian zone can negatively impact the short and long-term viability and productivity of fish and fish habitat in a watercourse (DFO, 1993). Riparian areas provide critical functions within a watershed such as water temperature regulation, nutrient cycling, bank stabilization, reductions in the velocity of flows during runoff events, provide overhanging vegetation and also provides sources of food for fish.

Current land use and development practices have resulted in incremental loss and damage of the riparian areas (Wyngaarden et al., 2008). Over the last decade there have been a number of stakeholder groups that have made efforts to improve land use practices that affect riparian area health but additional strategies need to be implemented to conserve and enhance riparian areas within the Heart River watershed.

3.3.2 Water Quality

In 2002, NSC commissioned a water quality study to determine impacts from land use within the watershed. The results of the study between 2002 and 2013 showed that water quality was poor throughout the watershed with the poorest quality belonging to Myrtle Creek and its tributaries (White and Logan, 2006).

Water quality degradation was considered significant enough to impair water quality at the Nampa intake (White and Logan, 2006) and has exceeded Canadian Council of the Minister of Environment Guidelines for Irrigation Uses and Alberta Surface Water Quality guidelines for total coliforms (during spring run-off), total nitrogen, and total phosphorus (Wyngaarden *et al*. 2008). Water quality results showed fecal contamination, increased nutrient levels, dissolved solids, and conductivity during low flow conditions indicates possible shallow groundwater contamination (Wyngaarden *et al*., 2008). Ground water sampling in 2012 showed extremely high concentrations of nutrients and solids as well as three pesticides not detected in surface water sampling (Wyngaarden et al., 2008).

Figure 6. Myrtle Creek. Photo credit: Kerri O'Shaunessy, Cows and Fish

The results of the water quality monitoring indicate that agricultural activities, private (rural) sewage systems and urbanization are contributing to the deterioration of source water quality within the Heart River watershed (Wyngaarden et al., 2008). It is known that agricultural land-use increases the run-off of nutrients, such as phosphorus and nitrogen, and dissolved and particulate organic carbon (Reynolds, 2008) and raises concentrations of herbicides, pesticides and other organic pollutants often via diffuse pollution (Jonsson, *et al*., 2011). Degraded water quality plus augmented sediment loads and oxygen deficits can reduce fish production (Fenn *et al*., 1998; Heaney *et al*., 2001).

3.3.3 Water Quantity

Water quantity has been surveyed since the 1960's with Water Survey of Canada operating a hydrometric station on the Heart River near Nampa, and Alberta Environment providing data since 1991 on a second station located at the Nampa (South) Drainage (Wyngaarden et al., 2008).

A hydrology study conducted on the drainage determined that that a rainfall event of 25.4 mm within a 24-hour period would trigger a run-off event (Wyngaarden et al., 2008). Run-off events in watersheds that have large amounts of upland areas cleared for in combination with reduced riparian areas can create a number of issues on the landscape. Increased risk of flooded areas and creation of new erosion and scour areas can create issues for landowners and can further degrade fish habitat potential within a watercourse.

3.4 Fish Passage

The Heart River is subject to various natural and man-made barriers to fish passage. Beaver dams, stream crossings, weirs, and seasonal water fluctuations including low water levels that may prevent fish from moving upstream and downstream to meet the habitat needs of their different life stages.

The middle and lower portions of the river contain a high proportion of roads with suspected culvert barriers, though a formal field inventory of these crossings has not been conducted. AESRD created a linear disturbance ArcGIS layer and determined that there were 1.08 crossings/km^2 of watershed, which is considered a low disturbance level compared to other Peace/Upper Hay watersheds (Schunicht and Sherburne, 2005). It is anticipated that this calculation has changed due to increased development of the watershed from oil and gas/forestry activities. The low disturbance level of watercourse crossings (Schunicht and Sherburne, 2005) allows for lower efforts and costs to undertake a formal fish passage inventory within the watershed.

The Nampa weir constructed on the Heart River has been in operation since the early 1960's, and received an upgrade in 1981. A 1983 inspection determined the weir is a fish migration barrier (Figure 7) and Schwanke (1983) provided recommendations to create additional 'steps' within the flow regime with gravel and rubble to provide better fish passage. The weir was visually assessed in summer of 2014 (Figure 8) and is expected to pass fish under most flow conditions throughout the year, except possibly during extreme low flow conditions (K. Wilcox, pers. comm. 2014).

Figure 7. Heart River weir. 1983. Photo credit: AESRD

Figure 8. Heart River weir. 2014. Photo credit: AESRD

A strategic plan to address the potential fish passage issues in the Heart River could benefit the fish populations by allowing upstream and downstream movement of fish to key habitat areas and could also provide benefits to water management concerns in the watershed. Connectivity is an essential component to ensuring the productive capacity of fish habitat.

3.6 Fish Habitat Impacts

Land use practices or development activities that negatively affect the various components of fish habitat can result in permanent loss of fish habitat and negatively affect fish populations that rely on that habitat to survive and reproduce.

Agricultural activities and industrial development have modified the physical aspects of the watershed and resulted in impacts to fish habitat. Clearing of land, altering wetlands and removing the riparian areas affects the filtering and buffering functions of the watershed. These alterations decrease the ability of the watershed to handle spring run-off or high flow events and result in excessive nutrients, sediments, bacteria and other pollutants entering the river or tributaries. Soil health can provide insight into issues within the watershed and affects water quality. As water quality decreases so does fish habitat potential. Degraded water quality and loss of fish habitat not only reduces aesthetic values and recreational fishing opportunities, but can affect human and livestock health as well. Table 1 lists watershed impacts occurring within the Heart River watershed and effects on fish and fish habitat. Unless mitigated, these changes will continue to result in increased erosion and sedimentation, which will continue to negatively affect water quality and quantity in the watershed.

Watershed Impact	Effects on Fish Habitat
Water withdrawals and diversions	Reduced water quantity, changes in hydrology. Potential to dewater downstream sections of watercourse affecting fish communities or creating fish passage or migration barriers.
Land Use Practices Involving Land Clearing such as Grazing, Forestry, Industrial	Land clearing that removes riparian areas or wetlands increases surface water runoff, reduces water retention on the landscape. Can alter the hydrology of a watercourse resulting in flooding. Can impact water quantity and affect the flows within the waterbody that fish need to carry out their life processes.
Agricultural management and activity, residential or commercial application of chemicals	Decreased water quality and water contamination from excessive nutrients, pesticides, herbicides and manure. Increase in nitrogen and phosphorus concentrations which can stimulate algae blooms, decrease amount of dissolved oxygen available to aquatic organisms. Chemicals can have an acute effect on stream biota or can be chronic/lethal. Can affect the benthic community.
Riparian Alteration or Destruction	Loss of bank stability and increased risk of erosion and sedimentation. Loss of fish habitat, changes in hydrology. Increases water temperatures by reducing stream shading and can alter fish communities, favor fish species tolerate of higher temperatures. Reduces available oxygen for aquatic organisms. Reduces terrestrial food sources for fish. Reductions of groundwater re-charge.
Bank Instability and Erosion	Increased amounts of suspended sediments can affect fish health by clogging fish gills and can result in fish mortality. Can fill in substrates used for fish spawning or cover eggs laid in the streambed.
Road-watercourse crossings	Habitat fragmentation from improperly installed or maintained culverts that act as fish passage barriers, increased erosion and sedimentation resulting from bank instability.
Private sewage systems	Bacterial and parasitic (fecal) contamination of soil and/or water.

Table 1. Watershed Impacts and Effects on Fish Habitat

4.0 Education and Outreach Initiatives

Outreach activities are essential for communicating the linkages between land use practices and watershed functions. A number of outreach methods have been employed in the Heart River Watershed in an effort to increase awareness of how development activities have affected the health of riparian areas and degraded water quality over time (Table 2).

Education and Outreach Tools	Organizational Use
Websites with watershed related information	MPWA, Cows and Fish
Informational articles	MPWA, SARDA, PCBFA
Brochures and booklets	MPWA, Cows and Fish, AESRD
Public engagement, open houses and workshops	MPWA, Cows and Fish, AESRD, SARDA
Tradeshows and display boards	Cows and Fish, AESRD, SARDA
On-site inspections	Cows and Fish, SARDA
Technical Assistance	SARDA

Table 2. Education and outreach tools and organizational use.

The MPWA, Cows and Fish, and AESRD all produce watershed health brochures and booklets (Figure 9). SARDA and Cows and Fish have provided resources and funding dedicated towards technical assistance as well as face-to-face interactions on private land. SARDA has also been providing technical assistance on riparian project design and implementation to 1 to 2 producers a year. NSC, MD of Big Lakes, and have provided financial support for this initiative.

Figure 9. Education materials available in the Heart River watershed. Photo credit: Wanda Watts

4.1 Outreach Evaluation

Historically, attendance at public engagement open houses and tradeshows hosted throughout by various stakeholders has been low compared to number of residents in the watershed. Increasing the number of participants at tradeshows, open houses and information sessions is challenging due to the large geographical area and low population densities. Scheduling of events is a challenge due to the obligations and commitments of the landowners and seasonal weather patterns play a role in the availability of landowners and their participation given their agricultural responsibilities.

The agencies and stakeholder websites currently in use are adequate, but few focus on water quality and connections to fish and fish habitat in the Heart River watershed.

Evaluating effectiveness of education and outreach materials can be conducted by assessing changes in behavior or practices that occur within the watershed. No formal assessment has been undertaken to understand the success of these outreach material and methods, therefore it is difficult to determine their effectiveness. Future outreach work should communicate the importance of changing land use practices for watershed health benefits and include a feedback mechanism to ensure the messages are reaching the target audience.

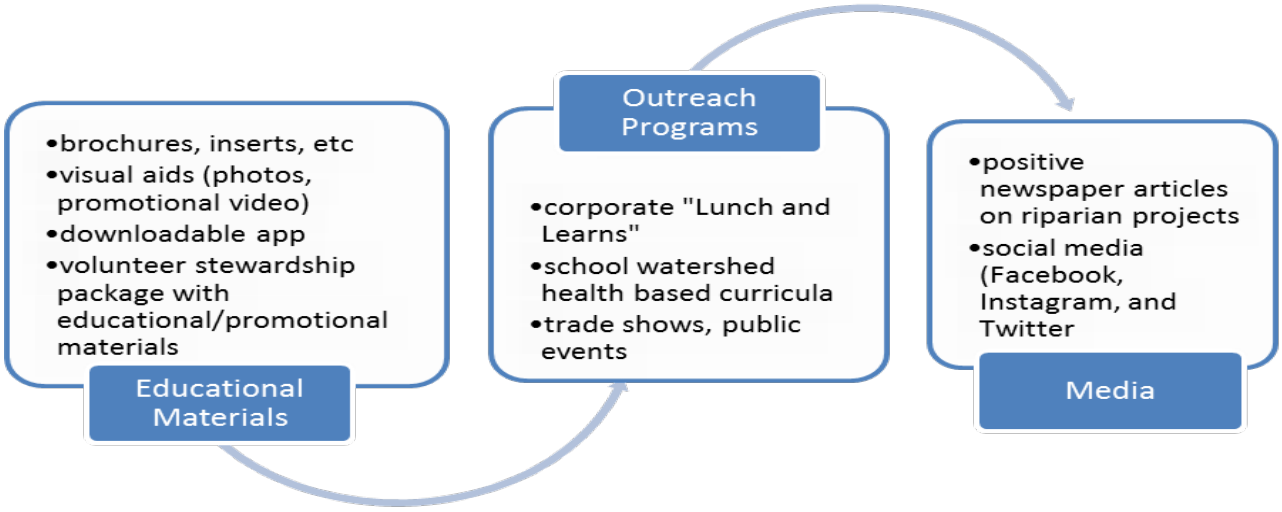
4.2 Future Outreach Strategies

Outreach programs should incorporate a variety of different strategies and flexibility should be the rule when developing and implementing programs. Watershed outreach programs have been shown to be more effective and have greater success when the landowners, residents and stakeholders that are affected by watershed decisions are included in the decision making process (EPA, 2010). Outreach strategies need to be ongoing and should constantly evolve to address any new issues that arise or to implement new approaches for effective behavior changes. It is also essential to provide education on what activities or behaviors are creating issues within the watershed and help residents, landowners and stakeholders understand the role they can play in being part of the solution.

Outreach activities should be coordinated with watershed scale land use planning. In addition to knowledge about the existing conditions within the watershed, a clear and focused management plan needs to be developed to inform restoration decisions within the Heart River watershed for maximum efficiency and reduced costs. Previous initiatives have provided momentum in the right direction, but more work needs to be done in order for watershed restoration activities to be considered a success. Continued collaboration is essential for a productive and unified approach to fish habitat restoration and improvements to aquatic ecosystem health in the Heart River watershed. Future outreach should include considerations of watershed goals that include changing behaviors or practices.

Outreach Strategies should focus on behaviors or practices that:

-will have the largest reduction in pollution affecting water quality.
-are affordable to promote for landowners, residents and stakeholders
-are the most attractive to the landowners, residents and stakeholders in the watershed.
-demonstrate links to issues within the watershed
-have the least barriers to implementation



5.0 Restoration Initiatives

Previous restoration efforts undertaken in the Heart River watershed included a total of six restoration projects (Table 3). All six restoration projects had a similar focus, with efforts concentrated on areas of degraded riparian vegetation.

Agency personnel chose riparian areas that would benefit from increased vegetative cover near the watercourses and improve bank stability. Landowner cooperation and agency resources were combined to undertake these restoration projects, including signage about the projects' purpose. Restoration efforts included installing cattle exclusion fencing and planting of vegetation. The project undertaken at the Harder property was the sole project to receive a formal Cows and Fish riparian health assessment.

Project Name and Location	Project Description	Project Date	Partners	Monitoring
Zak SW 19-81-20 W5M	Riparian plantings		NSC	Visual inspection, Site Visit
Harder NE 30-81-21 W5M	Riparian plantings and fencing	May 2006	NSC, AESA, DMI, WEP, AESRD	Cows and Fish Assessment, Site Visit
Dell SE 20-81-21 W5M	Riparian plantings	Unknown	NSC, ACA, AESA, AESRD, SARDA, Woodmere Nursery, Woodlot Extension Prog. AC	No information available
Skwarik SE 13-81-20 W5M	Riparian plantings	Unknown	NSC	Not inspected
Saliwonchuk NE 34-80-19 W5M	Riparian plantings	Unknown	NSC, AESA	Visual Inspection, Site Visit
Evaluating Livestock Use Benjamin Creek	Grazing management, riparian fencing	2007-2009	GoA (AESRD), PFRA	GPS Analysis, Site Visit

Table 3. Restoration Projects in the Heart River watershed

The project undertaken on Benjamin Creek involved analysis of cattle movements to adapt cattle grazing management strategies to reduce riparian impacts from cattle access. A series of site visits established before and after conditions at the same site (Figures 10 and 11).

Figure 10. Benjamin Creek with unvegetated, unstable banks. Photo credit: Colin Stone, AESRD

Figure 11. Benjamin Creek with stabilized banks. Photo credit: Colin Stone, AESRD

While some of the projects have photo records of the conditions before and after improvements were initiated, there have been limited measurements to assess the overall effectiveness of riparian restoration within these watercourses or within the watershed. Without detailed monitoring data, evaluating the effectiveness of restoration projects is challenging.

5.1 Future Restoration Initiatives

Impacts to riparian areas, water quality and water quantity are all factors in the degradation and loss of fish habitat in the Heart River watershed. The Heart River Watershed Restoration Project team has prioritized six restoration projects in efforts to improve watershed function and restore fish habitat components.

Prioritized Restoration for the Heart River Watershed

1. **Riparian Vegetation** – Performance measure: increase in the percentage of area vegetated, and increase in Cows and Fish Riparian Health score
2. **Farm water planning** – Performance measure: increase in water retention on the landscape, an increase in the distribution of nutrients
3. **Culvert improvement** – Performance measure: reduction in sediment loading, mitigation of 1 fish passage barrier
4. **Stream bank fencing/bank erosion** – Performance measure: reduction of sediment loading, area of bank stabilized
5. **Livestock management** – Performance measure: number of off-site watering points installed, increase in Cows and Fish Riparian Health score
6. **Cropper setbacks** – Performance measure: hectares put back into permanent vegetation, hectares put back into native vegetation, increase in Cows and Fish Riparian health score if it is in riparian zone.

5.2 Monitoring

Any restoration projects undertaken in the watershed require a defensible monitoring program to provide feedback and better inform future restoration efforts. Evaluating effectiveness of restoration efforts requires clear goals prior to project implementation. Monitoring and evaluation needs to focus on three key items:

1. What is the action or undertaking?
2. How will the result of the action or undertaking be measured?
3. What are the results and significance of the action or undertaking?

Determining the significance of the action or undertaking is arguably the most valuable assessment to understand the effectiveness of restoration initiatives. Significance can be attributed to a number of different categories (Figure 12).

Statistical significance – are the results statistically significant? For example, there was a statistical increase in fish populations or diversity.
Biological significance – are the results biologically significant? For example there were improvements to fish populations observed but they can't be statistically validated as significant.
Environmental significance – are the results environmentally significant? For example, there was increased vegetation growth in a riparian area, but the result can't be conclusively shown to have improved fish populations or diversity.
Social significance – are the results socially significant? For example, there were improvements in land use practices or knowledge that can't be shown as biologically or environmentally significant.
Economic Significance – are the results economically significant? For example, there were improvements in the watershed that have an economic benefit.

Figure 12. Categories for significance of results

6.0 Successes and Challenges

There have been a number of successful initiatives in the Heart River watershed in recent years. A collaborative partnership between NSC, the Village of Nampa, and Woodland Cree First Nation has resulted in the Regional Water System and Water Treatment Plant. This treatment plant has provided water sources for users drawn from the Peace River instead of the Heart River. Additionally, the water quality-monitoring program started in 2002 illustrates a vested interest by NSC in protecting water quality in the Heart River and tributaries. Restoration projects focused on riparian areas and cattle grazing strategies have improved localized bank stability and riparian vegetation growth. These efforts in combination show that a variety of organizations and individuals are committed to improving conditions within the Heart River watershed.

A significant challenge has been, and continues to be, landowner engagement and community participation in restoration initiatives within the watershed. Feedback received from producers is that there is a perceived negative stigma to participate in the current programs, as they would be admitting they were "bad land stewards." Landowner permission to carry out demonstration riparian restoration projects has been challenging (Aquality, 2010). A positive approach to encourage landowner participation would be to create a program that recognizes those producers who working/living within the watershed while still protecting the riparian areas of the watershed. This could also include a tax credit or some other monetary compensation provided by the NSC to further create the incentive to protect the water quality of the Heart River.

A simple recognition program for proactive landowners can help build the community's focus to protecting the Heart River watershed. It shifts the focus from a negative recognition program to one that reinforces positive land use behaviors.

Despite having legislation (Water Act, Fisheries Act, etc.) to protect water quality, fish habitat and riparian areas, there is a lack of manpower at all levels of government to enforce these programs. The shift in directive from federal and provincial governments in recent years has been to one of self-regulation, which is only effective if the community is united in a common goal of protecting the watershed. A sustained level of personnel and technical support by all the partners involved in this project are essential to affect change.

Although the consequences of watershed activities on aquatic environments are considered within federal and provincial government legislation, the full effect of harvest activities on fish and fish habitat within the Heart River watershed is not fully understood. The cumulative effects of industrial activities and developments on fish communities is detrimental however (Scrimgeour et. al., 2003), and therefore Forest Management Area holders should be sought out as partners to ensure the successful development and execution of the Heart River Watershed Restoration Plan.

With recognition of the importance of water resources to all their stakeholders and a commitment to balancing freshwater use with long-term sustainability, partnerships with oil and gas companies need to be developed. Baytex Energy, Penn West Petroleum Ltd. and Shell Canada are potential industrial partners as all three have water licenses for water use in the Heart River watershed.

7.0 Summary

A watershed restoration plan plays a vital role in watershed initiatives to provide a common direction for government agencies, landowners, industrial users and stakeholders to work effectively together and provide a common vision for restoration and enhancement possibilities within the watershed.

Restoration activities that restore primary watershed functions have the best chance of creating habitat that can successfully support fish populations. Restoration objectives are increasingly likely to succeed if considered in an ecosystem-based context to allow for the consideration of cumulative effects (Quigley and Harper, 2006). A functional watershed restoration plan should also be compatible with legislative and policy guidance pertaining to aquatic ecosystem health and fish habitat management objectives.

In the short term, the identification of goals and establishing criteria to determine success will be the key to strategically focusing available resources. The identification of any technical information gaps can helps to inform future inventory efforts. Developing a sound monitoring program is essential to determine restoration success within the watershed. Implementation of various strategies can occur simultaneously to maximize effects and collective motivation and initiatives.

Watershed management planning and multi-stakeholder advisory groups have been created to collaboratively implement programs and projects to address issues. Partnerships and community participation is a key component for the success of the Heart River Watershed Restoration Plan. Development of community partnerships will help to ease the workload burden in providing education and outreach activities to illustrate the linkage between land use activities and watershed health. Collaboration with landowners and stakeholders is key to stewardship and management of agricultural, commercial and residential lands to improve watershed health

This watershed restoration plan is primarily focused on fish and fish habitat and cannot be expected to provide complex land management direction. A number of interested stakeholder groups, not for profit organizations, industry representatives and provincial government agency staff will need to work together strategically to ensure the implementation of the Heart River Watershed Restoration Plan. Only with continued collaboration and cooperation will measurable improvements in the of the Heart River watershed occur.

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