Fish Bearing Stream Assessments

Alberta-Pacific Forest Industries Inc. (Al-Pac) is North America's largest single-line producer of high-quality kraft pulp. The majority of wood fibre for this pulp originates from Al-Pac's Forest Management Agreement (FMA) area located in northeastern Alberta. Through the company's FMA the Government of Alberta grants Al-Pac stewardship of 6.4 million hectares of forest land to sustainably harvest, establish, and grow timber. An important aspect of this work is the minimization of impacts on water resources such as streams, rivers, wetlands, and lakes and the fisheries located therein. As part of Al-Pac's environmental policy it is important to apply ecologically responsible forestry practices and maintain a progressive approach in the development of new operational techniques to ensure a minimal effect on the environment. The FMA area is crisscrossed with many watercourses and waterbodies, including countless smaller watercourses, many of which can contain fish or be used by fish for habitat, as shown in Figure 1.

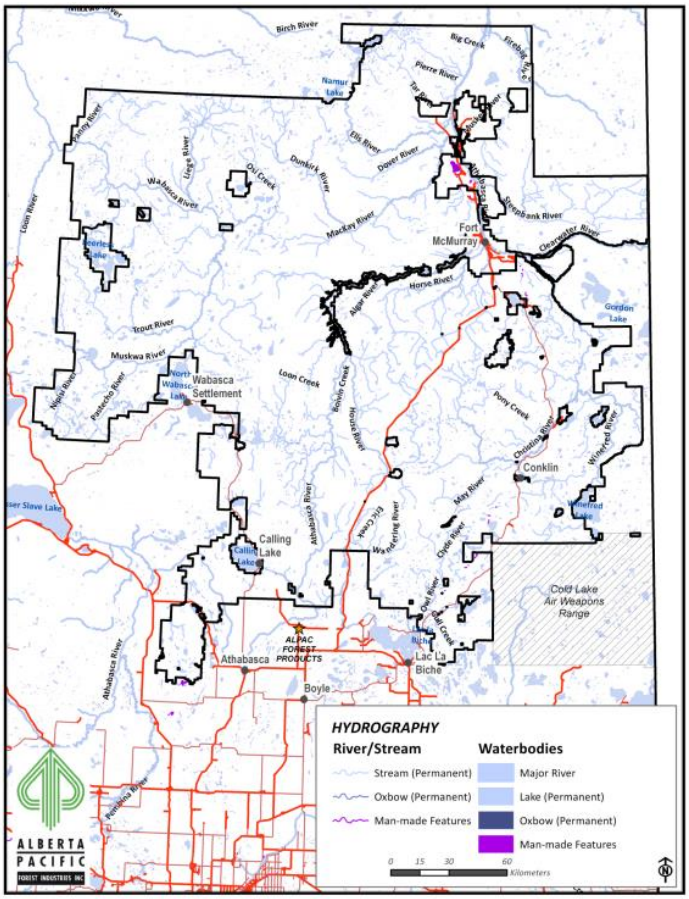

Figure 1. Map of the FMA with permanent waterbodies and rivers

In order to effectively conserve and protect water and fish resources on the FMA area, Al-Pac must monitor and mitigate the impacts of forest operations on fishery resources through a monitoring program. As part of this program, proposed stream crossings are inspected for their ability to support fish and their habitat with the support of an electrofishing sample program when required. Existing permanent stream crossings are inspected for signs of erosion or other possible effects on the aquatic environment and any concerns are reported to the relevant parties at Al-Pac to be corrected.

To aid in the access of forest resources, roads are constructed across the FMA area, oftentimes intersecting water resources, such as streams, in the form of various types of stream crossing structures (e.g., culverts or bridges). These crossings are regularly inspected to ensure that they comply with governmental regulatory and independent, third-party certification requirements (such as Forest Stewardship Council® (FSC®)) and are not disturbing the water with sedimentation or creating barriers to fish movement. Erosion around stream crossings can cause an increase in the amount of sedimentation (eg., soil, organic matter, or other debris) present in water courses. This sedimentation in water can have negative impacts on the watercourses ability to be suitable fish habitat. As well, watercourse crossings can create barriers to the movement of fish and other aquatic biota along watercourses if not properly installed or maintained adequately. Stream crossings thus have the ability to negatively affect the habitat of fish in the watercourse, and measures must be taken to monitor for these negative impacts. To meet the obligations of FSC® certification and the provincial Operating Ground Rules, Al-Pac is required to implement detailed best management practices and conduct regular monitoring.

Al-Pac has been conducting surveys of watercourse crossings and fisheries within the FMA area from 1999-2019. Surveys are conducted during the spring and summer for fish and sport fish habitat based on spawning, summer rearing, and overwintering potential. Sport fish species are fishes that are preferred by anglers for the sport in catching the sport fish. In the FMA area there are several sport fish species including walleye (*Sander vitreus*), northern pike (*Esox lucius*), and Arctic grayling (*Thymallus arcticus*). Examples of these sport fish can be seen in Figure 3. Other species present on the FMA include brook stickleback (*Culea inconstans*) and longnose suckers (*Catostomus catostomus*).

Prior to harvest, harvest areas (aka cutblocks) are planned and mapped by on the ground teams with potential stream crossings, and buffers are created around riparian zones. Proposed crossing locations are evaluated to determine the presence of fish (both non-sport and sport fish) habitat to determine what type of crossings Al-Pac could potentially install at the site. Al-Pac uses several different kinds of structures to cross watercourses such as bridges, culverts, or log fills. An example of a stream crossing can be seen below in Figure 2. Each watercourse is classified based on the width of the watercourse, the amount of water flowing through the watercourse, and interconnectedness of the water flow in the watercourse into: large permanent, small permanent, transitional, intermittent, or ephemeral. Table 1 describes the general criteria of how watercourses are categorized including the watercourses value for fisheries and potential impacts.

Table 1. Classification of watercourses into categories. Adapted from Operating Ground Rules.

Classification	Physical Description	Portion of Year Water Flows	Channel Width for Classification	Fisheries Values	Potential Impacts
Large Permanent	Major streams or rivers; Well-defined flood plains; Often wide valley bottoms	All year	Non-vegetated channel width >5m	Resident and migratory fish populations; Important over winter, feeding, and rearing habitat	Primarily sedimentation of stream channels; Loss of wildlife habitat, restriction of movement
Small Permanent	Permanent streams; Often small valley bottoms; Banks and channel well defined	All year but may freeze in winter or dry up during periods of drought	>.7 meters to 5 meters	Important spawning and rearing habitat; Resident and migratory fish populations	Primarily sedimentation of stream channels; Water quality and water yield; Fish population sensitive to siltation; Lost of stream bank fish habitat;
Transitional	Often small valley bottoms; Bench floodplain development	All year but may freeze in the winter or dry up during periods of drought	>0.4 meters to 0.7 meters	Important spawning and rearing habitat; Resident and migratory fish populations; Over wintering for non-migratory species	Primarily sedimentation of stream channels; Water quality and water yield; Fish population sensitive to siltation; Loss of stream bank fish habitat

Intermittent	Small stream channels Small springs are main source outside periods of spring runoff and heavy rainfall. Channel usually has no terrestrial vegetation.	During the wet season or storms. Dries up seasonally and during drought	=<0.4 meters	Potential spawning for spring spawning species; Spring fed areas may provide spawning potential for fall spawning species.	Sedimentation from bank and streambed damage will damage fish spawning and invertebrate habitat Water quality and water yield
Ephemeral	Often a vegetated draw connected to a higher order watercourse	Flows only during or immediately after rainfall or snowmelt	Little or no channel development; Flow area is usually vegetated.	Siltation may impact fish habitat downstream.	Sedimentation downstream due to ground disturbance

Figure 2. Temporary stream crossing in a cutblock. Modified logfill.

Spawning potential depends on substrate suitability and embeddedness, aquatic vegetation and gradient. The potential for fish to overwinter in a water body (overwinter potential) takes into account water depth, gradient, presence of cover, and substrate embeddedness. Based on spawning and overwinter potential, streams are categorized into three categories focusing on sport fish species: 1

(sport fish found at site or near by sites), 2 (no sports fish found but potential habitat), or 3 (limited potential for sport fish). Since 2004, each proposed watercourse crossing also receives a fish habitat rating distinct from sport fish habitat: 1 (fish found or potential habitat) or 2 (limited potential for fish). This was implemented to capture the presence of fish, not only sports fish, and ensure forest operations could be changed accordingly.

a) b) c)

Figure 3. Examples of sport fish found on the Al-Pac FMA: a) arctic grayling, b) northern pike, and c) Walleye. Courtesy of Alberta Fishing Guide.

The ability of a proposed watercrossing to support fish or sport fish informs Al-Pac's planning and harvest operations as to the kind of watercourse crossing that will be constructed. In the 2018 field season, 103 proposed watercourse crossings were assessed for fish and sport fish habitat and possible changes to forest operations such as the creation of watercrossings allowing the movement of fish. As can be seen in Figure 4, there were 103 proposed watercourse crossings investigated for the presence of fish (both non-sports and sports fish) in the 2018 field season. Of the 103 proposed watercourse crossings in the entire FMA, only 5 had the presence of fish detected. As can be seen in Figure 5, the number of fish (both non-sports and sports fish) detected in proposed stream crossings is low during the past 5 survey years.

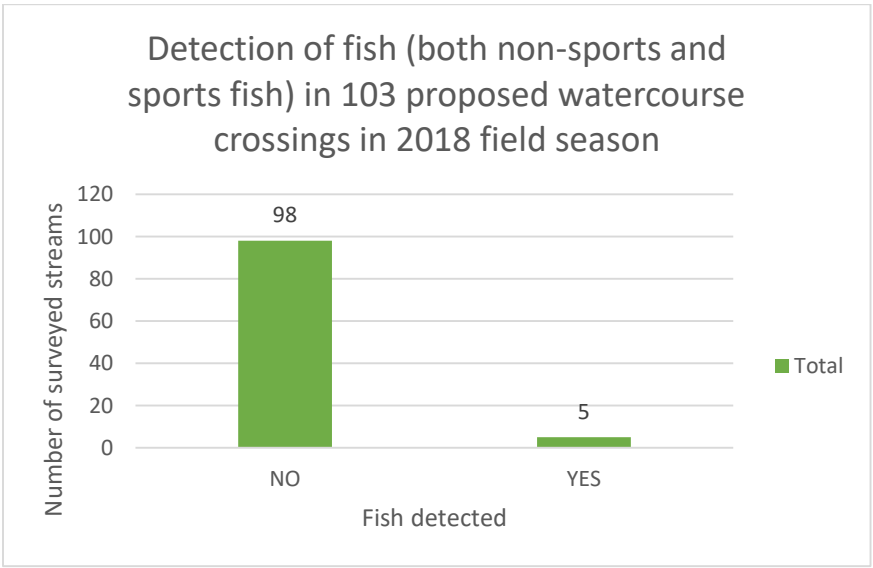

Figure 4. Fish detected in the 103 proposed watercourse crossing in the 2018 field season

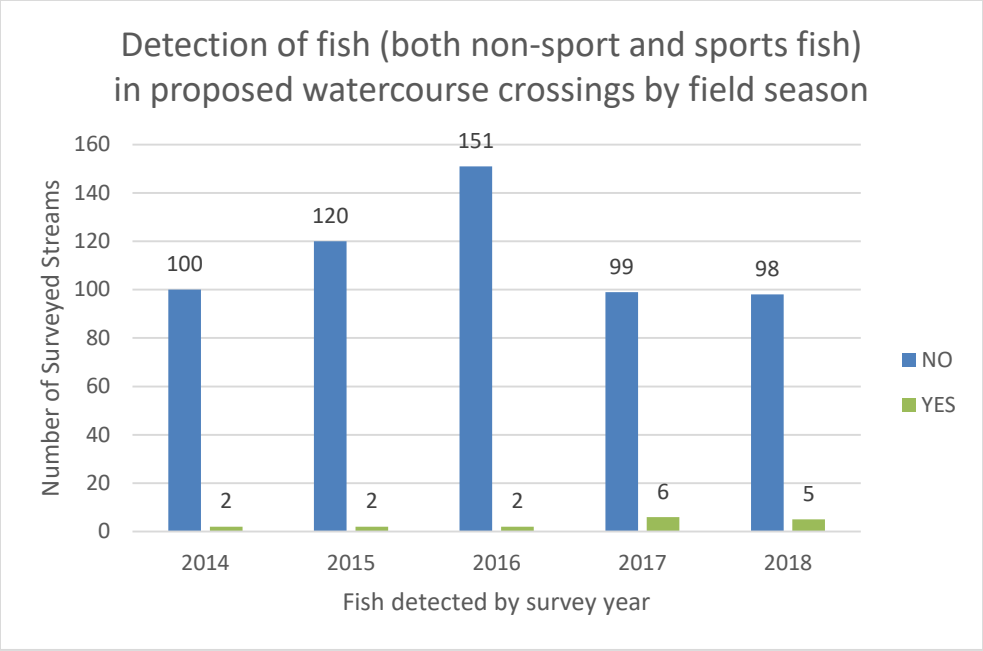

Figure 5. Fish detected in the 585 proposed crossings during surveys between 2014-2018

Existing permanent watercourse crossings are monitored every year across the entire FMA. Important considerations of watercourse crossings include the impact of man-made sedimentation or erosion and barriers to fish movement. Erosion of soil and other debris from watercrossings and their presence as sediment in the waterway can have a deleterious impact on fish habitat for effected watercourses. These conditions are monitored as well as fish and sport fish habitat compared to previous years. Sedimentation or barriers to fish movement identified at each watercourse crossing are reported to Al-Pac and steps are taken to mitigate/repair the problem. In the 2018 field season, 49 existing permanent water course crossings were inspected for issues involving fish movement or sedimentation/erosion as can be seen in Figure 5. Nine of the fish bearing watercourses had erosion or sedimentation problems. As can be seen in Figures 6 and 7, there have been problems identified with the crossings sampled in the previous five survey years. The number of existing watercrossings surveyed changes each year as new permanent crossings are constructed and retired from usage.

Once a problem is identified with a crossing, Al-Pac is given a report detailing possible corrections and mitigation tactics.

Each year, every existing permanent crossing is inspected and compared to the previous years of the crossings existence. An example of an existing watercourse crossing in the process of being monitored can be seen in Figure 8 with the surveyors being visible in Figure 9. This information can be used to inform best practices in the construction of watercourse crossings and aid in the protection of water and fish resources.

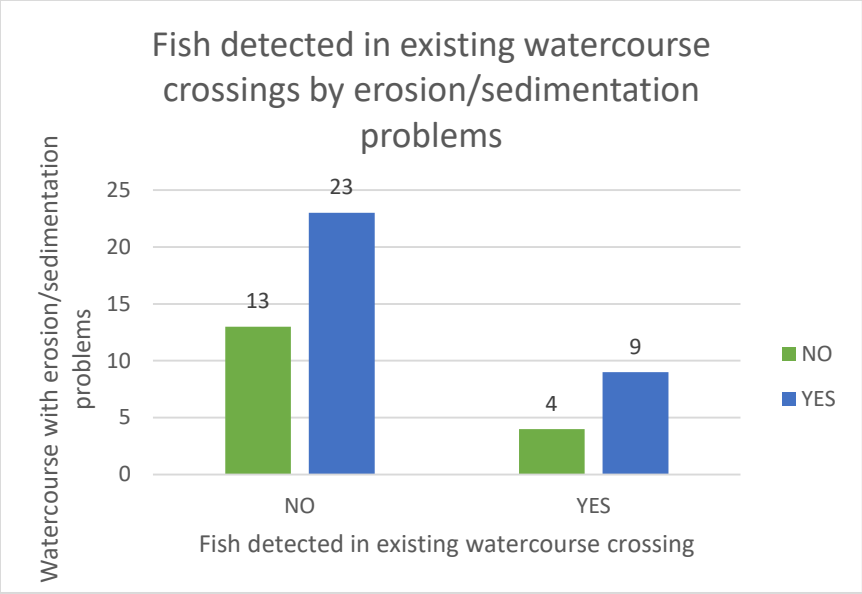

Figure 5. Fish detected in existing watercourse crossings by erosion/sedimentation problems

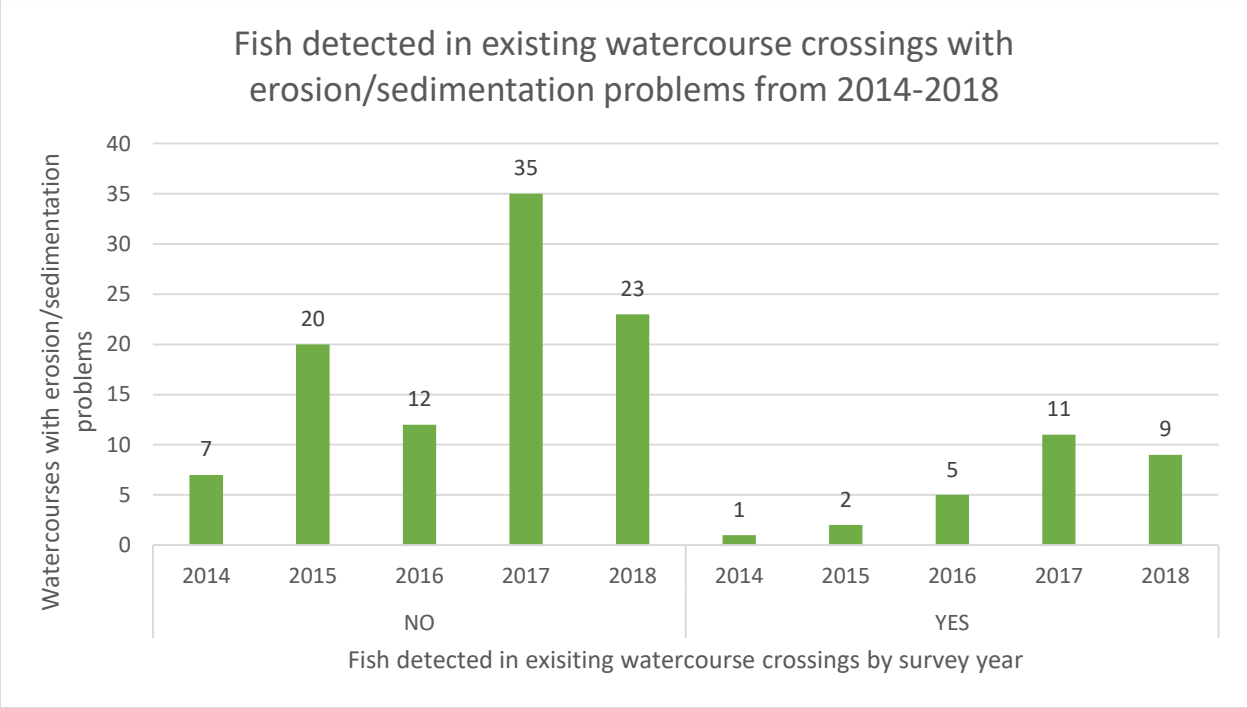

Figure 6. Fish detected in existing watercourse crossings with erosion/sedimentation problems surveyed (2014-2018)

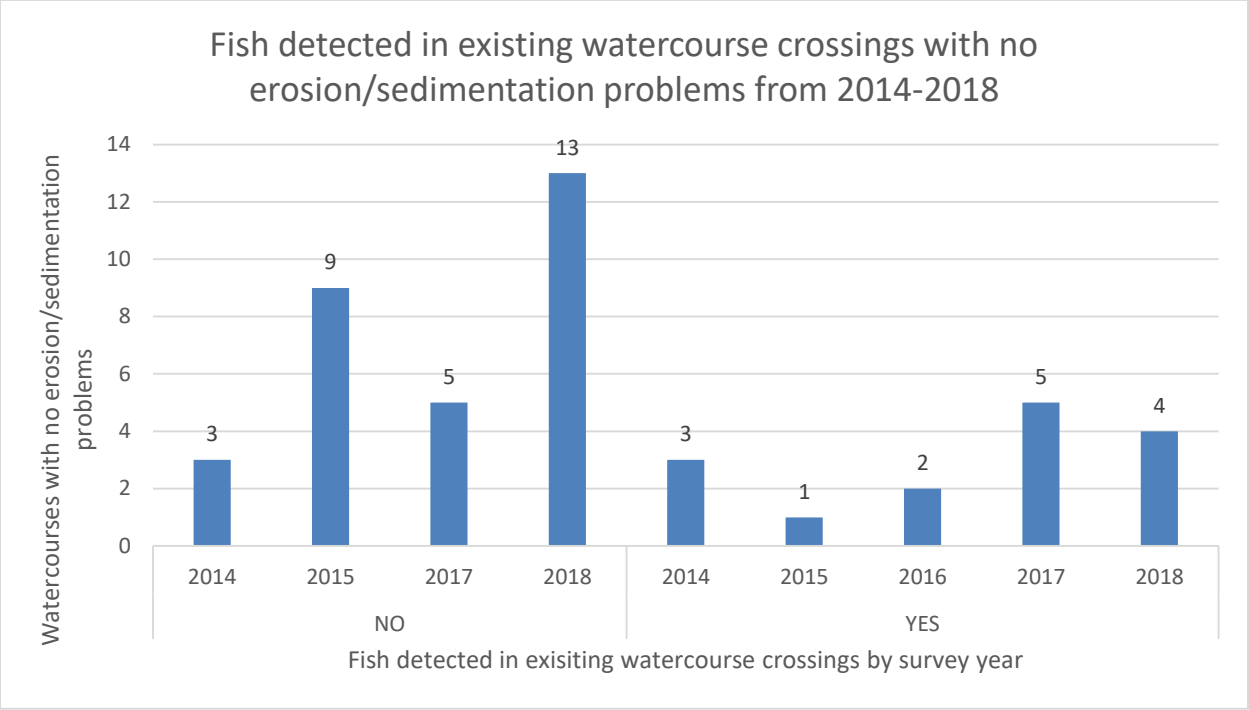

Figure 7. Fish detected in existing watercourse crossing with no erosion/sedimentation problems surveyed (2014-2018)

Figure 8. Existing watercourse crossing in the process of being surveyed

Figure 9. Existing permanent watercourse being surveyed