Stewardship Plan for the North River:

A Tributary of the Petitcodiac River

Fort Folly Habitat Recovery

Fort Folly First Nation

2024 Edition

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Disclaimer:

This document claims no authority by which to drive its implementation. Instead, it is intended simply to serve as a public resource that organizes available information and helps inform future decision making by identifying, and prioritizing needs and sites for restoration activities that will enhance habitat quality and promote species recovery. This is a reference, not intended to be read cover to cover. It is also a living document, current and definitive to the time of writing, but constantly evolving and will never assume an absolute "final" form. Instead, it will be updated and superseded by subsequent editions as additional information becomes available.

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Introduction

This Stewardship Plan for the North River is one of a series of seven such documents compiling, detailing, and presenting information about tributaries of the Petitcodiac River and surrounding watersheds. The purpose of these documents is to enable prioritization and planning of restoration activities within the following watersheds: 1) Demoiselle Creek, a small watershed that drains directly into Shepody Bay, near the mouth of the Petitcodiac River estuary, 2) the Memramcook River, immediately adjacent to the mouth of the Petitcodiac River at Fort Folly Point, 3) the main stem of the Petitcodiac extending between the Village of Petitcodiac (where the Petitcodiac "begins") down to the head-of-tide at Salisbury, and four tributaries of the Petitcodiac River system, 4) Little River, 5) Pollett River, 6) Anagance River, and 7) the North River. The location of these watersheds in or near the Petitcodiac system, (just outside of Moncton New Brunswick) is presented below in Figure 1. Each watershed was assessed according to the four-level approach laid out in the Department of Fisheries and Oceans document, "Ecological Restoration of Degraded Aquatic Habitats: A Watershed Approach" (Melanson et. al 2006). The first level of assessment is examination of the land use history of the watershed. The second level of

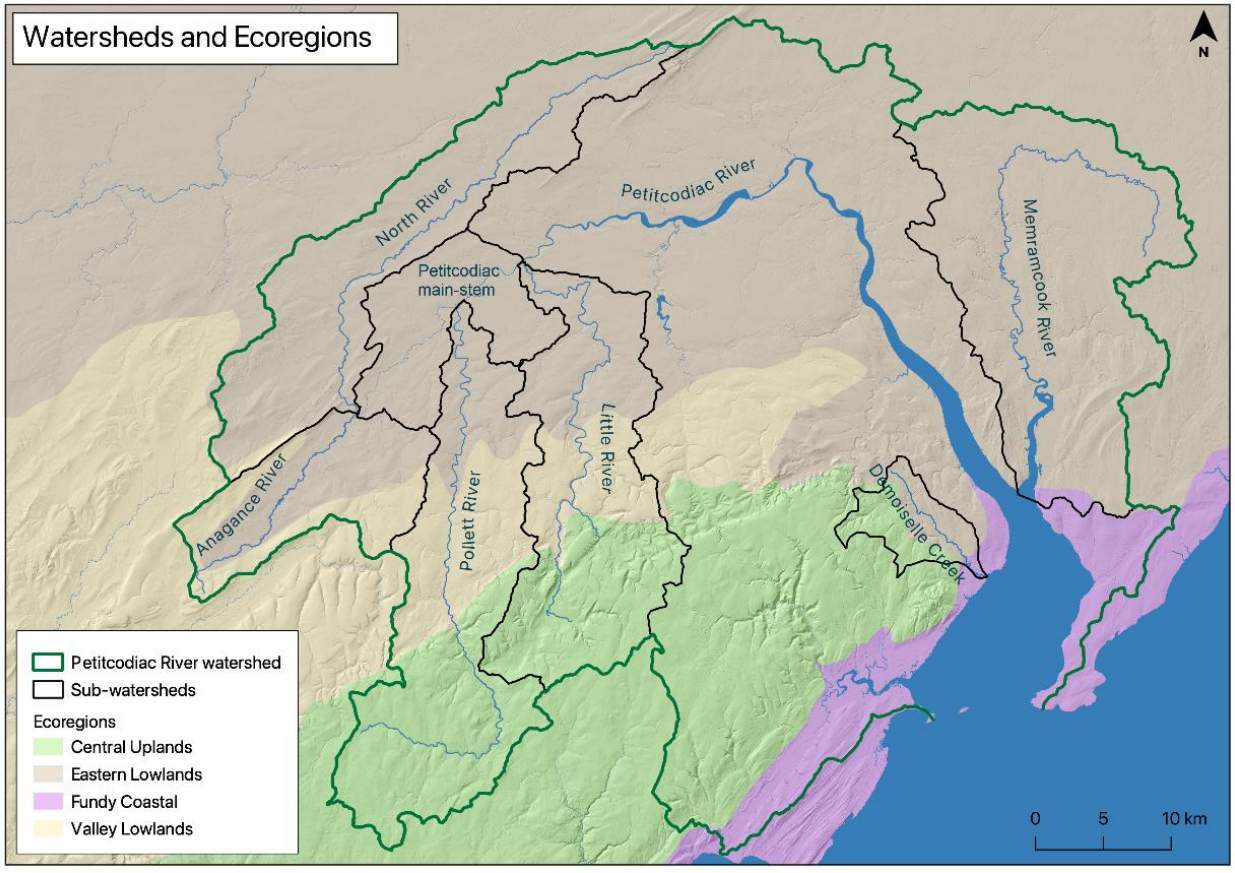

Figure 1: Location of the North River within the Petitcodiac system.

assessment looks at the current impacts. The third level of assessment considers the aquatic and riparian habitat, and the fourth level of assessment brings this information together to develop an aquatic habitat rehabilitation plan that identifies priorities and opportunities for interventions within each watershed to advance habitat restoration.

NORTH RIVER

The North River flows entirely within Westmorland County, New Brunswick. Its headwaters begin north of Moncton near the bases of Lutes Mountain and Indian Mountain, from which it drains from northeast to southwest, ending where it and the Anagance River come together, near the Village of Petitcodiac, to form the main stem of the Petitcodiac River. The North River watershed covers 264.8 km^2, making it the third largest tributary within the Petitcodiac River system. Its drainage area lies almost exclusively in the Eastern Lowlands

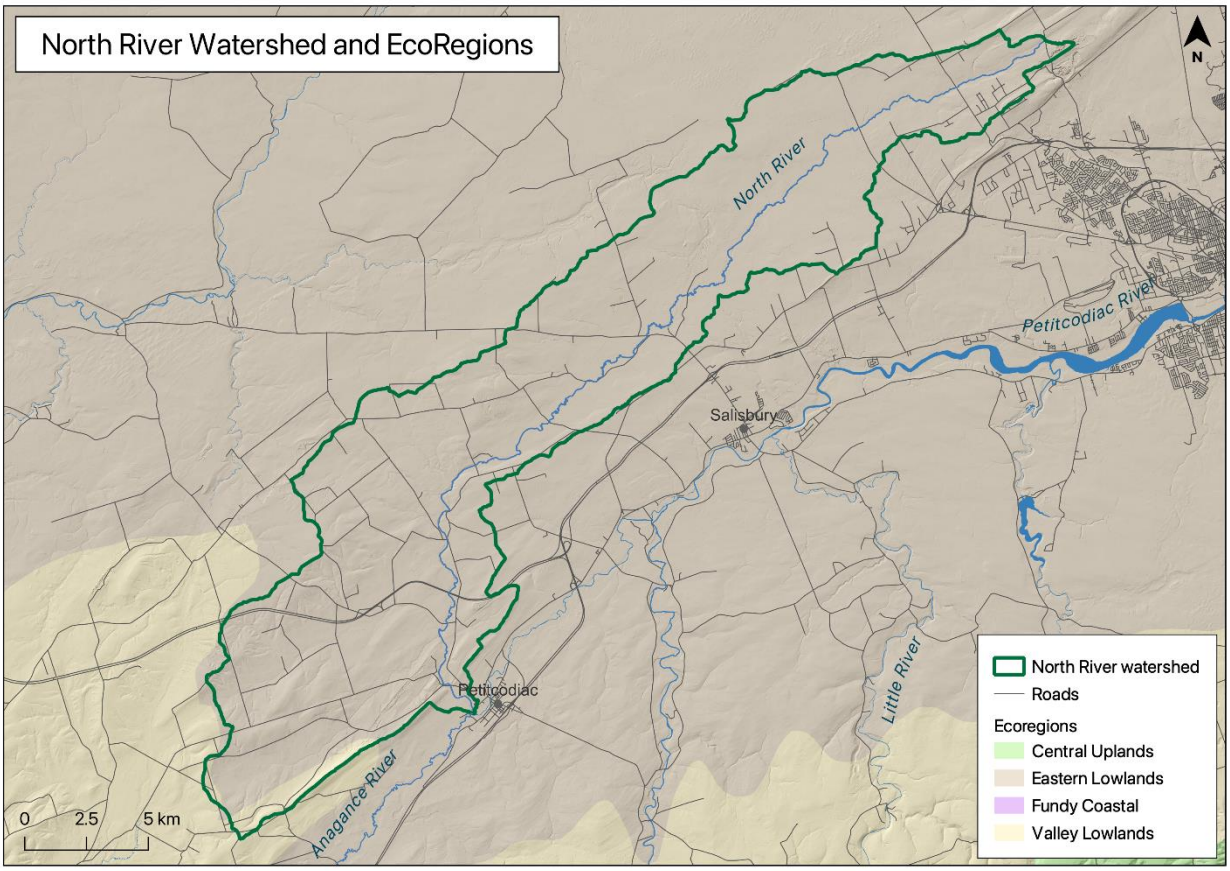

Figure 2: North River watershed.

Ecoregion (Department of Natural Resources 2007). The river has low gradient, dropping just 80 metres along the 49 kilometers from its headwaters near Route 126 to its confluence with the Anagance (Natural Resources Canada 1997; Natural Resources Canada 2008). From the communities of Monteagle to Second North River, the river is characterized by very low flow rates, huge log jams (cover: bottom photo) and grassy beaver meadows. It is a highly convoluted, meandering river with numerous oxbows and deep calm pools.

The North River is known as a trout producing river. There are no known historic salmon angling pools on the North River. In addition to its main stem, named tributaries of the North River include: Bennett Brook; Blakney Brook; Blakeney Brook; Killiam Brook; Lewis Mountain Brook; McLeod Brook; Mongomery Brook; Salt Springs Brook; and Walker Brook (Natural Resources Canada 1997; Natural Resources Canada 2008).

Unlike other tributaries of the Petitcodiac, the name of the North River appears to be rather self-explanatory. The North effectively defines almost the entire northern portion of the Petitcodiac River watershed, draining in a southwesterly direction, a short distance north roughly parallel to the main stem of the Petitcodiac (which flows in the opposite direction). The North ends where it and the Anagance meet, and the main stem of the Petitcodiac begins. From there the channel curves back upon itself, heading back in a northeasterly direction before bending again at Moncton, to head southeast into Shepody Bay.

First Level Assessment – Land Use History of the Watershed

Understanding historical land use in a watershed helps explain the underlying cause of issues present. The following outlines historical land use in the areas surrounding North River in Westmorland County. Communities surrounding North River include: Dobsons Corner; Fawcett Hill; Indian Mountain; Intervale; Lewis Mountain; Lutes Mountain; Petitcodiac; River Glade; Steeves Mountain; Second North River; and Wheaton Settlement.

The Maritimes have had human inhabitants for the last 11,000 years (Wicken 2002), though for most of that time precise cultural identities are impossible to determine today. By the early 1600s, when Europeans arrived, much of the native population of coastal Atlantic Canada shared a common culture and language identifying themselves as the L'nuk, "the People", and recognized by Europeans as the Mi'kmaq. During this time, the Mi'kmaq lived in large villages along the coasts from April to November. They grew corn in small garden plots but were mostly dependent upon fish and game for food. Therefore, they tended not to stay in one place for long given the need to follow their food sources so dispersed inland during the winter to hunt moose and caribou (Wicken 2002). Estimates of the pre-contact population vary between 15,000 to 35,000 in what is now Nova Scotia and New Brunswick (Miller 1976, Marble 1993). This declined between 75% to 90% due to social disruption and

Table 1: Brief historical background summary for communities bordering North River

Community	Settlement Type and Dates	Notes
Dobsons Corner *(North River)*	Settled: Not Available Farming	**1898** population 25, post office **2023** part of The Community of Three Rivers
Fawcett Hill *(North River)*	Settled: prior to 1832 Farming	**1898**: population 50, post office, railway siding on the Elgin, Petitcodiac and Havelock Railway **2023** part of The Community of Three Rivers
Indian Mountain *(North River)*	Settled: 1840 Farming and lumbering	**1898** population 150, 1 post office **2023** part of Maple Hills
Intervale *(North River)*	Settled: Not available Farming	**1898** population 30, was a siding on the Elgin, Petitcodiac and Havelock Railway, post office **2023** part of The Community of Three Rivers
Lewis Mountain *(North River)*	Settled: Not Available Farming	**1898** population 75, post office, 1 church **2023** part of Salisbury
Lutes Mountain *(North River)*	Settled 1811 by Lutes family Farming	**1866**: farming community **1898**: population 500, post office, 1 store, 1 grist mill, 1 shingle mill, 1 cheese factory , 2 churches **2023** part of Maple Hills
Petitcodiac (*Head of Petitcodiac*)	Settled: c. 1786 by Blakeney family Farming and Lumber	**Pre-European** Mi'kmaq Portage Route **1786:** Arrival of United Empire Loyalists **1836:** Overnight Coach stop on Carriage Route between Saint John and Amherst **1839:** First bridge over the Petitcodiac **1860** European and North American Railway connects Saint John to Moncton **1869** renamed Petitcodiac **1898** population 700, Station on Intercolonial Railway, depot for The Elgin, Petitcodiac, & Havelock Railway, post office, 6 stores, 2 hotels, tannery, sawmill, furniture factory, 4 churches **2023** part of The Community of Three Rivers
River Glade *(Petitcodiac River)*	Settled: Not Available Farming and lumbering	**1861** Post office & road to North River **1866** 27 resident families **1898** population 75, post office, store, sawmill, station on the Intercolonial Railway **1903** renamed River Glade **2023** part of The Community of Three Rivers
Steeves Mountain *(North River)*	Settled 1812 by Steeves family Farming	**1904** population 100, post office **2023** part of Salisbury
Wheaton Settlement *(North River)*	Settled: 1803 by Daniel Wheaton Farming	**1898** population 120, post office, 1 church **2023** part of The Community of Three Rivers

(Source: Provincial Archives of New Brunswick, 2015)

epidemics brought by Europeans (such as smallpox) during the first century of contact. By 1616, Jesuit priest Pierre Biard estimated the population as 3,500 (Mooney 1928). Physical impacts on the watershed were few compared to what was to follow.

Ganong's (1905) map of known First Nations villages and campsites includes a Mi'kmaq site at Salisbury located along the north bank of main stem of the Petitcodiac, near the head-of-tide between the mouths of Little River and the Pollett River. A native leaving Beaumont (where there was another camp in the lower Petitcodiac estuary) could ride the 13 km per hour tidal bore upstream to Salisbury, greatly facilitating such travel (Petitcodiac Heritage River Committee 2000). The importance of the Salisbury encampment was due to its location both at the head-of-tide and near the ends of a pair of portage routes leading to the Saint John River system. The more highly traveled of the two routes crossed from the main stem of the Petitcodiac River to the Canaan River (Ganong 1914) near what is now the Village of Petitcodiac, as doing so provided the best access to the upper St. John and on to the St. Lawrence (Petitcodiac Heritage River Committee 2000). The other route crossed from a tributary of the Petitcodiac, the Anagance River, to the Kennebecasis River (and from there to the lower portion of the Saint John River system). In fact, the name Anagance comes from Wolastoqey "Oo-ne- guncé" meaning portage (Ganong 1896), presumably a reference to the link provided by that tributary.

In the 1630's the French began to make a serious effort to colonize Atlantic Canada, beginning to arrive in numbers significant enough to develop an enduring Acadian identity (Laxer 2006), at a fairly similar timeframe to the English colonies further south. By 1676 the first Acadian settlers arrived at Beaubassin, near the current Nova Scotia Visitor's Centre along the Trans-Canada Highway at the New Brunswick border (Larracey 1985). During this time there was much Acadian and Mi'kmaq intermarriage (Marshall 2011) weaving a complex web of family relationships. French authorities encouraged intermarriage to produce a colonial hybrid population, while further south the English tended to aggressively enforce racial segregation (Prins 1996). Meanwhile the Mi'kmaq had begun to adopt Catholicism from the French, while the British were Protestants, at a time when such differences added fuel to conflicts. Acadians also maintained good relations with the Mi'kmaq in part because the lands Acadians occupied either complemented native use, as with fur traders, or were in areas that were marginal to native concerns as in the case of the Acadian farmers on the tidal flats (Mancke 2005).

By 1710, Acadians and Mi'kmaq in peninsular Nova Scotia fell under British control, which was subsequently formalized in 1713 under the treaty of Utrecht. Previous to the treaty, the French had claimed that the borders of Acadia reached all the way to the Kennebec River (well within in what is now Maine). After the treaty however French Authorities claimed that Acadia was just Port Royal (renamed Annapolis Royal by the British after they seized it in 1710) and the peninsula (modern Nova Scotia excluding Cape Breton). Based on that

assertion, the French continued to occupy the mainland (now New Brunswick), in addition to the territory they retained officially under the treaty (Martin 1995) i.e.: Île Saint-Jean (Prince Edward Island), and Île Royale (Cape Breton Island). The British were not in a position to contest this reality due to a lack of soldiers and settlers (Ganong 1901). By 1730 the Acadian community in the Petitcodiac was thriving precisely because they were under the jurisdiction of neither Great Brittan nor France (Faragher 2005). That situation did not last, however. With no agreed boundary between English and French territory provided by the Treaty of Utrecht, the French eventually adopted and defended the Missaquash River as the de facto boundary between the two powers (Milner 1911), the same boundary that is in modern use between New Brunswick and Nova Scotia. To Europeans the treaty had merely changed the status of Nova Scotia from a fairly uninhabited French territory with disputed boundaries, to a fairly uninhabited British territory with disputed boundaries (Martin 1995). It was rather more personal to the Mi'kmaq and Acadians who lived there.

Meanwhile, after 1713, New England fisherman pushed more aggressively into Nova Scotia's coastal waters sparking conflict with the Mi'kmaq (Wicken 2002). By 1726 the Mi'kmaq and the British signed the first of a series of Peace and Friendship treaties. What the British wanted from the agreement was native recognition of the Treaty of Utrecht whereby natives agreed not to molest His Majesty's subjects in "lawfully" made settlements, and the Crown could regulate the movement of European nationals into Acadia – i.e., exclude the French. In exchange the British agreed not to interfere with native hunting, fishing, planting activities.

In June 1749 Edward Cornwallis established Halifax with 2,500 settlers as a new capital for Nova Scotia (Beck 1979) and constructed the citadel there as a fortress to defend it. This marked the beginning of meaningful efforts by the British to settle the Maritimes. Prior to this time British authority at Annapolis Royal "had been no more than a mock government" that "did not extend beyond the cannon reach of the fort" (Philipps 1720). The Mi'kmaq immediately recognized the implications of this change and reacted with outrage to what they regarded as establishment of an unlawful settlement in violation of the Treaty of 1726, and theft of their land. No responsible indigenous leader could ignore the reality that environmental change brought about by such agricultural settlement was the most lethal threat that British imperial expansion posed to the existing economy, livelihood, and health of the Mi'kmaq (Reid 2013). Violence escalated until by late 1749 Governor Cornwallis proclaimed a policy aimed at "extirpation" of the Mi'kmaq (Paul 2000).

The French built Fort Beausejour in 1751 at the border to protect Acadian communities in what is now New Brunswick from attack by the British. By this time the Acadian population near the Fort had grown to 1,541 people, with an estimated additional 1,100 spread out at Shepody and along the Petitcodiac and Memramcook Rivers (Larracey 1985). Their physical impacts on the North River, what for them was a remote hinterland, were limited.

In 1752 the British signed yet another treaty with the Mi'kmaq reaffirming the 1726 treaty and also modifying it to formalize a commercial relationship between the British and the Mi'kmaq (Wicken 2002), encouraging not only hunting and fishing, but ensuring "free liberty" to sell the products of such activities in Halifax or any other settlement. For the British this provision was critical as an attempt to wean the Mi'kmaq from their friendly relationships with the Acadians and French officials in Louisburg. This treaty subsequently formed the basis of the 1999 Supreme Court Marshall decision and subsequent ongoing modern lobster fishery disputes.

Ganong (1899) notes that like First Nations, the French made use of the Kennebecasis-Petitcodiac portage along the Anagance to maintain communication between Fort Beausejour and Acadian settlements on the lower St. John. However, the French route between the Canaan and the Petitcodiac to access the upper St. John was slightly different than the one favoured by First Nations, reportedly crossing overland to the Canaan from the North River, rather than the main stem of the Petitcodiac (Raymond 1891). From there messengers from Fort Beausejour, and the Fortress of Louisbourg passed up along the St John to reach Quebec.

After the fall of Fort Beausejour in 1755, the British attempted to expel the Acadians, to open up land for English settlers. There is a record of an Acadian settlement, Village Victuare, located in Salisbury, close to the Mi'kmaq encampment there (Ganong 1930). It was documented in 1758 by British Major George Scott as he was forcefully removing Acadian families from the upper Petitcodiac (Scott 1758). The village appears to have been composed of approximately 10 homesteads, settled in about 1751, and was reportedly the largest Acadian village along the Petitcodiac upstream of Beausoleil Village, modern day Allison. Ganong (1930) suggests that it is likely that in the wake of the expulsion, Acadians briefly occupied locations such as Fourche-à-crapaud at the mouth of Turtle Creek, and on the Coverdale (Little), and Pollett Rivers in order to be near the head of tide and thus above the reach of English Ships. Major Scott apparently found the tidal bore on the Petitcodiac problematic during his raids in 1758, nearly losing two ships on one occasion (Pincombe and Larracey 1990).

Arsenault (2004) suggests that a settlement named Village des Babineau existed at the mouth of the "Coverdale" (Little) River near Salisbury. That is a surprisingly specific and questionable location given that Ganong (1899) using a map from 1754, puts Village des Babineau downstream, in what is now Riverview, at a location that prior to amalgamation in 1974 was called Coverdale (Provincial Archives of New Brunswick 2023). Surette et al. (1981) confirm this, indicating the Village des Babineau was an alternate name for a community named Fourche-à-crapaud, located at the mouth of Turtle Creek (Provincial Archives of New Brunswick 2023), an area later known as Coverdale. Presumably

Arsenault (2004) confused Turtle Creek and the later English community of Coverdale with the Coverdale (i.e. Little) River. Though Village des Babineau was reportedly destroyed by Scott in 1758 (Ganong 1905), it does not appear on his map at either location (Scott 1758).

The Mi'kmaq sided with the French (Wicken 2002), participating in the defense of Fort Beausejour, as well as the short guerilla war which followed its capture (Grenier 2008). There were several reasons that Mi'kmaq in New Brunswick did so. In addition to intermarriage, prior to the arrival of the British, native communities had already established trade networks with the Acadians for steel tools, weapons and other European goods (Walls 2010). Another source of friction was that the Mi'kmaq had begun to adopt Catholicism from the French, while the British were Protestants, at a time when such differences added fuel to conflicts. Acadians also had had good relations with the Mi'kmaq in part because the lands Acadians occupied either complemented native use, as with fur traders, or were in areas that were marginal to native concerns as in the case of the Acadian farmers on the tidal flats (Mancke 2005). English settlers on the other hand tended to seize land the Mi'kmaq valued, to clear the forest for agriculture (Francis et al. 2010).

Throughout 1760 and 1761 the British also signed a series of Peace and Friendship treaties with individual native communities, reaffirming the treaties of 1726 and 1752 (Wicken 2002), with the signature at Chignecto/ Missaquash occurring on July 8th, 1761. The important distinction with this iteration of the treaties was the provision by which natives agreed not to trade with the French. To ensure that such trade did not occur the British agreed to establish "truck houses" as points of trade near native communities.

The Treaty of Paris in 1763 ended the Seven Years War, with France ceding its territory in Canada and the Maritime region to Britain, except for the small islands of St. Pierre and Miquelon in the Gulf of St. Lawrence (Ganong 1901; Faragher 2005). The latter France retained in the interest of preserving its access the lucrative fishery in the Gulf of St. Lawrence and the Grand Banks (MacNutt 1970). Shortly thereafter a royal proclamation set the boundary between Canada (Québec) and Nova Scotia as being the watershed between the Saint Lawrence and points south until reaching the north coast of the Bay of Chaleur. All of Nova Scotia north of the Bay of Fundy (modern New Brunswick) was made part of Cumberland County. In 1765 that was changed to make the Saint John River into Sunbury County. There was no formally defined boundary between Sunbury and Cumberland Counties until 1770 when it was set as a somewhat arbitrary line beginning at Mispec (a short distance along the coast east of the mouth of the Saint John River) headed due north to the Canadian (Québec) border (Ganong 1901).

With peace, in 1763, Acadians throughout the region became British subjects, but this was not the case for First Nations, whose situation was more complex (Beaulieu 2014). The

British defeat of France at Louisburg in 1758 encouraged the political collapse of the Mi'kmaq population in Nova Scotia as a fighting force as the peace and friendship treaties signed between 1760 and 1761 brought an end to Indigenous-French relations and alliances (Patterson 1993). Between typhus brought by the d'Anvill expedition, violence promoted by LeLoutre, and Cornwallis' policy of Mi'kmaq extirpation, by 1763 First Nations had been decimated by decades of warfare and disease, with some estimates suggesting that there may have been fewer than 500 individuals remaining in the Maritimes (Statistics Canada 2020).

In 1764 the British government began to allow Acadians to resettle in Nova Scotia with the provision that they remain in small groups scattered throughout the province (MacNutt 1963). Initially they were not allowed to settle in groups larger than 10 persons, the goal being to keep them at great distances from each other, or even ultimately discourage them from remaining in the colony at all. Since the authorities did not give those Acadians who remained a fully legal position by making grants of land, their status was little better than squatters (MacNutt 1963). It is an important and sobering reminder that eighteenth-century people understood that military disruptions did not have the long-term permanence that they might want, without civil validation (Mancke 2019). Consequently, the ultimate dispossession of Acadians came not through the barrel of a gun, but through the power of the pen, and less in the heat of war, than in the quiet of peace.

During the American Revolution, control of Fort Cumberland (formerly Fort Beausejour) was briefly contested by rebels in 1776. Though unsuccessful, the participation of Mi'kmaq and Wolastoqiyik in the siege highlighted the vulnerability of Nova Scotia and prompted the Crown to enter into what became the final round of Maritime Peace and Friendship Treaties with First Nations in 1778 and 1779, reaffirming the previous treaties (Patterson 2009).

The American Revolutionary War ended with yet another Treaty of Paris, this one in 1783 (MacNutt 1963, Ganong 1901). Early in the war the Americans had taken it for granted that winning their independence also implied the acquisition of the two provinces (Nova Scotia and Canada) that had not revolted. In the end however, the agreed terms established rough boundaries between British holdings and the newly recognized United States, that while not yet finalized along the St. Croix River, were distant from the North River. The peace fell short of the hopes and expectations both sides had harbored during the war, but despite the distance from the border, was not without implications for the North River. For every Loyalist within British lines, there were five left living within territories dominated by the Continental Congress (MacNutt 1963). To such Loyalists, peace and recognition of the United States meant surrender of themselves and their possessions to those that had been their enemies. Although the Treaty of Paris promised Loyalists a safe return to their pre-war homes, persecution of "Tories" escalated with the rebel victory (Dallison 2003). An

attractive and safer alternative became clear. Across the water lay Nova Scotia, a (comparatively) vacant land which remained beneath the British Crown (MacNutt 1963).

As things warmed in the spring of 1783 the movement began, with all parts of the coastline receiving refugees, many of which landed on the north shore of the Bay of Fundy (Squires 2000), of which approximately 11,000 eventually stayed on (Wynn 1981a), tripling the population from a little more than 5,000 to more than 16,000 in less than a year. Almost 10% of the refugees were black loyalists, and 10% of those (i.e., approximately 1% of total Loyalist refugees) arrived in the region as slaves. (Hodges 1996). The main point of penetration was the Saint John River Valley, however, the Petitcodiac, Memramcook, and Chignecto regions each received a share Loyalist refugees as well (Wright 1945, Milner 1967, Bowser 1986).

Even before departure from New York, Loyalists had begun to contemplate a separate and distinct province (Dallison 2003), and support for the concept only grew once they arrived in Nova Scotia. Governor Parr began escheating parts of pre-Revolution grants immediately to provide lands for the newcomers jamming into port towns clamoring for land (Fellows 1971). The need for land was paramount as it meant survival, food, and fuel- as well as status and wealth. Parr's inability to release land quickly enough frustrated Loyalists (Snowdon 1983) and was a key factor driving calls for partition (Gilroy 1933). Edward Winslow, an individual responsible for settling Loyalist Regiments in Nova Scotia became a leading proponent for partition arguing in a letter to his friend Ward Chipman in 1783, "Take the general map of this province (even as it is now bounded) observe how detached this part is from the rest, how vastly extensive it is, notice the rivers, harbours, etc. Consider the numberless inconveniences that must arise from its remoteness from the metropolis and the difficulty in communication. Think what multitudes have and will come here, and then judge whether it must not from the nature of things immediately become a separate government" (Winslow 1783).

Halifax was opposed to Nova Scotia being subdivided for obvious reasons (Chipman 1784), however the authorities in London agreed (Gilroy 1933). On June 18th, 1784, Nova Scotia was partitioned, and the north shore of the Bay of Fundy became New Brunswick, a self governing "Loyalist" province. Once again, the Missaquash River was selected as the boundary (Allison 1916), with the North River watershed falling within what became Westmorland County (Ganong 1901). Thomas Carleton arrived in November 1784 to establish the new government and direct the colonization of New Brunswick (Fellows 1971). With access to title to land having been a driving factor in its formation, the newly established Province of New Brunswick required that existing land grants be re-registered both to facilitate escheat and to establish clear title for active landowners (Kernaghan 1981), and the House of Assembly focused on allocation of land as one of its initial priorities (Fellows 1971).

The dates that various communities listed in Table 1 were first settled (where available) indicate how movement by English colonists into the upper reaches of the Petitcodiac River above the head of tide occurred first along the more easily accessible main stem. Many of the early dates coincide with the arrival of United Empire loyalists from the 13 colonies (late 1770's - 1780's). After the arrival of the Loyalists, Mi'kmaq in what is now New Brunswick were moved off their lands and onto "reserves" (Walls 2010). This was done partially to provide land to incoming settlers, and partially to punish the Mi'kmaq for aligning themselves with the French.

Subsequent generations of English settler families and those that arrived after them then pushed further up the Petitcodiac and into its more remote tributaries such as the Little River, and the Pollett River (Wright 1945). An early example would be John Colpitts, the eldest son of Robert Colpitts who had settled near Salisbury in 1783. John Colpitts arrived from England as a teenager with his father and had already moved on to develop his own homestead just a few years later, founding Colpitts Settlement on the Little River (Moncton Daily Times, Thursday August 26th, 1920).

Given the technology available to early English settlers, there are two important differences between the North River and both the Little and Pollett. The first difference is that while the latter two flow north into the Petitcodiac roughly perpendicular to the main stem, the North flows predominantly southwest, somewhat parallel to the northeasterly flow of the Petitcodiac, offset by a short plateau of land between it and the main stem. As a result, the headwaters of both the Pollett and the Little become progressively more remote the further up one goes in them, as much as 30 km overland and 40 to 50 km upstream, while the entire watershed of the North is much more easily accessible. Though its headwaters are a similar 40 to 50 km upstream, the North runs for its entire length not much more than 10 kilometers (often less) overland away from the main stem of the Petitcodiac (Natural Resources Canada 1997; Natural Resources Canada 2008). The second difference is the soil and climate of the North River. While the Little and the Pollett travel a relatively steep gradient downstream starting in the Central Uplands Ecoregion, then descending into the Valley Lowlands Ecoregion, and finally ending in the Eastern Lowlands Ecoregion, the North River is relatively unique in that it flows entirely within the Eastern Lowlands Ecoregion (Department of Natural Resources 2007). So, in addition to being much more accessible throughout its entire length than either the Little or the Pollett, the soils and climate of the North River are on average better suited to agriculture. As a result, it appears that English settlers tended to spread overland from the main stem of the Petitcodiac into the North River watershed, rather than up along it's (often not very navigable) channel. For example, Wheaton Settlement, 14 kilometers upstream of the Village of Petitcodiac along the North (5 kilometers overland from River Glade) was settled

only 7 years prior to Lutes Mountain in the headwaters, more than 50 kilometers up stream of the Village of Petitcodiac (but only 12 kilometers overland from downtown Moncton).

Forestry Practices

The relative inaccessibility of the Petitcodiac stood in contrast to the Saint John River, as the comparative lack of long easily navigable tributaries within the Petitcodiac system discouraged commercial logging activities until the mid-1800s (Department of Natural Resources 2007). Instead, early settlers cleared the land to allow for agriculture, locally consuming cordwood for fuel, and lumber to build their homesteads, while generating only limited income by selecting marketable timber to send downriver to be sold for shipbuilding or export. As time progressed the latter gradually became a more significant aspect of the local economy. Timber harvest in the Petitcodiac timber district as a whole grew from 260 tons in 1818 to 3,137 tons by 1836 (Wynn 1981b), though this paled in comparison cutting in other more accessible portions of the province such as in numerous timber districts along the Saint John and Miramichi Rivers where harvests taking place at the same time were in some cases an order of magnitude greater.

During the early 1800s white pine was gradually culled from New Brunswick Forests to meet the demand for masts for the Royal Navy (Wynn, 1981b). The White Pines Act of 1722 established the requirement of a royal license to fell white pines with a diameter exceeding 24 inches unless they were privately owned, and in 1729 Parliament reserved all such trees to the government except those already in private hands before 1690 (Purvis 1999). Since New Brunswick came under British control well after that time, this exception did not apply at all to its forests. During the American Revolution and the Napoleonic Wars from 80 to 90 percent of all masts supplied to the Royal Navy came from Canada, mostly New Brunswick (Williams 1992). The Napoleonic blockade of the Baltic forced England to expand New Brunswick's lumber production twentyfold, transforming an "undeveloped backwater" of 25,000 people to a bustling colony of 190,000 (Gordon 2014). Pines could still be found in 1850, but few of the magnificent trees the region was known for earlier in the century remained. Spruce was more abundant, but the largest had also been cut. Though there were not many extensive cutover tracts, by 1850 the character and composition of the forests in New Brunswick had been drastically modified over the course of just 50 years of harvesting.

The effects of this early economic activity were not limited to just the forests. By 1820 importation of food into New Brunswick was the rule rather than the exception, everything hinged on the timber trade, though there were warning signs of the danger of single source economy (DeMerchant 1983). James Robb, professor of Natural Science at Kings College in Fredericton (now the University of New Brunswick), was appointed Secretary of the Provincial Board of Agriculture when it was established in 1858. He warned that timber

harvesting was so lucrative that it distorted development, and that when the market in Europe declined, the farmer neglecting his homestead to work in the woods would be "surprised to find his fences down, his fields grown up with bushes, and both himself and his snug little clearing generally all gone bad". It was not just agriculture that was falling short of its potential. In the years that shipbuilding boomed at St. John and other towns along the coast, even the fishing industry was neglected as men were drawn to the forest to supply wood (DeMerchant 1983).

To take advantage of the culled mixed forests during this time, many milling operations sprung up and some communities that had begun as a farming settlements developed into lumbering communities. The first mill in Petitcodiac was a grist mill in 1820, built by Humphrey Hayward, that would later be followed by a carding mill and sawmill owned by the same man (Burrows 1984). It was built on Hayward Brook and the settlement that built up around the mill, Hayward Settlement. The Jacknife Sawmill was in operation by 1833 in Petitcodiac, and a spool manufacturing plant by 1868. Mills were often operated by water, most likely from the river itself or its tributaries. Other milling operations in Petitcodiac included the Petitcodiac Lumber Company on the North River, and the Humphreys and Trites Mill on the mouth of the Anagance and North Rivers.

By 1860 the European and North American Railway linked Saint John and Moncton, passing near the mouth of the North River, through Petitcodiac Village (New Brunswick Railway Museum 2015), at the time known as Humphrey Corner (Village of Petitcodiac 2015). Its route followed the Kennebecasis / Anagance / Petitcodiac watersheds, similar to the old First Nation and French portage route. Fuel for the engines was cordwood in three-to-four-foot lengths purchased from farmers along the line (Stronach 1969). Farmers received "tokens" (redeemable for cash) for wood used by the railway company from piles placed along the track at designated locations. Petitcodiac Village itself served as a hardwood fueling station, and a lumber shipping station that would have rivaled larger cities of the time (Burrows 1984).

At that point the age of wooden ships was beginning to wind down however, causing a reduction in the scale of the demand for timber exports both as wood and manufactured into ships. By the end of the Crimean war in 1856, virtually all of the ships in the British Royal Navy were already fitted with steam engines rendering masts irrelevant (Evans 2004), and the conversion to iron hulls began within a decade thereafter.

A non-timber forest product that was commercially significant was maple sugar. Some of the lands bordering the North River were converted (perhaps by fire) to sugar bushes (Plummer 2013). Though the precise years of his bottling operation are unknown, Arthur Briggs (born 1852, died 1936) spent years producing and selling Maple syrup at Stilesville just north of Lutes Mountain (Briggs Maples 2015), along the divide between the North

River and the Shediac River (Natural Resources Canada 2008). Early on, birch from local trees was used to make pots to transport their product into town. They also used these timber by-products as molds for maple sugar candy (Plummer 2013).

Agricultural Practices

As noted in the timber section, before crops could be planted settlers were faced with cutting and clearing the forest. Stumps were often left a few years to rot, and crops were sown amongst them (DeMerchant 1983). Early English settlers, like the Blakeneys who settled the Village of Petitcodiac in 1786, would have cleared the land and planted gardens that they may have later expanded to crop fields (Burrows 1984). In Perley's (1857) Handbook of Information for Emigrants to New Brunswick, he suggests that "No emigrant should undertake to clear land and make a farm, unless he has the means of supporting his family for 12 months." However, it was not just a matter of the financial resources of individuals. Since in the early 1800's the province as a whole was not self-sufficient agriculturally, it is unlikely the communities along the North River were either. However, given the logistical challenges of transporting food to remote homesteads, it is doubtful that importation of food was as practical as in urban centres.

More likely for the early settlers, subsistence agriculture was supplemented with food available from the forest and river. The area surrounding North River, especially the New Canaan District was famous for its moose hunting (Burrows 1984). There are historic records of salmon in the North River (Dunfield 1991), and extensive fishing dating back to early settlement. Even as late as 1876 fishing regulators noted that farmers devoted a significant portion of their time to fishing salmon, with most of the entire catch being used for home consumption (Commissioner of Fisheries 1877). This pattern had already been established a generation previously downstream along on the main stem of the Petitcodiac. In 1783 while Robert Colpitts first crop at his farm near Salisbury was ripening, his family's main source of food was salmon (Moncton Daily Times, Thursday August 26th, 1920).

By 1850 over 25% of the land in coastal Parishes such as Hopewell, Dorchester, and Westmoreland had been cleared for agriculture, and Sackville Parish had 16,000 of its 100,000 acres fit for cultivation (Wynn 1981b). Only in Elgin and Salisbury Parish did the population density remain less than 5 people per square mile. Salisbury Parish included all of the lower end of the North River from where it is joined by the Anagance and becomes the Petitcodiac, up to a point along the river slightly northeast of Salisbury. Quality of land wasn't the limiting factor, however. Atkinson (1842) in his Emigrant's Guide to New Brunswick, British North America, noted that, "there is much ungranted land of a good quality" on the North River, and described it as follows, "On the banks of this river there are numerous and extensive tracts of intervale and it is a well settled country having been

peopled during the last forty years. The soil on the uplands is highly fertile and there are natural meadows that afford abundance of pasture." Monro (1855) acknowledged some short comings, but echoed much of this assessment, endorsing both the land immediately along the Petitcodiac, as well as further upstream in the North River watershed, but not the upland plateau between them stating, "With the exception of the intervale along the valley of the Petitcodiac the land in the front of this parish is generally of an inferior quality; that in its north west portion (along the North River immediately above the Village of Petitcodiac) is much better but additional roads are required to render it available for settlement. In consequence of there being so much bad land along the line of railway and the mail road agricultural operations in this parish are much retarded."

Intervale is a term local to the region that refers to fertile bottomlands, and was felt so apt, that one community along the river 4.5 km north of the Village of Petitcodiac actually adopted Intervale as its name, which it still goes by today. Traveling overland from Moncton to Saint John, Johnston (1851) described what he saw in that area, "We found some good farms along this part of the North River and good land derived from the mixed calcareous and sandstone debris The limestone was hard, destitute of apparent fossils, and as subsequent analyses showed very pure and admirably fitted for agricultural purposes. It had been quarried for building but the application of lime to the land was in this district scarcely known."

No doubt the arrival of the European and North American Railway in 1860 (Stronach 1969) at Petitcodiac Village reduced many of the logistical constraints both on bringing supplies into North River watershed, and just as importantly, moving marketable surpluses out to trade. This had substantial benefits going forward both for settlement and agriculture. The railway only passed the river near its end at the Village of Petitcodiac, where the North River becomes the main stem of the Petitcodiac River. However, since the Petitcodiac runs roughly parallel to the North, no point in the entire North River watershed up to its headwaters near Moncton was more than about 8 to 10 kilometers (often half that) from the rail line (Natural Resources Canada 1997; Natural Resources Canada 2008). The train made it possible to travel from Moncton to Saint John in about 6 hours (New Brunswick Railway Museum 2015). The Petitcodiac station, being not quite midway, would have been just a few hours travel away from either end. The connection to Saint John provided rapid year-round access to an ice-free port from which most of New Brunswick's exports were shipped overseas. In 1869, two years after Confederation, the line became part of the Intercolonial Railway system, which by 1876 (through Moncton) provided access from Halifax all the way to Upper Canada (New Brunswick Railway Museum 2015). Also in 1876, the construction of The Elgin, Petitcodiac, & Havelock Railway branch line, turned Petitcodiac Station into a local rail hub.

Dawson (2005) shows that by 1878 the road network within the watershed showed some improvement over what Monro reported in 1855. It looked quite recognizable to the modern eye, with roads of some kind already present along many (but by no means all) of the routes significant enough to be paved today, though obviously these wouldn't have been developed to that extent then. In-between the Village of Petitcodiac and Moncton, there were no fewer than six north-south roads, each crossing over from the main stem of the Petitcodiac River to provide access to settlements in nearby portions of the North River. The biggest single modern difference to the 1878 road network is the Trans-Canada Highway which cuts through the southwestern end of the North River watershed before crossing over into the main stem of the Petitcodiac watershed. The path it follows shows no 1878 precedent.

On the whole, however, the 1878 road network in the North River suggests that by that time, development, and by extension agriculture, had progressed significantly, but (as one might expect), was less than today. Interestingly, a similar comparison between the Little River in 1878 and today shows almost no change in road coverage during the same period; while on the Pollett, the number of roads in the upper reaches of that river was actually greater in 1878 than it is today. So while the North River watershed has continued to develop, the Little has not (comparatively speaking), and settlement on the Pollett actually appears to have contracted somewhat relative to 1878. This is consistent with the point made in the introduction that in addition to being much more accessible throughout its entire length than either the Little or the Pollett, the soils and climate of the North River are on average better suited to agriculture than is the case in much of the other two watersheds. These facts may have made farms in Westmorland County along the North River more resistant to economic downturns following the First World War that caused many people in rural Albert County to leave the area during that time to search for more arable land out west (Department of Natural Resources 2007; Degraaf et al. 2007). For that matter, those not wishing to move so far away, may have simply added instead to population growth along the North River and along the main stem of the Petitcodiac. As a consequence of all this, today more land in the North River basin is dedicated to agriculture than in Demoiselle Creek, Pollett River and Little River combined (Department of Natural Resources in 2014).

Crops reported being raised in the area by 1890 included: hay; grains (wheat, buckwheat, oats, and barley); vegetables (potatoes, carrots, and turnips); and fruits (apples, and plums) (New Brunswick House of Assembly 1890). Livestock included: cattle (Ayrshires, Jerseys, and short horns); sheep (Shropshire Downs); and pigs (Yorkshires and Berkshires). Dairy products were among those perishable products whose production and transport to market was made possible by the expanding road network and rail service. By 1891 a cheese factory was established just outside the watershed nearby at Corn Hill (New Brunswick Department of Agriculture 1892). Shortly thereafter, North River watershed

farmers were among those supplying the Corn Hill Cheese and Butter Company with raw products (Burrows 1984).

Mining Practices

The potential for production of agricultural lime noted by Johnston (1851), was eventually realized. The Geological Survey of Canada (1890) concluded that, “gypsiferous beds in the vicinity of the salt springs along Salt Springs Brook and in the North River valley near Petitcodiac enrich the soil in these particular localities.” The Petitcodiac Mining and Manufacturing Company (1860-1909) developed the lime resources of the Glenvale district along Salt Springs Brook (Burrows 1984). Years later Goudge (1934) noted the remains of the quarry just south of Glenvale, which had supplied local farmers with raw agricultural lime.

Indian Affairs

As laid out in previous sections, the Mi’kmaq and the Crown entered into a series of Peace and Friendship treaties between 1726, and 1779 (Nova Scotia Archives 2020), which form the basis of treaty rights held by the Mi’kmaq today. These were not treaties that surrendered land, but negotiations between sovereign entities. The Mi’kmaq never surrendered title to Mi’kma’ki (Mi’gmawe’l Tplu’taqnn 2023). Treaty rights and aboriginal rights are recognized and affirmed in Section 35 of the Constitution Act 1982 (Sanderson 2017). These treaties were briefly described in previous sections within the chronological context that gave rise to it, to track the evolution of the treaties. However, as these treaties are still in effect and still relevant in New Brunswick from that time up to today, there is also value in compiling these within a single section to provide focus, make them more easily accessible, and by doing so make them more easily understood in their entirety. The five treaties are listed and identified in Table 2.

In several cases a given treaty has more than one year attached to it. That is because of the complexity of negotiations, the large number of signatory communities, and the distances between venues at a time when mobility and communications were challenging meant that in several cases the signing process began on one year and was not completed until the following year.

After the arrival of the Loyalists in 1783, Mi’kmaq in New Brunswick were gradually moved onto "reserves" (Walls 2010), to provide land to incoming settlers. This was made possible in part by a legal technicality. The Treaty of Paris in 1763 ended the French presence in the Maritimes, and the subsequent Royal Proclamation of 1763 recognized the property rights

Table 2: Peace and Friendship Treaties between the Mi'kmaq and the Crown

Year	British Objective	Mi'kmaq Objective
1726	Mi'kmaq Recognition of 1713 Utrecht Treaty, "Lawful" British Settlements to be left undisturbed. British right to regulate Europeans	British Recognition of the legitimacy of Mi'kmaq Hunting, Fishing, and Planting activities
Comment:	When signed, the application of this treaty was within British controlled territory. The British interpretation of the 1713 treaty of Utrecht between them and France was that it gave them claim to all of Acadia including the north shore of the Bay of Fundy (modern New Brunswick), but effectively British authority did not go outside of peninsular Nova Scotia. Arguably it "did not extend beyond the cannon reach of the fort" at Annapolis Royal.	
1749	Reaffirm 1726, to end King George's War addressing Mi'kmaq cooperation with the Duc d'Anville expedition, and antipathy to British expansion beyond Annapolis Royal i.e. founding of Halifax. From British perspective did not modify 1726 in any way.	Reaffirm 1726 - British recognition of hunting and fishing
Comment:	Nothing new was offered in the treaty, just reaffirmation of the 1726 treaty. The context however was that it demanded acceptance of the fact the British were becoming more assertive than they had been previously. Among the Mi'kmaq, only the community at Chignecto signed - others refused to do so because British founding of Halifax a few months earlier was considered to be a violation of 1726.	
1752	Reaffirm 1726, to calm the effects of Father LeLoutre's War. Formalized commercial relationship between British and Mi'kmaq to wean Mi'kmaq from relationships with Acadians and French officials in Louisburg.	Reaffirm 1726 - British recognition of hunting and fishing rights and ensured the "free liberty" to sell the products of these activities in Halifax or any other settlement.
Comment:	By this point the French were actively defending the Missaquash River as the border with British territory in Father LeLoutre's War. Mi'kmaq in the Petitcodiac watershed were "on the front line", while those in peninsular Nova Scotia were "behind the lines", living amongst expanding British settlements. This treaty forms the basis of the Supreme Court of Canada 1999 Marshall Decision affirming the treaty rights of First Nations people all across Canada to hunt and fish and earn a moderate livelihood while doing so (Supreme Court of Canada 1999). Resistance to this ruling by non-native lobster fishermen prompted the Burnt Church Crisis between 1999 and 2002 (Wicken 2002). Recently tensions have flared up over lobster in Saint Mary's Bay	
1760/61	Reaffirm 1726 after defeat of the French in North America. This ended Indigenous-French relations and alliances and required natives to end trade with the French.	Reaffirm 1726 - British recognition of hunting and fishing rights, and with the end of French alliances and trade the British pledged to establish "truck houses" near native communities to provide alternative trade now that trade with the French was prohibited.
Comment:	This marked the end direct relations between the French Government and Native communities in the Maritimes. That was finalized in 1763 with the Treaty of Paris which ended the Seven Years War in which France ceded its territory in Canada and the Maritime region to Britain, except for the small islands of St. Pierre and Miquelon in the Gulf of St. Lawrence, which France retained to preserve access to fisheries there.	
1778/1779	Reaffirm 1726 within the new context of British North America being fractured by the American Revolution	Reaffirm 1726 - British recognition of hunting and fishing rights and maintain peace going forward to avoid being drawn into violence between the British and American revolutionaries.
Comment:	While the French were no longer a concern, the participation of Mi'kmaq and Wolastoqiyik (albeit only a few) in Eddy's siege of Fort Cumberland in 1776, and Allan's expedition into the Saint John Valley in 1777 highlighted the vulnerability the Maritimes to attempts by US agents to stir rebellion against the British.	

of the native peoples in the recently won portions of North America, but it had never been construed as applying to New Brunswick, which had been part of Nova Scotia at that time (Upton 1974). Safeguards concerning Indian lands and indebtedness, however questionable their ultimate value elsewhere, did not even exist in New Brunswick. Initially there had been little practical need for a policy as Mi'kmaq were few in number, and so scattered that they were not considered a threat to incoming settlers. With the arrival of the Loyalists, "the Indians were driven back into the wilderness without much ceremony".

The first real expression of concern amongst the government arose during the lead up to the War of 1812 (Upton 1974) that discontent might become a problem if war with the United States created an opportunity for trouble. Despite the fact some lands had been allocated to native people, they still maintained their nomadic way of life; and the colonial government's refusal to do anything further for them led to a complaint of "an injurious distinction between them and the Indians of Canada on one side and those within the limits of the neighboring American States on the other." The first listing of reserved lands was not published until 1838 and it identified 15 reserves in the province ranging from 10 up to 16,000 acres. About 60,000 total acres had been designated as Indian reserves in the early 1800s, but none were in Westmorland County (Goodrich 2020).

That changed in 1840 when the Provincial Government purchased 63 acres at Beaumont near Fort Folly Point (Goodrich 2020) at the head of Shepody Bay. The province then conveyed this land to the Magistrates of Westmorland County in Dorchester to hold in trust as a reserve. Then 126 Mi'kmaq moved there from various places within Westmorland County that they had been living to form the Fort Folly Reserve (Perley 1841, Ganong 1899). The land was not turned over to the Mi'kmaq themselves but vested in the county to be held for their exclusive use.

Second Level Assessment – Current Impacts

Forestry Practices

The North River watershed (Figure 3) covers 264.8 km^2, 67% of which is forested. Private woodlots are 137.1 km^2 (51.8%), Crown forests cover 6.6 km^2 (2.5%), Industrial freehold leases 33.8 km^2 (12.8%).

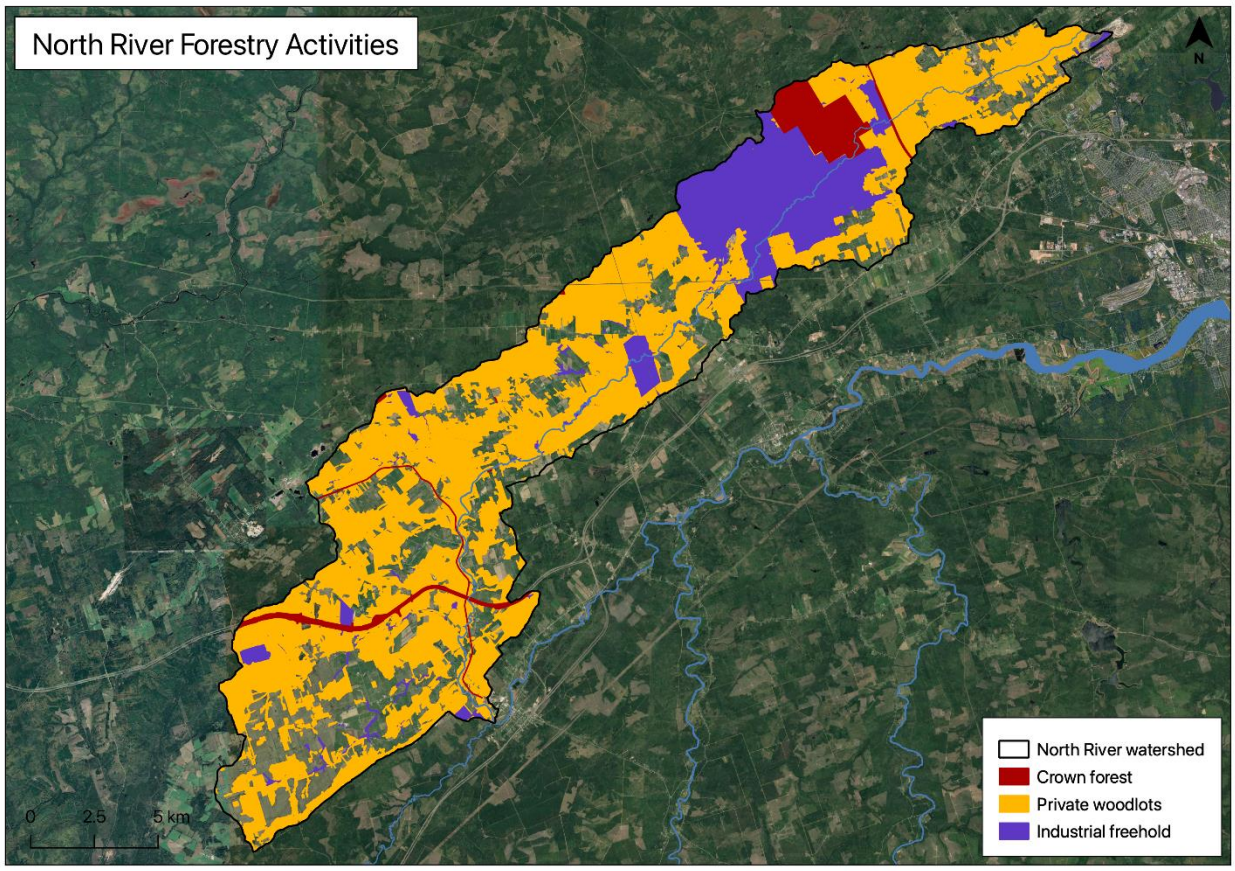

Figure 3 Forest tenure in the North River

Agricultural Practices

Non-forest Land Use data obtained from the New Brunswick Department of Natural Resources (2014) shows 31.6% of the watershed used for purposes other than forestry (Figure 4). Agricultural dominates, covering 26.5% of the basin (Figure 5). More land in the North River basin is dedicated to agriculture than in Demoiselle Creek, Pollett River and Little River combined (Department of Natural Resources in 2014). Land use is classified as: Settlement (4.63 km^2 or 1.75% of the basin), Industry (2.09 km^2 or 0.79% of basin), Crops & Grains – including hayfields (60.49 km^2 or 22.85% of basin), Pasture (9.28 km^2 or

3.5% of basin), Blueberry production (0.06 km^2 or 0.02%). 2 golf courses (1.26 km^2 or .48%).

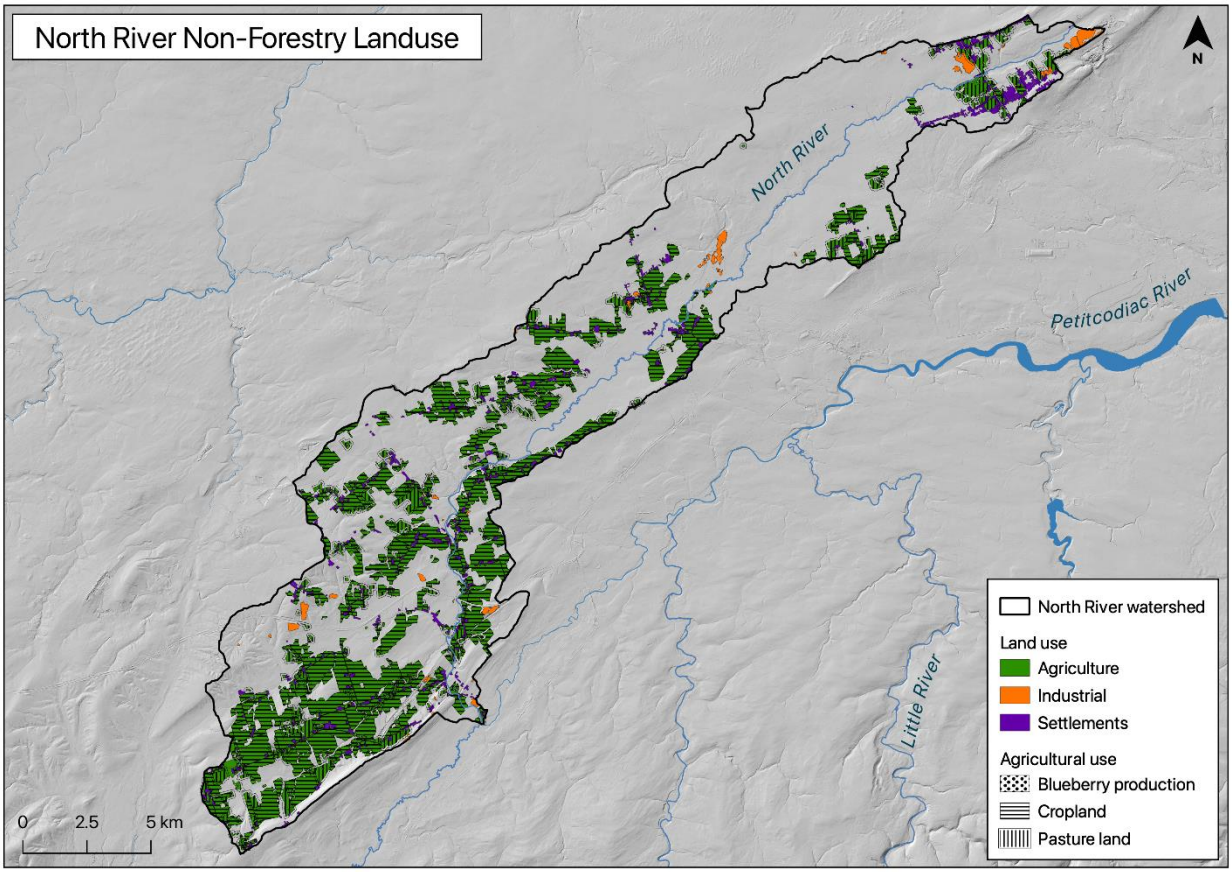

Figure 4: Non-forest land use in the North River watershed.

Transportation Development

A GIS layer of the road network (paved and unpaved) within the North River and its tributaries was overlaid to yield Figure 5. This analysis indicated a total of 184 locations where roads crossed the river or tributary streams. Of this 109 were defined as paved, and 75 were defined as unpaved. Being 59% paved is less than nearby on the main stem. That is not surprising however, as the main stem of the Petitcodiac is more populated and developed than its various tributaries, and so a higher proportion of paved roads there is to be expected. For comparison's sake, comparable figures for other watersheds for which FFHR has developed stewardship plans ranked according to proportion of paved crossings are as follows: main stem 69% paved; Little River 54% paved, Anagance River 42% paved; Demoiselle River 40% paved; and Pollett River 31% paved. The number of crossings appears reasonable for the large area involved (264.8 km^2,). For comparison's sake the total number of crossings within the 115.2 km^2 of the main stem is 95, essentially half as many, in an area nearly half the size.

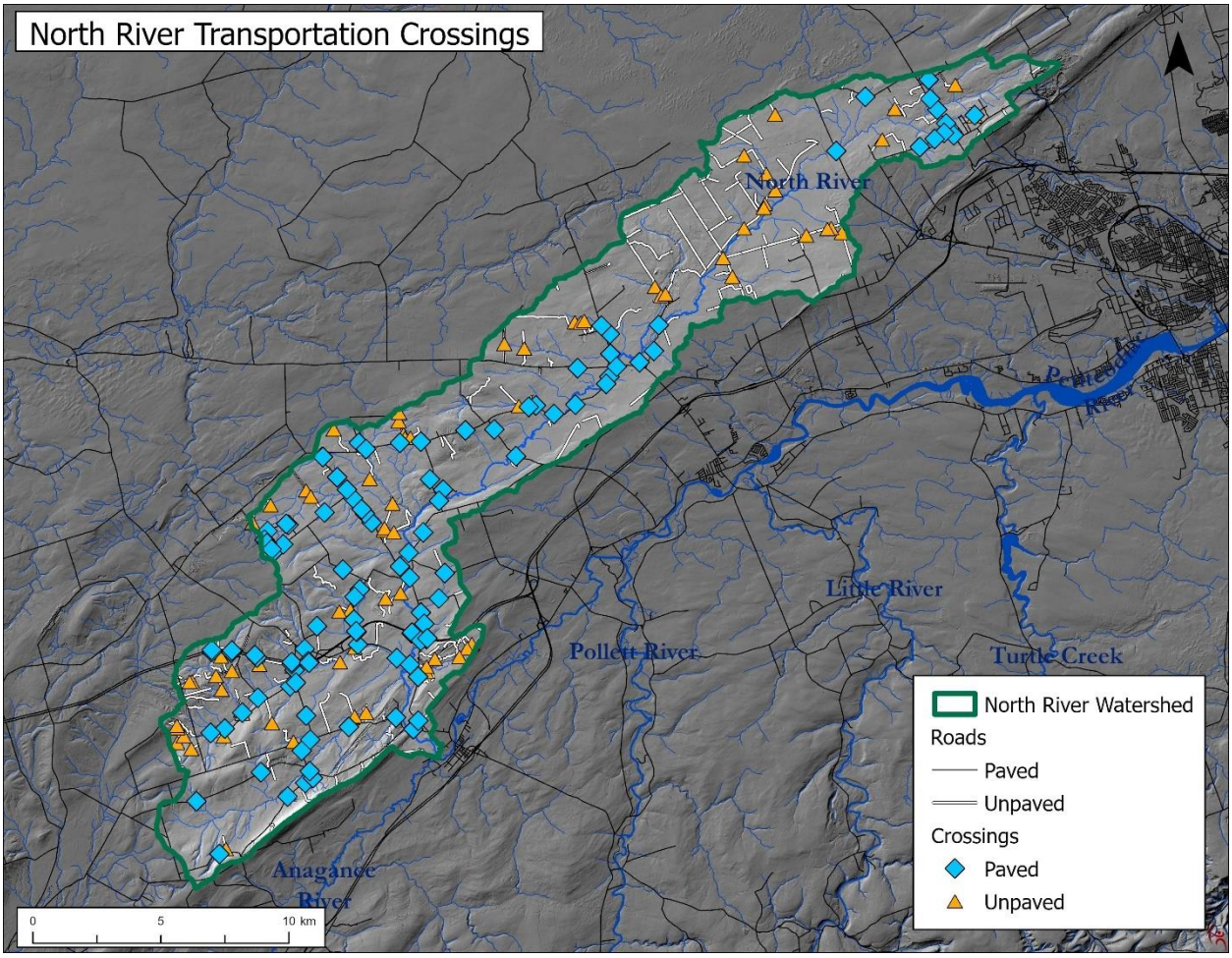

Figure 5: GIS analysis of road / water crossings in the North River.

A thorough inventory of the condition of all of these crossings is needed to examine the extent to which these may be limiting fish passage. Systematic collection of such data will also provide an opportunity to test the GIS analysis, and determine how many crossings that it has missed, and where they are. While several crossings within North River are known to be bridges such as the Trans Canada Highway Bridges, the majority are likely to be culverts of varying size and condition. The Petitcodiac Watershed Alliance has carried out a series of culvert surveys throughout the Petitcodiac watershed as part of their Broken Brooks project. Annual reports detailing that work are available for download on the publications section of their website https://www.petitcodiacwatershed.org/. These reports indicate 111 crossings assessed within the North River to date (Figure 6): 20 bridges, 3 fording sites, 20 culverts that were full barriers to fish passage, 11 culverts that were partial barriers to fish passage, 30 culverts that were not fish habitat, and 14 culverts that were not accessible (Petitcodiac Watershed Alliance 2017). Comparison of the 111 crossings that PWA have assessed to the 184 identified through this GIS analysis indicates that at least 73 water crossings within North River watershed remain to be assessed.

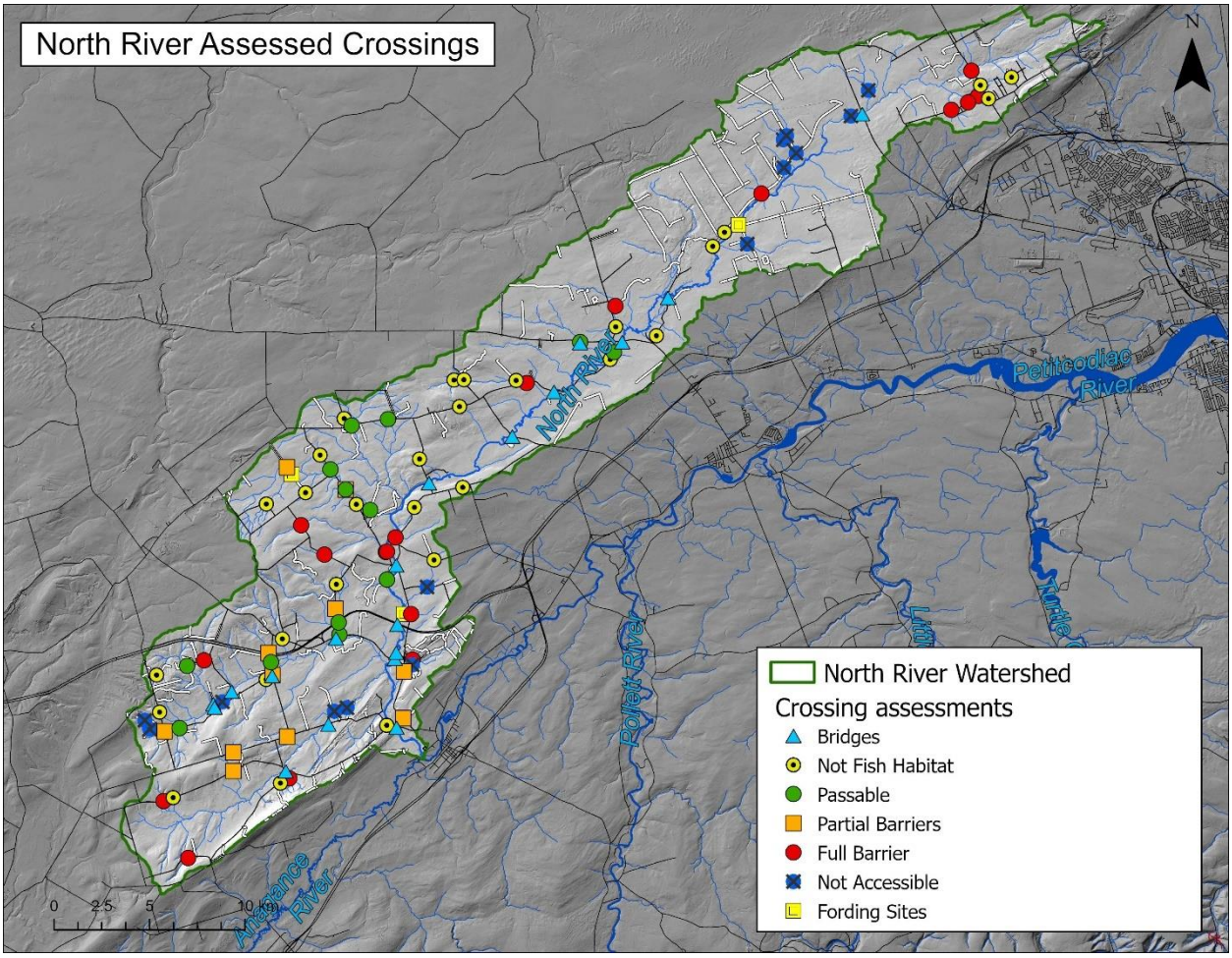

Figure 6: Water crossings visited and assessed by the Petitcodiac Watershed Alliance

Several of crossings that they examined were identified as problem culverts creating barriers to fish passage into useful habitat, potentially benefiting from remediation such as clearing of brush blockages or construction of rock weirs raise water levels in the case of perched culverts (Petitcodiac Watershed Alliance 2017).

While the New Brunswick Department of Transportation (DoT) is responsible for bridges and culverts on the public paved roads, they are not responsible for the vast majority of culverts on unpaved roads which are likely to be on either private woodlots, industrial freehold, or crown land. If a problem culvert is identified and there is a question of who is responsible (private landowner versus DoT), using GPS coordinates responsibility will be confirmed through further discussions with the Department of Transportation.

In 1968, 44 kilometers downstream in the estuary, the Petitcodiac Causeway was built instead of a bridge, in order to accommodate vehicular traffic between Moncton and Riverview. The fishway built into it proved to be ineffective. The causeway gates created a

barrier to fish passage with significant consequences for native fish species in the river and led to the decline in the populations of species such as alewife, blueback herring, rainbow smelt, and sea-run brook trout. Some species disappeared altogether from the upland reaches of the Petitcodiac (such as the North), including American shad. (Locke, et al. 2003). Atlantic salmon only remained present in the river as a consequence of ongoing stocking efforts (AMEC 2005)

In April 2010 the gates of the causeway control structure were opened as part of the Petitcodiac River restoration project. On May 25th, 2021, the new channel was opened underneath the bridge built to partially replace the Petitcodiac Causeway. October 5th, 2023, this bridge was named in honor of the late senator and MLA Brenda Robertson (Government of New Brunswick 2023a). Fourteen years of monitoring from 2010 to 2023 following the restoration of fish passage (Redfield 2024) found American shad, striped bass, and Atlantic tomcod returning to the river. Of these, the latter two have shown sustained and progressive increases in numbers over the years, while invasive non-native smallmouth bass have declined. Consequently, it is clear from these results that the fish community of the Petitcodiac has the capacity to recover, given the right conditions, and appears to be on its way to doing so.

Herbicide and Pesticide Use

Based on general information provided by Service New Brunswick, two forestry operators (JD Irving as Forest Patrol and Natural Resources) may have conducted work within the North River. While intended blocks of land to be treated were identified by operators that does not necessarily mean that they were treated with herbicides. Products used in these industries may contain the active ingredient glyphosate. Glyphosate is found in several formulations under the trade names Arsenal (PCP 23713), Forza (PCP 26401), Vantage (PCP 26884), Vision (PCP 19899) and Vision Max (PCP 27736). The active ingredient triclopyr has also been used in the past as Release (PCP 22093).

In addition, two industrial operators (Asplundh and NB Power Transmission) may have conducted work with respect to an industrial right-of-way perspective (rail, transmission lines, etc.). These companies may have used triclopyr as Garlon 4 (PCP 21053), Karmax (PCP 21252) and any of the aforementioned glyphosate products.

Private growers must be individually certified (hold a valid pesticide applicator certificate) but do not report their usage. Likewise, vendors must report total sales but do not provide a breakdown relevant to individual purchasers. It is difficult to find information about individual grower or vendor pesticide or herbicide use.

Mining Practices

Most of the Oil and Natural Gas lease rights with North River watershed upstream of Fawcett Hill are currently registered SWN Resources Inc. (Government of New Brunswick 2024). SWN is a wholly owned subsidiary of Southwestern Energy Company in the US (SWN 2015). Below Fawcett Hill, around the Village of Petitcodiac, is leased to Headwater Exploration Inc (Government of New Brunswick 2024). Headwater Exploration is a Canadian company that operates in Alberta and New Brunswick.

In 2013 seismic testing by SWN in New Brunswick on Mi'kmaq traditional lands north of Moncton was halted following protests that became violent and attracted national media attention. On March 17th, 2015, SWN received an extension on its licenses which were due to expire (Canadian Broadcasting Corporation 2015). The former Liberal Provincial government enacted a moratorium on expansion (Canadian Broadcasting Corporation 2014), however the new Conservative Government led by Blaine Higgs has announced its intention to put an end to the moratorium and renew fracking in New Brunswick (Canadian Broadcasting Corporation 2018). If wells are eventually drilled in the North River watershed, impacts will include freshwater extraction from streams, habitat destruction and sedimentation during road building, and the potential for wastewater spills contaminating surface waters.

Fort Folly First Nation

Mi'kmaq never surrendered title to Mi'kma'ki (Mi'gmawe'l Tplu'taqnn 2023), however have limited contemporary presence in the North River watershed (despite it being their traditional territory). There are relatively few Mi'kmaq, and government policies concentrated these downstream on the Fort Folly reserve at Beaumont (in Shepody Bay), at the mouth of the Petitcodiac. Economic decline of the building stone quarries at Fort Folly Point in the 1890s, profoundly affected the reserve. Many families moved to Shediac or land the band held in Richibucto, while others went to Dorchester and the surrounding area. By 1913 only three or four families remained at Beaumont, the last of which left in 1955. In 1958, Beaumont was no longer occupied, title was lost, which has subsequently been challenged in a land claim (Fort Folly First Nation 2021).

Mi'kmaq continued to be part of the community in and around Dorchester throughout the 1950s and 1960s after Beaumont ceased to be a reserve (Goodrich 2020), living as individual families with "status" but without a reserve. That changed in 1969 when the current Fort Folly First Nation Reserve was established near Dorchester at Palmer's Pond on Rte. 106. It was initially named Palmer's Pond Reserve (Fort Folly First Nation 2021), but the decision was soon made to rename it the Fort Folly Indian Reserve. The present band, which is mostly descended from those who had occupied Beaumont (Kristmason 2004), does not consider this to be a new foundation, but continuity, with a relocation from

Beaumont (Goodrich 2020). Fort Folly, which had been the name of the original reserve at Beaumont, was named geographically for the location on which it existed (Perley 1841, Ganong 1899). Today the band has thirty-six members living on reserve, and a further ninety-six living off reserve.

Urban Development

The North River watershed is mostly rural, with 1.75% in settlements, and 26.5% in agriculture. Thus, while not urbanized, the degree of development and settlement exceeds that of most other portions of the Petitcodiac watershed, except for the main stem of the Petitcodiac. The point where the North River meets the Anagance and becomes the Petitcodiac lies within the Village of Petitcodiac. The river's headwaters meanwhile begins some distance east near Magnetic Hill, just outside of Moncton. As a consequence, population densities at greatest at either end, and sparser in the middle. Local Governance Reform by the Province (Government of New Brunswick 2023b) amalgamated governance to divide the North River watershed between 3 local governments. Just outside of Moncton is Maple Hills, which lies in the North River headwaters and extends to about where the river crosses Taylor Road. Salisbury includes from Taylor Road to just before McKinnon Road in Wheaton Settlement. The Community of Three Rivers runs from where Salisbury ends and takes in the rest of the North River below that point including the parts of the Village of Petitcodiac that are not along the main stem of the Petitcodiac.

Third Level Assessment – Aquatic and Riparian Habitat Assessment

Wildlife

Several species of wildlife that warrant specific attention either are or have been historically found within the North River watershed: Atlantic salmon, American eels, brook floaters, and wood turtles. Guidelines for projects in areas with these are in the Appendix.

Atlantic salmon (*Salmo salar*) Inner Bay of Fundy (iBoF) populations were listed as endangered under the Species at Risk Act in 2003 (DFO 2010; SARA Registry 2013a), and the species is considered extirpated from the Petitcodiac River system, except for those introduced in stocking programs (AMEC 2005). The decline in iBoF salmon is a marked contrast to the abundance described by early settlers (Dunfield 1991). Though numbers had been decreasing for some time (Elson 1962) construction of the causeway between Moncton and Riverview in 1968 complicated fish passage and extirpated the species from a river system that despite being 1 of 50 iBoF rivers, represented 20% of the total iBoF population (Locke, et al. 2003).

American eels (*Anguilla rostrata*) were designated as "Special Concern" by COSEWIC in 2006 (COSEWIC 2006). Their status was re-examined and raised to "Threatened" in May 2012 (COSEWIC 2014). This species is being considered for listing under the federal Species at Risk Act, but currently it has no status (SARA Registry 2013b).

Wood turtles (*Glyptemys insculpta*) were designated as "Special Concern" by COSEWIC in 1996 which was raised to "Threatened" in 2007 (COSEWIC 2007; COSEWIC 2011). This species is listed as "threatened" under the Species at Risk Act (SARA Registry 2012).

Brook floaters (*Alasmidonta varicosa*), are a medium sized species of freshwater mussel (Figure 7) listed as Special Concern by COSEWIC (COSEWIC 2009), and as Schedule 1, Special Concern, under the Species at Risk Act in 2013 (DFO 2016). Brook floaters were well documented along the main stem by DFO in the late 1990s (Hanson and Locke 2001). Their numbers appear to have declined since that time.

Figure 7: Brook Floater- showing distinctive size, width, rays on shell, and orange flesh.

Brook floaters prefer clean running water with sand or sandy gravel substrates (Strayer and Ralley 1993; Nedeau et al. 2000) and are negatively impacted by increasing depth of fines (Baldigo et al. 2003) and turbidity (Strayer and Fetterman 1999). There is substantial evidence that sedimentation contributes to the decline of brook floater populations (DFO 2016).

The North River stood out in the late 1990s amongst the Petitcodiac tributaries surveyed by Hanson and Locke (2001) as almost devoid of all freshwater mussel species, due to habitat degradation associated with poor agricultural practices. That is consistent with what was seen by FFHR during follow up surveys roughly twenty years later in 2018. Brook

floaters were only found at one site (just above the Glenvale bridge) at which Hanson and Locke had documented them (Figure 8). Two of Hanson and Locke's sites on the North that declined in abundance classification for brook floaters from rare to none, were impressively poor in other mussel species as well. The site on the North River immediately above the mouth of the Anagance had only 19 mussels, none of which were brook floaters. Similarly, the North River site at Fawcett, immediately above the Highway 2 (Trans Canada) Bridges yielded only 1 mussel. Meanwhile, in 2018 sites elsewhere within the Petitcodiac regularly yielded hundreds of mussels of other species. Depending upon how few brook floaters had been seen at these North River sites in 1997-98, there may have been only a very slight change reflecting logical progression of trends already underway in the 1990s.

The distribution of the Species at Risk (SAR) within the North River watershed is presented in Figure 8. One conspicuous aspect of this figure is the lack of species other than brook floaters on it. While wood turtles have been encountered at several locations within the

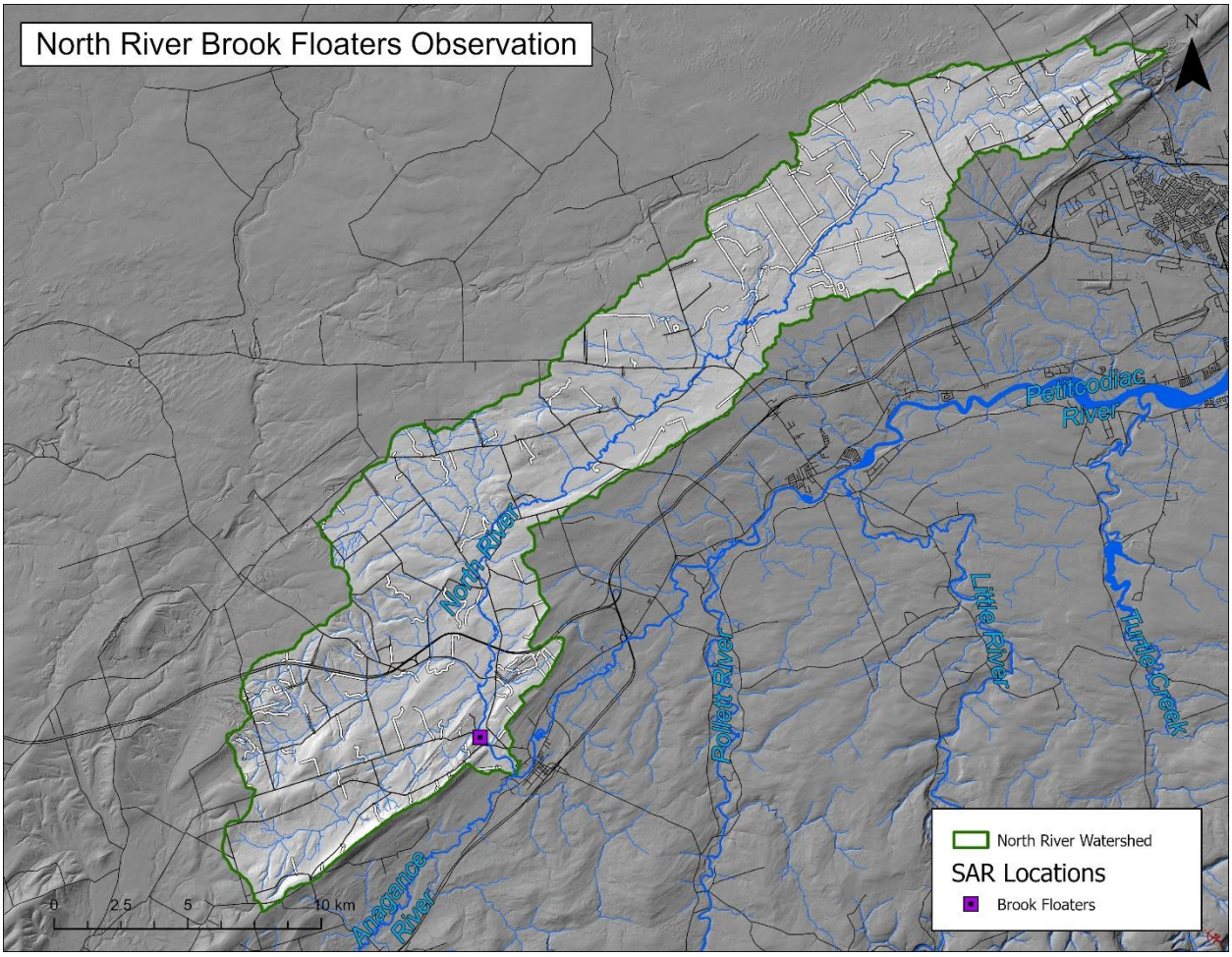

Figure 8: Locations of Encounters with SAR species on the North River.

watershed while conducting other field work, due to their small home range, and vulnerability to poaching, encounters with wood turtles are considered to be sensitive information, and so are being withheld here.

Salmon and eels are another matter. Fort Folly Habitat Recovery has not encountered salmon in the course of its field work on the North River, likely due to the low numbers of this species within the system, and the North River not being their prime habitat. DFO has extensive records of interaction with salmon on the North River (Elson 1941). Eels have not been encountered by Fort Folly Habitat Recovery along the North River, due in part to the limited amount of electrofishing done there (two sites in 2012). However, historically they have been found in the North River watershed (Andrews 1943), and unlike salmon, eels were not excluded by the Moncton to Riverview Causeway downstream on the Petitcodiac. In fact, while the causeway gates were closed eels were found to be the most abundant resident species upstream of the headpond (Flanagan 2001), and one of the dominant species within the headpond (Locke et al 2000). Though there is no recent data available on eel numbers within the North River watershed, unlike salmon there is no reason to think that they are absent. Arguably this indicates that there might be value in undertaking work within the North River to address this knowledge gap.

Water Quality

Water quality on North River has been monitored by the Petitcodiac Watershed Alliance as part of their basin wide water monitoring program, which has data going back to 2005. The 2021 results are presented in Table 2 (Petitcodiac Watershed Alliance 2022). The PWA maintains a fixed monitoring site on the upstream side of the Route 885 bridge over the North River at Intervale. Other relevant sites for water as it enters the main stem are available from: Little River (Route 112 Bridge); Pollett River (Powers Pitt Road); the

Table 3: Water Quality on the North River at the Rt 885 bridge at Intervale

(Petitcodiac Watershed Alliance 2022)

Monthly at Site	Dissolved Oxygen	Conductivity	Temperature °C	pH
May	12.8 mg/L	150.0 µS	9.6 °C	7.79
June	8.7 mg/L	513.0 µS	23.7 °C	8.10
July	10.3 mg/L	723.0 µS	21.7 °C	8.97
August	9.6 mg/L	439.3 µS	20.9 °C	8.17
September	11.1 mg/L	313.3 µS	11.6 °C	7.70
October	12.8 mg/L	259.0 µS	11.9 °C	7.88
Average	10.9 mg/L	399.6 µS	16.6 °C	8.10

Anagance River (Mill Road); and the main stem 112 Bridge over the Petitcodiac in Salisbury). It is noteworthy that while water temperatures at this location got high during July and August, these were not extreme, and dissolved oxygen remained well within an acceptable range for fish. Being a single site within this portion of the watershed there is a limited amount that can be concluded from it, however taken together with these other sites more can be gained. The fact this location has been monitored continuously by the PWA for years also provides significant time depth.

Geomorphic Analysis

Data collected from the Rapid Geomorphic Assessment (RGA) was used to evaluate the geomorphic condition and stability of the assessed reaches North River. In order to interpret the geomorphic data, the included maps of the watercourse are highlighted according to reach stability as well as the Primary Geomorphic Processes impacting each reach.

Rapid Geomorphic Assessments are used to quantify channel stability based on the presence and (or) absence of key indicators of channel adjustment with respect to four categories: 1) Aggradation, 2) Degradation, 3) Channel Widening, and 4) Planimetric Form Adjustment. Each indicator is described in detail below.

Aggradation

Channel aggradation may occur when the sediment load to a river increases (due to natural processes or human activities), and it lacks the capacity to carry it. Piles of sediment in the river can re-direct flows against the banks, leading to erosion and channel widening.

Typical indicators used to identify aggradation include:

- Shallow pool depths.
- Abundant sediment deposition on point bars.
- Extensive sediment deposition around obstructions, channel constrictions, at upstream ends of tight meander bends, and in the overbank zone.
- Most of the channel bed is exposed during typical low flow periods.
- High frequency of debris jams.
- Coarse gravels, cobbles, and boulders may be embedded with sand/silt and fine gravel.
- Soft, unconsolidated bed.
- Mid-channel and lateral bars.

Degradation

Degradation occurs as the river cuts deeper into the land and decreases its gradient. This can occur from a rapid removal of streambed material due to an increase in discharge, water velocity, or a decrease in sediment supply. Bed lowering can move in both an upstream (as a headcut or nick point) and/or downstream direction. Indicators of degradation include:

- Elevated tree roots.
- Bank height increases as you move downstream.
- Absence of depositional features such as bars.
- Head cutting of the channel bed.
- Cut face on bar forms.
- Channel worn into undisturbed overburden/bedrock.

Widening

Widening typically follows or occurs in conjunction with aggradation or degradation. With aggradation, banks collapse when flows are forced on the outside, and the river starts to widen. Wide, shallow watercourses have a lower capacity to transport sediment and flows continue to concentrate towards the banks. Widening can be seen with degradation, as it occurs with an increase in flows or decrease in sediment supply. Widening occurs because the stream bottom materials become more resistant to erosion (harder to move) by flowing waters than the stream banks.

Indicators of widening include:

- Active undermining of bank vegetation on both sides of the channel, and many unstable bank overhangs that have little vegetation holding soils together.
- Erosion on both right and left banks in riffle sections.
- Recently exposed tree roots.
- Fracture lines at the top of banks that appear as cracks parallel to the river, which is evidence of landslides and mass failures.
- Deposition on mid-channel bars and shoals.
- Urbanization and storm water outfalls leading to higher rate and duration of runoff and channel enlargement typically in small watersheds with >10% impervious surface.

Planform Adjustment

These are the changes that can be seen from the air when looking down at the river. The river's pattern has changed. This can happen because of channel management activities

(such as straightening the bends of the river with heavy equipment). Planform changes also occur during floods. When there is no streambank vegetation with roots to hold soil in place, rivers cut new channels in the weak part of the bank during high water. Planform adjustments typically are responses to aggradation, degradation, or widening geomorphic phases. Indicators include:

- Flood chutes, which are longitudinal depressions where the stream has straightened and cut a more direct route usually across the inside of a meander bend.
- Channel avulsions, where the stream has suddenly abandoned a previous channel.
- Change or loss in bed form, sometimes resulting in a mix of plane bed and pool-riffle forms.
- Island formation and/or multiple channels.
- Additional large deposition and scour features in the channel length typically occupied by a single riffle/pool sequence (may result from the lateral extension of meanders).
- Thalweg not lined up with planform. In meandering streams, the thalweg typically travels from the outside of a meander bend to the outside of the next meander bend.
- During planform adjustments, the thalweg may not line up with this pattern.

Upon completion of the field inspection, indicators are tallied for each category to produce an overall reach stability index. The index classified the channel in one of three stability classes:

Table 4: RGA reach stability index classification.

Factor Value	Classification	Interpretation
≤0.20	In Regime or Stable (Least Sensitive)	The channel morphology is within a range of variance for streams of similar hydrographic characteristics – evidence of instability is isolated or associated with normal river meander propagation processes.
0.21-0.40	Transitional or Stressed (Moderately Sensitive)	Channel morphology is within the range of variance for streams of similar hydrographic characteristics, but the evidence of instability is frequent.
≥0.41	In Adjustment (Most Sensitive)	Channel morphology is not within the range of variance and evidence of instability is widespread.

The RGA stability index results for the North River are shown in Figure 9. Approximately 22% of the reaches are in adjustment - as per Table 4- the most sensitive state. Only 4% of the reaches assessed were found to be stable (in regime). The remaining 74% were transitional between these two states.

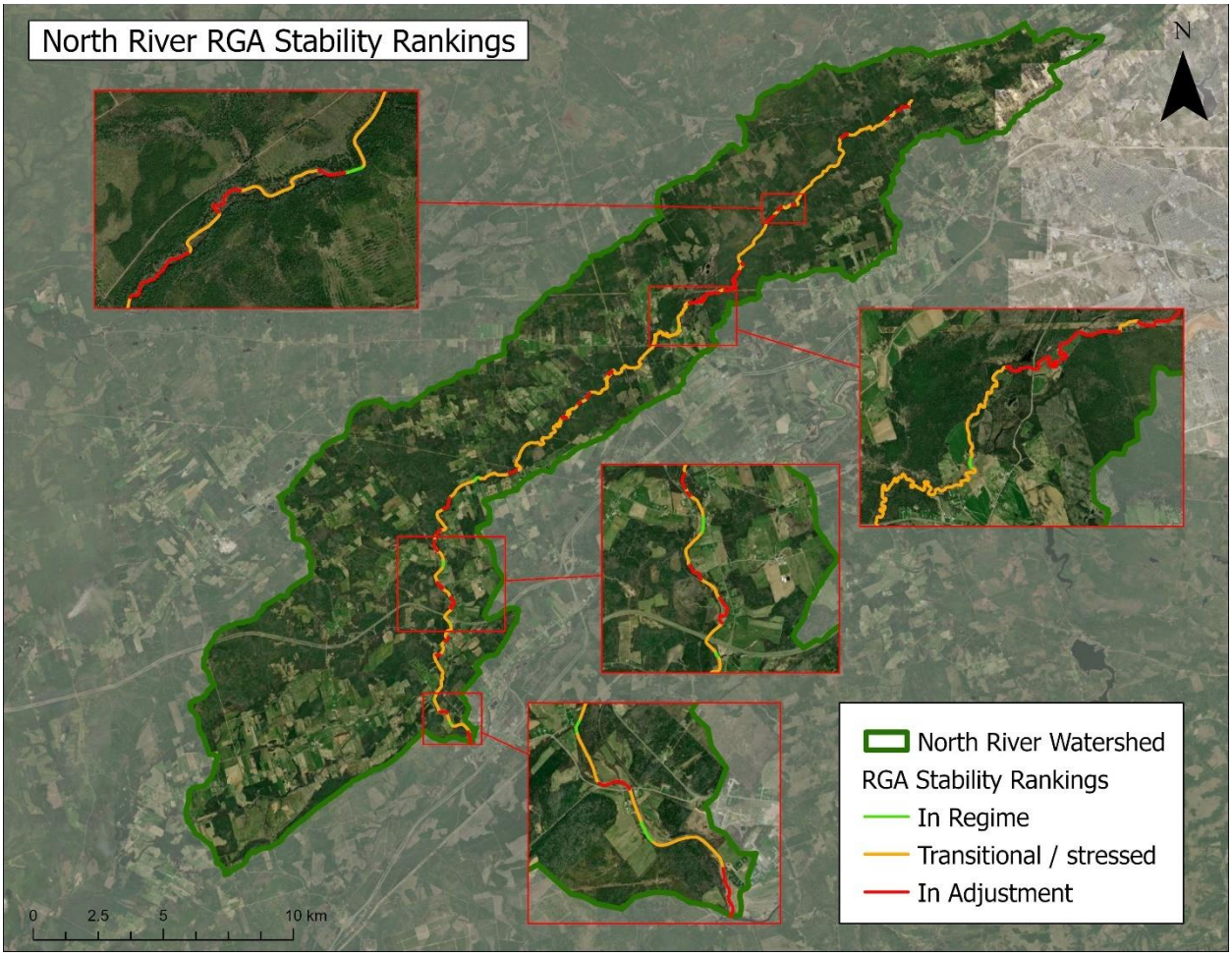

Figure 9: Stability Rankings for the North River

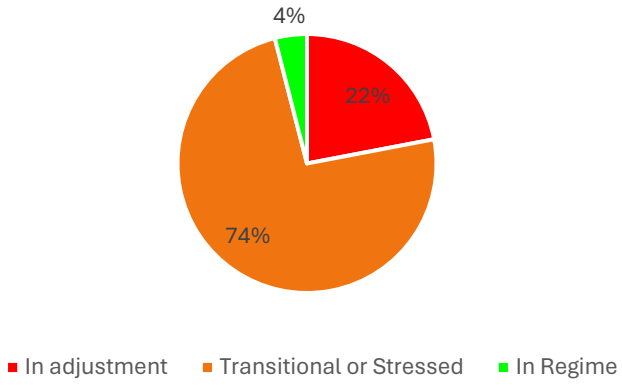

Figure 10: North River Stability Index Based on the Number of Reaches

Primary Geomorphic Processes

The primary geomorphic process identified on the North River are shown in Figure 11. Aggradation was the most common process observed at 47%, followed by Degradation 26%, Widening 26%, and Planiform adjustment 1%,

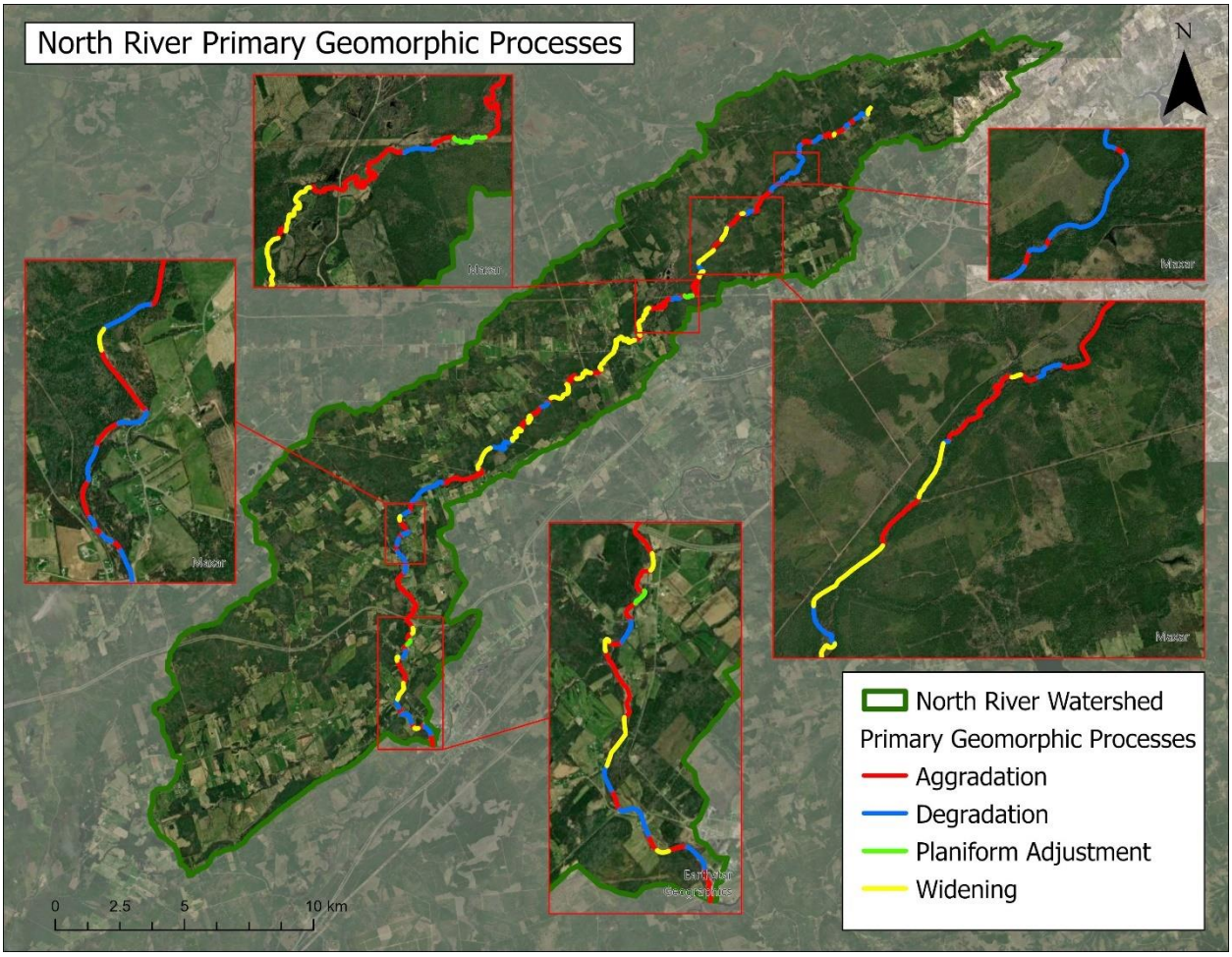

Figure 11: Primary Geomorphic Processes on the North River

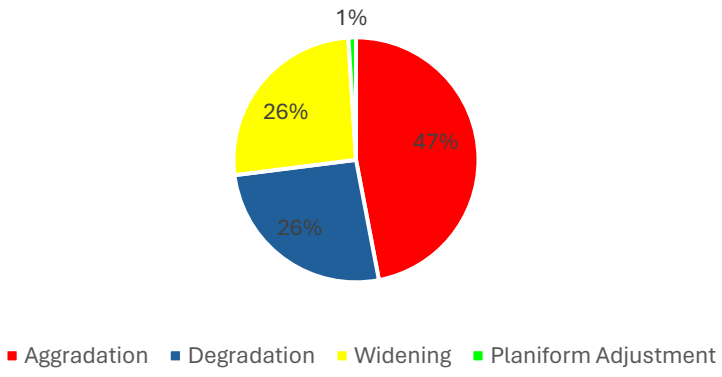

Figure 12: Primary Geomorphic Processes on the North River based on number of reaches.

Secondary Geomorphic Processes

The secondary geomorphic process identified on the North River are shown in Figure 13. Widening was the most common process observed at 41%, followed by Degradation 27%, Aggradation 18%, and Planiform adjustment 14%.

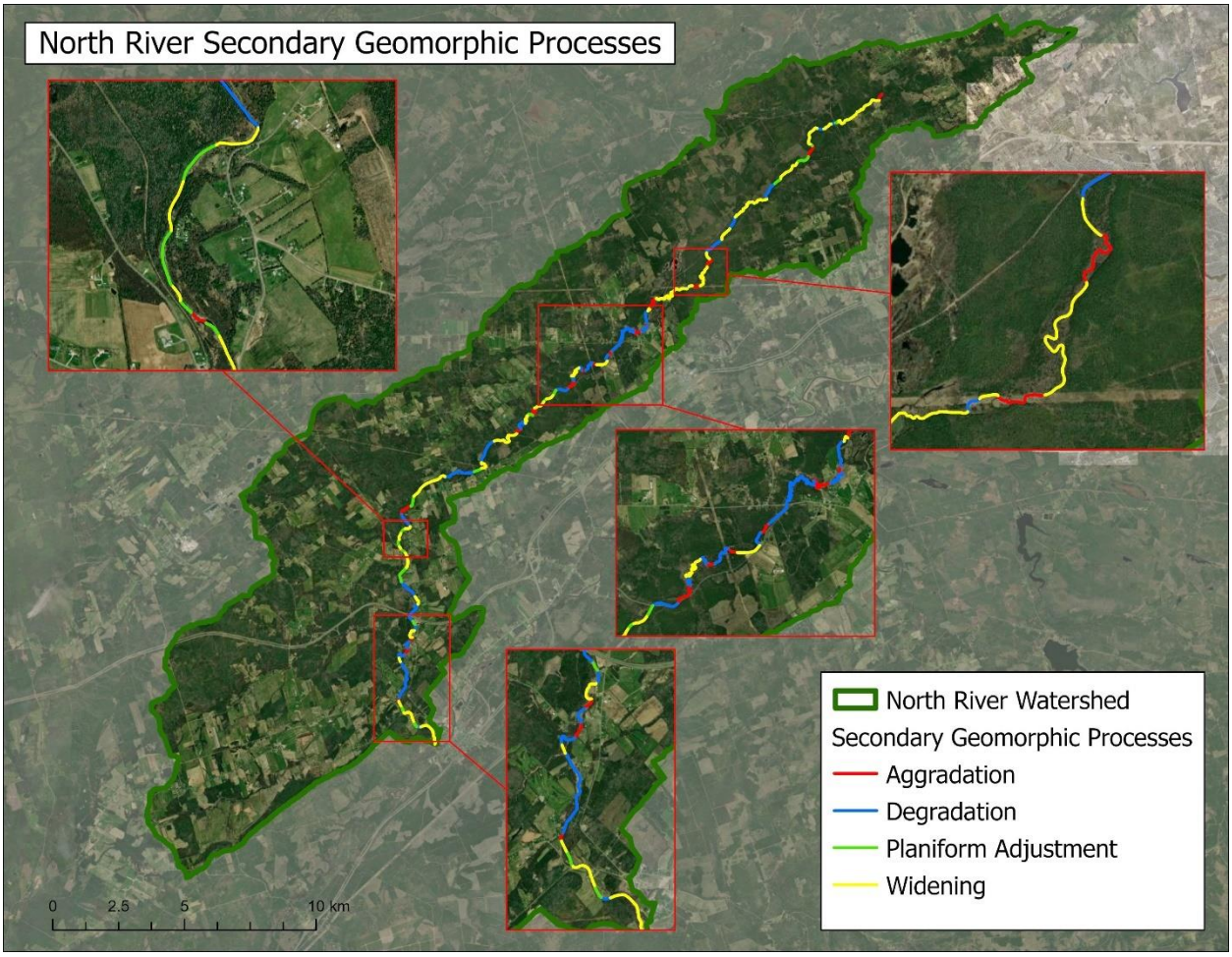

Figure 13: Secondary Geomorphic Processes on the North River

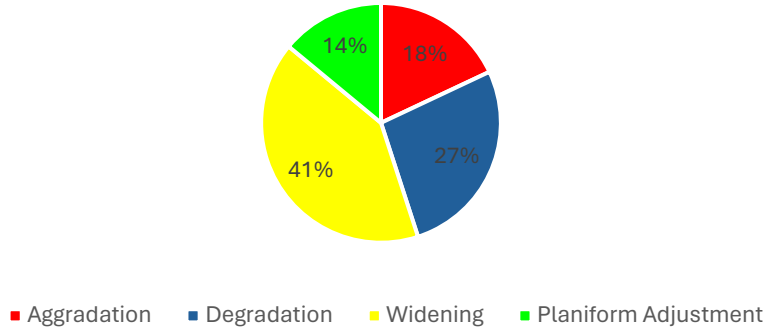

Figure 14: Secondary Geomorphic Processes on the North River based on number of reaches.

This RGA data indicates that most of the riverbanks along the North River are experiencing some degree of stress and disturbance. Unlike the main stem of the Petitcodiac, where 66% of the channel is "in adjustment", only 22% of the North River is. Instead, the majority of reaches within the North are "transitional or stressed". The primary form of this stress due to aggradation, where sediment is piling up in the river and re-directing flows against the banks. That in turn is producing the erosion that is driving widening as the secondary process in the river. Such disturbance is widely distributed throughout the river, rather than being part of a gradient going either upstream or downstream.

The purpose of RGAs is to inform future plans by helping to identify and prioritize areas needing the most attention. The reaches that are "in adjustment" are where from a stability perspective, problems are most acute. That said, "transitional or stressed" reaches may also warrant greater attention considering other factors – such as wildlife, say the brook floaters in Figure 8 just above the Glenvale bridge a short distance upstream of the Village of Petitcodiac. Landowner interest is another significant consideration, as will be explored in more detail as part of the process of developing the Aquatic Habitat Rehabilitation Plan.

Fourth Level Assessment - Aquatic Habitat Rehabilitation Plan

Summary of Issues Identified from Information on Current Impacts

Culvert surveys by the Petitcodiac Watershed Alliance as part of their Broken Brooks program noted 20 culverts that were full barriers to fish passage and 11 culverts that were partial barriers to passage (Figure 6) within the watershed, a total of 31 impacted culverts. With 184 crossings identified (Figure 5) and only 111 assessed (Figure 6), another factor identified here is the scope for additional assessments of water crossings within the North River watershed to identify other water crossings in need of attention. PWA's assessments have been well distributed throughout the watershed such that there is not one specific area which has been neglected, but there would be value to expanding efforts across the watershed as a whole.

Summary of Issues Identified from Aquatic and Riparian Habitat Assessment

Knowledge about wildlife within the North River is limited relative to other watersheds within the Petitcodiac system where more field work has been done. Most of what is known about SAR species here comes either as a result of brook floater surveys in 2018, or anecdotal data from encounters with wood turtles during Rapid Geomorphic Assessments. This suggests that there might be value to be had in projects in the North

River to address such knowledge gaps, though this is a circular problem, as the North River is known to be of less conservation value for salmon recovery, for example, than the Pollett River or the Little River. Consequently, projects in those watershed naturally tend to take priority. Rapid Geomorphic Assessments (RGAs) identified roughly 22% of the reaches along the North River as "in adjustment" indicating that instability is less widespread than further downstream along the main stem of the Petitcodiac.

Restoration Activities Undertaken

Several restoration projects have been done within North River to date (Figure 15). These have ranged from 1) a full culvert replacement by the Provincial Department of Transport and Infrastructure (DTI); to 2) work by the Petitcodiac Watershed Alliance improve passage through culverts that are barriers by either removing debris that is blocking them or building rock weirs down stream of the outflow to address perched culverts; to 3) work by Fort Folly Habitat Recovery to clean up illegal dump sites.

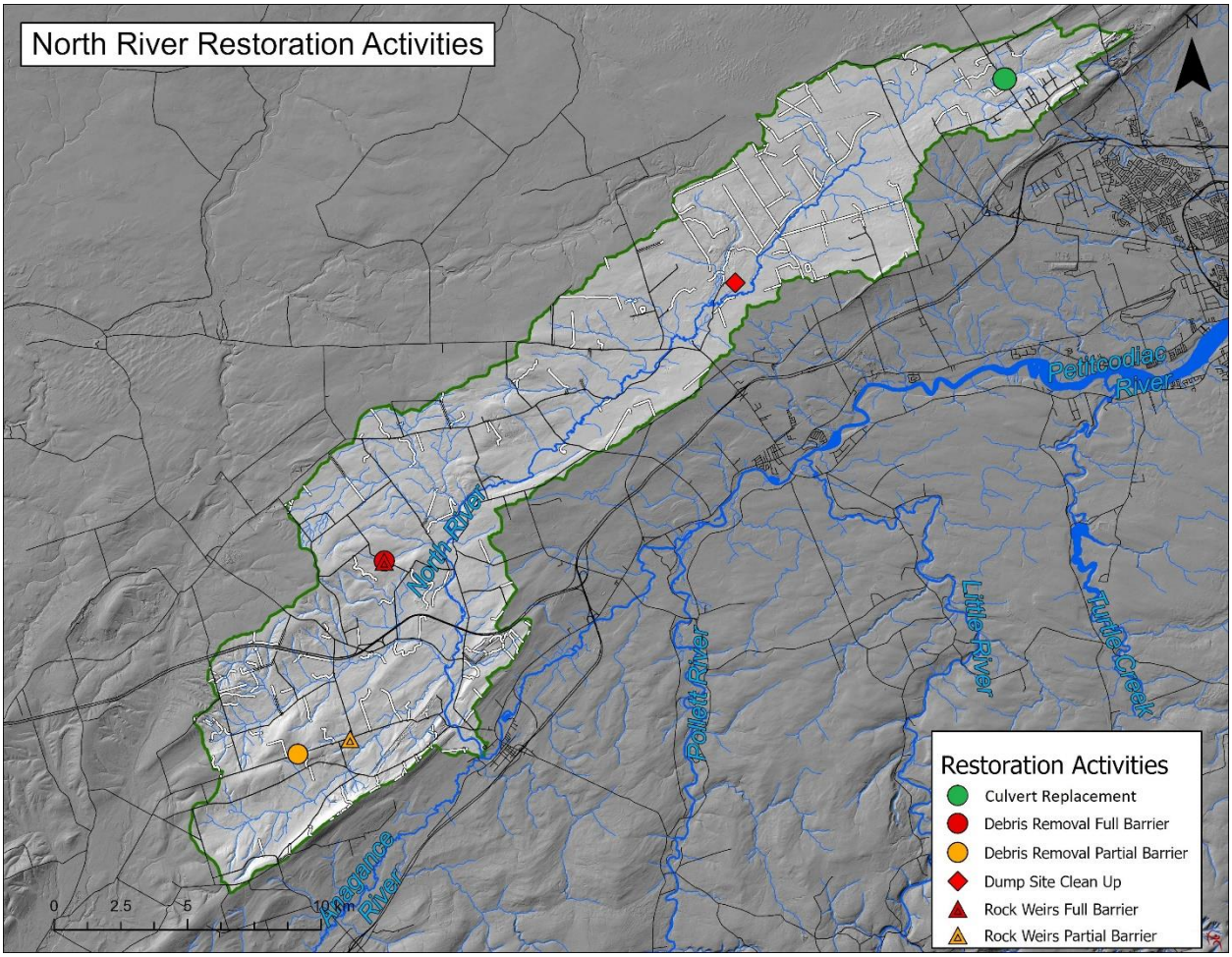

Figure 15: Restoration Activities Undertaken within the North River

Culvert Replacement

Route 126 over the North River in Maple Hills, DTI (2019): N 46.152440 W -64.927703

This project was undertaken not because it was planned, but instead because the culvert failed and forced replacement to allow use of Route 126 (cover: top photo). The failure in 2019 was dramatic. It generated a plume of turbidity visible in the river roughly 70 km downstream on the main stem of the Petitcodiac at the Fish Net Trap that Fort Folly Habitat Recovery operates within the head-of-tide at Highland Park in Salisbury . The culvert was one that there had been awareness of for some time. FFHR noted it as needing attention in 2012 in the first edition of this North River Stewardship Plan. At the time – looking through the culvert it appeared from the inflow as if the pipe might be collapsing (Figure 16: left). The outflow (Figure 16: right) was perched (likely making it impassable). Figure 17 shows the rebuilt crossing in 2024 – concrete, larger diameter, and twinned with one low to allow fish passage, and the second to better accommodate stormflow during extreme events.

Figure 16: Route 126 culvert in 2012: collapsing inflow left, and perched outflow right.

Figure 17: Outflow at new culvert on Route 126 in 2024

In 2016 the Peticodiac Watershed Alliance assessed this culvert as part of their Broken Brooks Project (Culvert C-140) and determined that it was a full barrier to fish passage (Figure 6) due to being perched such that the outflow was elevated above the plunge pool (Figure 16) limited access for fish attempting to move upstream beyond that point.

Debris Removal

Thompson Rd over Blakney Brook, PWA (2017): C-128 N 45.994773 W -65.231803

As part of the Petitcodiac Watershed Alliance's 2017 Broken Brooks field work they remediated a culvert (Figure 15) which they had assessed as a full barrier to fish passage (Figure 6) on Blackney Brook, where Thompson Road, a paved road, crosses over it (Figure 5). Debris clearance was not the only work that they did at this site as will be noted below the PWA also built a rock weir. According to their estimates, doing so opened up fish passage to 1.5 km of upstream habitat.

Baseline Road over Salt Springs Brook, PWA (2017): C-105 N 45.930225 W -65.274961

As part of the Petitcodiac Watershed Alliance's 2017 Broken Brooks field work they remediated a culvert (Figure 15) which they had assessed as a partial barrier to fish passage (Figure 6) on Salt Springs Brook, where Baseline Road, a paved road, crosses over it (Figure 5). According to their estimates, doing so opened up fish passage to 5 km of upstream habitat. There doesn't appear to be 5 m of habitat upstream of this site. The culvert itself is a minor crossing of a tributary to Salt Spring's Brook that was not detected as part of the GIS analysis (Figure 5). It is possible this culvert was mislabelled with the wrong GPS coordinates, as it was somewhat surprising that such a minor crossing would have been a priority to clear.

Rock Weir Installation

Thompson Road over Blakney Brook, PWA (2017): C-128 N 45.994773 W -65.231803

As part of the Petitcodiac Watershed Alliance's 2017 Broken Brooks field work they remediated a culvert (Figure 15) which they had assessed as a full barrier to fish passage (Figure 6) on Blackney Brook, where Thompson Road, a paved road, crosses over it (Figure 5). After clearing debris that was blocking this culvert they built a rock weir downstream of it. To reduce this barrier, a vortex rock weir design was selected to increase the height of the existing plunge pool to improve access to the outflow. Installing this type of structure raised water levels in the plunge pool to effectively eliminate the barrier outflow drop. The size and volume of the rock weir was based upon the stream and culvert characteristics calculated using data collected from the culvert assessment. The idea is that over time, the watercourse will naturally deposit material within the rock weir and fortify the

structure. According to their estimates, the combined benefits of debris removal and rock weir installation opened up fish passage to 1.5 km of upstream habitat. Given the number of years that have passed there would be value in revisiting this site to assess debris, and the current condition of the rock weir.

Baseline Road over Salt Springs Brook, PWA (2017): C-106 N 45.935353 W 65.249661

As part of the Petitcodiac Watershed Alliance's 2017 Broken Brooks field work they remediated a culvert (Figure 15) which they had assessed as a partial barrier to fish passage (Figure 6) on Salt Springs Brook, where Baseline Road, a paved road, crosses over it (Figure 5). They did so by installing a rock weir downstream of it to raise the water level which would improve access to the outflow. According to their estimates this rock weir installation opened up fish passage to 1.5 km of upstream habitat.

Dump Site Clean Up

Taylor Road, FFHR (2021-2023): N 46.086246 W -65.059693

While a single site was identified for the purpose of locating this activity in Figure 15, in actuality, the entire length of the Taylor Road seems to serve as an illegal dump site. Garbage was not limited to one specific area, but instead distributed along the entire road in its ditches. (Figure 18). This area was repeatedly suggested by members of the local community on Facebook as an active dump site, when FFHR began its dumpsites clean up in 2021.

Figure 18: Taylor Road before (left) and after (right) clean-up on June 7th, 2023.

A few larger piles of trash were noted and became priority. The contents of the waste collected varied from larger dumps to what staff considered teenage party rubbish. This meant a range of garbage from red solo cups to household items with the heaviest single load being construction material: 720 kilograms of shingles. Initial clean up in 2021 yielded a total of 1,050 kg. Taylor Road looked better in subsequent years, which was borne out by the data, as only 500 kg came off it in 2022, and 190 kg in 2023.

Opportunities for Future Restoration Activities

Restoration Framework –Stewardship Planning, Prioritization and Engagement

To address concerns within the watershed through an efficient use of finite resources (both human and financial), projects must be well prioritized, both in terms of the needs of the river, and those of the landowners on who's property the project is taking place. Fort Folly Habitat Recovery has developed a series of Stewardship Plans on a watershed-by-watershed basis within the Petitcodiac River system, of which this Stewardship Plan for the main stem of the Petitcodiac River is one. These plans provide a means of tackling the challenging task of identifying local problems, determining which ones warrant immediate attention, and determining how to proceed with them once chosen. This process is laid out in Figure 19 and Figure 20.

The field work that makes up the Third Level Assessment (Aquatic and Riparian Habitat Assessment) informs decision making by providing the wide context necessary to prioritize and target project selection. Without it, decisions about which project to undertake would be made without proper appreciation of how needs at a given site compare to those at other sites elsewhere in the system. At this point there is also an opportunity to ensure that efforts are well distributed across the watershed by including consideration of where previous projects have been done, to avoid focusing too much effort in just one area within too short a time period.

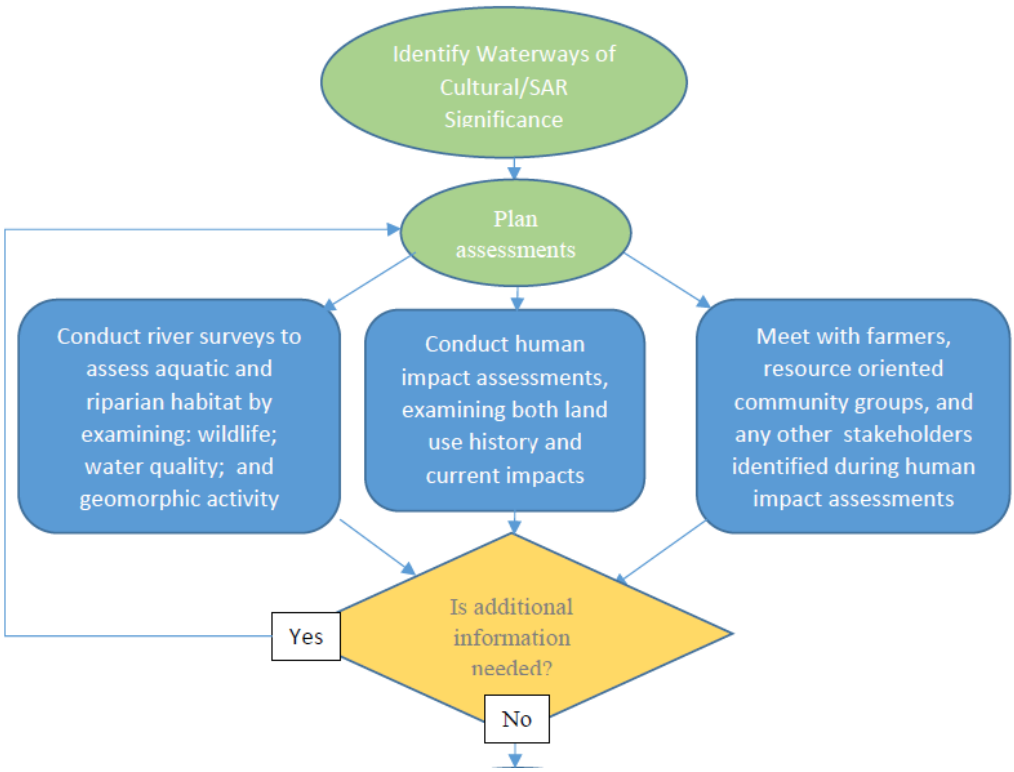

Figure 19: Stewardship Planning Process Part 1: Needs of the River

Applying such information, project selection can then proceed along the flowchart presented in Figure 20, where once identified, potential projects can be ranked according to their anticipated impact and viability. Viability is determined in part by the costs and benefits of the project, but is also dependent upon landowner interest, which comes from (to the extent practical) incorporation of landowner input into planning the project so that it is consistent with the landowner's needs.

Following this two-part selection process not only aids in decision making within the organization, doing so subsequently builds the case for any individual project when pursuing resources from outside the organization to undertake it, by providing the evidence to explain to others why it is necessary. This also creates further opportunities for outreach and engagement with landowners, through accessing and participating in existing social networks. Only once a project has been determined to be both worthwhile and feasible through this process should it then proceed to the design phase.

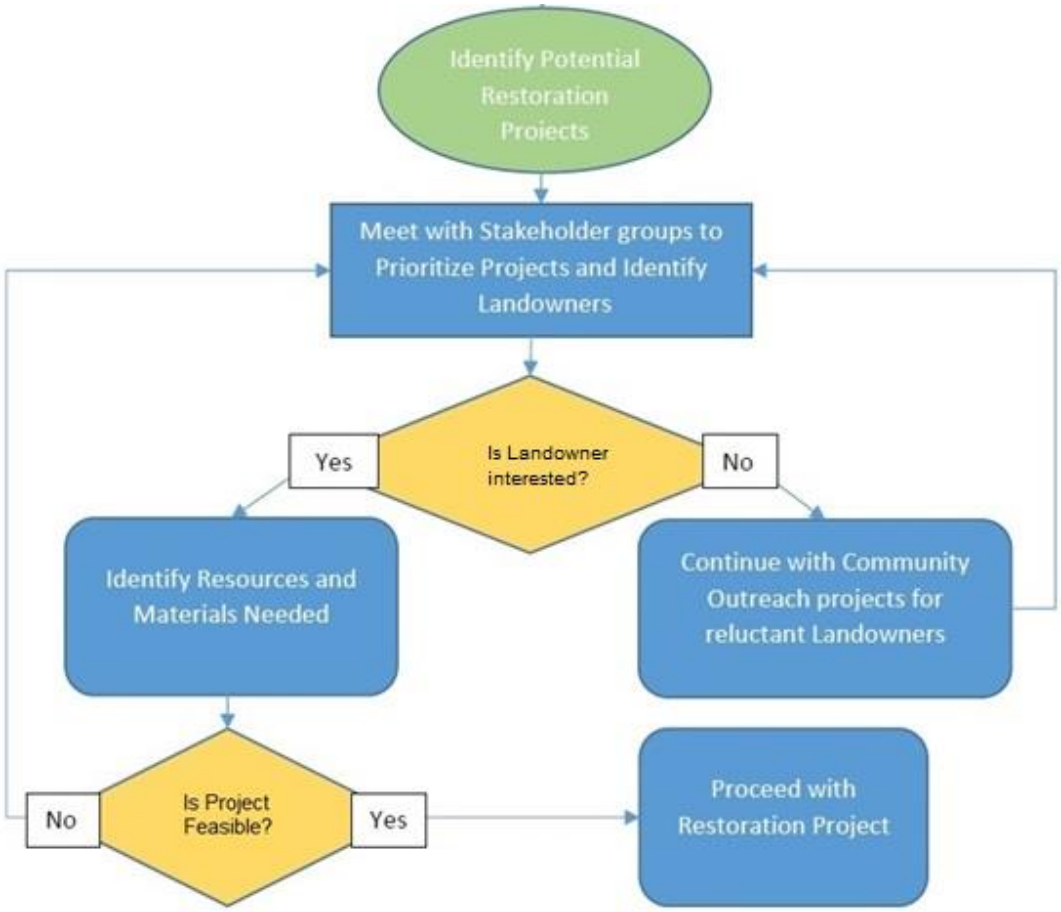

Figure 20: Stewardship Planning Process Part 2: Meeting Landowner Needs

Given finite resources, the value of a project with regards to advancing salmon recovery is one of the strongest considerations in prioritizing project selection within the Petitcodiac watershed as a whole. The detection of numerous iBoF Atlantic salmon redd sites in both the Little River and the Pollett River from 2011 onward demonstrates the importance of the spawning gravel in both Petitcodiac tributaries. Consequently, work within those tributary watersheds is of necessity, a greater priority than undertaking along the North River. Projects here would come at the expense of undertaking similar projects elsewhere that, regarding salmon recovery, are likely to yield greater benefits.

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Checklist for projects in Atlantic Salmon (*Salmo salar*) habitat

1). Determine if there are any obvious downstream natural or manmade barriers to fish passage (waterfalls, dams, perched culverts, etc) that could prevent salmon from accessing the site.
☐ Done Comment_____

2). If manmade barriers are found, note them for possible future action, or, if practical, consider mitigating them as part of the current project.
☐ Done ☐ Does not apply Comment_____

3). Even where such barriers exist, electrofish or otherwise sample the site to confirm current presence or absence of salmon as part of project planning, prior to any modification of site.
☐ Done Comment_____

4). If no salmon are found and the reason is determined to be a natural barrier, reconsider the need for the project. Perhaps the site should not be considered a priority unless reasons other than promotion of salmon are motivating factors, as resources might be better used elsewhere.
☐ Done ☐ Does not apply Comment_____

5). If no salmon are found at the site but there is no barrier to fish passage (manmade or natural) it is likely that this is a result of the declining population of wild salmon in the region. If salmon are found elsewhere on the river then treat the site as if it has salmon. If no salmon are found in that river then reevaluate the need for the project as resources might be better used elsewhere.
☐ Done ☐ Does not apply Comment_____

6). Plan project thoroughly and allow sufficient lead time to secure necessary permits and schedule work during optimal work conditions. This will help minimize the duration of in stream work, reduce negative impacts, and control costs.
☐ Done Comment_____

7). In sites where salmon are found, observe an operating window of July 1st to September 30th to time any earth moving operations between the end of alevin emergence and the start of spawning.
☐ Done ☐ Does not apply Comment_____

8). In sites where salmon are found, always assume that juveniles and / or migrating adults are present while doing any work during the operating window allowed in item 7. The window indicates reduced sensitivity of fish, not their absence. Care must still be taken to minimize direct harm to fish during work.
☐ Done ☐ Does not apply Comment_____

9). Incorporate erosion and sediment control practices into work plan as laid out in Section 3 of DFO's Land Development guidelines for Protection of Aquatic Habitat (http://www.dfo-mpo.gc.ca/Library/165353.pdf)
☐ Done Comment_____

10). Retain riparian vegetation to protect natural stream conditions and structure and promote stability of the bed and banks. Doing so maintains shade, water temperatures, dissolved oxygen, food supplies, organic debris, cover etc.
☐ Done Comment_____

Checklist for projects in American Eel (*Anguilla rostrata*) habitat

1). Determine if there are any obvious downstream natural or manmade barriers to fish passage (waterfalls, dams, perched culverts, etc) that could prevent eels from accessing the site.
☐ Done Comment_____

2). If manmade barriers are found, note them for possible future action, or, if practical, consider mitigating them as part of the current project.
☐ Done ☐ Does not apply Comment_____

3). Even where such barriers exist, electrofish or otherwise sample the site to confirm current presence or absence of eels as part of project planning, prior to any modification of site.
☐ Done Comment_____

4). Evaluate and estimate quantity and quality of watershed upstream of site for value to eels to better understand and document potential impacts of any gain or loss of access
☐ Done Comment_____

5). Where upstream habitat warrants it, ensure that project design will not create a barrier to eel passage when complete. The best means of maintaining unobstructed passage will be site and project specific, varying significantly between fords, dams, culverts etc.
☐ Done ☐ Does not apply Comment_____

6). If the project site is within 200 meters of the head of tide then time operations for July and August if possible in order to minimize risk of direct harm to elvers migrating upstream (May/June) and eels migrating downstream (September) that could be concentrated and sheltering amid substrates.
☐ Done ☐ Does not apply Comment_____

7). If the project site is more than 200 meters beyond the head of tide then if possible avoid operations during September in order to minimize risk of direct harm to eels migrating downstream that could be concentrated and sheltering amid substrates.
☐ Done ☐ Does not apply Comment_____

8). The primarily way that humans spread the swim bladder nematode (*Anguillicola crassus*) is by moving infected eels into unimpacted watersheds. Most restoration projects pose no risk of this. None the less, understand the nematode's lifecycle, and ensure that the project avoids spreading it.
☐ Done Comment_____

Checklist For Projects in Wood Turtle (*Glyptemys insculpta*) habitat

1). Conduct series of 3 surveys of the site and surroundings at appropriate time of year (spring is best) to determine presence of turtles as part of project planning, prior to any modification of site.
☐ Done Comment_____

2). In addition to looking for individual turtles, assess project site (and surrounding area) to identify turtle nesting sites (best done during nesting season (May/June) the prior year).
☐ Done Comment_____

3). Consider value of site for turtles (if present) relative to other species: stream bank stabilization may benefit salmon, but harm turtles. On a non salmon bearing stream that is home to turtles, taking no action may be the best management.
☐ Done ☐ Does not apply Comment_____

4). Be aware that shortly prior to nesting females concentrate in undisturbed sites adjacent to nest sites, so minimize impacts on the immediate surroundings of nest sites during nesting season.
☐ Done ☐ Does not apply Comment_____

5). If turtles or nest sites are present then plan to conduct restoration activities at both time of year and time of day to try to avoid encounters with turtles.

Time of year	Stage	distance from water	habitat use	most active
Jan/Feb/Mar	hibernating	in pools	in stream	not active
Late Mar/Apr	pre nesting	100 m	aquatic	morning & late afternoon
May /Jun	nesting	3km +	terrestrial	morning & early evening
Jul/ Aug/Sep	post nesting	100 m	aquatic	morning
October	pre hibernation	100 m	aquatic	morning & late afternoon
Nov/Dec	hibernating	in pools	in stream	not active

☐ Done ☐ Does not apply Comment_____

6). If turtles are present, do not stabilize or vegetate any sites that possess ALL of the following characteristics, as these may be nest sites:

a) full sun exposure to afternoon / evening sun (SW aspect)
b) slope less than 40 degrees (nests usually atleast 1.5 m above water surface)
c) sand or sand gravel substrate with little or no ground vegeation (>20% cover)

☐ Done ☐ Does not apply Comment_____

7). If intervention on nesting sites is unavoidable, then mitigate:

- time work either prior to nesting or after hatching (either April or November) if possible, to avoid destroying existing nests
- create compensatory habitat (witch characteristics of item 6: a, b, & c) nearby

☐ Done ☐ Does not apply Comment_____

8). If manipulating project site in turtle habit in July or August and air temps remain over 26° C, search directly affected portions of site for estivating turtles prior to beginning operations.
☐ Done ☐ Does not apply Comment_____

9). Maintain access across finished project site to adjacent suitable nest sites- a low profile wood structure with sod cap is preferable to large rocks or other material that results in slippery surface
☐ Done ☐ Does not apply Comment_____

10) If project has increased human access to site, protect nests with predator exclusion boxes, as human activity increases the density of nest predating species like raccoons and skunks.
☐ Done ☐ Does not apply Comment_____

Checklist for projects in Brook Floater (*Alasmidonta varicosa*) habitat

1). Plan project thoroughly and allow sufficient lead time to carry out necessary site surveys, secure required permits and schedule work during optimal conditions.

☐ Done Comment _____

2) . Compare site to the Petitcodiac map of distribution and abundance of brook floater (https://www.biodiversitylibrary.org/item/108793#page/347/mode/1up) (Hanson and Locke 2001, Canadian Field Naturalist 115(2) 329-340). This habitat lies along the main stem of the Petitcodiac (above the head of tide), and the lower portions of the Little River, and the North River.

☐ Done ☐ Does not apply Comment _____

3). If the site lies within the area identified in #2 then, prior to disturbing it, survey (snorkel or viewing buckets as conditions warrant) to determine if brook floater is present at the site or within 100 metres downstream. Ideal time is June to September (water levels low, turbidity minimal, light penetration best) to allow completion of the work before falling leaves obscure the river bottom in autumn.

☐ Done ☐ Does not apply Comment _____

4). If surveys detect brook floaters at or near the site, then ensure that all subsequent survey work and subsequent long term monitoring (electrofishing, CABIN, etc.) is conducted in a manner consistent with such awareness in order to avoid or minimize impacts on brook floaters.

☐ Done ☐ Does not apply Comment _____

5). If brook floaters detected near site then fording heavy equipment or carrying out in-stream work is problematic. Consult authorities (NB DELG, DFO) as part of WAWA process, and consider alternatives.

☐ Done ☐ Does not apply Comment _____

6). During earthmoving activities with equipment working along the river bank, incorporate erosion and sediment control practices into work plan as laid out in Section 3 of DFO's Land Development guidelines for Protection of Aquatic Habitat (http://www.dfo-mpo.gc.ca/library/165353.pdf)

☐ Done Comment _____

7.) Retain and if possible enhance riparian vegetation, to protect natural stream conditions and promote the structure and stability of the bed and banks. A healthy riparian zone maintains shade, retains sediment, and filters nutrients keeping them out of aquatic ecosystems.

☐ Done Comment _____

8). If cattle are present, measures to protect newly planted vegetation by excluding cattle (i.e. fencing) will also protect brook floaters. Open access to streams by cattle can cause direct mortality to mussels by trampling of mussel beds and lead to habitat degradation through sedimentation and eutrophication.

☐ Done ☐ Does not apply Comment _____