10.0 WILDLIFE AND WILDLIFE HABITAT

Wildlife and wildlife habitat includes wildlife (fauna) and the habitats that support wildlife species. This valued component (VC) is focussed on birds, mammals, amphibians, reptiles, and certain arthropods with terrestrial components of their life-cycle, as well as the habitats that support them. The Options have the potential to interact with wildlife and wildlife habitat by changing terrestrial and aquatic habitats or populations of wildlife. Particular focus is placed on Species at Risk (SAR) and Species of Conservation Concern (SOCC) and their habitats. SAR/SOCC are often susceptible to changes in the environment and are therefore useful indicators of ecosystem health and regional biodiversity.

The aquatic environment is reviewed in Section 8; vegetation communities and wetlands are reviewed in Section 9; surface water is reviewed in Section 6. Specific vegetation or wetland communities are discussed in this VC if they provide important wildlife habitats, are managed for wildlife, or may be affected by changes related to one of the Options.

10.1 SCOPE OF THE REVIEW

10.1.1 Why Wildlife and Wildlife Habitat is a Valued Component

Wildlife and wildlife habitat is a VC because the environment around the Saint John River supports terrestrial wildlife and is important to the public for the biodiversity it supports, including furbearers and game species.

The focus on SAR/SOCC is based on the potential sensitivity of their populations to changes in the environment. Game species and furbearers are addressed due to their importance to local people and the economy.

10.1.2 Regulations and Policies Relevant to Wildlife and Wildlife Habitat

The following provincial and federal regulatory and policy instruments, among others, are intended to protect wildlife populations and their habitats:

- *Migratory Birds Convention Act* (*MBCA*);
- New Brunswick *Fish and Wildlife Act;*
- federal *Species at Risk Act* (*SARA*); and
- New Brunswick *Species At Risk Act* (NB *SARA*).

These are discussed further below.

10.1.2.1 Migratory Birds

Migratory birds are protected federally under the *MBCA* and its regulations; specifically those species listed in the Canadian Wildlife Service (CWS) Occasional Paper No. 1, *Birds Protected in Canada under the Migratory Birds Convention Act* (CWS 1994). The Act and regulations state that no person may

disturb, destroy or take/have in their possession a migratory bird (alive or dead), or its nest or eggs, except under authority of a permit. The purpose of the *MBCA* is to protect and conserve migratory bird populations and individuals and their nests. Migratory birds that are protected under the *MBCA* in Canada, and that are relevant to the Project, include:

- waterfowl (*e.g.*, ducks and geese);
- rails (*e.g.*, coots, gallinules, sora and other rails);
- shorebirds (*e.g.*, plovers and sandpipers); and
- songbirds (*e.g.*, thrushes and warblers) (CWS 1991).

Birds not addressed under federal jurisdiction include grouse, quail, pheasants, ptarmigan, hawks, owls, eagles, falcons, cormorants, pelicans, crows, jays and kingfishers. Most birds not included in this list are protected under provincial laws (*e.g.*, New Brunswick *Fish and Wildlife Act*).

Because there are no authorizations to allow construction-related interactions with migratory birds and their nests, best management practices (*e.g.,* avoiding clearing activities during the breeding period) must be followed to prevent contravention of the *MBCA* under any of the three Options.

10.1.2.2 Fish and Wildlife Act

The New Brunswick *Fish and Wildlife Act* protects all fish and wildlife species (including all vertebrate animals or birds) from angling, hunting, trapping and other forms of intentional take, except under the authority of permits or licences. The Act also prohibits the disturbance, gathering or collection of the nests or eggs of any bird species, except under the authority of a permit. Under Section 4 of the Act, some wildlife and bird species (including American crow, double-crested cormorant and European starling) may be taken if they present a risk of injury to landowners, or a risk of property damage, but this requires a separate permit.

10.1.2.3 Species at Risk and Species of Conservation Concern

Species at Risk (SAR) are defined in this CER as species listed as Extirpated, Endangered, Threatened, or Special Concern under the NB *SARA* or federal *SARA*, or by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The purposes of the NB *SARA* and federal *SARA* are to prevent wildlife species from becoming extinct (extirpated); to provide for the recovery of species that are Extirpated, Endangered, or Threatened; and to manage species of Special Concern to prevent them from becoming Endangered or Threatened. While only species listed as Extirpated, Endangered, or Threatened in Schedule 1 of the federal *SARA* and those species listed under Schedule A of the *Prohibitions Regulation* of NB *SARA* currently have regulatory protection, the definition above also includes those species on the NB *SARA List of Species at Risk Regulation* and those listed by COSEWIC that are candidates for further review and may become protected within the timeframe of this Project. The federal *SARA* is co-administered by Environment Canada, Parks Canada Agency, and Fisheries and Oceans Canada. NB *SARA* is administered by the New Brunswick Department of Natural Resources (NBDNR).

Species of Conservation Concern (SOCC) are not listed under federal or provincial legislation but are considered rare in New Brunswick and/or the long-term sustainability of their populations has been evaluated as tenuous. SOCC are typically included in the description of existing conditions (Section 10.2) as a precautionary measure, in order to reflect observations and trends in the provincial population status. For this CER, SOCC are defined as species that do not meet the above definition of SAR but have been ranked in the province by the Atlantic Canada Conservation Data Centre (AC CDC) as S1 or S2, or S3 with a Canadian Endangered Species Conservation Council (CESCC) general status rank of at risk, may be at risk, or sensitive.

10.1.3 Area of Review

The area of review includes the Mactaquac headpond, which is defined by NB Power as extending from the Mactaquac Generating Station (the Station) to approximately 97 km upstream of the Station near the Town of Hartland, and further extending 63 km downstream of the Station to approximately the TransCanada Highway bridge in Coytown near the Village of Gagetown. Laterally, it also includes a 500 m buffer on either side of the Saint John River (Figure 10.1). This area of review is the same as that used in the discussion of interactions with vegetation and wetlands.

10.1.4 Key Issues

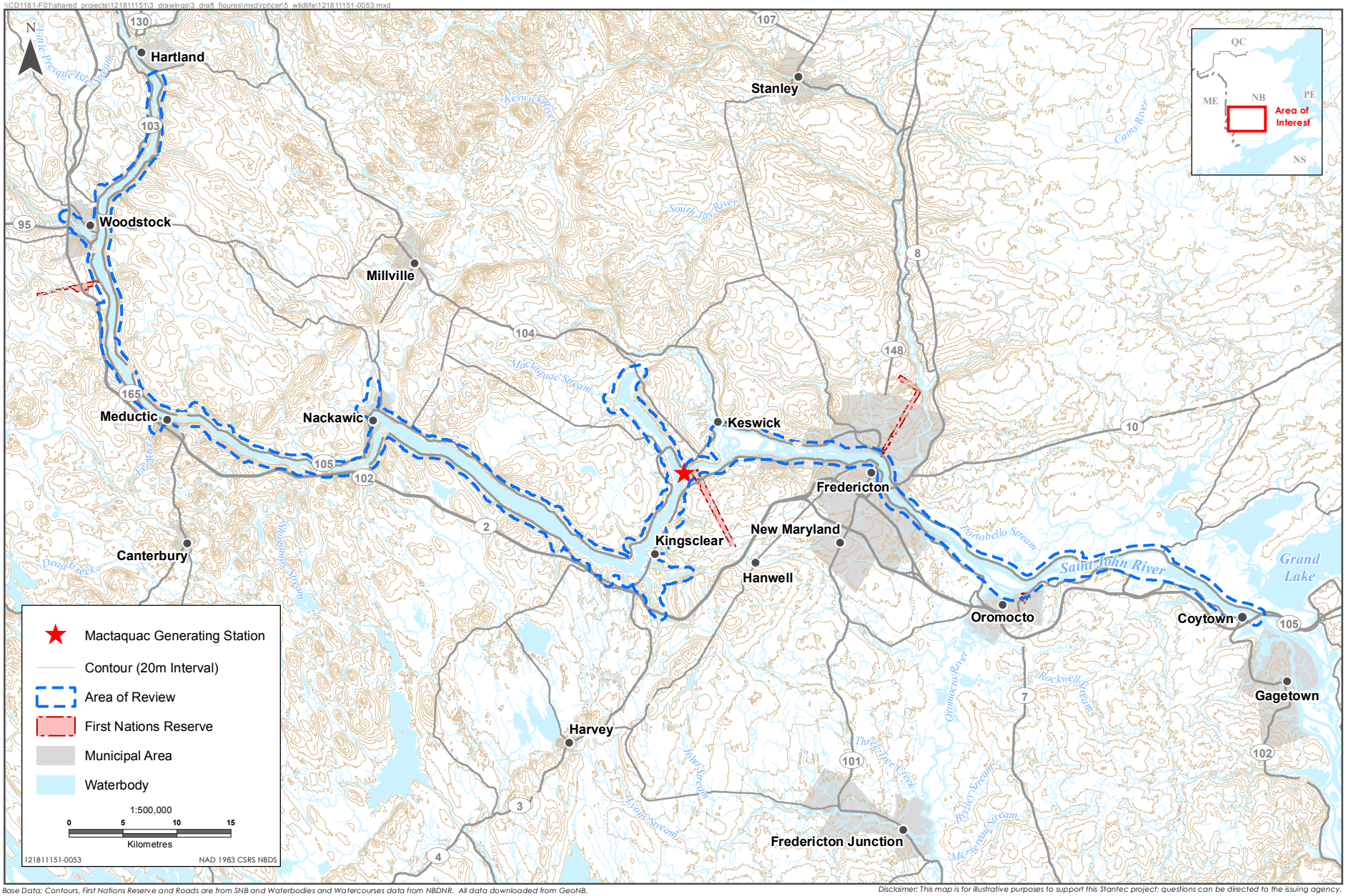
Interactions of the Options with wildlife will be limited mainly to species that depend highly on aquatic and riparian habitats during their life cycle. The interactions with the following are considered:

- wildlife species and habitat features that are identified or protected as important or sensitive, either through legislation or the assessment of recognized conservation organizations; and
- wildlife species or habitat features that may be affected by anticipated changes to the degree that the sustainability of their populations might be compromised.

Based on these considerations, three key issues have been identified (Table 10.1).

Table 10.1 Key Issues for Wildlife and Wildlife Habitat

Key Issue	Description
Potential change in wildlife habitat	• Change in hydrology upstream and downstream of the Station, affecting wildlife habitats. • Shift from a lake-like to a river-like environment in the headpond under Option 3. • Alteration of shoreline habitat. • Change in food availability for birds immediately downstream of the Station at the outflow. • Direct loss of habitat within the construction area of disturbance for the new facilities under Options 1 or 2. • Potential gain in habitat arising from Option 3 following dewatering.
Potential change in wildlife populations	• Potential loss of some individuals within the area of disturbance.
Potential change in species at risk and/or species of conservation concern	• Interactions with SAR/SOCC as a result of changes in habitat suitability and sensory disturbance.



Base Data: Contours, First Nations Reserve and Roads are from SNB and Waterbodies and Watercourses data from NBDNR. All data downloaded from GeoNB.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Stantec

121811151 - Mactaquac Project - NB Power

Area of Review for Wildlife and Wildlife Habitat

Figure 10.1

10.2 EXISTING CONDITIONS

10.2.1 Sources of Information

The following methods and sources of information were used to characterize existing conditions:

- available data on habitats, species records, wetlands, and Environmentally Significant Areas (ESAs) from various sources including the Atlantic Canada Conservation Data Centre (AC CDC), New Brunswick Department of Environment and Local Government (NBDELG), New Brunswick Department of Natural Resources (NBDNR), and GeoNB;
- historical information on the Saint John River, including aerial photography;
- information from past research, studies or assessments conducted in the region and elsewhere (literature review); and
- the Saint John River Basin Reports (1973–78, and others).

Habitat types, as defined in landbase data acquired from NBDNR, are summarized based on land cover and tree species composition. The interactions between the Options and various upland habitat (including forested areas and wetlands) were reviewed. Important habitat locations, such as ESAs and Protected Natural Areas (PNAs), and their potential interactions with the three Options, were also reviewed.

The location and extent of current wetlands was determined by combining available data from three sources: wetlands included in the NBDNR landbase data, GeoNB and provincially significant wetlands (PSW), and the New Brunswick Hydrographic Network wetlands (the most up-to-date wetland layer maintained by NBDNR).

The potential interactions between wildlife habitat features and the three Options are summarized for each SAR/SOCC in Table 2 (attached under separate cover). The sensitivity of each SAR/SOCC to the Options is based on existing knowledge and available literature. For each Option, the nature of potential interactions and the amount and direction of anticipated change were estimated. Only species that could experience interactions in a manner that could compromise their sustainability are considered for detailed analysis.

10.2.2 Description of Existing Conditions

The Saint John River watershed drains an area of approximately 55,000 km^2 (MacLaren 1979). The drainage basin extends from northern Maine and eastern Québec down through western New Brunswick where it drains into the Bay of Fundy (CRI 2011). In New Brunswick, there are three hydroelectric generating stations directly on the Saint John River: the Mactaquac Generating Station is located 19 km upstream from Fredericton, the Beechwood Generating Station is 160 km upstream of Fredericton, and the Grand Falls Generating Station is in Grand Falls, approximately 220 km upstream of Fredericton (Acres 1975). There are other generating stations on tributaries to the Saint John River.

More than 80% of land in the Saint John River basin is forested. The remainder has similar amounts of agricultural land and open wetlands (NBDOE 2007). Land cover data are summarized in Table 10.2. This information was first presented in the Vegetation and Wetlands Section (Section 9).

Table 10.2 Land Use Types within the Area of Review

Land Use Type	Upstream of the Generating Station (%)	Downstream of the Generating Station (%)	Total in the Area of Review (%)
Forested	36.2	19.5	30.3
Agriculture	10.3	22.8	14.8
Riparian mineral shore	0.3	0.8	0.5
Wetlands	0.8	5.0	2.3
Watercourses and waterbodies	37.7	35.2	36.8
Developed	14.6	16.7	15.4
TOTAL	**100**	**100**	**100**

Source: NBDNR (2013)

Three Ecoregions occupy most of the watershed: Central Uplands in the north, Valley Lowlands in the central and lower portions of the basin, and Grand Lake Lowlands in the lower reaches (Zelazney 2007).

The area of review spans the Meductic Ecodistrict (specifically in the southern portion of the Valley Lowlands Ecoregion) and the Aukpaque Ecodistrict (in the Grand Lake Lowlands Ecoregion).

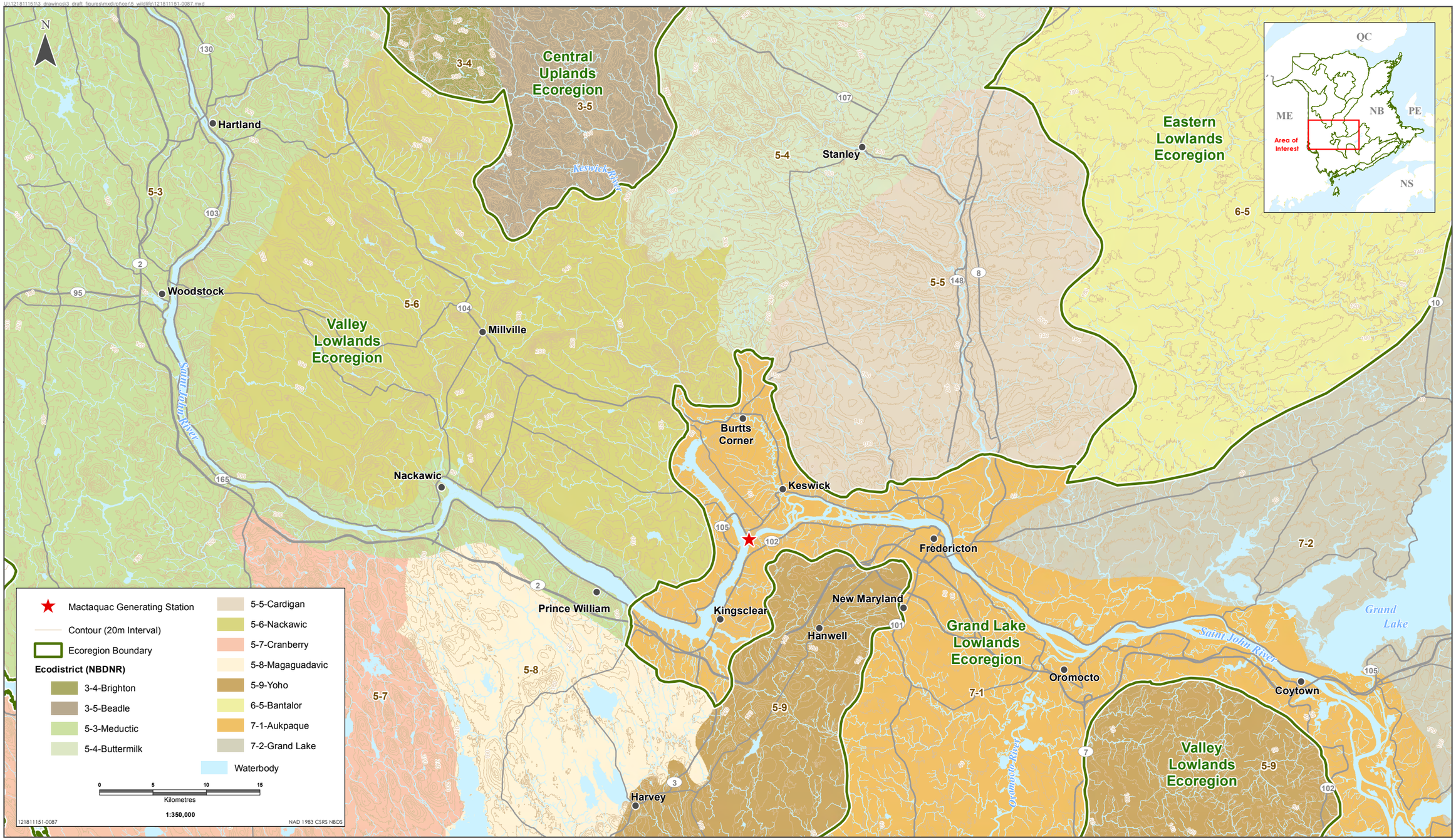
Did you know?

New Brunswick has seven ecoregions including the Highlands, Northern Uplands, Central Uplands, Fundy Coast, Valley Lowlands, Eastern Lowlands, and Grand Lake ecoregions. Ecoregions are defined primarily by their climatic differences as shaped by major landforms, elevation, latitude, marine influences, and broad aspect and are also distinguished on the basis of species distribution patterns influenced by the various climate-related factors (NBDNR 2007). Ecodistricts conform to major breaks in predominant rock type, glacial deposit type, relief, or elevation (NBDNR 2007).

The majority of the headpond is located within the Valley Lowlands Ecoregion (Figure 10.2). The Valley Lowlands Ecoregion is the largest ecoregion in New Brunswick, stretching from Edmundston southward to Passamaquoddy Bay, and from the Maine Border eastward to the Petitcodiac River. Much of the ecoregion flanks the upper and middle Saint John River valley. This region is diverse, and contains a large assemblage of vegetation species with southern affinities.

The area downstream of the Station is within the Grand Lake Lowlands Ecoregion, which encompasses the Grand Lake Basin, the Oromocto River watershed, and the lower Saint John River and its flood plains, from just upstream of the Station at Mactaquac. The most distinguishing features of this region are its floodplains and the warmest climate of any ecoregion in New Brunswick. The warm climate and rich soils support a number of plant and wildlife species at their northeastern range limit such as basswood (*Tilia Americana*), green ash (*Fraxinus pennsylvanica*), buttonbush (*Cephalanthus occidentalis*), cobblestone tiger beetle (*Cicindela marginipennis*), grey tree frog (*Hyla versicolor*), rough-legged hawk (*Buteo lagopus*), and black tern (*Chlidonias niger*). The lower section of the river from the city of Saint John upstream to the Station is tidal (SJRBB 1973a). The tidal portion of the river includes large flood plain storage areas as well as several islands with a mixture of important wetland and upland habitats.

U:\121811151\3_drawings\3_draft_figures\mxd\rpt\cer\5_wildlife\121811151-0087.mxd



Base Data: Contours and Roads are from Service New Brunswick and Ecoregions, Ecodistricts, Waterbodies and Watercourses data from New Brunswick Department of Natural Resources. All data downloaded from GeoNB.

Disclaimer: This map is for illustrative purposes to support this Stantec project; questions can be directed to the issuing agency.

Stantec

121811151 - Mactaquac Project - NB Power

Ecoregions and Ecodistricts in the Area of Review

Figure 10.2

10.2.3 Wildlife Habitat

The naturally formed low-lying floodplains and islands of the headpond area that were visible prior to construction of the Station are now submerged. Previously, the upstream portion of the river flowed through a wider area, but it is now more sharply confined by the steeper valley wall so that the transition between upland and water is distinct in most places. This more abrupt transition between land and water, combined with more stable water levels, has helped create an environment with minimal transitional and riparian habitat and with generally lower diversity compared to the downstream system. While the entire river system is extensively used by migrating waterfowl, other avian species and terrestrial species, there are some noteworthy differences in the availability of wildlife habitat and use of this habitat.

Downstream, the largely natural flow regime and the higher proportion of habitats that are intermediately between upland and water sustain a greater diversity of habitats relative to the headpond. While this difference is partly due to differences in landscape and tidal influence from the Bay of Fundy, the presence of the Station is an important contributing factor to this phenomenon. Important downstream wildlife habitat features include wetlands, islands, and managed or protected areas. These areas are addressed below.

10.2.3.1 Surface Water and Wetland Habitat Features

The area upstream of the Station has a lake-like character, and its flora and fauna are adapted to slow-moving water and relatively stable seasonal water levels. Because the area of islands and transitional floodplain habitat along the headpond is small, the system is less diverse (*i.e.*, it supports fewer species) than the river-like system downstream of the Station.

The use of surface water habitat by wildlife species is most often considered in the context of aquatic animals and fish, in particular. However, surface water features like the Saint John River contribute to the food chain for terrestrial species and birds, as well as for fish. Many species of birds, bats, amphibians and other wildlife rely heavily on the food energy provided by invertebrates, fish and plants that are associated with surface water and wetlands. Surface water features also play an important role in the lives of other species, including migrating waterfowl and furbearers such as beaver (*Castor canadensis*) and muskrat (*Ondatra zibethicus*). Wetlands associated with waterbodies are often the most productive and diverse habitat features; they provide essential feeding, breeding and nursery habitat for a wide range of species. Wetlands and surface water are the most noteworthy wildlife habitat features within the area of review, both in terms of total area and ecological importance.

The surface water of the Saint John River provides a high degree of connectivity between habitats, especially because it is moving water. Wildlife, plants and other organisms use that connectivity and movement to disperse, migrate and navigate. Birds travel along the river on their way to and from summer breeding grounds, plants widely disperse seeds in water, and many organisms use the movement of water to colonize new habitats.

Watercourses and waterbodies within the area of review include the Saint John River, its larger tributaries (*e.g.,* Meduxnekeag River, Eel River, Nackawic Stream, Keswick River, Nashwaak Stream, Nashwaak River and Oromocto River), and several smaller watercourses. Together they account for approximately 36.8% of the total area of review (Table 10.2). The total surface area of the headpond is 83.2 km²; the area of review downstream of the Station has 42.3 km² of surface water (Table 10.3).

Table 10.3 Key Surface Water Spatial Characteristics

Key Saint John River Features	Upstream of the Station	Downstream of the Station
Length of area of review from the Station	97 km	62 km
Wetted channel area	83.2 km²	42.3 km²
Average width/depth	740 m/26 m	600 m/6.6 m
Area of islands	0.43 km²	18.0 km²
Shoreline perimeter of islands	18.4 km	125.4 km
Total shoreline perimeter	354.6 km	236.7 km

The headpond is used as a migration route by waterfowl, including seaducks, on their way to northern breeding areas. As many as 2,000 Canada geese and 200 snow geese migrate along the headpond in spring and fall (Burrows and Cormier 2010). Migrating seabirds use the route during fall migration. A large wetland at the mouth of the Meduxnekeag River is used extensively as a stopover by migrating ducks during spring and fall (Burrows 2010). A pair of harlequin ducks (*Histrionicus histrionicus*, Endangered under *SARA*) was reported on the headpond in spring 2015 (Button, H., pers. comm., 2015). The Mactaquac Stream Basin (also known as the Mactaquac Arm) includes some of the larger wetland areas on the headpond and one of the few islands in the lower headpond. The downstream portion of the river has always been productive for waterfowl because it has vast expanses of floodplains, high spring and fall waters, and large wetland complexes. The headpond is also less productive for furbearing species than in downstream habitats (SJRBB 1973a).

The downstream portion of the area of review is well known for its importance in providing many types of bird habitat. It is also one of the most important areas for breeding and migrating waterfowl in New Brunswick and perhaps the Maritimes (Carter 1952; Mendall 1958; SJRBB 1973b; Burrows and Cormier 2010). The Canada Land Inventory (NRCan 1971) classifies waterfowl habitat quality on a range of Class 1 to Class 7, with Class 1 being the most productive. There are no Class 1 habitats in the area of review, and Classes 2, 3 and 4 comprise only 6% of the surface water habitat. However, most of the higher quality habitats are in the downstream portion of the area of review. The two best areas (Class 2) are along the lower Oromocto River and Portobello Creek to the east. Most of the surface water habitat in the area of review is rated as Class 3. The open river is not productive for breeding waterfowl, it but serves as a stopover for migrating waterfowl. The interface between land, wetland and water provide important breeding and foraging habitats for a variety of species. Waterfowl that breed in the downstream environment include blue-winged teal (*Anas discors*), American black duck (*Anas rubripes*), green-winged teal (*Anas crecca*), wood duck (*Aix sponsa*), ring-necked duck (*Aythya collaris*), and common goldeneye (*Bucephala clangula*). The wetlands of the lower Saint John River are used extensively by migrating Canada geese (*Branta canadensis*), Atlantic brant (*Branta bernicla*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), goldeneye, and many sea ducks. The area is also highly productive for muskrat (Dilworth 1966; SJRBB 1973a).

Did you know?

Riparian areas (specifically wetlands) are transitional between open water and upland habitats – this is the in-between area where water meets land. Riparian areas support a wide diversity of species, communities and functions (Naiman and Décamps 1997). The headpond area represents a lentic (lake-like) system with generally steep adjacent slopes. Therefore, it has minimal fluctuations in water flow and channel, which are necessary for maintaining riparian diversity (Naiman and Décamps 1997).

The presence of river valleys, backwater channels, varied climatic conditions, and diverse bedrock has produced a diversity of wetland types in the area of review. Many are situated in rich soils within riparian areas next to the Saint John River. Riparian wetlands support a diversity of plants and animals. Riparian wetlands are much more abundant downstream of the Station than along the headpond.

As discussed in detail in Section 9 (vegetation and wetlands), common wetland types in the area of review include aquatic bed, freshwater marsh, forested, and shrub wetlands. Within the area of review, nearly 800 ha of wetland have been mapped by various sources. This represents approximately 2.3% of the area of review, although wetland inventories for the province underestimate the area of forested wetland. Mapped wetlands tend to represent open wetlands or those that are easily interpreted from aerial imagery (*e.g.*, marshes, bogs). Of the mapped wetlands within the area of review, 78% (618 ha) are located downstream of the Station, and 22% (172 ha) are located upstream of the Station (Table 10.4); therefore, mapped wetland habitat is considerably more abundant downstream of the Station than upstream. The Grand Lake Meadows, the largest integrated wetland complex in New Brunswick and a Provincially Significant Wetland (PSW), are outside of the area of review but would add considerably to the downstream wetland area if accounted for in the wetland distribution provided in Table 10.4.

Table 10.4 Wetland Distribution

Wetland Parameter	Upstream of the Station	Downstream of the Station	Total
Total area (ha)	22,167.5	12,329.2	34,496.7
Wetland (ha)	172.2	618.4	790.6
Wetland (% of wetland upstream vs. downstream)	21.8	78.2	100.0
Wetland (% of total area in the area of review)	0.8	5.0	2.3

The function of these wetlands with respect to wildlife differs between the headpond and the downstream portion of the area of review because flow regimes and landscape differ upstream and downstream of the Station. Although wetlands are less abundant in the headpond, there are a few noteworthy wetland features that are important for wildlife, such as the marsh at the mouth of the Meduxnekeag River.

Since 1976, Ducks Unlimited Canada (DUC) (and since 1989, in conjunction with Eastern Habitat Joint Venture) has been modifying habitat within the Saint John River floodplain downstream of the Station to improve habitat for brood-rearing waterfowl. Their approach has primarily been to convert seasonally flooded wetland to impounded wetland that is permanently inundated. At least 2,000 ha of impoundment wetland have been created by DUC downstream of the Station, mostly in the vicinity of Grand Lake Meadows. These sites comprise approximately 15% of the Saint John River floodplain complex in that area, and vary in size from less than 6 ha to more than 70 ha. Controlling water levels to increase the amount of brood-rearing habitat has increased habitat use by waterfowl and other birds (Connor and Gabor 2006). Much of the seasonally flooded natural wetland area does not provide quality habitat for waterfowl broods because water levels are unstable during much of the breeding

season. Although approximately half of the available brood-rearing habitat is provided by DUC impoundment wetlands (Connor and Gabor 2006), brood-rearing habitat does not appear to be limiting waterfowl populations within the Saint John River floodplain.

Only one DUC impounded wetland is located within the headpond portion of the area of review, near Prince William.

10.2.3.2 Island Habitat Features

Several islands are located in the headpond area, but their total area within the area of review is only 0.43 km². The islands upstream of the Station within the area of review are concentrated in the upper reaches of the headpond between Hartland and Northampton, where the river still partially retains its lotic (river-like) character.

Downstream of the Station, an extensive chain of larger alluvial islands stretches from just downstream of the Station near the mouth of the Keswick River down to Coytown, and beyond. The total area of these islands within the area of review is 18 km². The islands are a defining feature of the landscape in this area, and provide community pasture lands for cattle during the summer. The islands also provide important breeding habitat for waterfowl. This area also contains the highest number of tree species and the greatest abundance of southerly plant and wildlife species in the province (NBDNR 2007). Many of the floodplain tree species, such as silver maple (*Acer saccharinum*), butternut (*Juglans cinerea*), and bur oak (*Quercus macrocarpa*) are dependent on the spring flooding. These species are scarce in New Brunswick outside of this region (NBDNR 2007).

Despite heavy agricultural development on many islands, they provide breeding habitat for several bird SAR/SOCC, including black tern, bobolink (*Dolichonyx oryzivorus*), Barrow's goldeneye (*Bucephala islandica*), common nighthawk (*Chordeiles minor*), least bittern (*Ixobrychus exilis*), marsh wren (*Cistothorus palustris*), and northern pintail (*Anas acuta*). They are also important refuges for breeding waterfowl. The SOCC cobra clubtail (*Gomphus vastus*) and SAR skillet clubtail (*Gomphus ventricosus*) (both dragonflies) have been recorded multiple times on the islands near the Grand Lake Meadows. Many islands are either fringed by or contain extensive wetland habitats. Ducks Unlimited Canada has altered many of these wetlands to improve waterfowl habitat suitability.

10.2.3.3 Managed Areas

Within the area of review, approximately half of the terrestrial habitat adjacent to the river is developed for agricultural or other uses. However, a number of habitat features that are interspersed along the length of the river are noteworthy for their importance to wildlife or for their status as managed areas that function as a refuge for wildlife. Some areas (such as Protected Natural Areas, PNAs, and Wildlife Refuges) are protected by legislation. This, combined with the importance of many of these areas to the people of New Brunswick, warrants their inclusion in this review as individual features.

The Nature Trust of New Brunswick compiled an inventory of 900 ESAs throughout the province (NTNB 2012; Tims and Craig 1995). There are 28 ESAs within the area of review. These are important for rare plants, birds, mammals, amphibians, reptiles, invertebrates, geological features, forest communities and wetlands. The ESAs, PNAs, Wildlife Refuges, and other managed areas are described below. These are also shown on the mapbook, and Table 3 (attached under separate cover).

Mactaquac Provincial Park (525 ha) is located at the mouth of the Mactaquac Stream Basin, less than 1 km from the Station. All nine species of flycatchers (birds) found in Atlantic Canada nest in the Park (Burrows 2010). Boat traffic around the marina and headpond pose threats to wildlife. Residential development along the shores of the headpond has increased in recent years following the rerouting of the TransCanada Highway (Route 2), which also disturbed riparian habitat. Waterfowl comprise a large component of Christmas bird counts at Mactaquac Provincial Park. American black duck, mallard (*Anas platyrhynchos*), common goldeneye, and common merganser (*Mergus merganser*) are regularly recorded during winter; Canada goose, Barrow's goldeneye, and hooded merganser (*Lophodytes cucullatus*) are occasionally recorded. The many Canada geese that congregate in the area migrate south before the headpond freezes.

Whip-poor-will and pine warbler have been recorded breeding at Currie Mountain, which is an ESA. This ESA is located on an ancient volcanic core, and the habitat conditions there are independent of the river hydrology.

The Mactaquac Dam ESA is an important feeding site for bald eagle and osprey; they feed opportunistically on injured or stunned fish that pass through the powerhouse turbines. Open water at the Station provides important winter habitat for a number of waterfowl species, such as American black duck, mallard, common goldeneye and common merganser (SJRBB 1973a; Burrows 2010).

In New Brunswick, there are two **bald eagle** populations; one which is a permanent resident and spends winters here, and one that annually migrates to and from the southern US (NBDNR website). Bald eagles have been endangered in New Brunswick since 1976. The species has slowly recovered and is making a comeback in New Brunswick through legislation to protect the eagle and its habitat as well as the banning of DDT and other pesticides in the 1970s (NBDNR 2008).

The Keswick Ridge Escarpment ESA is a river valley ecosystem on the north shore of the Saint John River downstream of the Station. It has a diversity of habitat types, including beach, exposed ledge and mature mixed-wood forest.

Five islands downstream of the Station (Savage, Sugar, Merrithew, Shore, and Keswick Islands), and the shore around the mouth of the Keswick River, make up the Sugar Island Group ESA. The area contains ponds and backwaters that provide important breeding waterfowl habitat. Sugar Island provides nesting habitat for Nelson's sparrow (*Ammodramus nelson*) and willow flycatcher (*Empidonax traillii*).

The Fredericton Wildlife Management Zone is a riparian area on both sides of the river, starting at the mouth of the Nashwaak River and extending down to the Princess Margaret Bridge. This area is identified as an ecologically significant area that contains a diverse mix of riparian forest, shrub, and wetland and shoreline habitats. A large number and variety of waterfowl migrate through this area, including common eider (*Somateria mollissima*), long-tailed duck (*Clangula hyemalis*), redhead (*Aythya Americana*), Eurasian widgeon (*Anas Penelope*), surf scoter (*Melanitta perspicillata*), black scoter (*Melanitta nigra*), and white-winged scoter (*Melanitta fusca*) (Burrows 2010).

The Lower Saint John River (Sheffield-Jemseg) is a nationally Important Bird Area (IBA) (Bird Studies Canada and Nature Canada 2004-2010). It includes a 25 km stretch of the river from 5 km northeast of the town of Oromocto to 25 km east of Oromocto. The area encompasses a number of ESAs: Portobello National Wildlife Area (just to the east of the area of review), Gilbert Island, Ox Island, Thatch Island, and Grand Lake Meadows. Tidal influence and extensive spring flooding in the area create a unique complex of habitats, including marshy islands, backwaters, creeks and marshes, which provide breeding habitat for the yellow rail (*Coturnicops noveboracensis*), a species listed as Special Concern under *SARA*. This area also supports a large breeding concentration of black terns, at Big Timber Lake. The only known breeding population of greater scaup in Atlantic Canada occurs in this region. Thousands of waterfowl are thought to use this IBA during migration. Skillet clubtail, a species listed as Endangered under *SARA*, has been recorded at a number of sites in the IBA.

Important Bird Areas (IBAs) are discrete sites that support specific groups of birds: threatened birds, large groups of birds, and birds restricted by range or by habitat. IBAs range in size from very tiny patches of habitat to large tracts of land or water. Canada's IBAs Program is an initiative to identify, conserve, and monitor a network of sites that provide essential habitat for Canada's bird populations (IBA Canada website). There are 26 IBAs in New Brunswick.

Gilbert Island ESA (approximately 325 ha) has a mixture of wetland and upland habitats, including marshes, sloughs, ponds, fields and forest land, which makes it ideal for nesting waterfowl. Sand spits on the upper and lower ends of the island become exposed when the water recedes in summer, which creates loafing sites for dabbling ducks.

Ox Island ESA (approximately 75 ha) is predominately fields and forest with a small area of marsh, which provides excellent waterfowl nesting habitat.

Babbits Marsh ESA (approximately 270 ha) includes floodplain wetland habitat on the south shore of the river near Gilbert Island (SJRBB 1973a). The area has three large impoundments that were built by DUC for waterfowl habitat.

Thatch Island ESA (approximately 50 ha) contains two small marshy areas, which provide good habitat for waterfowl and furbearers.

Grand Lake Meadows is the largest inland wetland in New Brunswick. The large freshwater impoundment and wet meadows provide important feeding, breeding and nesting habitat for a variety of wildlife, including amphibians, insects, birds and mammals.

10.2.3.4 Terrestrial Wildlife Habitat

The area of review contains a wide range of wildlife habitats of varying quality and function which are described in detail in the review of vegetation and wetlands (Section 9.2.2.4). Land use types (including vegetation communities) upstream, downstream, and in the area of review are summarized in Table 10.5. Further discussion is provided in Section 9.2.2.4.

Table 10.5 Land Use Types within the Area of Review

Land Use Type	Upstream of the Station (%)	Downstream of the Station (%)	Total in the Area of Review (%)
Forested	36.2	19.5	30.3
Agriculture	10.3	22.8	14.8
Riparian mineral shore	0.3	0.8	0.5
Wetlands	0.8	5.0	2.3
Watercourses and waterbodies	37.7	35.2	36.8
Developed	14.6	16.7	15.4
TOTAL	**100**	**100**	**100**

Source: NBDNR (2013)

Forested vegetation communities are summarized in Table 10.6. Further discussion is provided in Section 10.2.2.4.

Table 10.6 Forest Types within the Area of Review

Forest Type	Regenerating/Sapling (%)	Young/Immature (%)	Mature/Overmature (%)	Total in the Area of Review (%)
Hardwood	5.9	19.8	19.2	44.9
Mixedwood	0.5	8.3	11.5	20.3
Softwood	0.3	12.7	13.0	26.0
Plantations	0.2	–	–	0.2
Shrub	0.9	3.0	0.0	3.9
Unknown	4.7	0.0	0.0	4.7
TOTAL	**12.5**	**43.8**	**43.7**	**100.0**

Source: NBDNR (2013)

Within the area of review, approximately one third of the area is surface water, one third is forested, and one third is either agricultural or developed in some other way. In the historically forested landscape of New Brunswick, typical native terrestrial wildlife species depend on forest habitat. Species that are most sensitive to change and threatened by human development depend on mature forest for some component of their life cycle. Most forested habitats (44.9%) are deciduous forest types. The amount of forested habitat in a young and immature age class (43.8%) is similar to that in a mature and overmature age class (43.7%).

10.2.4 Species at Risk and Species of Conservation Concern

Twenty-one SAR and 42 SOCC have been historically identified within the area of review. A greater proportion of SAR/SOCC has been recorded downstream than upstream of the Station: 31 species have been recorded exclusively within the area of review downstream of the Station. The Project will likely have some limited interaction with many SAR/SOCC; however, only those species that have the most potential of being affected at the population level, or those that are protected under legislation (*i.e.*, *SARA* or NB *SARA*), are reviewed. Of the 63 SAR/SOCC with records of occurrence in the area of review, seven were considered to have the potential for a noteworthy interaction with any of the

Options. The predicted responses of species within the area of review to the Options are described in Table 2 (attached under separate cover).

Some SOCC, including Barrow's goldeneye, black tern, least bittern, northern pintail, and several dragonfly species, are associated with transitional habitats that occur exclusively in the downstream environment. Of the SAR/SOCC recorded in the area of review, two have been recorded exclusively in the headpond area and 31 have been recorded exclusively in the downstream portion of the area of review. The endangered cobblestone tiger beetle may have been widespread along the river in the headpond area prior to construction of the Station (Environment Canada 2013c).

10.3 SUMMARY OF STANDARD MITIGATION FOR WILDLIFE AND WILDLIFE HABITAT

Standard mitigation and best management practices that are relevant to the wildlife and wildlife habitat VC will be implemented for each Option. These measures (summarized below) are based on normal operating procedures and regulatory requirements as discussed in Section 2.6.

- Existing infrastructure and previously developed areas (*e.g.,* existing roads and bridges) will be used where feasible to reduce additional site clearing.
- Clearing activities will be restricted to the area needed for site development and operation.
- Environmentally sensitive features will be identified and clearly marked (*e.g.,* watercourses, wetlands, locations of SAR/SOCC, protected areas, areas of high archaeological potential).
- All equipment will be maintained in good working order to maintain noise suppression.
- Food and food waste will be stored and disposed of properly to avoid attracting wildlife.
- Natural vegetation buffers will be maintained, where feasible, around wetlands and riparian zones. Watercourse and wetland buffers will be at least 30 m wherever feasible.
- Whenever feasible, clearing activities will be scheduled outside the normal breeding season of migratory birds (generally April 1 to August 31).
- Vehicles will yield to wildlife and will be operated at appropriate speeds.
- Clean, coarse fill will be used for grading to avoid introducing or spreading exotic or invasive plant species.
- Construction machinery will be cleaned before entering and leaving the site to avoid introducing or spreading exotic or invasive plant species.
- Ground disturbance will be avoided, where feasible, in wetland areas to avoid environmental effects like erosion, sedimentation and the spread of exotic or invasive plants.

10.4 POTENTIAL INTERACTIONS BETWEEN WILDLIFE AND WILDLIFE HABITAT AND THE OPTIONS

Table 10.7 provides an overview of how the Options might interact with wildlife and wildlife habitat.

Table 10.7 Potential Interactions between Wildlife and Wildlife Habitat and the Options

Phase	Option 1			Option 2			Option 3		
	Potential Change in Wildlife Habitat	Potential Change in Wildlife Populations	Potential Change in Species at Risk and/or Species of Conservation Concern	Potential Change in Wildlife Habitat	Potential Change in Wildlife Populations	Potential Change in Species at Risk and/or Species of Conservation Concern	Potential Change in Wildlife Habitat	Potential Change in Wildlife Populations	Potential Change in Species at Risk and/or Species of Conservation Concern
Construction (new facilities, Option 1 or Option 2)	✓	✓	✓	✓	✓	✓			
Demolition (existing structures, Option 1 or Option 2)	✓	✓	✓	✓	✓	✓			
Operation (Option 1 or Option 2)	✓	✓	NI	✓	✓	NI			
Decommissioning (Option 3)							✓	✓	✓

Notes:
✓ = Potential interactions.
NI = No interaction.
Shaded cells are not applicable to the particular option and phase.

No change to SAR/SOCC is anticipated as a result of the operation of Option 1 or Option 2, as operation is expected to be largely similar to existing conditions. Some changes to food abundance are expected as a result of potentially improved fish passage, which may cause an indirect change; this is discussed as part of wildlife habitat.

10.4.1 Potential Change in Wildlife Habitat

Because Options 1 and 2 include many of the same activities and are of similar nature and duration, the potential interaction between wildlife and wildlife habitat and Option 1 or Option 2 is expected to be similar for both options. They are thus evaluated together, below.

10.4.1.1 Option 1 or 2

The construction and demolition phases of Option 1 or Option 2 are expected to interact with wildlife habitat surrounding the Station. This will occur through excavation along the right bank of the Saint John

River, and to a lesser extent, through potential sedimentation resulting from construction and demolition activities.

The Mactaquac Dam ESA (1.5 km downstream of the Station) may be subject to increased noise and dust resulting from construction activities. SAR/SOCC that might nest and forage nearby, such as bank swallow, bobolink and bald eagle, might be discouraged from using the area.

The habitat within areas of disturbance is a mix of agricultural land (fallow pasture), developed land (industrial and rural settlements), and young to immature-aged forests (dominated by poplar-hardwood, white spruce and non-commercial species). These habitats are within the areas of disturbance associated with the new main spillway and approach/discharge channel under Options 1 and 2, and the new powerhouse under Option 1. Habitats in these areas are expected to be completely lost. However, these habitats likely do not have high value as habitat for wildlife, and are not a limiting factor on wildlife populations that use the area of review.

Following construction and demolition, the surface water flow regime will change as the flow of the Saint John River is redirected. This may cause changes in local water velocities, which may increase local erosion in some areas. Physical disturbance associated with site preparation and excavation will also produce sediment from erosion and runoff, which may be released into the river.

Indirect interactions with wildlife habitat quality, including in the Mactaquac Dam ESA (1.5 km downstream of the Station), will result from increased noise and dust produced by construction and demolition activities. Species that may nest and forage nearby, such as bank swallow (*Petrochelidon pyrrhonota*), bobolink, and bald eagle (*Haliaeetus leucocephalus*), might avoid using the area during construction and demolition.

The operation of improved fish passage and modern turbine systems may reduce the number of live fish that linger on the downstream side of the Station, and are also expected to reduce the number of dead or injured fish that surface in that area, both due to improved passage. This area is an important foraging site for many fish-eating species such as osprey (*Pandion haliaetus)*, bald eagle, gulls (*Larus sp.*), and cormorants (*Phalacrocorax sp.*). To highlight the importance of this site to bald eagles and osprey, an Environmentally Significant Area (ESA) has been identified in the area immediately downstream of the existing powerhouse because it provides a local abundance of food. While the reduction or cessation of fish kills or fish impairments downstream of the existing powerhouse will ultimately be beneficial for the river system as a whole, this localized change will result in a long-term reduction in the quality of local habitat for bald eagles. However, this is not expected to lead to reduced survival of birds that forage in this area.

The operation of Options 1 or 2 will be similar to current conditions, except power generation will not occur under Option 2. The same maximum and minimum water levels will be maintained in the headpond as currently exist. During this phase, no new interactions with wildlife habitat are anticipated, except for reduced fish mortality and the associated reduced forage habitat quality downstream of the Station. However, the continued interruption in natural sediment transport could continue to affect the downstream environment.

The wide, low-lying floodplain of the Grand Lake Meadows area is largely a product of long-term sediment transport and deposit from upstream that occurs during spring freshets (SJRBB 1973a).

Sediment-laden floodwaters are slowed by the opposing tidally-influenced waters in this area, which causes seasonal deposition of sediment. Although sediment transport modelling for the Options is not yet complete, dams and associated headpond areas are known to decrease downstream sediment and nutrient transport (Gregory *et al.* 2002). A change or loss of important wildlife habitat within the downstream environment could continue to occur over the long-term. This could affect species that depend on islands and wetlands, such as invertebrate SAR and waterfowl.

Historical maps were analyzed to identify changes in shoreline features in the Grand Lake Meadows area over time, but no significant changes were noted (McGrath 2013).

10.4.1.2 Option 3

Option 3 activities include decommissioning and removal of the powerhouse, main spillway, diversion sluiceway and associated infrastructure, and removal of the earthen dam. The headpond will be lost, and that section of the Saint John River will revert to near natural flow conditions. Loss of the headpond will result in lower water depth and width, and increased water velocity. Suspended sediments may increase within the water column. These changes will likely be most pronounced immediately upstream of the Station, and will decrease with increasing distance upstream of the Station. Loss of the headpond will have two main interactions with wildlife habitat: it will lower the water table in adjacent riparian habitats, and it will expose previously submerged substrates, where new habitats will develop. The change in hydrology under Option 3 will affect riparian and open water habitats.

Natural riparian habitats are diverse and complex, and the zone between terrestrial and freshwater ecosystems are particularly sensitive to environmental change (Naiman and Décamps 1997). Riparian areas are subject to a cycle of natural disturbance that is unique for terrestrial systems. Many wildlife species have adapted to specific spatial and temporal relationships between riparian and aquatic habitat features along river systems. Riparian areas often have structurally diverse woody vegetation, which provides refuge for high densities and different species of birds, small mammals, amphibians and reptiles. These areas also provide highly productive vegetation that is consumed by ungulates (moose and deer), insects and other plant-eating wildlife. White-tailed deer have been found to use riparian areas at twice the rate of other habitats. While minor interactions may occur with many species, only species that breed and live on or near the river for some portion of their life cycle are likely to be affected, and populations of most wildlife species in New Brunswick are not limited by riparian conditions along the Saint John River or by the flow regimes of the headpond.

The various mechanisms by which Option 3 would be expected to interact with wildlife habitat are further described in the following sections.

10.4.1.2.1 Surface Water and Wetland Habitat Features

Under Option 3, mild to moderate changes in vegetation and wildlife species composition will likely occur in many habitat types as water levels are lowered. These changes will be most notable in wetland communities. Changes to wetlands are discussed in detail in Section 9 (vegetation and wetlands). In general, only the wetland features in the Mactaquac Arm and at the mouth of the Meduxnekeag River are anticipated to undergo negative interactions with Option 3. Wetland area is expected to increase in the headpond area, but no change in total wetland area is expected downstream of the Station. Although the area of mapped wetlands in the headpond area will decrease, new substrates will be exposed and they will likely develop into wetlands. This will result in a net increase of these habitats. Newly created wetlands will likely take many years to develop, and will not function as highly, including as wildlife habitat, as well-established wetlands for some time because many wetland functions require mature vegetation for full functionality.

The creation of the headpond flooded several islands. Deer wintering areas, which are often concentrated in river and stream bottoms, were also lost. Many of the inundated islands were stopover points for migrating waterfowl, and provided nesting and brood-rearing habitat. Under Option 3, the re-emergence of these islands could improve productivity of the headpond area for waterfowl, although this area has never been known to be as productive as the downstream portion of the area of review. Some areas of the headpond that have faster moving water will no longer be suitable as stopover points for many waterfowl species, but they may improve for fish-eating ducks such as mergansers.

Deer Wintering Areas: As snow accumulates, deer congregate in wintering areas, commonly known as 'deer yards' which are usually located in mature softwood stands to provide protection from the blustery winds, intercept snowfall, and minimize the animal's heat loss (GNB website). New Brunswick currently manages over 800 deer wintering areas which is approximately 280,000 hectares of land for about 50,000 deer (GNB website).

Historically, 3,000 ha of the best and perhaps only noteworthy pheasant habitat in central New Brunswick was located on the islands and riverbanks that were flooded by construction of the Station (Northeast Wildlife Station file data; Choate 1973). The remaining habitat is inferior (Choate 1973). The lowering of the water level under Option 3 could partially restore pheasant populations on the floodplains and islands of the headpond area.

As the Station provides limited water-level control downstream (discussed in Section 6), it is not expected that the removal of the Station will result in a negative change for waterfowl nesting success in this respect.

Muskrats may have suffered as a result of creation of the headpond because the marsh-like habitat types they use likely declined (Choate 1973). Choate (1973) reports that local inhabitants saw large numbers of muskrats fleeing the rising water after the gates at Mactaquac were closed. Under Option 3, wetland habitat in the headpond area will likely increase, which could result in an increase in food supply. This in turn could result in an increase in the muskrat population, but the change would likely be minimal on an overall population level and difficult to discern.

Otters (*Lutra Canadensis*) and mink (*Neovison vison*), which are trapped for fur in New Brunswick, are commonly associated with river-like habitats. Removal of the Station could improve habitat suitability for these species along much of the river. However, the lack of forest cover in the riparian zone following Station removal would likely reduce habitat suitability for these and other species that require woody

cover along waterways. Therefore, these species would likely experience a negative change in the short-term, which would improve over time with the natural revegetation growth expected within the riparian zone. The long term change would likely be positive.

Vegetation growth on exposed sediments can reduce downstream sediment transport (Shafroth *et al.* 2002). However, this will happen only after substantial natural revegetation has occurred. Until then, increased transport of fine sediment, either through natural shifting or release associated with decommissioning the Station, may interact negatively with riparian habitat both upstream and downstream of the Station. The sediment released when the Station is decommissioned could deposit in downstream riparian habitats, and the force of the initial release of water could remove existing vegetation (Acker *et al.* 2008). The riparian communities in the Keswick Ridge Escarpment ESA and the Shore Island Gravel Strand ESA may be particularly vulnerable to these interactions because of their location and community composition (Table 3, attached under separate cover). Preliminary results from the MAES indicate that sediment deposition is not likely to occur in these ESAs, but increased water velocities could have negative interactions with vegetation.

Some sediments upstream of the Station may have elevated concentrations of contaminants, which depending on the volume and concentrations, may be harmful to wildlife in some localized areas. Preliminary work carried out by the CRI has not found alarming concentrations of contaminants in sediment, though some parameters (*e.g.,* arsenic, some chlorinated pesticides) have been found to be elevated in some areas in comparison to CCME guidelines. CRI's characterization of sediment quality as part of the MAES will be available separately for NB Power to consider in its decision-making regarding the Station. Based on these results and anticipated sediment deposition on SAR/SOCC habitat located further downstream of the Station, potentially affected species should be further studied, including pygmy snaketail (*Ophiogomphus howei*) and skillet clubtail (*Gomphus ventricosus*).

Large volumes of water and sediment will be released when the Station is decommissioned. Dewatering is planned to be completed in two stages, with the first stage coinciding with the end of the spring freshet. The second stage of drawdown would coincide with the fall recharge period (a seasonal period of heavier precipitation) of the same year. Because the force of the initial release of water could interact with wildlife and wildlife habitat by removing vegetation and releasing sediment, both stages of the drawdown are intended to coincide with periods during which the river environment is accustomed to higher flows and increased sediment loads. Shoreline interventions along the headpond and erosion and sediment control structures will be used to reduce the amount of sedimentation caused by Project activities.

10.4.1.2.2 Island Habitat Features

Submerged islands and submerged areas of existing islands within the headpond will become exposed under Option 3. Historical topographic maps from the 1950s were used to estimate the area of island habitat in the headpond prior to construction of the Station (Section 9.4.1 and Photos 9.1 to 9.3). Historically, there was 4.2 km² of island habitat in the headpond, where currently there is 0.4 km². Therefore, approximately 3.8 km² of island habitat was submerged following construction of the Station. It is assumed that a similar area of island habitat could be re-created under Option 3.

A review of current and historical photos indicates that many of these islands are or were similar in their structure. Most contain or will contain an area of bare substrate, wetland and some shrub or forest.

Under Option 3, portions of these islands will be subject to increased ice scour. The change in island habitat from pre- to post-Station construction represents an estimate of how much island habitat may be created (see Photos 10.1 and 10.2).

Island habitats are important to a variety of wildlife species, including SAR and SOCC, and many tend to be agriculturally-productive. Islands tend to have high species diversity and elevated occurrences of rare species (such as cobblestone tiger beetle). They provide refuge for roosting, nesting or foraging by shielding wildlife from terrestrial predators and human-related disturbances such as ATV traffic, although several are partially used for agriculture which tends to compromise their suitability for many wildlife species. Waterfowl commonly roost on islands at night, and occasionally nest and raise broods on them. Islands in the Saint John River are also commonly associated with marshy habitats where sediment deposits underlie shallow water. These habitats are valuable to aquatic life and vegetation, which provide food and habitat for wildlife species. Islands in the Saint John River provide birds, amphibians, reptiles and, to a lesser extent, small mammals with high quality food, shelter and breeding habitat. An increase in island habitats will have a positive effect on many species that use the Saint John River. Habitat could also be recovered for species such as the endangered cobblestone tiger beetle, which is thought to have inhabited the now flooded islands within the headpond.

10.4.1.2.3 Managed Areas

Potential interactions of Option 3 with PNAs, ESAs and other managed areas that provide important wildlife habitat are summarized in Table 3 (attached under separate cover). Only habitat features along the headpond are expected to change. The area of terrestrial habitat and the distance of habitat features to the water's edge of the current headpond area are expected to increase. These changes are not expected to detrimentally affect wildlife over the long term. In the short term, species that prefer mature tree cover for nesting (*e.g.*, bald eagle) or cover may be disadvantaged, but the result is not expected to change populations.

The Mactaquac Dam ESA (1.5 km downstream of the Station) is the only managed area that is expected to experience a negative interaction with Option 3. It will be subject to increased noise and dust resulting from decommissioning at the Station. SAR/SOCC that might nest and forage nearby, such as bank swallow, bobolink, and bald eagle, might be discouraged from using the area during decommissioning.

The riparian communities in the Keswick Ridge Escarpment ESA and the Shore Island Gravel Strand ESA may be particularly vulnerable to sediment movement, as described in Section 10.4.1.2.2, because of their location and community composition (Table 3, attached under separate cover). The location, mobility, and amount of accumulated sediments will be described in the MAES and through ongoing studies. Preliminary results from the MAES suggest the mass redistribution of sediment downstream during dewatering is not expected in these sensitive areas due to expected high water velocities near the Station. Shoreline interventions in the headpond and erosion and sediment control structures will be used to reduce the amount of sedimentation caused by Project activities.

10.4.1.2.4 Terrestrial Wildlife Habitats

Option 3 will result in lower water levels within the river where the headpond used to be, which will also lower the water table in adjacent vegetation communities. In the short to medium term, the lower

water level will result in exposed soils that will become vegetated with early-successional species (*e.g.,* shrubs, grasses), largely through natural revegetation processes over time.

For wildlife, there are currently mature trees at the current headpond edge that can be used for nesting, foraging, hunting, and shelter by various species. As discussed in Section 9, most of the forested habitat along the current headpond is independent of the headpond hydrology. Therefore, adjacent forested areas are not expected to experience substantial changes, although some mortality may be expected. The greater change will be that the available habitat will be located further from the water than it is currently, which will change its availability and function. This change will not be permanent since forested habitat would be expected to naturally return to the water's edge over the course of years to a few decades. Species that could be affected include cavity-nesting waterfowl, such as wood duck, common goldeneye and hooded merganser, and bald eagle and osprey, which require tall trees near waterbodies for nesting. The construction of nesting boxes and platforms for certain species in the riparian area may be considered where there is a reasonable likelihood that they will be used.

Much of the change in terrestrial wildlife habitat will be caused by lowering the water table. Different tolerance levels of plant species for soil moisture creates gradients (differences) in vegetation communities with increasing distance from water. These gradients are also affected by other factors including soil drainage, slope, frequency of flooding, and natural disturbance regimes. Much of the headpond is surrounded by well-defined banks with moderately steep slopes that rise abruptly from the headpond. As a result, there is a narrow riparian area so that much of the adjacent habitat is independent of the hydrology of the current headpond. Because only a narrow band of vegetation is subject to the hydrology of the headpond in most areas, the changes to wildlife habitat along much of the existing headpond edges are expected to be minimal under Option 3. Low lying habitats along the current headpond that are affected by water levels are described in Section 9.4.1.2 (vegetation and wetlands). It is likely that these habitat types will increase over the long-term within the newly exposed riparian area under Option 3.

While there is a potential to recover a large area of high-value native riparian wildlife habitat, there is potential for invasive species (*e.g.,* canary grass) to negatively affect the function of this habitat and impede or even prevent the development of native communities. As discussed in Section 9, after the water level recedes, newly exposed substrates will likely be rapidly colonized by herbaceous species. Mitigation such as planting/hydroseeding can help reduce, but not eliminate, the potential influx of invasive species (Orr and Koenig 2006b).

10.4.2 Potential Change in Wildlife Populations, and Potential Change in Species at Risk and/or Species of Conservation Concern

Each Option has the potential to affect many wildlife species. However, populations of common and widely distributed species are not expected to be compromised. Even among SAR/SOCC, no populations are expected to be placed at risk under any of the Options. However, in the case of protected SAR, according to federal and provincial legislation it is illegal to kill, harm or harass individuals. SAR also tend to be most vulnerable.

A large number of SAR/SOCC are known through historical observation to occur within the area of review; therefore, a high-level review was conducted to identify which species are most likely to be associated with harmful interactions. Table 2 (attached under separate cover) presents a summary of interactions between each Option and SAR/SOCC in the area of review.

This section discusses the interactions between the Options and those species that are most likely to experience noteworthy changes as a result of the Project: arthropods (skillet clubtail, pygmy snaketail, cobblestone tiger beetle, monarch butterfly) and birds (bald eagle, and bank swallow). Although no noteworthy changes are anticipated, a brief discussion on wood turtles (*Glyptemys insculpta*) is also provided to address comments and questions received on this specific species.

10.4.2.1 Option 1 or 2

Because Options 1 and 2 include many of the same activities and are of similar nature and duration, the potential interaction between wildlife and wildlife habitat and Option 1 or Option 2 is expected to be similar for both options. They are thus evaluated together, below.

The **Monarch** is a large, showy, orange and black butterfly with a wing span 93-105 mm. Its wings are mostly orange with a broad black border and two rows of circular white spots (COSEWIC 2010c). In New Brunswick, breeding occurs mainly along the banks of the Saint John River (COSEWIC 2010c).

Interactions with wildlife resulting from Option 1 or Option 2 will be confined mainly to the area immediately around the Station. Option 1 has the highest potential to cause direct mortality of SAR/SOCC because it will have the largest area of disturbance. Option 2 also has the potential to cause direct mortality near the Station during construction and demolition, similar to Option 1, but the area of disturbance will be smaller.

Under these Options, clearing and grubbing activities and vehicle strikes have the greatest potential to cause direct mortality of SAR/SOCC. Vegetation clearing during the growing season or breeding season has a reasonably high potential of affecting nesting migratory birds and monarch butterflies. The monarch butterfly has been recorded once within the Option 1 area of disturbance. Increased construction traffic could lead to an increase in bird strikes and collisions with terrestrial mammals and amphibians.

The only SAR/SOCC in the vicinity of the Station for which there are AC CDC records are the monarch butterfly (listed as Special Concern under *SARA*) and northern rough-winged swallow. Bald eagle and bank swallow are anecdotally known to use the area as well. None of these species is likely to be directly affected by Option 1 or Option 2, although the areas around the construction and demolition site would be surveyed prior to any disturbance and mitigation identified to protect any local populations if found to exist near the construction site. If these species breed in the area, they might be adversely affected by noise generated by construction or demolition activities. Bald eagles and bank swallows have been seen using the area as recently as June 2015. Because of the potential for bank swallow nesting activity near the Station, there is some potential for interaction with this species. No bald eagle nests are known to occur nearby.

Wood turtles (listed as Threatened under *SARA*) are known to occur within 5 km of the area of review, but specific locations of observations were not provided by the AC CDC due to concerns over the potential exploitation of this species. Wood turtles are not anticipated within the construction footprint

for Options 1 or 2 or directly downstream of the Station due to the steep embankments and lack of suitable nesting, hibernation, and foraging areas. As such, it is unlikely that there will be interactions with this species during construction.

The operation of Options 1 and 2 will be similar to current conditions, except power generation will not occur under Option 2. The same maximum and minimum water levels as currently will be maintained. The continual stabilization of the new portion of the river channel may result in sediment movement for some time following construction and demolition, but this is expected to be minimal. As discussed in Section 10.4.1.2.1, reduced fish mortality as a result of the removal or replacement of turbines and potentially improved fish passage may reduce available food for foraging species including bald eagle; however, this is not expected to lead to reduced survival of birds that forage in this area. Thus, the operation phase of Option 1 or Option 2 is expected to cause minimal changes to SAR/SOCC.

10.4.2.2 Option 3

Option 3 has the lowest potential to cause direct mortality of SAR/SOCC because it has the smallest area of disturbance. There is minor potential for bank swallows, monarch butterflies, northern rough-winged swallows (*Stelgidopteryx serripennis*), and other migratory birds to be directly affected by construction, noise or traffic associated with demolition in the vicinity of the Station. Similar to Option 1 or 2, the removal of the turbines could reduce available food for bald eagles; however, this is not expected to affect survival of the population.

Although the endangered cobblestone tiger beetle has not been recorded in the area of review, it is thought to have occurred there in the past. The cobblestone tiger beetle inhabits rocky shorelines of islands upstream of the headpond, and along the northern side of Grand Lake (COSEWIC 2008c). Up to 75% of habitat for this species in New Brunswick is thought to have been lost when the headpond was created and the islands and native shoreline habitats were flooded (COSEWIC 2008c). The alteration of natural flow regimes, which influence the structure of habitat for this species, may have also contributed to the exclusion of this species from the headpond environment. However, the distribution of this species in New Brunswick prior to construction of the Station is unknown. Option 3 may provide an opportunity to recover lost habitat in the headpond area for this species, which could lead to a partial local recovery of the species.

Bank swallows tend to nest along, and forage over water. This species (as well as cliff swallows [*Riparia riparia*]) may be nesting near the Station; but the presence of a persistent breeding population in that area requires confirmation. Option 3 could interact with this species in the vicinity of the Station either directly through alterations to the river banks in the area, or indirectly through noise associated with demolition.

Two SAR invertebrates with limited Canadian distribution occur within the area of review: skillet clubtail and pygmy snaketail (both dragonflies). The low numbers of these species and their localized distribution places them at risk of extirpation due to changes in the Saint John River. Both species are being studied as part of MAES.

Skillet clubtail is a potentially rare dragonfly species; it occurs in relatively large, slow-flowing rivers that have fine sand or muddy substrates (COSEWIC 2010c). In the Saint John River, it has been recorded between Fredericton and the Jemseg area, upstream of the confluence with Washademoak Lake. The

geographical extent and abundance of the local population is poorly characterized despite considerable recent survey effort. There is growing concern that the local population is in decline. COSEWIC assessed the species as Endangered in 2011. It has not yet received federal *SARA* status, but it is listed as Endangered under NB *SARA*.

Aquatic habitat conditions for skillet clubtail larvae are of greater importance than terrestrial habitat conditions for adults (COSEWIC 2010b). The larvae develop over soft substrates and at variable depths in nutrient-rich, slow-moving rivers and lakes (COSEWIC 2010b). Although the preferred substrate typically includes a considerable silt component, the larvae are sensitive to siltation/sedimentation and low dissolved oxygen concentrations.

The most noteworthy threats to the local skillet clubtail population are loss and degradation of breeding habitat due to impoundments and human activities that increase siltation, nutrient loading and chemical contamination (*e.g.*, pesticides) (COSEWIC 2010b). The construction of the Station may have destroyed upstream larval habitat, but it apparently did not disturb downstream habitat. There is also concern that urban development around the Fredericton area reduced the availability of terrestrial habitat, which could limit the local population.

The dewatering of the headpond could restore habitat for this species in that area, but it could also alter habitat downstream of the Station. Larval habitat could be affected by the transport and deposition of sediment that was trapped in the headpond, or by increased ice scouring downstream of the Station. Some sediments upstream of the Station may have elevated concentrations of contaminants. Due to the nature of the potential contaminants and the associated sediments, it is unlikely that this sediment will interact with skillet clubtail. Section 6 presents a review of water quality issues.

Pygmy snaketail is a globally rare species of dragonfly that is characteristic of large, clear, fast-flowing rivers (COSEWIC 2008b). New Brunswick represents the northern extent of the pygmy snaketail's distribution (COSEWIC 2008b); the species has been observed in only one location on the Saint John River—at Baker Brook, near Edmundston, in 2002 (COSEWIC 2008b). Pygmy snaketail has also been recorded in the Magaguadavic, Miramichi and Salmon River watersheds (COSEWIC 2008b). The size and distribution of the local population is largely unknown. The species likely inhabits portions of the Saint John River between Madawaska County downstream to where the influence of the Station begins (Brunelle, P., pers. comm., 2015). Given its rarity and limited global distribution, pygmy snaketail has been designated as Special Concern by COSEWIC, *SARA,* and NB *SARA*.

Pygmy snaketail lays its eggs in smooth-flowing sections of rivers, and the larvae develop among the substrate of fast-flowing areas (COSEWIC 2008b). Fine sand or small gravel is the preferred substrate. Larvae are opportunistic carnivores; they feed on a variety of smaller invertebrates and, supposedly, small fish. Pygmy snaketail is generally not found in streams less than 10 m wide or in high-gradient streams. Adults are terrestrial, aerial hunters that use a variety of riparian and non-riparian habitats.

Larval pygmy snaketail are sensitive to increased nutrient loading, sedimentation and pesticide contamination, which can result from agricultural, forestry and urban activity (COSEWIC 2008b). Impoundments have a detrimental influence on pygmy snaketail breeding habitat, both upstream and downstream of dams (Environment Canada 2013d). Other potential threats include recreational

boating, invasive species of predators, and introduction of other aquatic invertebrates used as biological controls for insect populations (*e.g., Bacillus thuringiensis* spp.).

Option 3 could have negative interactions with pygmy snaketail that are similar to those associated with skillet clubtail.

Wood turtles are not anticipated to occur directly adjacent to the lower portions of the headpond where the most notable changes in water levels are expected due to the steep embankments and lack of suitable nesting, hibernation, and foraging areas. It is more likely that this species would occur within small tributaries to the Saint John River both upstream and downstream of the Station, which will not be affected by dewatering. Over the long-term, there would likely be an increase in the amount of suitable habitat for wood turtles as downstream portions of tributaries re-establish following dewatering as well as an increased potential for movement between the former headpond and downriver. Overall, there is potential for minor positive changes for wood turtles to occur over the long-term.

10.5 SUMMARY OF INTERACTIONS BETWEEN WILDLIFE AND WILDLIFE HABITAT AND THE OPTIONS

As described in Section 10.4, this review has identified the requirement for some additional potential mitigation and requirements for further study in some areas. These potential requirements are summarized in Table 10.8.

Table 10.8 Summary of Interactions between Wildlife and Wildlife Habitat and the Options

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Has additional mitigation been recommended?
Potential Change in Wildlife Habitat						
Option 1: Construction, demolition and operation	Negative	Low	Site	Permanent	Single	Yes
Option 2: Construction, demolition and operation	Negative	Low	Site	Permanent	Single	Yes
Option 3: Decommissioning	Positive and Negative	High	Region	Permanent	Continuous	Yes
Potential Change in Wildlife Populations						
Option 1: Construction, demolition and operation	Negative	Low	Site	Short	Single	Yes
Option 2: Construction, demolition and operation	Negative	Low	Site	Short	Single	No
Option 3: Decommissioning	Negative	Low	Site	Short	Single	No
Potential Change in Species at Risk and/or Species of Conservation Concern						
Option 1: Construction, demolition and operation	Negative	Low	Site	Permanent	Continuous	Yes
Option 2: Construction, demolition and operation	Negative	Low	Site	Permanent	Continuous	Yes
Option 3: Decommissioning	Positive and Negative	Low	Region	Permanent	Continuous	Yes

Key Issue	Is the interaction negative or positive?	What is the amount of change?	What is the geographic extent?	How long does the interaction last?	How often does the interaction occur?	Has additional mitigation been recommended?
KEY **Is the interaction negative or positive?** • Positive. • Negative. **What is the amount of change?** • Low – a change that remains near existing conditions, or occurs within the natural variability for wildlife and wildlife habitat. • Medium – a change that occurs outside the natural variability for wildlife and wildlife habitat but does not change the overall status of wildlife and wildlife habitat. • High – a change that occurs outside the natural range of change for wildlife and wildlife habitat that will change the status of wildlife and wildlife habitat locally or regionally. **What is the geographic extent?** • Site – the interaction is limited to the immediate area where Project-related activities occur. • Area – the interaction is limited to the general area surrounding the Station. • Region – the interaction occurs throughout the area of review and may extend to other regions. • Province – the interaction affects the entire province.						
			How long does it last? • Short – the interaction occurs for less than 3 months. • Medium – the interaction occurs for 3 months – 1 year. • Long – greater than a year. • Permanent – there is no foreseeable end-date for the interaction. **How often does it occur?** • Single – the interaction occurs once. • Multiple – the interaction occurs several times, either sporadically or at regular intervals. • Continuous – the interaction occurs continuously. **Has additional mitigation been recommended?** • Yes. • No.			

10.5.1 Summary of Additional Potential Mitigation and Information Requirements

The review identified the potential need for additional mitigation and further study (Table 10.9).

Table 10.9 Summary of Requirements for Additional Mitigation and Information

Option	Additional Potential Mitigation	Additional Information Requirements
Option 1 or 2: Construction, demolition and operation	• It is recommended that noise- and dust-generating activities be initiated outside the normal breeding bird season if avian SOCC are breeding in or near the construction site. • Clearing of vegetation should be conducted outside the normal breeding bird season, and open-area nest surveys are recommended before ground disturbance is conducted during the normal breeding bird season.	• Wildlife surveys are required to determine the use of the proposed areas of disturbance by wildlife. • Surveys of breeding birds near the Station are required to determine the use of the area by SAR and SOCC.
Option 3: Decommissioning	• It is recommended that noise- and dust-generating activities be initiated outside breeding bird season if avian SOCC are breeding in or near the facilities being decommissioned. • It is recommended that opportunities to create or enhance marsh areas along the post-headpond river channel to benefit wildlife be identified. • Mitigation measures proposed in the vegetation and wetlands VC	• Further study on the ecology of skillet clubtail and pygmy snaketail is required to determine the potential effects of sedimentation on its life cycle and potential mitigation. This is ongoing through MAES. • Further study is required to understand the anticipated sedimentation patterns associated with this Option, especially as it relates to the potential for sediment deposition near known breeding areas

Table 10.9 Summary of Requirements for Additional Mitigation and Information

Option	Additional Potential Mitigation	Additional Information Requirements
	(Section 9) are recommended to promote the recovery of natural, healthy vegetation communities in the formerly flooded area. This will help stabilize the area and optimize habitat suitability for wildlife. • A gradual drawdown would allow wildlife communities and vegetation to gradually adapt to the disturbance. • The formerly flooded area will lack tall woody vegetation for several years. This will reduce habitat suitability for many species, especially those that nest in cavities or tall trees adjacent to water. The construction of nesting boxes and platforms for certain species in the riparian area may be considered where there is a reasonable likelihood that they will be used. • The vegetation and wetlands VC (Section 9) proposes the use of wetland-specific mitigation for the former headpond area that is designed to optimize wetland quality and quantity. These mitigation measures will also promote wildlife habitat quality, abundance, and diversity because many of the species associated with the river are expected to benefit from an increase in wetland habitat and seasonally flooded areas.	of skillet clubtail. • Surveys of breeding birds, such as bank swallows and bald eagles, near the Station are required to determine the use of the area by SAR and SOCC.

10.5.2 Discussion

Riparian areas and waterbodies are important to many species of wildlife because they provide physical and biological features that are not widely available across the landscape. The importance of these areas varies greatly among species and individuals. For example, the aquatic environment of the Saint John River provides an abundant food supply for many species, including those that scavenge dead or injured fish from the shoreline or forage on aquatic vegetation or emerging insects. For other species, the river provides a navigational cue during migration or a source of drinking water. Changes in the physical and biological features of riparian areas and waterbodies can alter habitat suitability for many species. The complexity of the relationship between the aquatic environment of the Saint John River and the abundance of species associated with it for some part of their lifecycle presents a challenge in assessing how changes in the river system as a result of the Options might affect wildlife.

Option 1 or 2 is expected to have limited interactions with wildlife beyond those associated with construction. Option 3 is expected to have the greatest interaction with wildlife and wildlife habitat. There are a number of potential benefits associated with dam removal (Bednarek 2001), but the initial changes associated with the process represent a large-scale disturbance (Stanley and Doyle 2003). Under Option 3, the reversion to a river system in the headpond would constitute short-term (spanning

several years) stress for local wildlife habitat and communities but could cause long-term improvements in, and enrichment of, the current headpond area.

Habitat will be altered under each Option. Unique habitat features are not expected to be lost under any Option, but Option 3 may interact with habitat downstream of the Station that is important to some arthropod SAR.

Some wildlife SAR and several SOCC have been recorded in the area of review but are not likely to be affected substantially by any of the Options (*e.g.,* wood turtles). SAR and SOCC that may interact with the Project are bald eagle, bank swallow, and the dragonfly species, skillet clubtail, and pygmy snaketail. No Option is expected to cause the decline of any population of a wildlife SAR or SOCC threatening their survival in New Brunswick. More study is needed to understand the potential for interactions between Option 3 and dragonfly species.

Adverse interactions between the Options and wildlife and wildlife habitat will be reduced by implementing mitigation measures, such as timing restrictions on clearing and various other measures. While wildlife and wildlife habitat may be sensitive to change, secure and non-secure wildlife populations will not change substantially on a local or regional basis.

Under Option 3, wildlife and wildlife habitat upstream of the Station will experience changes resulting from a drop in water level and a return to river-like riparian conditions. An increase in various types of wetland and riparian mineral habitat is expected. These habitats are important for many SAR and SOCC; therefore, an increase in their area may allow SAR and SOCC to colonize this section of the Saint John River. Some species that may have occurred in the headpond section of the Saint John River before construction of the Station may return under Option 3. Downstream habitat and wildlife species will experience a large release of water and sediments when the Station is removed.

The speed and method by which the water is drained from the headpond could interact with:

- the rate and character of species recolonization of the newly exposed riparian area;
- the survival rates of populations of plants and animals that live along the headpond; and
- the transport of sediment and resulting change in habitat both upstream and downstream of the Station.

Any drawdown scenario will cause at least a short-term stressful disturbance for many wildlife species that reside in the riparian zone. Under an accelerated drawdown scenario the water table in the riparian area will change rapidly. The location, mobility, and amount of accumulated sediments will be described in the MAES, and should Option 3 be selected as the Preferred Option, further study will likely be required to determine a final drawdown schedule that reduces negative interactions with wildlife and wildlife habitat.

10.5.3 Assumptions and Limitations

Wildlife habitat was characterized using NBDNR landbase data. These data are several years old and were collected with a forest harvesting bias. Complete coverage of landbase data was not available. It was assumed that landbase data for the areas with coverage were representative of the remaining areas that lacked coverage.

Wetland analysis relied on mapped wetland sources, which likely do not accurately reflect the actual extent of wetlands. The difference between the extent of mapped wetlands and actual wetlands may be larger in some areas than in others, depending on the wetland type, surrounding vegetation type and topography.

Sediment deposition and transport modelling for the Options is being completed as part of the MAES. Potential interactions between sediment and wildlife and wildlife habitat have been discussed at only a conceptual level based on preliminary results of the MAES available at the time of the CER.

Field data collection and modelling was not conducted as part of this review. Some of this work is currently underway as part of the MAES program, and more such work would be expected in support of a future EIA/EA of the selected Preferred Option. Therefore, the characterization of interactions associated with each Option could be conducted at only a preliminary level. In some cases, the magnitude of the change could not be reliably discussed.