BIG CREEK NATIONAL WILDLIFE AREA

MANAGEMENT PLAN
2020

Environment and Climate Change Canada
Environnement et Changement climatique Canada

Canada

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Environment and Climate Change Canada
Public Inquiries Centre
12th Floor, Fontaine Building
200 Sacré-Coeur Boulevard
Gatineau QC K1A 0H3
Telephone: 819-938-3860
Toll Free: 1-800-668-6767 (in Canada only)
Email: ec.enviroinfo.ec@canada.ca

Aussi disponible en français

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The 1984 *Management Plan: Big Creek National Wildlife Area*, prepared by Gerald McKeating and Kendal Dewey of the Canadian Wildlife Service (Ontario) provided the groundwork for this update.

Copies of this plan are available at the following addresses:
Environment and Climate Change Canada
Public inquiries centre
Fontaine Building 12th floor
200 Sacré-Coeur Blvd
Gatineau QC K1A 0H3
Telephone: 819-938-3860
Toll-free: 1-800-668-6767 (in Canada only)
Email: ec.enviroinfo.ec@canada.ca

Environment and Climate Change Canada - Ontario Region
Canadian Wildlife Service
4905 Dufferin Street
Downsview, Ontario M5H 5T4

Environment and Climate Change Canada Protected Areas website**:**
https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas.html

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About Environment and Climate Change Canada's Protected Areas and Management Plans

What are Environment and Climate Change Canada Protected Areas?

Environment and Climate Change Canada establishes marine and terrestrial National Wildlife Areas for the purposes of conservation, research and interpretation. National Wildlife Areas are established to protect migratory birds, species at risk, and other wildlife and their habitats. National Wildlife Areas are established under the authority of the *Canada Wildlife Act* and are, first and foremost, places for wildlife. Migratory Bird Sanctuaries are established under the authority of the *Migratory Birds Convention Act, 1994* and provide a refuge for migratory birds in the marine and terrestrial environment.

How has the federal government's investment from Budget 2018 helped manage and expand Environment and Climate Change Canada's National Wildlife Areas and Migratory Bird Sanctuaries?

The Nature Legacy represents a historic investment over five years of $1.3B and will help ECCC expand its national wildlife areas and migratory bird sanctuaries to contribute to Canada's biodiversity targets and increase ECCC's capacity to manage its protected areas.

ECCC will be conserving more areas, and have more resources to effectively manage and monitor the habitats and species who reside in its protected areas

What is the size of the Environment and Climate Change Canada Protected Areas Network?

The current Protected Areas Network consists of 55 National Wildlife Areas and 92 Migratory Bird Sanctuaries, comprising more than 14 million hectares across Canada.

What is a Management Plan?

A management plan provides the framework in which management decisions are made. They are intended to be used by Environment and Climate Change Canada staff to guide decision making, notably with respect to permitting. Management is undertaken in order to maintain the ecological integrity of the protected area and to maintain the attributes for which the protected area was established. Environment and Climate Change Canada

prepares a management plan for each protected area in consultation with Indigenous Peoples, the public and other stakeholders.

A management plan specifies activities that are allowed and identifies other activities that may be undertaken under the authority of a permit. It may also describe the necessary improvements needed in the habitat, and specify where and when these improvements should be made. A management plan identifies Aboriginal rights and allowable practices specified under land claims agreements. Further, measures carried out for the conservation of wildlife must not be inconsistent with any law respecting wildlife in the province in which the protected area is situated.

What is Protected Area Management?

Management includes monitoring wildlife, maintaining and improving wildlife habitat, periodic inspections, enforcement of regulations, as well as the maintenance of facilities and infrastructure. Research is also an important activity in protected areas; hence, Environment and Climate Change Canada staff carries out or coordinates research in some sites.

The series

All of the National Wildlife Areas are to have a management plan. All of these management plans will be initially reviewed 5 years after the approval of the first plan, and every 10 years thereafter.

To learn more

To learn more about Environment and Climate Change Canada's protected areas, please visit our website at https://www.canada.ca/en/services/environment/conservation/protected-areas.html or contact the Canadian Wildlife Service in Ottawa.

BIG CREEK NATIONAL WILDLIFE AREA

The Big Creek National Wildlife Area (NWA) was established in 1977 to protect wetlands essential as staging, stopover and feeding habitat for waterfowl and other migratory birds. The 769.7 ha NWA is composed of two separate management units: the Big Creek and the Hahn Marsh Units.

Situated along the north shore of Lake Erie, the wetlands of the Big Creek National Wildlife Area are 104 km southeast from London, and 3 km south from Port Rowan. Located at the base of the Long Point peninsula, these wetlands are an integral part of the largest sandspit-marsh complex of the Great Lakes. Long Point and its marshes are recognized as a continentally significant staging area for migrating waterfowl and provides important year-round habitat for both rare and common birds, mammals, reptiles, amphibians, fish and plants.

Every spring and fall, tens of thousands of waterfowl visit the Long Point region during their annual migration. Up to 100,000 waterfowl may be found resting and feeding at Long Point marshes during the peak of fall migration. The most abundant species using the marshes are wood duck *(Aix sponsa),* green-winged teal *(Anas crecca),* mallard *(A. platyrhynchos),* American black duck *(A. rubripes),* redhead *(Aythya americana),* ring-necked duck *(Aythya collaris),* Canada goose *(Branta canadensis),* tundra swan *(Cygnus columbianus),* American wigeon *(Mareca americana),* gadwall *(Mareca strepera),* and ruddy duck *(Oxyura jamaicensis).*

Over 200 species of birds have been observed in the Big Creek NWA, and more than 80 of those species have been reported breeding at the NWA.

Forty-four federally listed (endangered, threatened, and special concern) species under the *Species at Risk Act* (SARA), have been reported at the Big Creek NWA, including: 2 vascular plants, 1 invertebrate, 6 fishes, 1 amphibian, 11 reptiles, 22 birds, and 1 mammal. The NWA provides breeding habitat for marsh-dwelling species at risk such as the threatened least bittern (*Ixobrychus exilis)* and swamp-dwelling species such as the endangered prothonotary warbler (*Protonotaria citrea*) - one of Canada's rarest songbirds. The Big Creek NWA is also an important resting, breeding and feeding area for monarch (*Danaus plexippus)* during migration. In late summer and early fall, several thousand monarchs can be observed daily on the Long Point peninsula as they migrate to their southern wintering grounds.

The Big Creek NWA will be managed to maintain and improve habitats for migratory birds and native wildlife and plants, including species at risk. A variety of wildlife and habitat management techniques will be employed. Priority management actions include the manipulation of water levels to maintain open water and marsh vegetation, and the removal and reduction of invasive and non-native species to improve biodiversity.

The public can access the Big Creek Unit via the public parking lot at 737 Highway 59 (Causeway), and the Hahn Marsh Unit via laneway and public parking lot at 2330 Lakeshore Road (formerly County Road 42).

Most of the Big Creek NWA, including portions of both units, is closed to the public in order to provide undisturbed staging habitat for migratory waterfowl, with exceptions made for research, surveys and monitoring activities authorized by permit under the *Wildlife Area Regulations* of the *Canada Wildlife Act*.

The NWA may be accessed by the public for day use hiking, wildlife viewing, photography, cross-country skiing, snowshoeing and interpretation only on designated trails and roads in designated areas between sunrise and sunset. At the Big Creek Unit, a walking trail and two wildlife-viewing towers are open to the public year-round and allow optimum waterfowl and migratory bird viewing during spring and fall migration. A 1.5 km walking trail that accesses the marsh interior is open seasonally between May 15th and September 15th. Within the previously mentioned restrictions of location and time, gatherings of 15 or more people are permitted.

Activities prohibited at all times (except in accordance with a permit) within the NWA include: overnight camping (except related to hunting in season in the Hahn Marsh Unit - see Appendix 2), swimming, fires, off-leash dogs (for non-hunting purposes), the introduction of a living organism, agricultural activities, operation of a conveyance without a driver on board (including remotely piloted aircraft systems), conducting the take off or landing of any aircraft, removing/damaging infrastructure or natural objects, the use of motorized off-road vehicles, carrying out behaviour or actions that are likely to disturb, damage, destroy, or remove any wildlife (whether alive or dead) or wildlife residence or habitat, and dump or deposit any rubbish or waste material.

Motorized and non-motorized boats (operated at a maximum speed of 8 km/hour) may be launched year-round into the Big Creek Channel (north of the Big Creek bridge) at 881

Highway 59. In the Big Creek Unit, motorized and non-motorized boats (operated at a maximum speed of 8 km/hour) may access wetlands adjacent to the Big Creek Channel as posted from May 15th to September 15th. Access to the north and south cells of the impoundment wetlands (impoundment) is prohibited at all times. Non-motorized boats may be unloaded in the Hahn Marsh Unit Access Channel in order to access designated hunting areas. Boat mooring is prohibited within the NWA.

Waterfowl hunting from blinds in designated hunting areas (with off-leash dogs for allowed hunting purposes only) is permitted at the Big Creek and Hahn Marsh Units of the NWA from half an hour before sunrise to half an hour after sunset, in designated areas and seasons, subject to federal, provincial and municipal regulations. Hunters may park in designated areas of the Hahn Marsh Unit for a maximum of two consecutive days beginning on September 10th and ending on December 20th of any year. Refer to Appendix 2 for description of conditions of access and special restrictions for waterfowl hunting.

Sport fishing (no lead sinkers/jigs and no spears) is permitted within the Big Creek Channel and wetlands adjacent to the Big Creek Channel as posted from May 15th to September 15th, but is prohibited from any shore or dike and is subject to federal and provincial regulations. Sport fishing is permitted within the Hahn Marsh Access Channel (no lead sinkers/jigs and no spears), but is prohibited in any other area of the Hahn Marsh Unit, including from any shore or dike, and is subject to federal and provincial regulations.

Trapping is allowed within the NWA only with a permit.

The Big Creek NWA is one of 10 National Wildlife Areas in Ontario. This 2020 Big Creek NWA Management Plan is an update of the *Management Plan: Big Creek National Wildlife Area* (McKeating and Dewey 1984), and replaces all previous versions.

Nothing in this management plan shall be construed so as to abrogate or derogate from the protection provided for existing aboriginal or treaty rights of the aboriginal peoples of Canada by the recognition and affirmation of those rights in section 35 of the *Constitution Act, 1982*.

Big Creek National Wildlife Area is helping to Connect Canadians to Nature

This site has been selected as one of 10 National Wildlife Areas across the country to be part of the Connecting Canadians to Nature (CCtN) initiative. This initiative will invest funding on selected sites over five years (2015-2020) and beyond to improve infrastructure and the accessibility of the site and develop interpretive on-site programming that will be delivered through collaborative partnerships. One of the aims is to provide Canadians with more opportunities to recreate and connect to nature on federal lands managed on their behalf, where these activities will not interfere with the conservation of wildlife and are consistent with management goals for the site.

Big Creek NWA was selected to implement the initiative because of its proximity to nearby communities and large urban centers in southwestern Ontario, its natural, cultural, and economic heritage within the Long Point region, existing appeal to visitors, existing trail and wildlife viewing towers, and the abundance of migratory birds and other wildlife and natural features.

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1.0 DESCRIPTION OF THE PROTECTED AREA

1.1 BIG CREEK NATIONAL WILDLIFE AREA

The Big Creek National Wildlife Area (NWA) makes up a large part (769.7 ha) of a 1200 ha complex of several wetlands known as the 'Big Creek Marsh Complex' situated at the base of the Long Point peninsula along the north shore of Lake Erie in southwestern Ontario (Figure 1). The Big Creek NWA consists primarily of marsh, swamp, sand beach and dunes, and small areas of upland. The predominant habitat within the NWA is cattail marsh. The Big Creek NWA is comprised of two sections of land, the Big Creek Unit (607.7 ha) and the Hahn Marsh Unit (162 ha) both of which are entirely in the province of Ontario.

The Big Creek Unit is located 3 km southwest of Port Rowan bounded by Highway 59 on the east side, and Norfolk County road allowance (Hastings Drive) on the south side of the unit. The Hahn Marsh Unit is located approximately 4.5 km west of Port Royal, south of Lakeshore Road, along the north shore of Lake Erie (Figure 2). The Big Creek and Hahn Marsh Units are separated by two other marshes: The Flight Club Marsh, a Nature Conservancy Canada (NCC) owned property adjacent on the west side of the Big Creek Unit, and the Lee Brown Marsh, Long Point Region Conservation Authority (LPRCA)-owned property on the east side of the Hahn Marsh Unit (Figure 2).

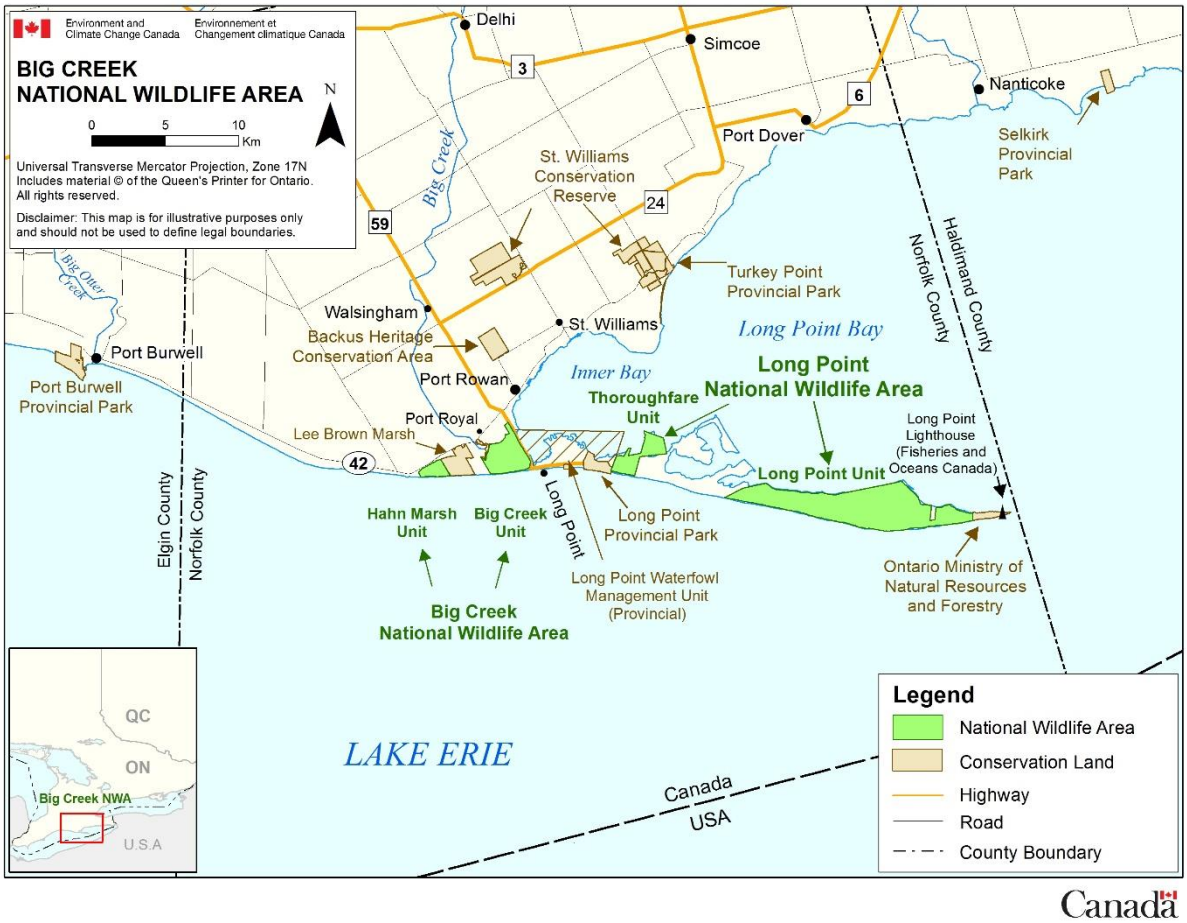

Figure 1. Location of the Big Creek National Wildlife Area, Lake Erie, Ontario.
Source: Environment and Climate Change Canada, Canadian Wildlife Service.

Big Creek Unit

The Big Creek Unit is predominantly marsh, with the exception of a small strip of vegetated dunes (along Lake Erie shore), a small vegetated upland strip along the north side of Big Creek Unit, and upland area within the Environment and Climate Change Canada (ECCC) Canadian Wildlife Service (CWS) (collectively referred to as ECCC-CWS) NWA office compound. Central to this Unit is a large 90 ha diked impoundment consisting of two cells (North Cell and South Cell), separated by an earthen cross-dike (Figure 3). The impoundment is isolated from the surrounding marsh and water levels are regulated by a pump that moves water via the channel connected to the Big Creek/Port Royal Ship Canal (hereafter Big Creek Channel).

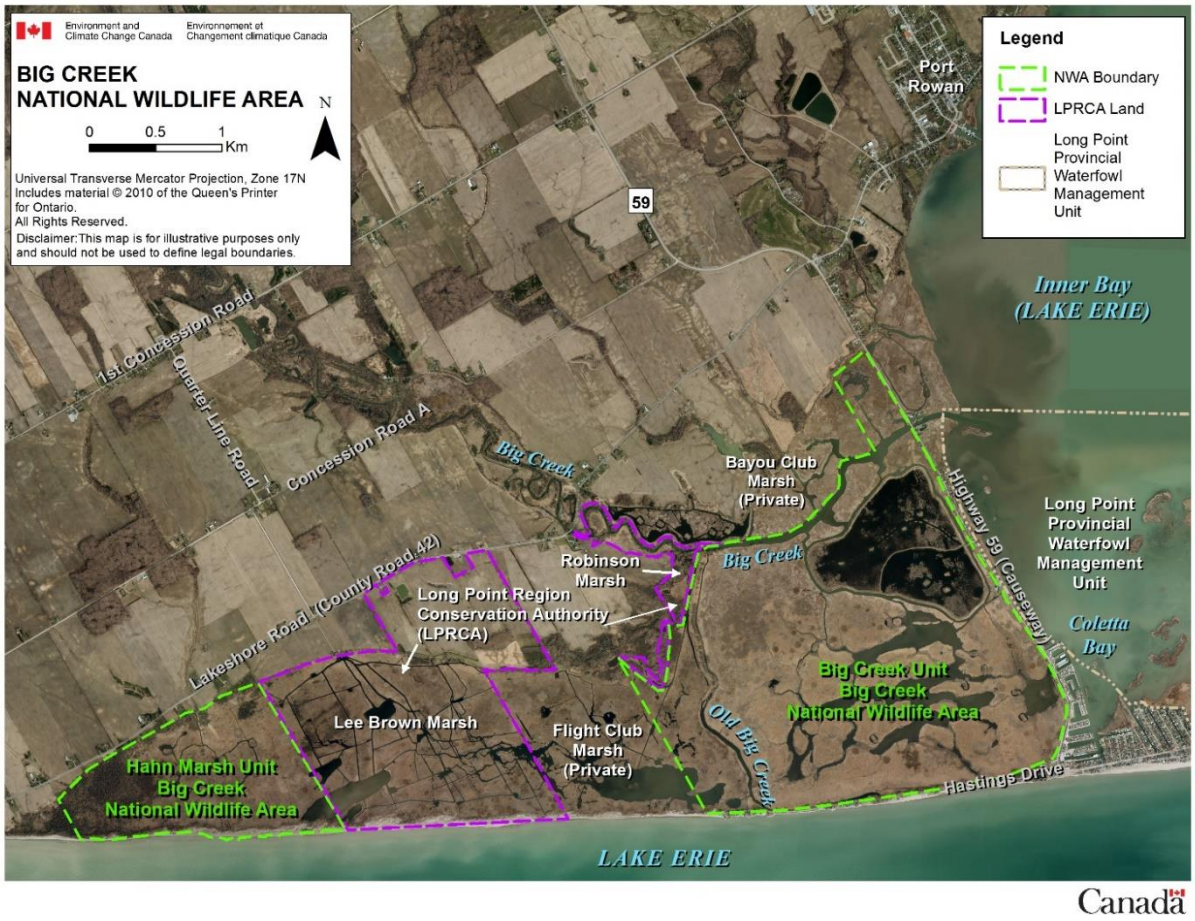

Figure 2. Aerial view of the Big Creek National Wildlife Area, Lake Erie, Ontario, 2010.
Source: Environment and Climate Change Canada, Canadian Wildlife Service – Ontario

The water levels in the un-diked marsh portion of the Big Creek Unit are indirectly influenced by Lake Erie water levels through a semi-permeable barrier beach. The barrier beach isolates the marsh from the lake; however, storm surges may cause breaches allowing lake water to replenish the marsh. During lake seiche events (a temporary oscillation in water level caused by an atmospheric change or wind), water levels in the Inner Bay can rise and cause periodic flooding in the Big Creek Unit marsh (outside of diked wetland impoundments) (Beacon Environmental 2010).

There are two municipal roads along the Big Creek Unit boundaries: Highway 59 along the eastern boundary and a portion of Hastings Drive along the southern boundary (Figure 3). The section of Highway 59 that connects the mainland to Long Point, between the Inner Bay and the Big Creek Unit, is known locally as the Long Point Causeway, and will hereafter be referred to as Highway 59 (Causeway) (Figure 3).

Two wildlife-viewing towers are accessible from the public parking lot on Highway 59 (Causeway) and a public trail runs along the top of the dikes (Figure 3).

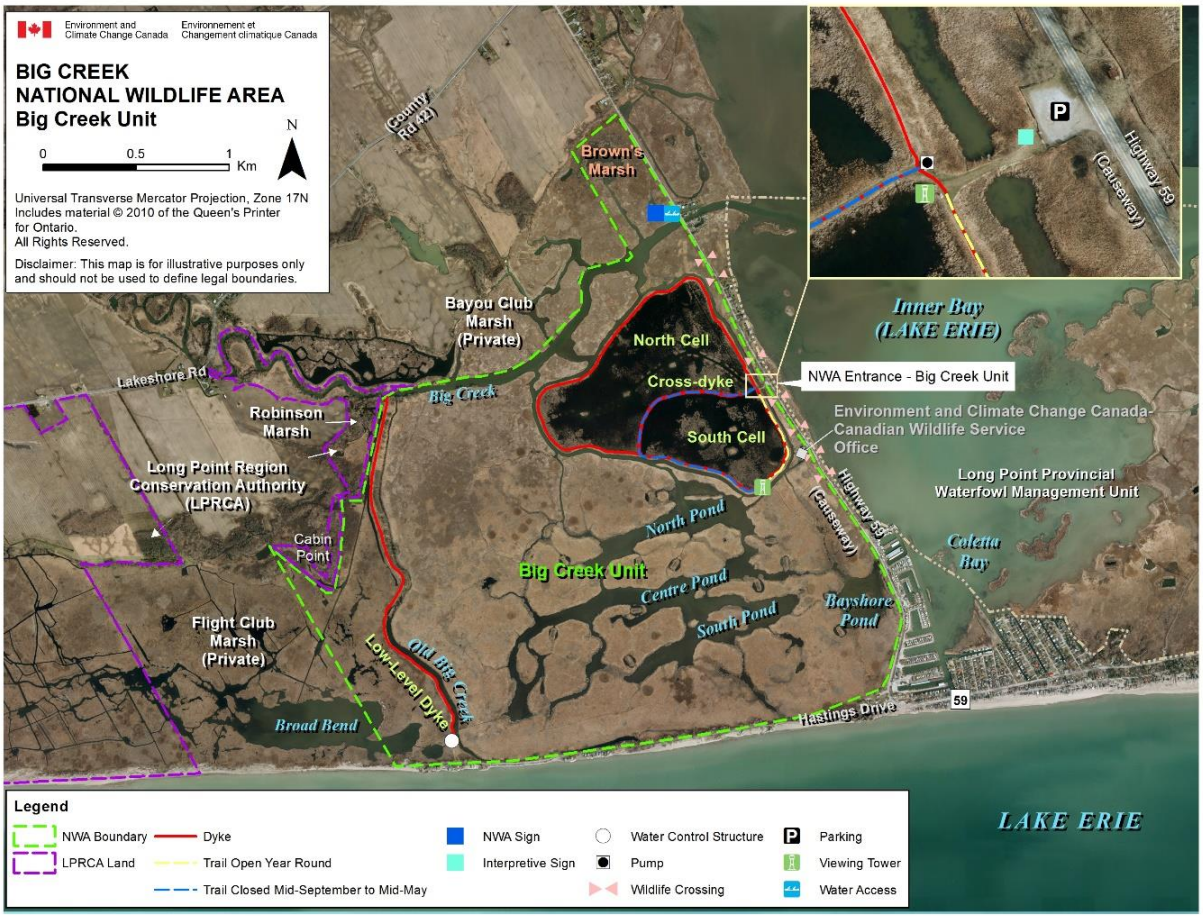

Figure 3. Aerial view of the Big Creek Unit, Big Creek National Wildlife Area, 2010.
Source: Environment and Climate Change Canada, Canadian Wildlife Service.

The majority of land immediately adjacent to the Big Creek Unit is owned by LPRCA and private landowners. Agricultural fields, and private hunting marshes surround the north boundary, and along the west boundary is marsh managed primarily for waterfowl hunting. The NCC owned Flight Club Marsh and the Robinson Marsh (owned by LPRCA) border the west side, and the privately owned Bayou Club Marshes (Murray Marsh and Marshland Farms Marsh) border the north side of the Unit.

Several cottages and residences are located across from the NWA, along the east side of the Highway 59 (Causeway) along the Inner Bay and along the north and south sides of Hastings Drive (Lake Erie).

Hahn Marsh Unit

The Hahn Marsh Unit[1] consists of a variety of complex habitats including wooded swamp, lowland deciduous forest, shrub thicket, marsh, sand dune and beach. The western third of the Unit is primarily wooded swamp and lowland deciduous forest referred to as the 'Hahn Woods' (Figure 4). The remaining portion of the Unit is primarily marsh and shrub thicket referred to as the 'Hahn Marsh' (Figure 4). There is very little open water within the Hahn Marsh Unit, except for dredged channels and a few ponds.

Water within the Hahn Marsh Unit flows eastward into Big Creek and then out to the Inner Bay of Lake Erie. The Hahn Marsh is underlain by extensive organic deposits that facilitate the movement of water. During high water storm events, large floating vegetation mats shift substantially due to their buoyancy. The water levels of the Hahn Marsh are also influenced occasionally by Lake Erie water levels, as there is a semi-permeable barrier beach that isolates the marsh from the lake (along the south boundary of the Unit). The beach can sometimes be breached during a storm surge allowing the Hahn Marsh Unit to be replenished with lake water (Beacon Environmental 2010).

Access to the Hahn Marsh Unit is from Lakeshore Road, north of the Unit. A short gravel road leads to a public parking lot and water access to the Hahn Marsh (Figure 4).

Land surrounding the Hahn Marsh Unit is owned by private landowners. Agricultural fields surround the north boundary, and wooded swamp along the west boundary. The Lee Brown Marsh along the east boundary is owned and managed by the Long Point Region Conservation Authority.

[1] 'Hahn Marsh Unit' also known locally as 'Hahn Unit', 'Hahn Marsh', and 'Hahn Woods'

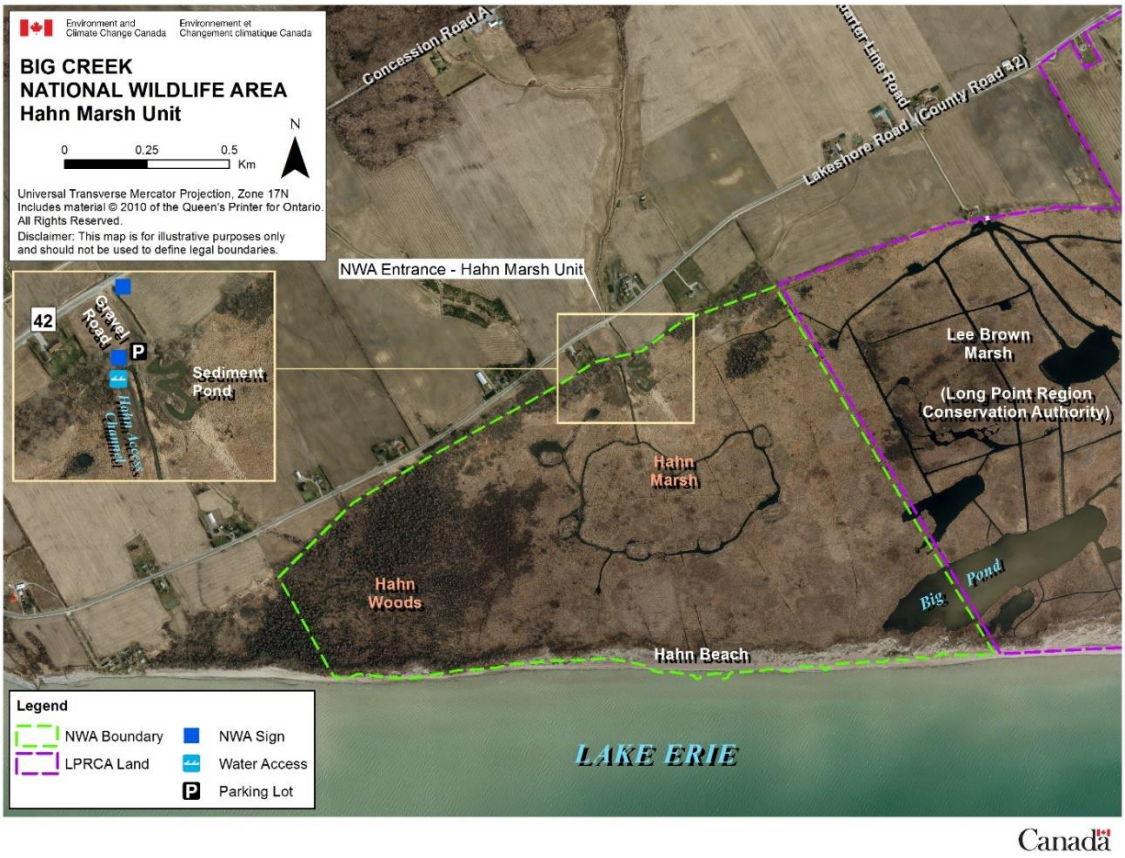

Figure 4. Aerial view of the Hahn Marsh Unit, Big Creek National Wildlife Area, 2010.
Source: Environment and Climate Change Canada, Canadian Wildlife Service.

Table 1: Big Creek National Wildlife Area Summary Information

Protected Area Designation	**Big Creek National Wildlife Area**
Province/Territory	Ontario
Municipality	Norfolk County (formerly Regional Municipality of Haldimand-Norfolk)
Geographic Township	South Walsingham
Latitude/Longitude	Big Creek Unit : 42°59’ N / 80°46’ W Hahn Marsh Unit: 42°58’ N / 80°53’ W
Size	Total 769.7 ha Big Creek Unit: 607.7 ha Hahn Marsh Unit: 162 ha
Environment and Climate Change Canada Protected Area Designation Criteria	Criteria 1a) "The area supports a population of a species or subspecies or a group of species which is concentrated, for any portion of the year". • During spring and fall, tens of thousands of diving ducks found in rafts on Lake Erie to the south and on the Inner Bay to the east of the NWA. • Marshes adjacent to the lake provide habitat for tens of thousands of dabbling ducks, geese and swans. • A large proportion of the eastern population of tundra swans

	(*Cygnus columbianus*) pass through the region in early spring and fall. • Refuge is provided for several species of waterfowl and marsh birds in summer and fall during post-breeding moult. • Monarch (*Danaus plexippus*) breed in the NWA (June-September), feed and rest at the NWA during migration (late summer-early fall), when several thousand can be observed per day in the Long Point area. Criteria 3.a) "The area is rare or unusual wildlife habitat, of a specific type in a biogeographic region." • Wetland is rare in southwestern Ontario, 82.1% of pre-European settlement wetlands in the surrounding county have been converted since pre-settlement times, primarily for agriculture (Ducks Unlimited Canada 2010). • NWA marshes are part of internationally significant coastal wetland complex. • NWA marshes and beach are contiguous with Long Point peninsula, the longest peninsula in the Great Lakes. • Plant and animal species richness is high due to moderate climate and several species at the northern extent of their North American range. • Significant number of species at risk in Canada and/or rare species in Ontario occurs in the NWA.
Environment and Climate Change Canada Protected Area Classification (Environment Canada 2005)	A (high): species or critical habitat conservation.
IUCN Classification (International Union for Conservation of Nature and Natural Resources)	Category IV Habitat/species management area: Category IV provides a management approach used in areas that have already undergone substantial modification, necessitating protection of remaining fragments, with or without intervention (Dudley 2008).
Order in Council Number	P.C. 1977-2958
DFRP Number	Big Creek Unit: 10479 Hahn Marsh Unit: 10480
Gazetted	1977
Additional designations	• Part of the Long Point Ramsar Site, a Wetland of International Importance. • Part of 'Long Point Marshes Complex'- Provincially Significant Wetland. • Part of the Long Point peninsula and Marshes globally significant Important Bird Area. • Part of the North American Waterfowl Management Plan 'Lower Great Lakes and St. Lawrence River Area of Continental Significance' (Eastern Habitat Joint Venture). • Part of the Long Point World Biosphere Reserve designated by UNESCO.

Faunistic and floristic importance	• Over 200 bird species have been observed at the NWA between 1978-2013, and more than 80 have been recorded breeding at the NWA. • Over 20 species of waterfowl have been recorded at the NWA, primarily mallard (*Anas platyrhynchos*), American black duck (*A. rubripes*), green-winged teal (*A. crecca*), redhead (*Aythya americana*), ring-necked duck (*Aythya collaris*), Canada goose (*Branta canadensis*), hooded merganser (*Lophodytes cucullatus*), gadwall (*Mareca strepera*), American wigeon (*Mareca americana*), ruddy duck (*Oxyura jamaicensis*) and tundra swan. • The Long Point region (includes Big Creek NWA and Long Point NWA) is an important staging area for waterfowl; with fall and spring peaks of 78,000 and 17,000 birds respectively. • The Big Creek Marsh Complex (includes the Big Creek NWA) is an important staging area for waterfowl, with fall and spring peaks of 7,500-15,000 and 2,200 birds respectively. • A large proportion of the eastern population of Tundra Swans passes through the NWA in the spring on route to breeding grounds in the Canadian Arctic and Alaska. • Provides important habitat for both common and rare plant and animal species. • Key habitats include large cattail marshes and wooded swamp, and vegetated sand beach and dunes.
Species at Risk	• 44 federally listed (endangered, threatened, and special concern) species under the *Species at Risk Act* (SARA) including: 2 vascular plants, 1 invertebrate, 6 fishes, 1 amphibian, 11 reptiles, 22 birds, and 1 mammal. • 44 Committee on the Status of Endangered Wildlife in Canada (COSEWIC) designated species have been recorded at the NWA.
Invasive and/or Non-native Species	• **Plants:** Garlic mustard (*Alliaria petiolata*), European black alder (*Alnus glutinosa*), flowering-rush (*Butomus umbellatus*), Canada thistle (*Cirsium arvense*), honey locust (*Gleditsia triacanthos*), European frog-bit (*Hydrocharis morsus-ranae*), yellow iris (*Iris pseudacorus*), purple loosestrife (*Lythrum salicaria*), Eurasian water-milfoil (*Myriophyllum spicatum*), white sweet-clover (*Melilotus albus*), spotted lady's-thumb (*Persicaria maculosa*), reed canarygrass (*Phalaris arundinacea*), the European lineage of *phragmites* (*Phragmites australis* subsp. *australis*), curly-leaved pondweed (*Potamogeton crispus*), multiflora rose (*Rosa multiflora*), non-native willow complex (*Salix alba*, *S. fragilis*, and *S.* X *rubens),* bittersweet nightshade (*Solanum dulcamara*), common sow-thistle (*Sonchus oleraceus*) and blue cattail (*Typha* X *glauca*). • **Animals:** temperate-breeding (resident) Canada goose, domestic dogs (*Canis lupus familiaris*), mute swan (*Cygnus olor)*, common carp (*Cyprinus carpio)*, zebra mussel (*Dreissena polymorpha),* quagga mussel (*Dreissena rostriformis bugensis*), feral domestic cats (*Felis catus domesticus*), round goby (*Neogobius melanostomus),* double-crested cormorant (*Phalacrocorax auritus*), European starling (*Sturnus vulgaris*) and red-eared slider (*Trachemys scripta elegans*).
Management Agency	Environment and Climate Change Canada - Canadian Wildlife Service (ECCC-CWS), Ontario.

Public Access and Use	**The Big Creek NWA – Big Creek Unit** is open to the public from May 15th to September 15th for bird watching, hiking and photography on the designated trail for day use only. There is a 600 m designated walking trail, two viewing towers, interpretive signage, and parking lot accessible from Highway 59 (Causeway) that is open to the public year-round. A 1.5 km trail (accessible from the same location on Highway 59) extends into the marsh interior and is open from May 15th to September 15th. **The Big Creek NWA – Hahn Marsh Unit** is open to the public year round for bird watching, hiking and photography, for day use only. There are no designated trails. There is a public parking lot accessible from Lakeshore Road. To protect wildlife and their habitats and limit human disturbance, portions of the NWA are permanently closed to the public, and some areas are seasonally closed during spring and fall waterfowl migration. Recreational boating, sport fishing and waterfowl hunting are only permitted in designated areas, and are subject to provincial and federal regulations. Public notices listing the authorized activities are posted at access points.

1.2 REGIONAL CONTEXT

The Long Point region is predominately underlain by limestone bedrock. As the Erie lobe of the Wisconsin glacier retreated, deltaic deposits were formed (Chapman and Putnam 1966). These deposits resulted in the sandy soils that can be found today in the Norfolk Sand Plain (Chapman and Putnam 1966; Francis and Whitelaw 2001).

The Norfolk Sand Plain is drained by the Big Creek Watershed, which surrounds the Big Creek NWA. This watershed is approximately 725 km^2 and spans 90 km from north to south and 21-36 km east to west. There is an approximate grade (slope toward the Lake Erie outlet) in elevation of 1.4 m/km. The headwaters of the watershed are located in Oxford County near the Ingersoll Moraine (LPRCA 2007). The Big Creek Watershed is isolated from the Inner Bay (Long Point Bay, Lake Erie) by Highway 59, a paved causeway. Although the un-diked marshes of the Big Creek Unit and the Inner Bay are separated by a causeway, seiche events within the Inner Bay and a semi-permeable barrier beach on the Lake continue to influence water levels within the Big Creek Marshes (Beacon Environmental 2010; McCracken et al. 1984). Until recently, the only direct water connection between the NWA and the Inner Bay was the Big Creek Channel. From 2014-2016, twelve wildlife culverts were added under Highway 59 (Causeway) to allow wildlife to move between the Big Creek Marsh (Big Creek Unit) and the Inner Bay (Figure 8).

Prior to European settlement, 30% (87,232 ha) of Haldimand-Norfolk county was covered by wetlands. By the year 2002, 5.4% (15,572 ha) of these wetlands remained, representing a loss of 82.1% (71,661 ha) (Ducks Unlimited Canada 2010). Much of these wetlands were drained and converted to agricultural land (Ducks Unlimited Canada 2010; Snell 1987). Despite these large losses, extensive marshes occur in the Long Point region and Big Creek Watershed, largely due to the foresight and stewardship by private landowners, hunt clubs, and conservation organizations and agencies. The Long Point coastal wetlands cover approximately 13,465 ha along the peninsula and Inner Bay of Long Point Bay. The marshes close to the Big Creek NWA that contain wetlands of significance include the Long Point NWA (including the Thoroughfare Point Unit), Flight Club Marsh, Murray Marsh, Marshland Farms, Bayou Marsh, Turkey Point Marsh, Crown Marsh, Long Point Company Marsh, Lee Brown Marsh (Lee Brown Waterfowl Management Area), and Robinson Marsh (Bartok 2011; D. Bernard, personal communication, 2014). Key among these wetlands is the large portion of the Long Point peninsula marshes that has been owned and managed by the Long Point Company for waterfowl hunting and conservation since 1866.

Long Point and its marshes are recognized as a continentally significant staging area for migrating waterfowl and provides important year-round habitat for both rare and common birds, mammals, reptiles, amphibians, fish and plants (UNESCO 2015). The Long Point region (including the Big Creek NWA and Long Point NWA) has been recognized as a conservation priority on international, national, and provincial levels because of the large number of migratory birds that use the extensive marshlands it provides. Within the Long Point peninsula, Big Creek NWA is unique due to the geographic size and quality of undisturbed habitat for staging waterfowl.

In 1982, the Long Point wetlands were designated as a Ramsar site for the internationally significant wetland complex that can be found both on Long Point and in the Big Creek NWA (Ramsar Convention Secretariat 2011). In 1986, the Long Point region was designated as a World Biosphere Reserve by the IUCN, as an example of a Great Lakes coastal ecosystem (Francis and Whitelaw 2001; Pollock 2009). The core of this reserve is the Long Point NWA, while the reserve's buffer includes the Big Creek NWA and a wide range of areas protected by the Province of Ontario and a host of private entities (Francis and Whitelaw 2001).

In 1996, the 'Long Point Peninsula and Marshes' (includes Big Creek NWA) was designated by BirdLife International as the first globally significant Important Bird Area (IBA) in Canada, due to congregatory species, large waterfowl and migratory landbird concentrations,

and nationally significant due to occurrence of threatened bird (BirdLife International 2014). The provincially significant Long Point coastal wetlands complex encompasses approximately 13,465 ha and includes more than 70% of the total wetland area along the north shore of Lake Erie (EC-OMNR 2003). A summary of Great Lakes (Ontario) coastal wetlands found that Lake Erie coastal wetlands support the largest diversity of plant and wildlife species and the greatest number of provincially significant wildlife and plant species in Ontario (EC-OMNR 2003).

In 1960, the Long Point Bird Observatory (LPBO) was founded to monitor spring and fall migration of birds across the Long Point peninsula. Long Point is a Canadian Migration Monitoring Network (CMMN) station operated by Bird Studies Canada, and 402 bird species have been reported between1960-present (Bird Studies Canada 2019).

The Long Point NWA Monarch Butterfly Reserve is one of three international monarch butterfly reserves designated in southern Ontario as part of the 1995 Canada–Mexico declaration to create the International Network of Monarch Butterfly Reserves. Typically, many thousands of migrating monarch (*Danaus plexippus*) feed and rest at Long Point and along the north shore of Lake Erie in late summer and early fall in preparation for their long journey south to Mexico (Crewe and McCracken 2015).

The Big Creek marshes provide commercial and recreational benefits. Recreational boating, recreational fishing, wildlife viewing, hunting, and associated tourism bring important economic returns while offering popular recreation for thousands of people.

1.3 HISTORICAL BACKGROUND

It is acknowledged that Big Creek NWA is situated within the traditional territory of the Haudenosaunee and Anishinaabe (Mississaugas of the New Credit) Nations within Treaty 3 lands. The Long Point region was first inhabited by early Indigenous peoples ~11,000 years before present (BP), followed by the earliest known occupation of Long Point between 1050 and 650 years BP (Francis and Whitelaw 2001). The first residents of Long Point developed seasonal and permanent palisaded villages on the peninsula, and used the land for agriculture, fishing, hunting and foraging (Francis and Whitelaw 2001). The lake and surrounding marshes and forests provided a transportation corridor and an abundance of fish and wildlife for consumption and clothing for First Nations in the area (Raphael 1987). A chronological study of human history of the Long Point area reported numerous artifacts and evidence of occupation by various First Nations on the Long Point peninsula and surrounding area, dating as far back as 9500 BC (Dakin and Skibicki 1994). The time period between ~1550 and 1795 AD marked a period of extreme change within the Long Point region, including the appearance of European

explorers (and the rapid creation of a commercial fur trade) in the mid 1500's, the arrival of Jesuit missionaries (1634-1640), and the influx European settlers (throughout the 1780s) (Dakin and Skibicki 1994). Warfare with neighbouring tribes, declining food sources due to European demand, and the introduction of diseases such as smallpox and cholera decimated the Indigenous population (Dakin and Skibicki 1994).

With greater settlement, the first land surveys occurred between 1793 and 1794 (Francis and Whitelaw 2001), and the County of Norfolk was established shortly afterwards. Township surveys were completed by 1798. The early 1800s was the beginning of a period of intensifying human impact in the Long Point area, including logging and related wildfires, clearing of the land for agriculture, and the grazing of livestock (Dakin and Skibicki 1994; Heffernan 1978).

Early industries included iron smelting, gristmills, distilling, wool dressing, tanning, commercial fishing, and the production of lye and potash. Industrial development, however, was hampered by an inefficient road system and unsafe water transportation on Lake Erie. The extension of a rail service to the area in 1888 increased access to markets for the commercial sale of the region's wildlife resources. The introduction of the rail system also opened up the area to other outside recreational and commercial interests (Hardy 1979).

Port Rowan, the nearest town to the Big Creek NWA, was first named "John Cartright's Landing" in 1797. By 1845, Port Rowan consisted of a store, a tavern, and 16 dwellings supporting a population of 100. The expansion of lumbering and new sawmills doubled the population by 1850. As the lumber industry slowed, Port Rowan's population declined. The population was estimated at 1000 in 1888, then 657 in 1901 following a census. Today, the town of Port Rowan has a population of 790, as reported by Norfolk County (Norfolk County 2014).

Optimal soil conditions, a favourable climate and close proximity to fresh water made agriculture a practical venture within the region, and has been the predominant land use since the 1800s (Dakin and Skibicki 1994). By 1860, the extensive removal of trees along the peninsula led to large blowouts and erosion of the sandy soils by wind, causing miles of sandy shoreline to disappear (Barrett 2000; Francis and Whitelaw 2001).

The Long Point Causeway was constructed in 1928 to connect the mainland to the Long Point peninsula and provide better access to the newly established Long Point Provincial Park (Hazen 2000). In 1950, the Long Point Causeway was designated as part of the Provincial Highway 59. Today the Causeway portion of Highway 59 is maintained by Norfolk County.

There is a strong cultural history of conservation and stewardship of the significant natural features of the Long Point region, and in turn support recreation and tourism. Historically, much of the Long Point peninsula and Big Creek marshes were privately owned and managed for waterfowl hunting.

Today the tourism and cottage industry continue to be one of the region's most important contributors to the local economy, providing activities such as angling, waterfowl hunting, and many other nature-oriented activities (Francis and Whitelaw 2001; Norfolk County 2018).

History of the Big Creek Unit

In 1889, the land that is now the Big Creek Unit was purchased by several Toronto sportsmen, who operated the Toronto Big Creek Shooting Club and built the clubhouse (Hardy 1979) that served as the ECCC-CWS office and field station from the early 1970's until 2014.

In 1916, the Welland Vale Manufacturing Company of St. Catharines purchased the property and formed the St. Catharines Shooting Club. Four members hunted waterfowl in one section of the property and leased the remaining area to other duck hunters.

In 1927, Mr. H. H. Hastings purchased the property and formed the Big Creek Muskrat Farms Limited, an operation that raised and sold muskrats (*Ondatra zibethicus*) for breeding purposes. Duck hunting rights were also leased out to interested tenders at this time. Between 1927 and 1928, the entire muskrat farm was enclosed by a woven wire fence, topped with galvanized steel, and diked with wooden piles to contain the muskrats. In 1932 most of the marsh was sold to the Big Creek Development Company, a private shooting club. Mr. Hastings retained a portion of the property along the south beach of Lake Erie, and initiated a cottage development in 1935, along Hastings Drive.

In order to maintain the water levels of the marsh, the Big Creek Development Company operated two water pumps and installed wooden sheet pilings in dredged channel openings. Even so, fire was sometimes used in low-water years to thin the dense vegetation prior to the duck nesting season.

History of the Hahn Marsh Unit

In 1950, Mr. J. Hahn bought the marsh and flooded woods known as “The Cove Swamp” from Mr. D.W. Brown for duck hunting and Muskrat trapping. During low-water periods, dredging was routinely needed to keep channels and ponds open. Fire was also occasionally employed to thin the vegetation. In 1971, this property was sold to Mr. B. Hahn.

Establishment of the Big Creek NWA

In 1973, the CWS-Environment Canada purchased three land parcels totalling 1448.5 acres (586.2 ha) from the Big Creek Development Company. In 1977, CWS purchased two land parcels totalling 53.2 acres (21.5 ha) (reference plan 37R-980) on the north side of Big Creek Chanel known as the Brown Marsh from Mr. and Mrs. Stewart Brown. These five parcels, totalling 1501.7 acres (607.7 ha) were designated as the ‘Big Creek Unit’, named after the Big Creek Channel that runs through the property (Figure 3).

In 1974, the CWS purchased the 162 ha property (known locally as the Hahn Marsh and Hahn Woods) from Mr. B. Hahn and designated the entire parcel as the ‘Hahn Marsh Unit’.

The Big Creek NWA was formally established in 1977 under the *Canada Wildlife Act* to protect wetlands essential as staging, stopover, and feeding habitat for waterfowl and other migratory birds.

This 2020 Big Creek NWA Management Plan is an update of the *Management Plan: Big Creek National Wildlife Area* (McKeating and Dewey 1984), and replaces all previous versions.

1.4 LAND OWNERSHIP

Big Creek NWA is owned by the Government of Canada and administered by ECCC-CWS as described in Schedule 1 of the *Wildlife Area Regulations* of the *Canada Wildlife Act*. It is comprised of two parcels of land and water: The Big Creek Unit and Hahn Marsh Unit (Figure 1). All land and water (i.e., ponds, channels, Big Creek, Old Big Creek) within the Big Creek Unit and all land and marshland to the water’s edge of the Hahn Marsh Unit, along Lake Erie, land and water (i.e., ponds and the Hahn Access Channel) are protected as part of the Big Creek NWA. The Crown in Right of Canada does not hold the subsurface mineral rights for the Big Creek NWA**.**

ECCC-CWS owns and maintains infrastructure (i.e., dikes, roads, driveways, gates, and fences) within the Big Creek NWA. Where infrastructure occurs along NWA boundaries, any shared responsibility for maintenance and operations of infrastructure is conducted via

agreements and permits under the *Canada Wildlife Act* (see Section 1.6, Table 2). Because the system of dikes, channels, and drains run through the NWA and adjacent properties, ECCC-CWS works with neighbouring landowners (i.e., marsh managers, farmers, hunt clubs, and organizations such as Ontario Ministry of Natural Resources and Forestry (OMNRF, formerly Ontario Ministry of Natural Resources), LPRCA, Ducks Unlimited Canada (DUC), and Norfolk County) to monitor and manage water levels within the Big Creek Marsh Complex and the NWA.

Dikes, pumps, or other structures installed by DUC are maintained and repaired through a formal agreement between ECCC-CWS and DUC; the agreement is not registered on title.

ECCC-CWS also has vested interests in land and infrastructure immediately adjacent to the NWA, because landowner activities may affect the NWA. For example, Norfolk County is the responsible authority for municipal roads and road allowances (i.e., Highway 59, Hastings Drive, Lakeshore Road), authorization of installation and maintenance of wildlife culverts (aquatic and terrestrial pathways located under Highway 59 (Causeway) between the Big Creek Unit and the Inner Bay), along Highway 59, and agreements with Ontario Hydro and Bell Canada for service lines on NWA property.

The Big Creek NWA is located within the traditional territory of the Haudenosaunee and Anishinaabe (Mississaugas of the New Credit) Nations within Treaty 3 lands. Nothing in this management plan shall be construed so as to abrogate or derogate from the protection provided for existing aboriginal or treaty rights of the aboriginal peoples of Canada by the recognition and affirmation of those rights in section 35 of the *Constitution Act, 1982*.

1.5 WATER MANAGEMENT

Big Creek Unit

Within the Big Creek Unit, a narrow channel surrounds the diked wetland impoundments and is connected to Big Creek in three locations by unvegetated channels. This channel was created by dredging and requires periodic maintenance to remove sediment and insure water supply to the pump.

On the western portion of the Big Creek Unit along the west bank of Old Big Creek, a low-level dike (Figure 2) was constructed to retain water in the upper marshes including the Flight Club Marsh, Lee Brown Marsh, and the Hahn Marsh Unit.

Hahn Marsh Unit

A pump and water control structure (west of the Big Creek Unit low-level dike) in the Robinson Marsh is operated by the LPRCA to control water levels in the upper marshes. During periods of low water, water may be pumped from the Big Creek (channel) into the upper marshes to maintain preferred levels. During storm events or periods of high water, water from the upper marshes may be released via the Robinson Marsh water control structure and/or the Big Creek Unit low-level dike spillway accessible from Hastings Drive.

The Hahn Access Channel runs from the parking lot, south to the marsh interior. This channel is dredged as needed and maintained to provide access to the marsh for biological monitoring, habitat management and safe access for visitors (Figure 3).

1.6 FACILITIES AND INFRASTRUCTURE

ECCC-CWS

Since the Big Creek Unit and Hahn Marsh Unit properties were acquired and the NWA formally established, emphasis has been on water level management to maintain marshes for waterfowl staging habitat.

Key management activities within the Big Creek NWA include the installation and maintenance of dikes, channels, and sediment ponds, control and removal of invasive and non-native plants, and water level management.

ECCC-CWS and Ducks Unlimited Canada Big Creek NWA Management Agreement

In 1986, ECCC-CWS entered into a formal long-term agreement with DUC to permit DUC to undertake the installation, maintenance, and repairs to the dikes, pumps, or other select installations constructed or installed by that organization within the Big Creek and Hahn Marsh Units, for the purpose of water level management, improving habitat for migratory waterfowl and other wildlife, and invasive and non-native species control.

Maintenance of Infrastructure

ECCC-CWS works with partners (i.e., OMNRF, Department of Fisheries and Oceans (DFO), DUC, and LPRCA) to monitor channels, drains, ponds, and watercourses within the NWA.

Management of the Big Creek Marsh Complex

ECCC-CWS works in collaboration with OMNRF, LPRCA, and other agencies, organizations, and landowners to promote a holistic and coordinated approach for the management and conservation of the Big Creek Marsh Complex. In recent years, the responsible agencies have begun to meet informally to coordinate water conservation, sediment, and marsh management within the Big Creek marshes and the broader Big Creek watershed.

ECCC-CWS Office and Field Station

The ECCC-CWS office and field station, located at 695 Highway 59 (Causeway) on the east side of the Big Creek Unit, serves as the southern Ontario Canadian Wildlife Service office and field station. This office is also the base for the daily operation of both the Big Creek and Long Point National Wildlife Areas.

The operational compound is comprised of a multi-purpose facility (office space and overnight accommodations for researchers and workshop), garage, boathouse, and staff parking area (Table 2; Figure 2). The parking lot located outside of the compound (695 Highway 59) is used by staff, visitors and researchers, and provides overflow parking for visitors to the Big Creek Unit (trail, viewing tower and parking) at 737 Highway 59 (0.5 km north of the ECCC-CWS office).

Big Creek Unit

Infrastructure consists of signs, fencing, gates, and items listed below for water management (Figure 9; Table 2).

Between the Big Creek Unit (southern boundary) and the Lake Erie shoreline, there is a municipal road allowance (Hastings Drive), as well as a number of cottages and private homes (Figure 2). Portions of the municipal road allowance, and in some areas cottage development, occur within the NWA boundary. In 2016, ECCC-CWS and Norfolk County began working to document and formally recognize respective boundaries and reduce the effects of human disturbance along NWA boundaries.

Maintaining infrastructure is an ongoing need at the Big Creek NWA. Regular maintenance is required in order to ensure the safety of visitors, and to minimize potential risks associated with any built structures (i.e., gates, boardwalks, water control structures, and buildings).

Maintenance of infrastructure required in the medium term (3-5 years) will include repair or replacement of the wildlife viewing tower on the South Cell dike, west of the ECCC-CWS office compound.

To reduce road-kill of wildlife species (particularly herptiles) crossing Highway 59 (Causeway) and improve connections between the Inner Bay and the Big Creek Marsh Complex, wildlife culverts have been installed along the Long Point Causeway (Highway 59) to allow wildlife to pass under the Causeway between the Big Creek marsh and Long Point Inner Bay. This project was a multi-stakeholder initiative known as the Long Point Causeway Improvement Project, led by the Long Point Biosphere Reserve. To date, twelve wildlife culverts have been installed along Highway 59 (Causeway) within the municipal road allowance. In addition, silt fencing has been installed along portions of the Causeway to limit wildlife access to the road and direct wildlife toward the wildlife culverts.

The public entrance to the Big Creek Unit is located at 737 Highway 59. Public facilities include a parking lot, a designated walking trail (approximately 3 km) along dike tops and interpretive signage (Figure 3). There are two wildlife-viewing towers; one located at the parking lot and one along the trail (Figure 5).

Within the Big Creek Unit, there is a grassed boat launch located north of the Big Creek bridge. ECCC-CWS maintains this site on a regular basis (i.e., mows the grass, keeps the site free of garbage, and monitors its use). From this location, the public can launch small boats (motorized and non-motorized) to access the Big Creek (channel), marsh interior (outside of the diked impoundments) and designated waterfowl hunting area. However, parking is not allowed at this location. The public must use nearby county roads or commercial marina facilities for parking.

The public can also gain water access to the Big Creek Unit from Lake Erie via the Port Royal Shipping Canal/Big Creek Channel. Public access to water within the diked impoundments is prohibited at all times.

Figure 5. Viewing tower, dedication plaques, and public washrooms; Big Creek Unit, Big Creek National Wildlife Area, 2018.
Photo: Graham Howell © Environment and Climate Change Canada.

Hahn Marsh Unit

The infrastructure at the Hahn Marsh Unit consists of signs, fencing, gates, and items listed below for water management (Figure 4; Table 2).

The Hahn Marsh Unit can be accessed from a gravel laneway at 2330 Lakeshore Road (formerly County Road 42). This laneway is a right-of-way owned by the adjacent landowner. The laneway that leads to the public parking lot and the main public access point for the marsh has no formal agreement between ECCC and the landowner of the laneway, however has historically been jointly maintained. The adjacent landowner owns the creek and has historically withdrawn water for agricultural purposes.

There is a parking lot and grassed area available for day use. Visitors can access the Hahn Marsh and the designated waterfowl hunting area via the Hahn Access Channel, located at the southwest edge of the parking lot. This channel is dredged periodically and the water access is gravelled and graded periodically to maintain water access by small boats (only non-motorized boats are allowed). Physical access to the Hahn Marsh Unit from the parking lot (for monitoring and maintenance) can be difficult due to dense marsh vegetation, uneven topography, and variable water levels. The gravel laneway and parking area occasionally flood or wash out during storm events, resulting in a need for repairs. ECCC-CWS works with the landowner to maintain. The Hahn Marsh Unit is open to the public for recreation, however there are no designated trails, and access is limited by the physical site conditions. Historically there have been instances of trespassing when adjacent landowners accessed the beach with all-

terrain vehicles, requiring the boundaries of the Hahn Marsh Unit to be clearly marked with signage.

A large volume of sediment is carried by the Hahn Creek and moves south into the Hahn Marsh and settles in ponds and channels. A sediment pond (approximately 3 m deep) was constructed in 2009 where the Hahn Creek enters the Hahn Marsh Unit to trap sediment and run-off from neighbouring agricultural lands (Figure 10). Channel widening, clearing of vegetation and debris from channels, and dredging are some of the measures taken to improve flow and restore the channels and ponds of the Hahn Marsh Unit. The act of restoring these channels and ponds would remove foreign sediment (that causes in-filling) and dense undesired vegetation, maintain connectivity within the Big Creek marsh complex and improve the access to the Unit. Taking these actions would allow for invasive species control, wildlife monitoring, and improve the utility of the system as habitat for wildlife. In 2013, the Hahn Access Channel and sediment pond were dredged as part of the regular maintenance required to remove sediment and debris and maintain water access. This sediment pond is physically separated from the other channels by a low-level berm to deter sediment from entering the main marsh system.

Figure 6. Sediment pond (left) and Hahn Access Channel (right); Hahn Marsh Unit, Big Creek National Wildlife Area, 2015.
Photo: Danny Bernard © Environment and Climate Change Canada

Big Creek NWA

Signs

Signs are posted to identify NWA lands, indicate areas where entry is prohibited, outline permitted uses and conditions of access, and provide interpretation. Signs require frequent maintenance due to damage from weather and vandalism.

Signs posted along the shore or in the water are susceptible to damage from weather and ice. ECCC-CWS may remove some signs temporarily during periods of high water or winter (i.e., along Big Creek and the Hahn Beach). Access remains prohibited during these periods, and signs are re-posted in the spring.

Table 2: Facilities and Infrastructure at the Big Creek National Wildlife Area

Big Creek Unit		
Type of Facility or Infrastructure	**Approximate Size or Number**	**Responsibility Holder or Owner**
Signs		
911 sign: 695 Highway 59 Canadian Wildlife Service Office	1 sign	**Municipality of Norfolk County**
911 sign: 737 Highway 59 Big Creek Unit, viewing tower parking lot	1 sign	**Municipality of Norfolk County**
911 sign: 881 Highway 59 water access to Big Creek Channel at bridge	1 sign	**Municipality of Norfolk County**
NWA Identification	2 signs, 4’ X 8’	**ECCC-CWS**
NWA Boundary	~122 signs	**ECCC-CWS**
NWA Entry Prohibited	~122 signs	**ECCC-CWS**
Interpretation	7	**ECCC-CWS**
Ducks Unlimited Canada Partners	1 monument/sign	**DUC/ECCC-CWS**
Ducks Unlimited Canada Dedication	1 sign	**DUC**
Buildings and structures		
Office/Researcher Accommodations/Workshop	448 m^2	**ECCC-CWS**
Garage/Workshop	184.3 m^2	**ECCC-CWS**
Boat House	71 m^2	**ECCC-CWS**
Hazardous Materials Storage Building	5 m^2	**ECCC-CWS**
Pumphouse	5 m^2	**ECCC-CWS**
Channels, dikes and water control features		
Old Big Creek Channel	2.5 km	**ECCC-CWS/DUC**
Big Creek (length within NWA)	1.96 km	**ECCC-CWS/DUC**
Dikes (*total=cross-dike + impoundment dike + low-level dike)*	6.9 km total	**ECCC-CWS/DUC**
Cross-dike (between North and South Cells)	0.9 km	**ECCC-CWS/DUC**
Impoundment Dike (Bordering North and South Cells)	3.9 km	**ECCC-CWS/DUC**
Low-level dike (parallel to Old Big Creek)	2.1 km	**ECCC-CWS**
Pump	1	**ECCC-CWS/DUC**
Low-level dike/water control structure	1 km	**Long Point Region**

Big Creek Unit		
Type of Facility or Infrastructure	**Approximate Size or Number**	**Responsibility Holder or Owner**
Water level data loggers	9	**Conservation Authority ECCC-CWS**
Culvert (between parking lot and trail to viewing tower)	1	**ECCC-CWS/DUC**
Roads/water culverts/wildlife culverts		
Gravel driveway and compound	~0.5 km	**ECCC-CWS**
Highway 59 (Causeway)	3.6 km	**Norfolk County**
Water culverts	1	**Norfolk County**
Wildlife culverts (connect Big Creek Unit, under Highway 59, to Inner Bay)	12	**Norfolk County**
Silt fencing (on/bordering NWA property)	~3.7 km	**Norfolk County (installation, operations, maintenance, monitoring)/ECCC-CWS**
Public facilities		
ECCC-CWS office/public parking lot (695 Highway 59)	10 vehicle capacity	**ECCC-CWS**
Viewing tower parking lot (737 Highway 59)	630 m^2	**ECCC-CWS**
Viewing tower (737 Highway 59)	6 m L X 6.5 m W X 4 m H	**ECCC-CWS**
Cross-Dike viewing tower	2.5 m L X 6 m W X 2 m H	**ECCC-CWS**
Public washrooms	5 m L X 6 m W X 3 m H	**ECCC-CWS**
Walking trail on dike top (Open Year-round)	0.6 km	**ECCC-CWS**
Walking trail (ppen mid-May to mid-September)	1.6 km	**ECCC-CWS**
All walking trails	2.2 km	**ECCC-CWS**
Water access point (grassed) Big Creek (north side) in NWA	1	**ECCC-CWS**
Designated waterfowl hunting locations	4	**OMNRF/ECCC-CWS**
Other		
Wood foot bridge (to access walking trail for maintenance) (office)	16.5 m L X 2 m W	**ECCC-CWS**
Gates on cross-dike	2	**ECCC-CWS**
Gate at NWA driveway/municipal property	2	**ECCC-CWS/Norfolk County**
Gate and cable fence (Hastings Drive)	1	**ECCC-CWS/Norfolk County**
Gate and cable fence	1	**ECCC-CWS**
Gate and Fence (Hahn beach)	1	**ECCC-CWS/Norfolk County/LPRCA/adjacent landowners**
Robinson Marsh - water control structure/pump outlet (on Big Creek NWA boundary, conveyance to NWA)	1	**Long Point Region Conservation Authority (LPRCA)**
Hastings Drive (municipal road allowance) along NWA southern boundary	~2 km	**Norfolk County**

Hahn Marsh Unit		
Type of facility or infrastructure	**Approximate size or number**	**Responsibility holder or owner**
Signs		
911 sign: 2330 Lakeshore Road		
Hahn Marsh Unit entrance (gravel access road and parking lot)	1 sign	**Municipality of Norfolk County**
NWA Identification	1 sign	**ECCC-CWS**
NWA Boundary	~45	**ECCC-CWS**
NWA Entry Prohibited	~45	**ECCC-CWS**
NWA Public Notice re Waterfowl Hunting	1	**ECCC-CWS**
Ducks Unlimited Canada Dedication	1	**DUC**
Channels, dikes and water control features		
Hahn Creek	~20 m	**ECCC-CWS**
Hahn Access Channel	245 m	**ECCC-CWS**
Sediment pond	~220 m long	**ECCC-CWS**
Berm	~243 m	**ECCC-CWS**
Roads		
Lakeshore Road (formerly County Road 42)	1.7 km	**Norfolk County**
Gravel right of way/driveway	~110 m	**ECCC-CWS**
Public facilities		
Gravel parking lot	12 vehicle capacity	**ECCC-CWS**
Water access point (gravel) location – see Big Creek Unit above	1	**ECCC-CWS**
Designated waterfowl hunting locations/ Numbered parking spots (only 4 could be accessed circa 2018)	8	**ECCC-CWS**

a)

b) **c)**

Figure 7. a) The public parking lot off Highway 59 (Causeway), b) Interpretive signs at the Big Creek Unit, c) The trail that leads to a second viewing tower, Big Creek Unit, Big Creek National Wildlife Area, 2018.

Photos: Jason Read © Environment and Climate Change Canada.

a) **b)**

Figure 8. a) Aquatic wildlife culvert on the east side of Highway 59 (Causeway) connects the Inner Bay to the Big Creek Unit (2016), b) Aquatic wildlife culvert on the Big Creek Unit side, Big Creek National Wildlife Area, 2018.

Photo: a) Danny Bernard © Environment and Climate Change Canada,
b) Graham Howell © Environment and Climate Change Canada.

Figure 9. Public parking lot, Hahn Marsh Unit, Big Creek National Wildlife Area, 2018.
Photo: Graham Howell © Environment and Climate Change Canada.

Figure 10. Sediment pond, Hahn Marsh Unit, Big Creek National Wildlife Area, 2012.
Photo: Danny Bernard © Environment and Climate Change Canada.

2.0 ECOLOGICAL RESOURCES

2.1 TERRESTRIAL AND AQUATIC HABITATS

The Big Creek NWA is predominately marsh habitat (95%), with the remaining 5% consisting of wooded swamp, shrub thicket, barrier beach and dunes. Aquatic habitats within the marshes include natural and dug channels, portions of the Big Creek Channel, Old Big Creek, Hahn Creek, Hahn Access Channel, small ponds, and open water areas.

Big Creek Unit – Marsh, Barrier Beach and Dunes

The Big Creek Unit is primarily marsh dominated by cattail (*Typha* spp.). The substrate is composed of impermeable silt-clay cover with a 15-30 cm organic layer. It is highly productive and allows for lush growth of vegetation. Open water areas, ranging in size from small muskrat clearings to channels and large ponds, characterize the marshes outside of the diked impoundments. Hence, numerous submergent vegetation species occur; muskgrass (*Chara* spp.), waterweed (*Elodea* spp.) and water-milfoil (*Myriophyllum* spp.) and stonewort (*Nitella* spp.) are the most widespread. Important plants for waterfowl consumption include several species of pondweed (*Potamogeton* spp.), as well as American eel grass (*Vallisneria americana).* Fragrant water-lily (*Nymphaea odorata*) carpets the surfaces of shallow backwaters. Swamp loosestrife (*Decodon verticillatus*), pickerelweed (*Pontederia cordata*) and wildrice (*Zizania* spp.) border and grow within the open water areas. Bluejoint reedgrass (*Calamagrostis canadensis*) is the most common species growing in the marsh interior. Bluejoint reedgrass occurs either in pure stands or intermixed with sedges (*Carex* spp.), cattail, native common reed (*Phragmites australis* subsp. *americanus*), the European lineage of common reed (*Phragmites australis* subsp. *australis*, hereafter referred to as *Phragmites*), arrowhead (*Sagittaria spp.*) and burreed (*Sparganium* spp*.)* (Beacon Environmental 2010; Ralph and Heffernan 1979).

There are two diked wetland impoundments in the northeast section of the Big Creek Unit known as North Cell and South Cell (See Figure 3). The North and South Cells are predominantly shallow marsh interspersed with submerged and floating aquatic vegetation and small pockets of mixed meadow cells (Figure 3) (EC-CWS 2009). In addition to marsh and meadow, there are several small areas of both native and non-native *Phragmites* within the impoundments. These impoundments are surrounded by water channels and shallow marshlands (EC-CWS 2009). Water drawdowns within the impoundments, undertaken periodically to increase vegetation diversity and open water, have not been undertaken in recent

years because of concerns that a drawdown and subsequent re-flooding could promote the spread of non-native *Phragmites* (D. Bernard, personal communication, 2016).

There is a narrow strip of sand beach and vegetated dunes along the south boundary of the Big Creek Unit. This beach accounts for the majority of terrestrial systems in the Big Creek Unit, including sections of deciduous forest, open sand barren/dunes, and deciduous thickets.

Figure 11. Marsh, Big Creek Unit, Big Creek National Wildlife Area, 2014.
Photo: Danny Bernard © Environment and Climate Change Canada

Hahn Marsh Unit - Marsh, Wooded Swamp, Shrub Thicket, Barrier Beach and Dunes

The eastern portion of the Hahn Marsh Unit is predominantly marsh; water levels are shallow and the vegetation is dense, and there are few open water areas. Bluejoint reedgrass and sedge meadow communities dominate this portion of the Unit. The *Species at Risk Act* (SARA) and *Endangered Species Act* (ESA)-listed swamp rose-mallow (*Hibiscus moscheutos*) occurs in small numbers within the marsh (AECOM Canada 2009).

In the central portion of the Hahn Marsh Unit, the dense marsh transitions to a narrow shrub thicket zone, primarily composed of speckled alder (*Alnus incana* subsp. *rugosa*), dogwoods (*Cornus* spp.) and willows (*Salix* spp.) and then abruptly transitions to a deciduous hardwood swamp. Within this transition zone, there is a relatively dense distribution of the European black alder (*Alnus glutinosa*), although dogwoods and willows can also be found (AECOM Canada 2009). Some non-native willow species (i.e., *Salix alba*, *S. fragilis*, and *S.* X *rubens*) were identified in this portion (AECOM Canada 2009).

The hardwood swamp is dominated by red maple (*Acer rubrum*) and silver maple (*Acer saccharinum*) along with a variety of water-tolerant shrub species. The general condition and health of the forest has not been recently assessed. It is possible that the canopy of this forest may be affected by emerald ash borer (D. Bernard, personal communication, 2019).

Species found within drier sections of the hardwood swamp include white ash (*Fraxinus americana*), red ash (*Fraxinus pennsylvanica*), black walnut (*Juglans nigra*), sycamore (*Platanus occidentalis*), white oak (*Quercus alba*) and basswood (*Tilia americana*). During a 2011 ECCC-CWS wildlife inventory, a single butternut (*Juglans cinerea*) was found at the Hahn Marsh Unit (EC-CWS 2011).

Although the swamp (within the Hahn Marsh Unit) is the oldest successional stage of the Big Creek Marsh Complex, a wide variety of herbaceous marsh plants thrive. These include arrowhead, burreed, cattail, and rice cutgrass (*Leersia oryzoides*). The presence of such plants illustrates the persistence of the marsh condition.

There is a narrow strip of barrier beach fronting Lake Erie (along the southern boundary of the Hahn Marsh Unit), referred to as the Hahn Beach. The beach strip is comprised of sand, low sand dunes, and slacks. A small open canopy community of eastern cottonwood (*Populus deltoides*), silver maple, and willows grows along the barrier beach abutting the lake (AECOM Canada 2009; Ralph and Heffernan 1979). Eastern cottonwood and willow grow along the beach margins, as do herbaceous species such as water sedge (*Carex aquatilis* var. *aquatilis*), wild chicory (*Cichorium intybus*), common boneset (*Eupatorium perfoliatum*), knotted rush (*Juncus nodosus*), white sweet-clover (*Melilotus albus*), common three-square bulrush (*Schoenoplectus pungens* var. *pungens*), coltsfoot (*Tussilago farfara*) and common mullein (*Verbascum thapsus* subsp. *thapsus*) (AECOM Canada 2009; McKeating and Dewey 1984; Ralph and Heffernan 1979). Beach vegetation is essential in stabilizing the sand so that a barrier between the marsh and the lake is maintained. The dunes are considerably smaller than dunes found further east on Long Point, but still form a dune ecosystem that shares similar habitat functions for a variety of plant and wildlife species.

Over time, some of the open water habitats within the Hahn Marsh Unit have filled in with sediment, enabling vegetation to expand into channels and ponds. Of particular concern within Hahn Marsh Unit is the expansion of non-native and invasive plant species such as non-native *Phragmites* and cattail. Other invasive species such as garlic mustard (*Alliaria petiolata*), purple loosestrife (*Lythrum salicaria*) and bittersweet nightshade (*Solanum dulcamara*) have been identified within the Hahn Marsh Unit.

Big Creek NWA - Dikes and Managed Lawn

Land cover at the ECCC-CWS operational compound, on dike tops, at the boat launch (north side of Big Creek), and along NWA boundaries up to the municipal road allowance (Highway 59) is grassed lawn, dominated by Kentucky bluegrass (*Poa pratensis* subsp. *pratensis*), common plantain (*Plantago major*) and white sweet-clover. These areas are mowed on a regular basis and maintained for public access and ECCC-CWS operations. These areas are also inspected frequently for invasive and non-native plants, the presence of wildlife (i.e., birds, turtles, and nests), evidence of predation of wildlife, and actions necessary to protect wildlife and habitat (i.e., restrict public access or move or protect nests) are undertaken.

2.2 WILDLIFE SPECIES

2.2.1 Birds

The Long Point region (including the Big Creek Marsh Complex) provides essential staging, stopover, feeding, and moulting habitat for waterfowl and other migratory birds along the Atlantic and Mississippi flyways in fall and spring. Over 200 bird species have been recorded at the Big Creek NWA since 1978, including several federally listed species at risk (EC–CWS 2014a; Government of Canada 2018; Table 3). The NWA provides important breeding habitat for more than 80 species of birds (EC–CWS 2014a). During the time between spring and fall migrations, no more than ~30 bird species use the NWA over the winter months (R. Ridout, personal communication, 2018)

Waterfowl

The marshes of Lake Erie and Lake St. Clair combined form the most extensive and highest quality areas for staging waterfowl in Ontario south of James Bay. Every spring and fall, hundreds of thousands of waterfowl visit the wetlands of the Long Point area (includes Big Creek Marsh Complex) during their annual migration. Located on the northern shore of Lake Erie, the Long Point region is one of the most important stopover areas for dabbling and diving ducks on the Canadian side of Lake Erie (Badzinski et al. 2006).

These birds congregate in the marshes and waters along the north shore of the lake and at Long Point Bay (including Inner Bay). On peak days during the fall migration, 7,500-15,000 waterfowl may be found resting and feeding in the Big Creek Marsh Complex (includes the Big Creek NWA) (EC-CWS 2014d). Staging waterfowl require open water areas and thus the majority of waterfowl using the Big Creek NWA are found within the Big Creek Unit (S. Badzinski, personal communication, 2014). In the fall, the number of waterfowl in the Long Point

region has approached 200,000, while in the spring peak numbers have been as high as 90,000 birds (S. Badzinski, personal communication, 2014).

Use of the Big Creek NWA by migrating birds is dominated by waterfowl, totalling over 20 species. Common migrants that use the NWA for feeding and staging include wood duck *(Aix sponsa),* green-winged teal *(Anas crecca),* northern pintail (*A. acuta*)*,* mallard *(A. platyrhynchos),* American black duck *(A. rubripes),* redhead *(Aythya americana),* ring-necked duck *(Aythya collaris),* canvasback (*Aythya valisineria*), Canada goose *(Branta canadensis),* tundra swan *(Cygnus columbianus),* hooded merganser (*Lophodytes cucullatus*), gadwall *(Mareca strepera),* American wigeon *(M. americana),* ruddy duck *(Oxyura jamaicensis),* and blue-winged teal (*Spatula discors*), (D. Bernard, personal communication, 2018; S. Badzinski, personal communication, 2016).

Figure 12. Tundra Swans at Big Creek Unit, Big Creek National Wildlife Area, 2009.
Photo: Danny Bernard © Environment and Climate Change Canada

Many birds use the NWA marsh to roost in the fall and spring. In the fall, thousands of ducks and geese can be seen leaving and returning to the NWA marshes between feeding in nearby fields (T. Barney, personal communication, 2014).

A large proportion (approximately 30%) of the eastern population of tundra swans passes through the Big Creek Marsh Complex in the spring (March–April) on their way to breeding grounds in the Canadian Arctic and Alaska (Petrie 1998). Typically, much of the NWA

is frozen when the peak number of swans arrive in the spring. The NWA marsh is used heavily by tundra swans in the fall; up to 1160 birds have been observed at the NWA in a single day (S. Badzinski, personal communication, 2014).

Waterfowl species such as American black duck, blue-winged teal, Canada goose, mallard, and wood duck are known to breed at the NWA (EC-CWS 2014a). However, nesting habitat is generally limited to drier portions and trees with cavities found in the Hahn Marsh Unit. The NWA is also significant for brood-rearing areas for ducks. Specifically, Wood Ducks have been recorded taking their broods to both the Big Creek and Hahn Marsh Units during the brood rearing period in summer (Dyson 2015). The hardwood swamp and bordering shrub thicket (at the Hahn Marsh Unit) are also important areas for ducks during moulting and as roosting areas (McCullough 1975).

The drier areas within the NWA provide important habitat for waterfowl during the post-breeding moult period. During this 3-4 week period in the summer, waterfowl shed their flight feathers (birds remain flightless and vulnerable to predation until new feathers grow). Hundreds of mallards and wood ducks use the NWA during post-breeding moult (Mohr and Maltby 1985).

Mid-winter Waterfowl Surveys are conducted annually over wetlands and open ice holes along the Lake Erie shoreline and Big Creek Marsh Complex (includes the Big Creek NWA) to document winter use by waterfowl populations (S. Badzinski, personal communication, 2014). Several species of migratory waterfowl (i.e., American black duck, common goldeneye (*Bucephala clangula*), Canada goose, and mallard) use the NWA and remain well into winter as long as some open water areas remain and food is available (T. Barney, personal communication, 2014).

Waterbirds

Over 20 different species of waterbirds have been recorded at the Big Creek NWA including; great egret (*Ardea alba*), sandhill crane (*Antigone canadensis*), green heron (*Butorides virescens*), American coot (*Fulica americana*), common gallinule (*Gallinula galeata*), pied-billed grebe (*Podilymbus podiceps*), sora (*Porzana carolina*) and Virginia rail (*Rallus limicola)* (EC-CWS 2013c; EC–CWS 2014a).

The Big Creek NWA marshes provide important breeding habitat for both common and rare waterbirds such as: American bittern (*Botaurus lentiginosus*) and Virginia rail*,* as well as colonial nesting waterbirds such as great blue heron (*Ardea herodias*) and black tern (*Chlidonias niger*) (Bartok 2011; EC-CWS 2014a; Government of Canada 2018; Kozlovic 1998;

Timmermans 2007; Weseloh 2007; Woodliffe 2007a, 2007b). The NWA is particularly important for secretive marshbirds such as the threatened least bittern (*Ixobrychus exilis*) and the endangered king rail *(Rallus elegans*), whose preferred habitat is often densely vegetated shallow marshes dominated by cattail as found at Big Creek NWA (Bartok 2011; Kozlovic 1998).

The marshes within the Hahn Marsh Unit are less complex than marshes within the Big Creek Unit, and historically supported fewer breeding waterbird species. There are fewer areas of open water and less diverse vegetation at the marshes of the Hahn Marsh Unit compared to the Big Creek Unit, and fewer breeding pairs of species such as pied-billed grebe, least bittern, Virginia rail and American coot nest within the Hahn Marsh Unit than in the Big Creek Unit (McKeating and Dewey 1984).

The marsh also provides foraging grounds for many waterbirds in summer such as the great blue heron, green heron, Caspian tern (*Hydroprogne caspia)*, belted kingfisher (*Megaceryle alcyon*) and black-crowned night-heron *(Nycticorax nycticorax*) (EC-CWS 2013c).

Figure 13. Great egret on Bayshore Pond, Big Creek National Wildlife Area, 2011.
Photo: Danny Bernard © Environment and Climate Change Canada

Shorebirds

Many shorebirds are common visitors or migrants along the beach area and in the marsh proper when water levels drop to expose mud flats. For example, whimbrel (*Numenius phaeopus*) and black-bellied plover (*Pluvialis squatarola*) use the beach areas for roosting and

species such as greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*T. flavipes*) and sandpipers use the marshes for feeding and stopover habitat.

Shorebird species reported breeding at the NWA include spotted sandpiper (*Actitis macularius*), killdeer (*Charadrius vociferus*), wilson's snipe (*Gallinago delicata*) and American woodcock (*Scolopax minor*) (C. Friis, personal communication, 2019).

Records of the endangered piping plover *circumcinctus* subspecies *(Charadrius melodus circumcinctus)* nests and migrants in the Long Point peninsula are historic (COSEWIC 2013). Nonetheless, there is suitable piping plover habitat available at the NWA, and surveys are conducted at the NWA to monitor the habitat and detect the presence of piping plovers as they continue to recover in the Great Lakes region.

Landbirds

Numerous landbird species migrate through the Long Point area and surrounding region in the spring and fall to forage and rest as they move across Lake Erie (Beacon Environmental 2010; McKeating and Dewey 1984). Long Point Bird Observatory has noted ~300 species of land birds at Long Point, with 134 species banded in 2017 (Bird Studies Canada 2018). Common migrants include red-winged blackbird (*Agelaius phoeniceus*), northern harrier (*Circus cyaneus*), common yellowthroat (*Geothlypis trichas),* swamp sparrow (*Melospiza georgiana)*, yellow-rumped warbler (*Setophaga coronata)* and white-throated sparrow (*Zonotrichia albicollis)* (EC–CWS 2014a).

Wild turkeys (*Meleagris gallopavo*) have been observed at the Hahn Marsh Unit. Following extirpation from Ontario due to hunting and habitat loss, this species was successfully reintroduced to the region in the 1980's (Cadman et al. 2007).

Landbird species reported nesting at the NWA include the belted kingfisher, cedar waxwing (*Bombycilla cedrorum)*, great horned owl (*Bubo virginianus)*, yellow-billed cuckoo (*Coccyzus americanus)*, northern flicker (*Colaptes auratus)*, gray catbird (*Dumetella carolinensis)*, baltimore oriole (*Icterus galbula)*, song sparrow (*Melospiza melodia)*, brown-headed cowbird (*Molothrus ater*), great crested flycatcher (*Myiarchus crinitus)*, indigo bunting (*Passerina cyanea)*, downy woodpecker (*Picoides pubescens)*, blue-gray gnatcatcher (*Polioptila caerulea)*, red-winged blackbird, yellow warbler (*Setophaga petechia),* tree swallow (*Tachycineta bicolor*), house wren (*Troglodytes aedon)*, eastern kingbird (*Tyrannus tyrannus)*, warbling vireo (*Vireo gilvus)* and red-eyed vireo (*V. olivaceus)* (AECOM Canada 2009; EC-CWS 2014a). Also included is the threatened red-headed woodpecker (*Melanerpes erythrocephalus)*.

Local residents such as the bald eagle (*Haliaeetus leucocephalus*) can be seen foraging in the NWA and nesting nearby.

2.2.2 Mammals

Over 20 mammal species have been observed at the Big Creek NWA, including: short-tailed shrew (*Blarina brevicauda*), coyote (*Canis latrans*), American beaver (*Castor canadensis*), Virginia opossum (*Didelphis virginiana*), red bat (*Lasiurus borealis*), striped skunk (*Mephitis mephitis*), meadow vole (*Microtus pennsylvanicus*), muskrat, American mink (*Neovison vison*), white-tailed deer (*Odocoileus virginianus*), white-footed mouse (*Peromyscus leucopus*), deer mouse (*P. maniculatus*), northern raccoon (*Procyon lotor*), eastern gray squirrel (*Sciurus carolinensis*), eastern cottontail (*Sylvilagus floridanus*) and red fox (*Vulpes vulpes*). Also included is the endangered little brown myotis (*Myotis lucifugus*) (AECOM Canada 2009; EC-CWS 2014b).

Historically, muskrats were the most common mammal in the NWA and played a significant ecological role in the marsh environment by using cattail as a major food supply and for building lodges. Muskrats play an ecological role by controlling the spread of cattail in the marsh ponds and channels. Muskrats can therefore complement marsh management by maintaining areas of open water used by staging waterfowl and waterbirds for breeding, foraging and resting (Errington 1963). Current muskrat population estimates for the Big Creek and Hahn Marsh Units are unknown; however, there is anecdotal evidence that suggests muskrat populations in the Long Point area have declined over the past decade and monitoring is needed to assess populations and the potential effects of Muskrat population decline on marsh habitat (D. Bernard, personal communication, 2018). It has been documented that American mink, northern raccoon, striped skunk, Virginia opossum predate bird and turtle nests along the dike tops.

2.2.3 Reptiles and Amphibians

The variety of habitats (i.e., open water, marsh, wooded swamp, dunes and beach) provide important breeding habitat, cover, and food for a variety of reptile and amphibian species.

Several species of snake inhabit the NWA and are most often found along sandy shores and grass-dominated areas. The most common species observed are the northern water snake (*Nerodia sipedon sipedon*) and the eastern garter snake (*Thamnophis sirtalis sirtalis*)

(McKeating and Dewey 1984; Piraino and Gillingwater 2005). The endangered eastern foxsnake (Carolinian population) (*Pantherophis gloydi*) is also known to inhabit the NWA.

Many turtle species have been reported at the Big Creek NWA, including the midland painted turtle (*Chrysemys picta marginata*) and the snapping turtle (*Chelydra serpentina*). (COSEWIC 2018; EC-CWS 2014c; Government of Canada 2018). There have also been observations of the non-native red-eared slider (*Trachemys scripta elegans*), which are likely unwanted pets released into the NWA.

Seven frog and toad species inhabit the NWA, including: the American toad (*Anaxyrus americanus*), American bullfrog (*Lithobates catesbeianus*), northern leopard frog (*L. pipiens*), green frog (*L. clamitans*), spring peeper (*Pseudacris crucifer*) and western chorus frog (Carolinian population) (*P. triseriata*). Also included is the endangered Fowler's toad (*Anaxyrus fowleri*). These have been reported at the NWA during spring and summer amphibian surveys (AECOM Canada 2009; COSEWIC 2010; EC-CWS 2014c; Piraino and Gillingwater 2005). Long term research to understand the population dynamics of reptiles and amphibians (including annual Fowler's toad and turtle surveys) have been undertaken from the Hahn Marsh Unit of the Big Creek NWA east to the Thoroughfare Point Management Unit of the Long Point NWA since 1988 (Beacon Environmental 2010; Green 2008; Piraino and Gillingwater 2005). The Ontario population of Fowler's toad has variable population trends, and following a peak in the early 1990's has seen an overall downward trend (COSEWIC 2010). In 2010, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) noted that this negative trend may be misleading given that expanded ideal breeding conditions were created during the study period.

In addition to other amphibians, the blue-spotted salamander (*Ambystoma laterale*) has bene identified within the NWA (Piraino and Gillingwater 2005). The endangered Jefferson's salamander (*Ambystoma jeffersonianum*) has been historically present in the NWA area (EC-CWS 2014c).

Reptile and amphibian research and surveys at the Big Creek NWA and Long Point NWA have provided long-term data sets for reptiles and amphibians at risk in Canada (Piraino and Gillingwater 2005; Samure 1995). These studies have found significant populations of rare reptiles and amphibians have persisted over the past 30 years.

2.2.4 Fish

The Big Creek NWA marshes and watercourses provide important spawning, nursery, and foraging sites for a variety of fish. More than 30 fish species have been identified at the Big

Creek NWA, including: brown bullhead (*Ameiurus nebulosus)*, yellow bullhead (*Ameiurus natalis*), northern pike (*Esox lucius*), yellow perch (*Perca flavescens*), bluegill (*Lepomis macrochirus)*, pumpkinseed sunfish (*Lepomis gibbosus)*, largemouth bass (*Micropterus salmoides)*, golden shiner (*Notemigonus crysoleucas)*, creek chub (*Semotilus atromaculatus)* and central mudminnow (*Umbra limi*). Several species at risk such as the special concern grass pickerel (*Esox americanus vermiculatus*) and warmouth *(Lepomis gulosus),* the threatened spotted gar (*Lepisosteus oculatus*) and the endangered lake chubsucker (*Erimyzon sucetta*) and pugnose shiner (*Notropis anogenus*) have been identified in the NWA (Fisheries and Oceans Canada 2012; LPRCA 2010; Marson et al. 2010; Staton et al. 2012).

2.2.5 Invertebrates

Information on the occurrence and distribution of invertebrate populations at the Big Creek NWA is limited - invertebrates have not been thoroughly inventoried or surveyed within the NWA. There are few inventories and surveys (i.e. pollinators, butterflies, dragonflies, damselflies, and crayfish) specific to the Big Creek NWA and much of the information is based on incidental observations. Nonetheless, the NWA supports a variety of invertebrates, as evidenced by the diversity and food preferences of birds, and at particular times of the year, the large concentrations of insects that can be seen. Dragonflies, damselflies, whirligig beetles, caddisflies, and snails are some of the most visible species. The wetlands produce numerous flying insects which fuel migration of insectivorous bird species in the spring and fall.

Data on macroinvertebrates within the Big Creek NWA was collected in 2013 in two locations in the Big Creek Unit, and the results were represented on the basis of the diversity and abundance of species in the form of a qualitative score. In 2013, the sampling site in the non-diked area of the Big Creek Unit had a qualitative score of “good”, and the sampling site in the diked Southern Cell had a qualitative score of “very good”. Both scores were lower than most of the 2013 Long Point NWA sites, and the Big Creek non-diked site score was below the average of all Lake Erie sites sampled in 2013. Despite their ranking, both Big Creek Unit sites had higher scores than all Lake Erie sites that are considered “degraded” (EC-CWS 2013a, G. Fiorino, personal communication, 2019).

There is limited information on the occurrence and distribution of crustaceans at Big Creek NWA: records are limited to incidental observations. Crayfish are known to be an important food source for a variety of wildlife including the endangered king rail and endangered queensnake (*Regina septemvittata*) (Environment Canada 2012; ECCC 2016).

The special concern monarch has been reported breeding in the NWA (June to September) and uses the NWA as migratory and stopover habitat to feed and rest in the late summer and early fall. During migration, large aggregations of several thousand individuals move through the Long Point region in a single day, stopping to feed on plants, congregate, or roost in trees on their way south to their wintering grounds (COSEWIC 2010; Environment Canada 2014b; McKeating and Dewey 1984).

2.3 SPECIES AT RISK

Forty-four federally listed (special concern, threatened and endangered) species under the *Species at Risk Act* (SARA), have been reported at the Big Creek NWA, including: 2 vascular plants, 1 invertebrate, 6 fishes, 1 amphibian, 11 reptiles, 22 birds, and 1 mammal (Table 3) (Government of Canada 2018). Forty-four species designated by COSEWIC have been recorded at the NWA (COSEWIC 2018; Table 3). Several species at risk found in the NWA are not listed here or in Table 3 because these species are vulnerable to illegal collection and disclosure of their names may threaten their conservation. The names of these sensitive species have been withheld from this management plan where there are location sensitivities (i.e., s.124 of the *Species at Risk Act*).

Also observed at the NWA are four *Endangered Species Act*, 2007 listed bird species that have been observed in the NWA (Table 3) (Government of Ontario 2018; Table 3). Three species that have been reported at this site are not listed under SARA but are of local importance and listed under the Ontario *Endangered Species Act*, 2007: the special concern bald eagle, black tern, and the endangered golden eagle (Government of Ontario 2018, Table 3).

The NWA provides important breeding habitat for several species at risk such as the endangered Fowler's toad, threatened least bittern, the threatened red-headed woodpecker, and the endangered prothonotary warbler-one of Canada's rarest songbirds. Critical habitat[2] under the *Species at Risk Act* has been identified for a number of species at risk in Big Creek

[2] *Species at Risk Act* "critical habitat" means the habitat that is necessary for the survival or recovery of a listed wildlife species and that is identified as the species' critical habitat in the final recovery strategy or in an action plan for the species. (Government of Canada, 2002; http://laws-lois.justice.gc.ca/PDF/S-15.3.pdf).

National Wildlife Area; for example, the Prothonotary Warbler, Least Bittern and Lake Chubsucker (ECCC 2016; ECCC 2017; Environment Canada 2011b; Environment Canada 2014a; Staton 2010). Due to the high number of species at risk (Table 3) on-site, it is anticipated that critical habitat will be identified for several other species in the future (i.e., king rail) (Environment Canada 2012). Several king rail individuals were confirmed in the Big Creek NWA in 2016 and 2017 (J. Brett, personal communication, 2018).

Species-specific habitat regulations currently exist under the ESA for several Provincial species at risk reported at Big Creek NWA including bobolink (*Dolichonyx oryzivorus*), eastern sand darter, eastern foxsnake (Carolinian population) and Fowler's toad (Government of Ontario 2018).

Appendix 1 provides links to more information on federal and provincial species at risk legislation in Ontario.

For more information on SARA, COSEWIC, and the ESA refer to Appendix 1 or visit:

- http://www.registrelep-sararegistry.gc.ca/
- https://www.canada.ca/en/environment-climate-change/services/committee-status-endangered-wildlife.html
- http://www.ontario.ca/laws/regulation/080230

Figure 14. Prothonotary warbler feeding young at nest box in the Big Creek NWA, 2011. Photo: Matt Dyson © Environment Canada.

Table 3: Species at Risk at Big Creek National Wildlife Area. This list was created with an emphasis on resident species in Big Creek NWA or species that use the NWA for breeding/a significant part of their life cycle. This list is not comprehensive and vagrant/transitory species are not necessarily represented or considered in management planning.

Common and Scientific Names of Species	Status		
	Canada		Ontario
	SARA[a]	COSEWIC[b]	ESA[c]
Vascular Plants			
Butternut *Juglans cinerea*	Endangered	Endangered	Endangered
Swamp rose-mallow *Hibiscus moscheutos*	Special Concern	Special Concern	Special Concern
Invertebrates			
Monarch *Danaus plexippus*	Special Concern	Endangered	Special Concern
Fishes			
Eastern sand darter (Ontario populations) *Ammocrypta pellucida*	Threatened	Threatened	Endangered
Grass pickerel *Esox americanus vermiculatus*	Special Concern	Special Concern	Special Concern
Lake chubsucker *Erimyzon sucetta*	Endangered	Endangered	Threatened
Pugnose shiner *Notropis anogenus*	Endangered	Threatened	Threatened
Spotted gar *Lepisosteus oculatus*	Threatened	Endangered	Endangered
Warmouth *Lepomis gulosus*	Special Concern	Endangered	Endangered
Amphibians			
Fowler's toad *Anaxyrus fowleri*	Endangered	Endangered	Endangered
Reptiles			
Eastern foxsnake (Carolinian population) *Pantherophis gloydi*	Endangered	Endangered	Endangered
Eastern hog-nosed snake *Heterodon platirhinos*	Threatened	Threatened	Threatened
Eastern milksnake *Lampropeltis triangulum*	Special Concern	Special Concern	Not classified
Eastern ribbonsnake (Great Lakes population) *Thamnophis sauritus*	Special Concern	Special Concern	Special Concern
Midland painted turtle *Chrysemys picta marginata*	No status	Special Concern	Not Classified
Queensnake *Regina septemvittata*	Endangered	Endangered	Endangered
Snapping turtle *Chelydra serpentina*	Special Concern	Special Concern	Special Concern
Birds			
Acadian flycatcher *Empidonax virescens*	Endangered	Endangered	Endangered
American white pelican *Pelecanus erythrorhynchos*	No Status	Not at risk	Threatened
Bald eagle *Haliaeetus leucocephalus*	No Status	Not at Risk	Special Concern

Common and Scientific Names of Species	Status		
	Canada		Ontario
	SARA[a]	COSEWIC[b]	ESA[c]
Bank swallow *Riparia riparia*	Threatened	Threatened	Threatened
Barn swallow *Hirundo rustica*	Threatened	Threatened	Threatened
Black tern *Chlidonias niger*	No Status	Not at Risk	Special Concern
Bobolink *Dolichonyx oryzivorus*	Threatened	Threatened	Threatened
Buff-breasted sandpiper *Tryngites subruficollis*	Special Concern	Special Concern	Not classified
Canada warbler *Cardellina canadensis*	Threatened	Threatened	Special Concern
Chimney swift *Chaetura pelagica*	Threatened	Threatened	Threatened
Common nighthawk *Chordeiles minor*	Threatened	Special Concern	Special Concern
Eastern meadowlark *Sturnella magna*	Threatened	Threatened	Threatened
Eastern whip-poor-will *Antrostomus vociferus*	Threatened	Threatened	Threatened
Eastern wood-pewee *Contopus virens*	Special Concern	Special Concern	Special Concern
Golden eagle *Aquila chrysaetos*	No Status	Not at Risk	Endangered
Golden-winged warbler *Vermivora chrysoptera*	Threatened	Threatened	Special Concern
Horned grebe (Western population) *Podiceps auritus*	Special Concern	Special Concern	Special Concern
King rail *Rallus elegans*	Endangered	Endangered	Endangered
Least bittern *Ixobrychus exilis*	Threatened	Threatened	Threatened
Olive-sided flycatcher *Contopus cooperi*	Threatened	Special Concern	Special Concern
Peregrine falcon *anatum/tundrius* subspecies *Falco peregrinus anatum/tundrius*	Special Concern	Not at Risk	Special Concern
Prothonotary warbler *Protonotaria citrea*	Endangered	Endangered	Endangered
Red knot *rufa* subspecies *Calidris canutus rufa*	Endangered	Endangered	Endangered
Red-headed woodpecker *Melanerpes erythrocephalus*	Threatened	Endangered	Special Concern
Rusty blackbird *Euphagus carolinus*	Special Concern	Special Concern	Special Concern
Short-eared owl *Asio flammeus*	Special Concern	Special Concern	Special Concern
Mammals			
Little brown myotis *Myotis lucifugus*	Endangered	Endangered	Endangered

Common and Scientific Names of Species	Status		
	Canada		Ontario
	SARA[a]	COSEWIC[b]	ESA[c]

a. SARA *(Species at Risk Act)*: Extinct, Extirpated, Endangered, Threatened, Special Concern, Not at Risk (assessed and deemed not at risk of extinction), or No Status (not rated).
b. COSEWIC (Committee on the Status of Endangered Wildlife in Canada): Extinct, Extirpated, Endangered, Threatened, Special Concern, Not at Risk (assessed not at risk), or Data Deficient (available information is insufficient to resolve eligibility for assessment or permit an assessment of the wildlife species' risk of extinction).
c. ESA (*Endangered Species Act, 2007*), Species at Risk in Ontario List: Extirpated, Endangered, Threatened, Special Concern, or not classified.

Sources: Cadman et al. 2007; COSEWIC 2010; EC-CWS 2013c; EC-CWS 2011; Environment Canada 2013a; Government of Canada 2018; Government of Ontario 2018; Mandrak et al. 2006; Marson et al. 2010.

3.0 MANAGEMENT CHALLENGES AND THREATS

3.1 WATER MANAGEMENT, CLIMATE VARIABILITY AND PROJECTED CLIMATE CHANGE

Sedimentation is a natural process that led to the development of the Big Creek delta and marsh. Over time, sedimentation (accelerated by land clearance and drainage on the upland areas in the Big Creek watershed) have led to high sediment loading from upstream sources. This has resulted in infilling and an increase of emergent vegetation, decreased water depths and flows, and a loss of open water habitats.

It is anticipated that water management problems at the Big Creek NWA will be exacerbated by climate change and the continued sedimentation challenge from upstream.

Site-specific information is needed to assess seasonal water flow and circulation within both units of the Big Creek NWA and the broader Big Creek Marsh Complex to identify options to improve water flow and circulation. This information is required for water management planning (i.e., drawdowns, dredging of sediment ponds) and to assess the effects of habitat management structures such as aquatic wildlife culverts.

The timing and duration of drawdowns and required dredging activities must be carefully planned to consider the needs of species at risk as well as other sensitive species, and to limit the potential expansion of undesirable species (i.e., non-native *Phragmites*).

The cost of maintaining current habitats within existing diked wetlands are resource-intensive and requires technical expertise. Much time, money and disturbance is involved maintaining integrity and operability of the dike infrastructure. All structures should be redeveloped every 20-30 years, and may require heavy equipment access, excavation, fill, and installation processes in a protected natural area, subject to environmental regulation (Section 3

of the *Wildlife Area Regulations*). Long term financial and resource commitments must be planned in advance, including regulatory compliancy, where appropriate.

In the face of projected climate change and continued variability, the resources required to monitor maintain infrastructure such as dikes, water control structures and pumps, as well as managing invasive and non-native plan species are expected to increase (Galloway et al. 2006).

3.2 MAINTENANCE OF SAFE WATER SUPPLY

Limited data are available on water quality within the Big Creek NWA. To date, water quality studies in Great Lakes wetlands have been designed to assess the overall integrity of coastal wetlands at a regional, lake and basin-wide scale (i.e., Chow-Fraser 2006; Grabas 2009). Data on water quality within the Big Creek NWA were collected in 2013 as part of the Great Lakes Coastal Habitat Assessment and Monitoring Project (CHAMP) (Huron–Erie corridor sites) (Grabas 2009). CHAMP monitors several water quality attributes known to affect wildlife habitat quality. The Coastal Habitat Assessment and Monitoring Project survey protocol was used to monitor water quality for two wetland sites at the Big Creek NWA in 2013. When compared to other wetlands in the Long Point area sampled in 2013, the Big Creek NWA sites had similar Water Quality Index (WQI) scores and nutrient levels – the lone exception being Cedar Creek, which had a significantly lower WQI score and higher nutrient levels (EC-CWS 2013b). However, relative to Lake Erie coastal wetlands outside of the Long Point area that were sampled in 2013, the Big Creek NWA sites had the highest WQI scores and generally lower nutrient levels (EC-CWS 2013b).

Additional site-specific information is needed to assess seasonal water quality of both the water within wetlands and the diked impoundments to identify potential sources of contaminants and options to improve water quality if required. Upstream runoff contains excess fertilizers which can cause nutrient loading of wetlands, but also contamination from residual pesticides (i.e., not taken up by target plants). Monitoring the potential effects on aquatic vegetation, invertebrates, and wildlife productivity would be ideal areas for long-term research.

In addition, there is a need to develop an emergency response plan to intervene in cases of spills and fire within or adjacent to the Big Creek NWA. There is a risk of chemical and fuel spills in Lake Erie that pose a significant threat to wildlife and natural habitat particularly at certain times of the year (i.e., waterfowl staging and fish spawning).

3.3 INVASIVE AND NON-NATIVE PLANTS

A large number of non-native and invasive plant species occur within the NWA (see Table 1 for a more detailed list). However, some have become well established over decades and are integrated into existing habitats. Problems arise with aggressive species that have evolved to rapidly spread and displace native species and cause decreases in native (i.e., appropriate) biodiversity.

Within the Big Creek NWA, the expansion and invasive characteristics of two species are of particular concern: non-native *Phragmites* and European black alder. Non-native *Phragmites* is established in dense stands in areas of shallow water and damp soil in the marsh (i.e., along edges of dikes), thereby reducing the open water available for staging waterfowl to land and areas for birds such as the great blue heron and least bittern to hunt and feed. Non-native *Phragmites* has expanded rapidly in the past 10 years, and overall wetland plant diversity has declined. Dense stands of non-native *Phragmites* can reduce access and habitat from open water to adjacent shorelines for other wildlife such as turtles and amphibians (Markle and Chow-Fraser 2018). There are some areas within the NWA where non-native *Phragmites* presents a physical barrier to human access, thus making recreation or conservation management more difficult. Not only can these species spread rapidly, but they also outcompete native species, decrease biodiversity, and are difficult to remove or control once established.

Determining effective management options to reduce the impacts of these species is often hampered by limited knowledge of the distribution and abundance of the species in the NWA and the ecological adaptability of many of these species. Early detection is key to the control and management of invasive plants, i.e., before species become established. Within the NWA, non-native *Phragmites* grows in both dry and wet substrates. Methods to control non-native and invasive plants growing in standing water (i.e., by cutting them) are labour-intensive or have limited success. Although over-water herbicides may be applied to select plants, as of writing there are no approved herbicides in Canada that can be applied to non-native *Phragmites* plants growing in standing water (beyond an Emergency Use exception). It is anticipated that products will be approved for over water control of non-native *Phragmites* in the future, and that a non-native *Phragmites* pilot control project will be created for Big Creek NWA.

3.4 INVASIVE AND NON-NATIVE ANIMALS

Numerous invasive animal species can be found in the Big Creek NWA (see Table 1 for a more detailed list). Management actions involving invasive animals are unique to each species, and several notable species are described below.

Mute Swans

The mute swan is an invasive and non-native bird from Eurasia that has rapidly expanded into the Lake Erie region since they first began colonizing the lower Great Lakes in the mid-1960s and 1970s (Petrie and Francis 2003).

The mute swan population at Lake Erie increased significantly in recent years and this increase is expected to continue (Meyer et al. 2012). Within the NWA, mute swans have been recorded in small numbers and exhibited aggressive behaviour, prevented breeding attempts of native bird species and caused significant damage to marsh vegetation as a result of feeding (D. Bernard, personal communication, 2016). As such, the mute swan population is closely monitored within the NWA. This species is a growing concern because mute swans compete for habitat and food with other native waterfowl species, and have few natural predators (Petrie and Francis 2003). Reducing the impacts of mute swans on native birds and habitat requires active management to prevent mute swans from nesting and establishing territories in the NWA.

Emerald Ash Borer

The emerald ash borer (*Agrilus planipennis*) is an invasive beetle that feeds on and kills all species of ash trees. It has expanded northward from the U.S. into southern Ontario (Canadian Food Inspection Agency [CFIA] 2011). The emerald ash borer poses a significant threat to the forest canopy of the Hahn Marsh Unit. Although the emerald ash borer is able to fly several kilometres, it is often spread through the transportation of wood products (CFIA 2011). The CFIA has created wood and wood product movement restrictions to try and regulate the spread of emerald ash borers; these restrictions are in place in Norfolk County (CFIA 2011).

Common Carp

The common carp (*Cyprinus carpio*) is an introduced species in North America and are known to have detrimental effects on aquatic vegetation. Carp cause increased turbidity created by their bottom-feeding habits. This inhibits growth of submergent plants, disturbs other wildlife, and reduces plant food available to waterfowl and other wildlife.

Common carp are found in both NWA units but are of particular concern in the Big Creek Unit and adjacent waterways where they are well established. At The Big Creek Unit, high densities of common carp could become a threat to at-risk fish species such as lake chubsucker and pugnose shiner.

3.5 OVERABUNDANT WILDLIFE

A wildlife species may be considered overabundant or a problematic native species if the species is a threat or damage is occurring to; wildlife habitat, species at risk, NWA infrastructure, or public health and safety.

3.5.1 Muskrats, American Beavers and Northern Raccoons

Some wildlife species are invasive/problematic native species, and can be difficult to monitor and/or control. The muskrat, American beaver and northern raccoon, all native to Ontario, can become overabundant and create management challenges. Muskrats can cause damage to dikes and berms, and American beavers can create dams and lodges that can impede water flow in channels and water control structures. Northern raccoons are omnivorous, opportunistic feeders and considered to be the greatest predator of turtles at all turtle life stages (Browne and Hecnar 2007). Northern raccoons also pose a threat to bird nests, especially within forest and wooded habitats (Thompson and Burhans 2003). Muskrat, American beaver and northern racoon populations are regularly assessed and animals are removed from the NWA by licensed trappers if the species is a threat or damage is occurring to wildlife habitat, species at risk, NWA infrastructure, or public health and safety.

3.5.2 Temperate-Breeding (Resident) Canada Geese

There is a need to balance the conservation of migrant Canada geese with the need to manage abundant temperate-breeding (resident) Canada geese within the NWA.

The NWA provides important habitat for migrant Canada geese that breed and raise their young in northern locations. Migrant Canada geese stop in southern Ontario to rest and feed during spring and fall migrations between summer breeding grounds in southern James Bay and wintering areas in the United States.

Temperate-breeding Canada geese nest and reside year-round in southern Ontario. The temperate-breeding Canada goose population presents an ongoing challenge for the maintenance of infrastructure and habitat management within the NWA, as well as outreach and communications with landowners in the local area and the public at large. It can be difficult to prevent temperate-breeding Canada geese from taking up residence each spring, and once the geese have nested successfully, they tend to return to the area in future years in growing numbers. In the NWA, the adults and young impact early spring plant growth on dikes and berms by removing and trampling vegetation and cover that could be used by other wildlife. While trampling of vegetation does not pose a serious threat to marsh management,

unvegetated areas caused by high numbers of geese could cause localized sections of the dike banks to erode.

3.6 FERAL AND DOMESTIC ANIMALS

Within the Big Creek NWA, feral and domestic cats, dogs and the non-native red-eared slider have been documented. These animals may be feral strays, unwanted pets (i.e., dogs, turtles and fish), or unwanted wildlife (i.e., striped skunk, northern raccoon, squirrels and woodchucks) that have been released illegally in the NWA (D. Bernard, personal communication, 2018). Although the number of feral cats and dogs in the NWA may be low and released infrequently, these animals can exert significant predatory pressure on native wildlife. This requires ongoing active management. Impacts of feral animals include nest destruction, eating birds and turtle eggs and individuals, the spread of disease and pathogens to wild animals, and the disturbance of natural habitats (i.e. soil disturbance).

3.7 WETLAND HABITAT LOSS AND FRAGMENTATION

Across Southern Ontario, agriculture, large urban centres and roads have reduced and fragmented natural areas (Smith et al. 2011). In recent decades, the human population has been increasing within the Lake Erie Basin, and associated shoreline development may increase (ECCC and US EPA 2017). With future population increases, tourism and the development of private sections of the Long Point peninsula may continue to increase. Development activities along the Lake Erie shoreline and near the NWA may reduce the overall biodiversity of the Big Creek Watershed and cause adverse effects on local habitat and wildlife species (i.e., reduction of species diversity along shoreline corridors). In order to maintain North American waterfowl populations, it is critical to manage the NWA and sustain linkages to nearby wetlands as refuges for migratory and resident species.

3.8 OTHER MANAGEMENT CHALLENGES

3.8.1 Increased Demand for Public Access and Services

Since the NWA was established, the population growth in nearby urban centres and increased public interest in recreation has resulted in a rise in the number of visitors to the NWA and an increased demand for services. This trend is expected to continue particularly as ECCC-CWS is encouraging further visitation through the Connecting Canadians to Nature (CCtN) initiative. Prior to the initiative, the visitation level has been carefully managed to limit activities to certain times of year and within designated areas to limit disturbance to wildlife and habitat. The anticipated rise in number of visitors may have the potential to put additional pressure on

the site. There may be an increase in the demand on infrastructure and resources for maintenance of grounds and facilities (i.e., trail, parking, access roads, signs, and washrooms), as well as an increase in the need to develop outreach materials to promote stewardship and compliance with *Wildlife Area Regulations*. This includes increased demands on ECCC-CWS as well as Environment and Climate Change Canada's Wildlife Enforcement Directorate (ECCC-WED) staff. The occurrence of prohibited activities in the Big Creek NWA, such as off-road ATVs and vehicle use, garbage dumping, vandalism, and collection of plants and wildlife places additional pressures on resources required to prevent and mitigate these activities.

It will become increasingly important to educate Canadians about stewardship of the NWA and acknowledge positive behaviour on the part of visitors. Under the CCtN (2015-2020), investments will be made to repair and improve the existing trail network, signage, public access to various points of interest and infrastructure, and to update and improve interpretive materials.

3.8.2 Multi-species Conservation and Species at Risk

Multi-species conservation and recovery is an ongoing challenge in the Big Creek NWA. The Big Creek NWA requires active management to maintain ecosystem functions and species diversity and abundance. For example, activities that are integral to sustaining habitats include the removal and control of invasive plants, annual water level control, periodic drawdowns and re-flooding within the diked wetland impoundments, and regular dredging of the channels, drains, ponds and sediment basins. Many species have complex site-specific habitat requirements that are not well understood, and small and/or widely distributed populations are often under-represented in general research studies. Critical habitat has been identified for a number of species in the NWA (i.e., least bittern, lake chubsucker) with species-specific habitat protection needs. A foreseeable challenge will be balancing the varying habitat needs of multiple species, including both common species and species at risk.

3.8.3 Legacy Issues

National Wildlife Area Boundaries

Uncertainty of NWA boundaries can become an enforcement challenge and threatens habitat conservation. Several roads, channels, creeks, dikes, and fence lines occur along the boundaries of the Big Creek NWA (Figures 2 and 3). Neighbouring property owners and land managers include private landowners, Long Point Region Conservation Authority, Nature Conservancy of Canada, and Norfolk County.

Ownership and maintenance of some of the infrastructure (i.e., fences) along the NWA boundaries is shared between ECCC-CWS and neighbouring land managers (Table 2). Over the years, encroachments onto the NWA property from private lands and municipal roads have occurred. In some cases, NWA infrastructure, such as parking lots, are not completely within federal lands and fall within the County road allowance. Boundary delineation and agreements or other legal tools need to be put in place to ensure conservation of the NWA habitats.

Without clearly marked and field-delineated boundaries, restricted access and trespass issues will cause confusion for neighbouring landowners and visitors to the NWA regarding prohibited and authorized activities. It is a particular management challenge to communicate boundaries and seasonal restrictions along the water and thus to visitors accessing the NWA by water.

It is anticipated that the continuation of shared ownership and arrangements for management practices will need to be formalized to ensure conservation goals and objectives are met and compliance with federal laws and policies.

3.8.4 Climate Variability and Projected Climate Change

Current models predict that climate change will affect the Great Lakes basin by causing warmer air temperatures (with an average increase in average annual temperature of ~2 to 4 °C), increased evaporation, increased precipitation, a decrease in winter ice cover, and subsequent lower lake levels (particularly in the lower Great Lakes) (Expert Panel on Climate Change for Ontario 2009). In this future state, Ontario coastal wetlands (such as those within the Inner Bay) may be damaged by climate change (Expert Panel on Climate Change for Ontario 2009) and could decrease in area as water levels fall or the range of water level fluctuations is reduced. It is expected there could be changes in the distribution, range and breeding behaviours of migratory birds due to climate change (National Audubon Society 2009). Although the exact impacts of climate change on the habitats and wildlife on the NWA are unknown, wildlife use of areas like the NWA are likely to shift from historical norms (Expert Panel on Climate Change for Ontario 2009). In particular, some wetland fauna species that are sensitive to fluctuating hydrology may be impacted greater than other species (Environment Canada 2013b). It is anticipated that climate change and the variability/shifting of Lake Erie water levels could exacerbate the spread and expansion of non-native species (i.e., non-native *Phragmites*) and could lead to an eventual reduction of biodiversity (Expert Panel on Climate Change for Ontario 2009).

There is a need to develop adaptive management strategies to consider changes over time and other potential effects of climate change and variability on habitat and wildlife (including species at risk), and to identify if additional habitat management practices to restore and protect habitats are needed.

4.0 GOALS AND OBJECTIVES

4.1 VISION

The overall management vision for the Big Creek NWA is to protect, improve and restore wetland and upland habitats to provide secure and undisturbed habitat for migrating waterfowl, wildlife, plants, and species at risk while providing limited public access for recreational or cultural activities in designated areas. The NWA is a continentally-significant staging area for migratory birds and waterfowl and a nationally significant habitat supporting a concentrated diversity and abundance of migratory birds. Priority habitats for conservation are wetlands and watercourses, forest, beaches and dunes. Priority wildlife include migratory birds (with an emphasis on waterfowl and waterbirds) and wildlife species at risk.

Where it does not compromise wildlife management goals, Environment and Climate Change Canada intends to manage the site in a way that allows and encourages public access for the purposes of research, conservation and interpretation in order to encourage public understanding and participation in the conservation of this exceptional site. Section 4.3 and Table 4 contain a description of approaches that could be used in the management of the Big Creek NWA, however management actions will be determined during the annual work planning process and will be implemented as human and financial resources allow.

4.2 GOALS AND OBJECTIVES

Goal 1: Wetlands will be managed so that populations of migratory birds and resident flora and fauna, including species at risk, are sustained and/or habitats and residences are created, restored or maintained through active management.

Objectives:

a) Manage water levels and marsh vegetation within the diked wetland impoundments to replicate an ecosystem driven by periodic water level fluctuations to achieve diverse wetland vegetation communities and a hemi-marsh (i.e., composition of vegetation and water has a ratio of 1:1) system. This will include patchy vegetation interspersed with areas of shallow open water, and will be attained within the next five years and maintained over the long term.

b) Maintain and improve facilities and infrastructure (dikes, water control structures, sediment ponds, site access) associated with water level and habitat management through the development (within the next three years) and implementation of a 10-year maintenance plan thereafter.

c) Maintain and improve water flow and circulation within wetlands, ponds, creeks and channels within the NWA. Develop and implement a water management strategy (within

the next five years) that will include an emergency response to spills and adaptations to mitigate potential impacts of climate variability and projected climate change.

d) Within the next five years, conduct a non-native *Phragmites* control pilot project in two priority areas, and create an NWA-wide *Phragmites* management plan thereafter.

e) Reduce the area dominated by non-native *Phragmites* in the NWA to less than 10% of its 2018 extent, by 2025.

f) Continue to monitor the impacts of overabundant wildlife and feral and domestic animals on infrastructure and diversity of native flora and fauna. Maintain management of overabundant wildlife populations (if required) to eliminate significant impacts on native species and/or habitats, over the long term.

Goal 2: Terrestrial habitats will be restored and managed so that populations of migratory birds and resident flora and fauna, including species at risk, are sustained and/or habitats and residences are created, restored or maintained through active management.

Objectives:

a) Maintain and improve the structure and diversity of forest habitat within the Hahn Marsh Unit through development (within the next three years) and implementation of a 10-year plan thereafter.

b) Upland habitats (i.e., dunes, sand beach, and riparian areas along dikes, channels, and creeks) will be monitored and surveyed to identify areas of natural disturbance and areas vulnerable to human disturbance. Management actions will be applied where necessary.

c) Within the next three years, conduct riparian restoration, including native plantings, along the dikes and watercourses to emulate a natural riparian environment and buffer to improve wildlife habitat.

d) Develop and implement a plan to reduce the extent and/or rate of expansion of invasive and non-native plant species in areas of concern, within the next 5 years.

e) In co-ordination with partners, continue to reduce and prevent road mortality of wildlife along NWA boundaries through infrastructure maintenance, habitat restoration and public outreach.

Goal 3: Promote opportunities for ecologically appropriate and responsible public access and use to enhance Canadians' connection to nature. This will be done while managing and monitoring visitor (staff, researchers, the public and partners) activities in the NWA, to ensure a safe environment and to reduce the ecological impacts of human use on the NWA.

Objectives:

a) Coordinate with federal wildlife enforcement personnel to encourage compliance with the *Canada Wildlife Act and Wildlife Area Regulations*, the *Migratory Birds Convention Act*, 1994 and the *Species at Risk Act*, and reduce the number of incidents of prohibited activities within the NWA to no more than five per year.

b) Manage agreements, leases, research permits, and public access to ensure compliance with all federal laws and policies.

c) Plan and implement CCtN infrastructure (trails, signage, and interpretive displays) and outreach materials to promote/maintain positive visitor experience, increase public support and participation in the conservation of the site, and mitigate effects of human disturbance on wildlife and habitat.

d) Increase the number of annual visitors using interpretive initiatives such as CCtN, improved website design, etc.

e) Manage and monitor visitor (i.e., staff, researchers, the public and partners) activities in the NWA, to ensure a safe environment for visitors and staff and to reduce the ecological impacts of human uses on the NWA.

Goal 4: Increase habitat connectivity in the vicinity of the Big Creek NWA, and support regional landscape-level conservation efforts and partnerships.

Objectives:

a) Increase the connectivity of habitats and migration corridors by consolidating and, where possible, expanding the protected area land base, through partnerships. Identify and protect at least one priority conservation land parcel near or adjacent to the NWA within the next 10 years.

b) Ensure ECCC-CWS capacity to maintain relationships with government and non-government organizations and stakeholders to participate in community and stakeholder meetings and coordinate with partners on shared issues and management approaches.

Table 4: Management Challenges, Threats and Approaches for Big Creek National Wildlife Area

Management Challenge or Threat	Goals and Objectives	Management Approaches (actions, including level of priority[1])
▪ Loss of biodiversity due to the decline of interspersion and open water	**Goal 1: Wetlands will be managed so that populations of migratory birds and resident flora and fauna, including species at risk, are**	▪ Conduct biological inventory for the NWA every five years to report on biological diversity and threats. **(2)** ▪ Monitor habitat change (i.e., extent and quality of wetland and upland vegetation

Management Challenge or Threat	Goals and Objectives	Management Approaches (actions, including level of priority[1])
patches due to increased emergent vegetation and sedimentation from upstream, ▪ Reduction in biodiversity due to expansion of invasive and/or non-native plant species ▪ Limited ability to manage water levels due to climate change and variability ▪Sedimentation from upstream and water levels outside of diked wetland impoundments are outside of ECCC-CWS control ▪Habitat degradation and predation pressures by feral and domestic animals ▪Data deficiencies about site-specific habitat requirements for species at risk ▪Managing for varying species habitat needs	**sustained and/or habitats and residences are created, restored or maintained through active management.** Objectives: a) Manage water levels and marsh vegetation within the diked wetland impoundments to replicate an ecosystem driven by periodic water level fluctuations to achieve diverse wetland vegetation communities and a hemi-marsh (i.e., composition of vegetation and water has a ratio of 1:1) system. This will include patchy vegetation interspersed with areas of shallow open water, and will be attained within the next five years and maintained over the long term. b) Maintain and improve facilities and infrastructure (dikes, water control structures, sediment ponds, site access) associated with water level and habitat management through the development (within the next three years) and implementation of a 10-year maintenance plan thereafter. c) Maintain and improve water flow and circulation within wetlands, ponds, creeks and channels within the NWA. Develop and implement a water management strategy (within the next five years) that will include an	communities, including the extent of invasive species (i.e., non-native *Phragmites*, purple loosestrife) and overabundant vegetation using aerial photography and site visits. **(1)** ▪ Conduct ground-based monitoring to monitor water levels, site infrastructure, water chemistry and habitat and wildlife responses to management activities. **(1)** ▪ Survey and monitor species at risk populations to evaluate effectiveness of management activities to protect and enhance critical habitats, in accordance with species at risk recovery strategies. **(1)** ▪ Implement recommendations from recovery documents (recovery strategies, action plans, management plans, etc.) for species at risk where feasible. **(1)** ▪ Continue to support established bird and amphibian population survey programs (i.e., Decadal Migrant Waterfowl Survey, Annual Mid-winter Waterfowl Survey, Annual Marsh Monitoring Program, Christmas Bird Count, Coastal Habitat Assessment and Monitoring Project) that occur at Big Creek NWA. Encourage and support monitoring and research projects that support NWA management objectives and address data and knowledge gaps. **(2)** ▪ Monitor and document seasonal habitat use (including nearshore waters) by waterbirds, waterfowl, shorebirds, and landbirds and other migratory species (i.e., monarch butterflies, bats). **(1)** ▪ Prepare a water management strategy and infrastructure maintenance plan for the Big Creek NWA to include; the short- and long-term actions necessary to maintain and improve water flow and circulation, water quality and supply within

Management Challenge or Threat	Goals and Objectives	Management Approaches (actions, including level of priority[1])
▪ Maintain safe water supply ▪ Predation pressures and habitat disruption by overabundant wildlife	emergency response to spills and adaptations to mitigate potential impacts of climate variability and projected climate change. d) Within the next five years, conduct a non-native *Phragmites* control pilot project in two priority areas, and create an NWA-wide *Phragmites* management plan thereafter. e) Reduce the area dominated by non-native *Phragmites* in the NWA to less than 10% of its 2018 extent, by 2025. f) Continue to monitor the impacts of overabundant wildlife and feral and domestic animals on infrastructure and diversity of native flora and fauna. Maintain management of overabundant wildlife populations (if required) to eliminate significant impacts on native species and/or habitats, over the long term.	the Big Creek and Hahn Marsh Units, and an emergency response plan to respond to spills in Lake Erie, channels, ditches and diked wetland impoundments. **(1)** ▪ Undertake planting of native species to restore disturbed sites and to increase riparian and vegetative buffers. **(2)** ▪ Monitor and manage, where feasible, muskrat, American beaver, mute swan, temperate breeding Canada goose and common carp populations and impacts on the NWA. **(1)** ▪ Initiate scheduled review of agreements, permits and collaborative arrangements, revise and renew as appropriate. **(1)** ▪ Provide guidance to visitors (i.e., public, permit holders, ECCC-WED) to avoid and reduce disturbance to wildlife and habitat. **(1)** ▪ Reduce or prevent the expansion of non-native *Phragmites* in the NWA by applying herbicide using targeted approaches in sensitive areas, and use a combination of hand wicking, backpack spraying, ground-vehicle application, and aircraft application using experienced contractors across the NWA. (1) ▪ Promote recovery of areas treated to remove non-native *Phragmites* to return to functional habitat by flattening dead stalks, conducting prescribed burns, and controlling re-colonizing plants as needed. (2)
▪ Loss of biodiversity due to invasive and non-native plant and wildlife species ▪ Declines in availability and quality of	**Goal 2: Terrestrial habitats will be restored and managed so that populations of migratory birds and resident flora and fauna, including species at risk, are sustained and/or habitats and residences are created, restored or**	▪ Develop and implement a comprehensive terrestrial habitat plan to improve habitat quality and biodiversity and include a range of management practices (weed and invasive species control, prescribed burns, cutting, monitoring techniques, etc.). **(2)** ▪ Establish a baseline inventory and monitor habitat change (i.e., extent and

Management Challenge or Threat	Goals and Objectives	Management Approaches (actions, including level of priority[1])
habitats for wildlife ▪ Disturbance (i.e., increased erosion, trampling) to fragile sand beach and dune environment and wildlife from prohibited activities ▪ Predation pressures and habitat disruption by feral and domestic animals	**maintained through active management.** Objectives: a) Maintain and improve the structure and diversity of forest habitat within the Hahn Marsh Unit through development (within the next three years) and implementation of a 10-year plan thereafter. b) Upland habitats (i.e., dunes, sand beach, and riparian areas along dikes, channels, and creeks) will be monitored and surveyed to identify areas of natural disturbance and areas vulnerable to human disturbance. Management actions will be applied where necessary. c) Within the next three years, conduct riparian restoration, including native plantings, along the dikes and watercourses to emulate a natural riparian environment and buffer to improve wildlife habitat. d) Develop and implement a plan to reduce the extent and/or rate of expansion of invasive and non-native plant species in areas of concern, within the next 5 years. e) In co-ordination with partners, continue to reduce and prevent road mortality of wildlife along NWA boundaries through infrastructure maintenance, habitat restoration and	quality, of upland vegetation communities, including the extent of invasive species (i.e., non-native *Phragmites*, purple loosestrife) using aerial photography and site visits. **(1)** ▪ Where ecologically appropriate, undertake planting of native species to restore disturbed sites and to increase riparian and vegetative buffers. **(2)** ▪ Prepare and implement an invasive species control plan for the NWA to reduce the spread of invasive and non-native species, where feasible, and prevent new invasive non-native plant species from establishing. **(2)** ▪ Implement erosion control (i.e., revegetation, sediment traps) to retain sand and promote dune restoration, where ecologically appropriate. **(2)** ▪ Undertake targeted control to reduce the spread of invasive and non-native species where feasible. Consider best management practices and guidance documents, where available. **(1)** ▪ Manage and remove overabundant, non-native and/or invasive animals where feasible. **(1)**

Management Challenge or Threat	Goals and Objectives	Management Approaches (actions, including level of priority[1])
	public outreach.	
▪ Unauthorized access causing disturbance to wildlife and habitat (particularly staging and nesting birds, amphibians, and reptiles) ▪ Increased demand for public access and use ▪ Road mortality of amphibians, reptiles and birds due to vehicles on Highway 59 (Causeway)	**Goal 3: Promote opportunities for ecologically appropriate and responsible public access and use to enhance Canadians' connection to nature. This will be done while managing and monitoring visitor (staff, researchers, the public and partners) activities in the NWA, to ensure a safe environment and to reduce the ecological impacts of human use on the NWA.** Objectives: a) Coordinate with federal wildlife enforcement personnel to encourage compliance with the *Canada Wildlife Act* and *Wildlife Area Regulations*, the *Migratory Birds Convention Act, 1994* and the *Species at Risk Act*, and reduce the number of incidents of prohibited activities within the NWA to no more than five per year. b) Manage agreements, leases, research permits, and public access to ensure compliance with all federal laws and policies. c) Plan and implement CCtN infrastructure (trails, signage, and interpretive displays) and outreach materials to promote/maintain positive visitor experience, increase public support and	▪ Publish public notices, install signs, post notices at access points, prepare targeted outreach materials for visitors (i.e., boaters, hikers, fishers, waterfowl hunters) and maintain ECCC–CWS website, to promote compliance with the *Wildlife Area Regulations*, *Canada Wildlife Act*, and *Migratory Birds Convention Act, 1994* and *Species at Risk Act* and reduce unauthorized access and occurrence of prohibited activities, and avoid and reduce disturbance to wildlife and habitat. **(1)** ▪ Communicate with local tourism operators and the provincial tourism department concerning the protected status of Big Creek NWA and provide material demonstrating the ecological value of the area. **(1)** ▪ Provide outreach and education materials to permit holders, neighbours, stakeholders and visitors. **(1)** ▪ Conduct weekly/biweekly site visits to monitor and maintain facilities and infrastructure, assess human impacts on wildlife and habitat, and evaluate management actions. Results will be documented and reported on a regular basis to ECCC–CWS and ECCC–WED. **(1)** ▪ Complete periodic formal assessments of all facilities and infrastructure and identify contaminant or other risks (i.e., building condition reports). **(2)** ▪ Repair or replacement of public facilities (i.e., wildlife viewing towers, parking lots). **(1)** ▪ Enforce the *Wildlife Area Regulations* through regular visits by ECCC-WED. **(1)** ▪ Complete periodic monitoring and risk assessments by Environment and

Management Challenge or Threat	Goals and Objectives	Management Approaches (actions, including level of priority[1])
	participation in the conservation of the site, and mitigate effects of human disturbance on wildlife and habitat. d) Increase the number of annual visitors using interpretive initiatives such as CCtN, improved website design, etc. e) Manage and monitor visitor (i.e., staff, researchers, the public and partners) activities in the NWA, to ensure a safe environment for visitors and staff and to reduce the ecological impacts of human uses on the NWA.	Climate Change Canada's Contaminated Sites program. **(1)** ▪ Implement the CCtN visitor landscape plan. **(1)** ▪ Communicate with visitors on the ecological values and protected status of the Big Creek NWA and safe practices, and provide outreach materials, as required. **(1)** ▪ Review permits and collaborative arrangements, revise and renew as appropriate and to meet current standards. **(1)** ▪ Monitor visitation numbers by counting/estimating visitor numbers and measure visitor impacts on the NWA. **(1)**
▪ Fragmentation and degradation of habitats and travel corridors for wildlife as result of development pressures, conversion of wetland to other uses (i.e., agriculture, residential, marinas). ▪ Agriculture, and residential land use. ▪ Rapid expansion of non-native *Phragmites*, sedimentation and infilling of open water and channels,	**Goal 4: Increase habitat connectivity in the vicinity of the Big Creek NWA, and support regional landscape-level conservation efforts and partnerships.** Objectives: a) Increase the connectivity of habitats and migration corridors by consolidating and, where possible, expanding the protected area land base, through partnerships. Identify and protect at least one priority conservation land parcel near or adjacent to the NWA within the next 10 years. b) Ensure ECCC-CWS capacity to maintain relationships with government and non-government organizations	▪ Identify priority lands adjacent to the NWA for conservation; contribute to regional landscape-level conservation initiatives. **(2)** ▪ Encourage conservation of priority adjacent lands through expansion of the NWA or other securement options such as conservation easements, best management practices, and partnerships with the private sector, land managers and non-government organizations. **(2)** ▪ Participate in partnerships and collaborations to address conservation of adjacent lands and regional conservation initiatives. **(1)** ▪ Formalize collaborative agreements, revise and renew as appropriate. **(1)** ▪ Complete outreach and education initiatives within neighbouring communities. **(2)**

Management Challenge or Threat	Goals and Objectives	Management Approaches (actions, including level of priority[1])
decrease in open water habitats and loss of biodiversity ▪ Co-ordination of wetland management and conservation within the Big Creek Marsh Complex ▪ Development pressures within Big Creek Watershed and Norfolk County	and stakeholders to participate in community and stakeholder meetings and coordinate with partners on shared issues and management approaches.	

[1] **Level of Priority**: 1 (from 0–3 years); 2 (from 4–6 years); 3 (from 7–10 years).

4.3 EVALUATION

Annual monitoring will be performed within the limits imposed by the availability of financial and human resources. The management plan will be reviewed 5 years after its initial approval and updated every 10 years thereafter. The evaluation will take the form of an annual review of monitoring data obtained from the monitoring and research projects outlined below. This monitoring will be used to establish priorities for action and to allocate resources.

5.0 MANAGEMENT APPROACHES

Active management to maintain wetland, terrestrial and aquatic habitats and the associated species is required at the Big Creek NWA. Species habitat use, timing windows, critical habitats and other constraints will be considered within all management actions.

This section and Table 4 have a description of approaches that could be used in the management of the Big Creek NWA. However, management actions will be determined during the annual work planning process and will be implemented as human and financial resources allow.

5.1 HABITAT PROTECTION AND MANAGEMENT

5.1.1 Wetland Habitat Management

The wetland and aquatic habitats within the NWA are influenced by water levels on Lake Erie, Big Creek Channel, Old Big Creek, Hahn Creek and the Hahn Access Channel, and the hydrology of the Big Creek Marsh Complex. In many respects, management of these habitats is beyond the control of NWA staff. ECCC-CWS will continue to work in collaboration with OMNRF, DUC, LPRCA, NCC, private landowners, and marsh managers to co-ordinate water level, sediment, and vegetation management within the Big Creek Marsh Complex and broader Big Creek Watershed.

A variety of wetland management techniques may be used in specific areas to achieve long-term management goals and objectives. Those techniques include water level manipulation, vegetation management (i.e., cutting, mowing and prescribed burns), channel and pond restoration and creation, and maintenance of existing diked impoundments.

Management will vary from intensive manipulation to non-interference with natural processes. Emphasis will be directed toward those species of wildlife, especially waterfowl and species at risk, that require the marsh environment to survive. Management actions that are implemented for a particular species will be implemented in such a manner as to minimize stress upon other wildlife. Management will not be single purpose in approach but will reflect the habitat requirements of a variety of wildlife and plant species.

Wetlands within the diked impoundments will be managed to achieve hemi-marsh conditions, primarily through water level manipulation (i.e., drawdowns and flooding), and vegetation management to maintain open water and water flow. The water levels within the impoundments will continue to be artificially controlled using a low-level dike and pump. Water

levels within the diked impoundments will be managed following established normal operating levels (a range of low and high water levels) for each cell, as necessary to maintain hemi-marsh conditions (EC-CWS 1994). To stimulate improvement of plant growth, richness and diversity, water levels may be managed both seasonally and over a period of years to replicate the natural rise and fall of water levels in coastal wetlands that are open to the lake.

Biological management should be decided collaboratively, and based on annual evaluations of water levels and habitat changes, determined through site inspections and aerial photography. Management may include manipulation of water levels to control areas of over abundant vegetation or invasive species (particularly cattail, non-native *Phragmites*, purple loosestrife and reed canarygrass stands) and increase the amount of edges and shallow water openings for the benefit of waterfowl and other marsh-related species, including species at risk.

Maintenance of dikes and pumps include frequent inspections and the occasional use of heavy equipment for soil excavation and replacement, dredging and clearing of channels, drains and ponds, culvert replacement, and revegetation of disturbed sites. These activities will be consistent with the *Federal Policy on Wetland Conservation*, and not result in significant adverse environmental effects under *Canadian Environmental Assessment Act, 2012*. Where activities may impact species at risk or migratory birds, permits are required. Monitoring species and habitat responses to management activities will help mitigate against potential negative impacts, and support adaptive management decisions.

In both managed and unmanaged wetlands, regular monitoring will be conducted to track changes in wetland extent, vegetation community density and extent, biodiversity and wetland-dependent species at risk through site surveys, vegetation mapping using aerial photography, and collaborative monitoring (i.e., Coastal Habitat Assessment and Monitoring Program (CHAMP), bird monitoring programs).

5.1.2 Water Management and Water Quality Protection

Water levels on Lake Erie, Big Creek, Old Big Creek, and the Hahn Access Channel are the primary factor affecting the extent and ecological integrity of wetlands within the Big Creek NWA. Their water levels are primarily driven by climate. In addition, sediment from upstream has resulted in infilling and reduced areas of open water. Because many of the habitat types (i.e., wetlands, uplands, watercourses, ponds) are contiguous with properties adjacent to the NWA, land and water and vegetation management on lands adjacent to the NWA Units also influence water supply and quality at the NWA.

There is a need to develop a water management strategy for the Big Creek NWA to maintain key wildlife requirements for water supply and quality, with an emphasis on waterfowl, migratory breeding birds, aquatic species and species at risk. ECCC-CWS will prepare and implement a 10-year water management strategy for the Big Creek and Hahn Marsh Units. The strategy will strive to identify short- and long-term actions necessary to maintain and improve water flow and circulation and water quality within the Big Creek NWA. The strategy will describe the maintenance requirements of the facilities and infrastructure over the long term, and will outline the potential impacts and adaptations to address climate change and variability under high and low lake levels and extreme weather events. Long-term monitoring of vegetation communities on the NWA (using aerial photography) can retain a historical record of site changes and document significant climatic events. To address water quality issues, the strategy will outline mitigation options to reduce the spread of invasive aquatic and emergent plants to the wetland habitats from the water supply, as well as identify areas where riparian and vegetative buffers can be improved through planting initiatives. This plan will also include an emergency response plan to reduce risk and respond to potential chemical and fuel spills (i.e., into Lake Erie, creeks, channels, drains, ponds and diked wetland impoundments) and fire within the NWA.

ECCC-CWS will implement a landscape plan (i.e., native plantings) along the dikes and watercourses within the NWA to emulate a natural riparian environment and buffer to improve wildlife habitat. ECCC-CWS will encourage the use of vegetated buffers and best management practices for agriculture and fish and wildlife habitat conservation along common boundaries (i.e., private property, roads, channels, creeks) bordering the NWA.

5.1.3 Terrestrial Habitat Management

ECCC-CWS will develop and implement a 10-year plan to improve the structure and diversity of forest habitat within the Hahn Marsh Unit. The strategy will include actions to maintain and improve shrub thicket and wooded swamp habitat types. The overall management approach will be to allow the wooded swamp and shrub thicket habitat types to naturally succeed to mature forest. At present, physical access to portions of the Hahn Marsh Unit is difficult due to dense vegetation and shallow water and consequently, management actions have been limited. Some management activities may be undertaken to improve access, promote succession and improve species diversity or improve breeding habitat for bird species. Additionally, vegetation will be used in terrestrial environments to buffer aquatic and wetland habitats in order to improve water management. Invasive and non-native plant species will be

actively managed through removal and control measures (i.e., cutting, mowing and herbicide application). Where feasible, invasive plant species and non-native trees and shrubs will be monitored and removed, and areas replanted with native species.

Trees and shrubs may be planted to provide wildlife corridors as visual barriers to minimize disturbance to staging birds, to establish wind breaks, or to provide the necessary habitat components for birds and other wildlife. All plantings will be for the benefit of wildlife and only those species native to southwestern Ontario will be used. Grasses may be planted on the dikes to provide suitable cover for wildlife and to stabilize embankments. Non-native trees and shrubs within the NWA will be removed and native species will be replanted where appropriate and necessary.

Rare plants and plant species at risk censuses (as guided by recovery documents) will determine the number of plants, extent and health of stand, and measures to mitigate threats. For example, butternut trees will be monitored and recovery actions (i.e., the prospect of replanting canker resistant trees) will be applied where appropriate.

There has been limited active habitat or vegetation management on the sand beach and dunes at the NWA. Natural processes occur unimpeded and the primary focus of habitat protection is to ensure that human activities do not interfere with natural sand beach and dune dynamics and habitats for migratory birds and species at risk. Public access is prohibited year-round to the beach and dunes at Big Creek NWA. Periodic visits by ECCC staff (particularly during periods of high use) will occur, and enforcement actions will be taken when required.

The sand beach and dunes will be monitored regularly to identify issues such as unauthorized access, garbage and debris, sick or injured wildlife, or erosion that may require a management response. ECCC-CWS will not interfere with natural forces that act on the sand beach and dunes. However, mitigation measures may be contemplated if there is a threat due to human disturbance or destruction of the vegetation. Erosion control may occur on a limited scale by means of revegetation or restoration of the dunes and beach.

Authorized visits to the sand beach and dunes and low-impact studies will be kept to a minimum and monitored over time to assess effects of disturbance to wildlife and habitat. ECCC-CWS will work with partners and landowners to reduce and mitigate the effects of human disturbance and encroachments onto the NWA dunes and beaches, adjacent to the South Beach and along the Hastings Drive municipal road allowance and Highway 59 (Causeway) if the need arises.

All other terrestrial habitat types within the NWA, including shorelines, dikes, roadsides, embankments and office grounds will be monitored through routine site visits to assess wildlife use (i.e., nesting sites and travel corridors) and visitor use (i.e., trails, shorelines, dikes, parking lots) and to identify emerging issues such as new invasive species that may require a management response. Changes in terrestrial habitat extent and composition will be monitored using aerial photography and vegetation mapping.

The top of dikes will be mowed regularly during the growing season. Brush will be removed to allow access, facilitate maintenance and safety. Weeds and invasive non-native plants will be controlled using a combination of cutting, pulling, herbicides, and water level management, employing the Ontario guidance on best management practises (i.e., for non-native *Phragmites* (OMNR 2011)) where appropriate.

A long-term management strategy to remove and reduce invasive and non-native plants on the NWA is needed. This should include an inventory of species (known problem species include: non-native *Phragmites*, reed canarygrass, purple loosestrife, Eurasian water-milfoil, European frog-bit, and flowering rush) and monitoring the extent and rate of expansion using site surveys and aerial photography and the effectiveness of management and impacts on other species should be evaluated. Non-native plant species will not be deliberately introduced to the NWA. If a new non-native plant species with the potential to become invasive is detected, and monitoring and research determines that these or other species are limiting the ecological integrity of wetland, forest and/or upland habitats, or are detrimental to wildlife use, control or removal methods will be considered. Efforts will be made to control and/or remove invasive plants within two years of detection.

The distribution and percent cover of invasive and non-native plants will be mapped every five years to determine areas of concern. ECCC-CWS will develop and implement a plan to reduce the extent and/or rate of expansion of invasive and non-native plant species and areas of concern, within the next five years. Priority species for control are non-native *Phragmites*, purple loosestrife, reed canarygrass and European black alder. ECCC-CWS will consider the Ontario guidance documents on best management practices for invasive species (i.e., non-native *Phragmites*) within the NWA. European black alder trees will be removed and where feasible, sites will be restored to native vegetation within the next five years.

Agriculture and Agri-Food Canada and the Canadian Food Inspection Agency (AAFC–CFIA) wood and wood product movement restrictions are in effect in the Norfolk County (AAFC–

CFIA 2011), and will be followed on the Big Creek NWA in an effort to curtail the spread of Emerald Ash Borers.

5.2 WILDLIFE MANAGEMENT

Research and surveys at Big Creek NWA have reported significant threats to reptile and amphibian populations, including: high mortality of several species along Highway 59 (Causeway), boat mortality in the Inner Bay, as well as high rates of predation of nests and juveniles by birds and mammals, loss of breeding habitat due to increase of invasive plant species (i.e., non-native *Phragmites*), illegal collection and trapping of wildlife, and habitat loss due to changing environmental conditions (i.e., low water levels, natural succession, etc.) (Ashley and Robinson 1996; Green et al. 2011; Greenberg and Green 2013; Piraino and Gillingwater 2005). Protection and conservation of migratory birds, species at risk, and other wildlife will be mainly achieved through limitation of human disturbance. As per the *Canada Wildlife Act*, all wildlife species are protected within the NWA. Migratory birds, species at risk and other wildlife will be monitored and surveyed as part of broader efforts (i.e., waterfowl surveys, marshbird and amphibian monitoring).

5.2.1 Waterfowl and Migratory Birds

The Big Creek NWA habitats are predominantly managed as a staging area and resting site for migratory waterfowl and breeding bird populations. The management strategy will place emphasis on those species of waterfowl that require a marsh environment for refuge from disturbance, particularly during fall.

Active management may be undertaken when the need arises. For example, installation of nest boxes to increase nesting habitat for migratory birds. However, certain threats to the birds (i.e., changes in food resources, weather events, and increased incidence of botulism, toxics, disease, and bird mortality) are considered to be beyond the influence of management approaches outlined in this plan.

5.2.2 Management of Overabundant Wildlife, and Feral and Domestic Animals

ECCC-CWS will monitor muskrat, American beaver and northern raccoon populations within the NWA, and partner with local marsh managers and agencies to better understand the population dynamics within the NWA and broader Big Creek Marsh Complex. ECCC-CWS will identify best management practices to monitor and sustain muskrat populations.

The trapping of muskrats on a sustainable population basis will be undertaken when needed to reduce damage to the dikes, thereby reducing maintenance activities and their associated costs. The trapping program will be monitored closely to reduce adverse impacts upon the resident muskrat populations, minimize disturbance to other wildlife and habitats, and document contributions from trapping to the local economy. The management or harvesting of other mammals such as American beaver and northern raccoon may also occur as population conditions warrant. Trapping will take place under the authority of a CWA permit, using approved techniques by trappers licensed through the OMNRF.

Mute swans and temperate-breeding Canada geese will be monitored on a regular basis. Birds will be discouraged from nesting and will be removed if damage or numbers present problems for other wildlife or compromise safety of visitors to the NWA.

Common carp numbers and behaviour will be monitored visually at the diked impoundments during water level manipulations throughout the year. If evidence of damage becomes evident and carp numbers become too high, carp may be controlled or removed using nets to reduce the population.

Where routine monitoring of the NWA identifies particular problems with feral wildlife, removal of problem animals may be undertaken by ECCC–CWS. Outreach to promote compliance with *Wildlife Area Regulations* will be undertaken. People releasing or feeding wild or feral animals will be reported to ECCC–WED.

5.3 SPECIES AT RISK

Species at risk and habitats required for their persistence, breeding, stopover and recovery within the NWA will be identified and protected. The annual planning for impoundment management and maintenance is based on an ecosystem approach and considers the requirements for protecting and preventing negative impacts to species at risk and identified critical habitat. ECCC–CWS works closely with DFO and the OMNRF to identify and monitor aquatic species (i.e., fish, mussels, crustaceans, benthic invertebrates) in managed and coastal wetlands, channels and ditches in the Big Creek NWA and adjacent waters of Lake Erie, and Big Creek Marsh Complex, with an emphasis on species at risk.

Species and habitats will be monitored to evaluate the effectiveness of management activities to maintain, protect and restore critical habitat. In addition, recommendations from species at risk recovery documents (i.e., recovery strategies, action plans, management plans)

will be implemented where feasible, and based on guidance from responsible jurisdictions and species experts.

5.4 MULTI-AGENCY LAND MANAGEMENT PARTNERSHIPS

Efforts to maintain or increase capacity of ECCC-CWS staff to establish and maintain relationships with neighbours, local planning authorities, government and non-government organizations, Indigenous communities, conservation organizations, other stakeholders (i.e., agricultural organizations) and enforcement personnel will facilitate a holistic and coordinated approach for the management and conservation of the Big Creek marshes.

The maintenance of creeks, channels, drains, fences, and roads bordering and/or passing through the NWA is shared between ECCC–CWS and adjacent landowners. Land management on the NWA is also a collaborative effort, carried out using a number of agreements, permits and collaborative arrangements in compliance with the *Canada Wildlife Act*. Where cooperative management occurs or is desired, formal agreements may be needed, renewed or revised to clarify roles and responsibilities, sharing of equipment and dispute resolution.

ECCC-CWS will need to:

- Assess and update agreements and leases with OMNRF for habitat and species management activities, including wetland management, waterfowl conservation, and administration of waterfowl hunting within the Big Creek NWA, and visitor outreach in the Long Point area, species at risk recovery, and invasive species control. Agreements will be modified or maintained as appropriate.
- Assess and update the formal agreement (1986) with DUC to undertake maintenance and repairs to the dikes, pumps or other installations constructed or installed by them within the Big Creek NWA. Updates to this agreement may identify opportunities to address current and future management challenges and threats, including regional wetland conservation, waterfowl conservation, multi-species conservation, control of invasive and non-native species, adaptations to climate change and variability, and species at risk recovery.
- Assess formal and informal agreements with agencies and organizations (i.e., LPRCA, Norfolk County, NCC), private landowners, and hunt clubs for habitat and species management activities, wetland and water level management, facilities and infrastructure maintenance, species at risk recovery, and invasive species control. Agreements will be

modified or maintained as appropriate.

- Assess formal and informal agreements with neighbours for maintenance activities of drains, ditches, channels and ponds, fences and gates along NWA boundaries that will be reviewed annually and modified or maintained as appropriate.
- Assess formal and informal agreements with Norfolk County for maintenance of the municipal road allowance along Highway 59 (Causeway) and Hastings Drive, and with Ontario Hydro and Bell Canada for service lines. Agreements will be modified or maintained as appropriate.

5.5 MONITORING AND SURVEYS

Monitoring and surveys at the Big Creek NWA may be authorized for ECCC–CWS staff, ECCC–WED, and other federal and provincial agencies and researchers where it supports identified research and management needs. Effective and efficient monitoring requires careful planning and a coordinated approach. For species at risk, locations (i.e., resident, breeding and migrant) in the NWA will be identified and monitored over time to assess population size and distribution as well as potential and existing threats. Monitoring methods and priorities will be in accordance with animal care protocols and species recovery strategies, management plans, action plans and other relevant policies. Ongoing monitoring needs are as follows, and will be conducted on an as-needed basis:

1. Establish a baseline for and track changes in wetland, terrestrial and aquatic habitats (i.e., extent and quality, biodiversity, and habitat-dependent species at risk);
2. Establish baseline population and distribution estimates for key plant and animal species within the NWA;
3. Assess the overall ecosystem quality of the area for a range of wildlife and plant species, with an emphasis on habitats required by staging waterfowl, marsh-dependent wildlife, migratory birds and species at risk, as well as other provincially rare species; monitor responses to threats;
4. Assess migratory bird habitat use within the NWA and nearshore waters and wetlands adjacent to the NWA, with an emphasis on waterfowl and marshbirds;
5. Assess the effectiveness of current or future management practices;
6. Monitor and assess the effects of visitation and access to the NWA;
7. Assess the changes in extent and density of invasive and non-native species, and the applicability of control and eradication methods; and
8. Assess the vulnerability of wetland and terrestrial plant and wildlife communities to climate change and water level variability.

Currently ongoing surveys conducted using established protocols, at specific times of the year (and providing valuable data at the site, region and provincial scales) include the following:

- Decadal Migrant Waterfowl Survey
- Annual Mid-winter Waterfowl Survey
- Mute Swan Survey (every 3 years)
- Annual Volunteer Christmas Bird Count
- Annual Great Lakes Marsh Monitoring Program (birds and amphibians)
- Great Lakes Coastal Habitat Assessment and Monitoring Project (water quality, aquatic macro-invertebrates, breeding birds, submerged aquatic vegetation)

Many of the biological questions and issues identified from periodic surveys and research may be beyond the influence of localized management options. For example, changes in food resources, weather events, and increased incidence of botulism, toxics, disease and bird mortality can affect waterfowl and migratory bird numbers and species at risk populations. Should changes in population numbers or events be recorded, this information will be forwarded to the appropriate management authority (i.e., Canadian Cooperative Wildlife Health Centre, ECCC–CWS Population Conservation Section and ECCC–CWS Species at Risk Unit) and will be used to assist in directing mitigation, research or population recovery.

5.6 PUBLIC ACCESS, INFORMATION AND OUTREACH

Public access, visitor activities, and outreach materials are designed to promote public understanding, appreciation and stewardship of the NWA while at the same time maintaining habitat integrity and protection for wildlife.

For the Big Creek NWA, public access is limited to portions of the Big Creek and Hahn Marsh Units. Section 6.2 lists authorized activities with special restrictions for the Big Creek NWA.

Goals for public information and outreach include the following:

a) Explaining the nature of NWAs, their local and regional importance of establishing them, and the general role of the ECCC-CWS Protected Areas Network and national habitat program;

b) Explaining the natural and historical human phenomena leading to the diversity of habitats now encountered in the NWA;

c) Explaining the importance of different NWA habitats to migratory birds and wildlife, and emphasizing the importance of the geographic location of the NWA to annual migration patterns;

d) Outlining the importance of the NWA habitats for other wildlife species, including species at risk (plants, reptiles, amphibians, fishes, mammals, etc.);

e) Promoting appreciation for habitat and wildlife at the Big Creek NWA and the public's role in ongoing stewardship and protection of the site;

f) Outlining health and safety hazards and precautions and promoting safe practices for visitors;

g) Increasing awareness of and promoting compliance with the *Canada Wildlife Act*, *Wildlife Area Regulations*, *Migratory Birds Convention Act, 1994* and *Species at Risk Act.*

To meet these goals, ECCC-CWS has established a protected area specific website at https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/locations/big-creek.html, developed printed materials such as the Big Creek NWA fact sheet, and installed interpretive signs in public access areas. In addition, ECCC–CWS staff deliver presentations profiling the NWA to local groups.

ECCC-CWS signage, communications and outreach materials are reviewed and updated periodically to provide clear direction to visitors on the permitted and prohibited activities, jurisdictional boundaries, and health and safety hazards within the NWA.

The Big Creek NWA has been selected as one of 10 National Wildlife Areas across Canada to be part of the CCtN initiative. This initiative will invest funding on selected sites over five years (2015-2020) and beyond to improve access infrastructure and to support the development of on-site interpretive programming delivered through collaborative partnerships. Its aim is to provide Canadians with more opportunities to recreate and connect to nature on federal lands managed on their behalf, where these activities will not interfere with the conservation of wildlife and are consistent with site objectives. Funding will be used for basic infrastructure to make sites more accessible, to improve trails and opportunities to view wildlife, and to support a variety of low-impact public uses. Visitation will be managed to ensure that any activities do not interfere with the conservation of wildlife.

The Big Creek NWA was selected to implement the initiative because of its proximity to nearby communities and larger urban areas, existing trail and viewing towers, appeal to visitors, and the abundance of wildlife during migration and other natural features.

For Big Creek NWA, CCtN funding will be used to improve access to trails and viewing towers, maintain public washrooms at the Big Creek Unit, and support outreach materials to appeal to the general public and nature enthusiasts.

Beyond fixed signs, interpretive displays, and benches (Figure 7), further on-site interpretive programs are not being planned for Big Creek NWA. Education and awareness is generated through an ECCC-CWS website and printed materials available on the Environment and Climate Change Canada Protected Areas website at: https://www.canada.ca/en/environment-climate-change/services/national-wildlife-areas/locations/big-creek.html.

For more information on National Wildlife Areas in Ontario, contact the Environment and Climate Change Canada Ontario Region office as per the address below. Please note that all requests must be made in writing to the following address:

Environment and Climate Change Canada - Ontario Region
Canadian Wildlife Service
4905 Dufferin Street
Downsview, Ontario
M5H 5T4
Email: ec.enviroinfo.ec@canada.ca

5.7 CONSERVATION OF THE BIG CREEK MARSH COMPLEX

ECCC–CWS will continue to work with neighbouring landowners to develop and implement actions to benefit the broader Big Creek Marsh Complex and watershed as well as encourage the use of vegetated buffers and best management practices for agriculture and fish and wildlife habitat that occur along common boundaries (i.e., private property, roads, channels) bordering the NWA.

ECCC-CWS will seek opportunities and increase capacity for ECCC-CWS to collaborate with land managers within the Big Creek Marsh Complex to identify shared issues and management approaches and contribute to the long-term conservation of the Big Creek Marsh Complex.

The goals will be to:

1. Pool expertise to determine what co-operative activities are needed and possible;
2. Identify monitoring and research needs;
3. Communicate with and engage partners, neighbours, stakeholders and the local community in stewardship of the Big Creek Marsh Complex;
4. Develop a long-term collective vision for conservation of the Big Creek Marsh Complex;

and engage land managers to implement and coordinate actions for conservation of natural areas in the Big Creek Marsh Complex and Big Creek watershed.

6.0 AUTHORIZED ACTIVITIES AND PROHIBITIONS

In the interest of wildlife and wildlife habitat, human activities are minimized and controlled in NWAs through the implementation of the *Wildlife Area Regulations*. These regulations set out activities that are prohibited (subsection 3(1)) in the wildlife area, and provide mechanisms for the Minister of the Environment and Climate Change to authorize certain activities to take place in NWAs that are otherwise prohibited. The regulations also provide the Minister with the authority to prohibit entry into NWAs.

Activities within an NWA are authorized where notices have been posted at the entrance to or along the boundaries of the NWA, or when notices have been published in local newspapers. All activities within an NWA are prohibited unless a notice has been posted or published authorizing the activity to take place. In addition to notices, certain activities may be authorized by obtaining a permit from the Minister of the Environment and Climate Change.

The Minister has the legislative authority to permit activities in the NWA according to the following acts and regulations:

- *Canada Wildlife Act* (section 12 (g)) and *Wildlife Area Regulations* (sections 3(2), 4 and 8)
- *Species at Risk Act* (sections 73 and 74)

For greater certainty, nothing in this management plan shall be construed so as to abrogate or derogate from the protection provided for existing Aboriginal rights or treaty rights of the Aboriginal peoples of Canada by the recognition and affirmation of those rights in section 35 of the *Constitution Act, 1982*.

6.1 PROHIBITION OF ENTRY

Under the *Wildlife Area Regulations*, the Minister may publish a notice in a local newspaper, or have notices posted at the entrance of any wildlife area or on the boundary of any part thereof, prohibiting entry to any wildlife area or part thereof. These notices can be posted when the Minister is of the opinion that entry is a public health and safety concern or when entry may disturb wildlife and their habitat.

For Big Creek NWA, entry is prohibited to portions of the wildlife area and public access is restricted seasonally to protect wildlife and habitat and limit human disturbance during spring and fall bird migration. Authorized activities and those activities that may be considered for permitting are described below.

6.2 AUTHORIZED ACTIVITIES

For the Big Creek NWA, notices authorizing the following activities will be posted at entrances and in public use areas in association with NWA identification signs.

The majority of the Big Creek NWA, comprising portions of the Big Creek Unit and the Hahn Marsh Unit, are closed to the public, except for research and monitoring purposes authorized by a permit under the *Wildlife Area Regulations*. Access and recreational activities are restricted in the Big Creek NWA because a key conservation purpose is to provide secure undisturbed staging habitat for migratory waterfowl. Limited public access for interpretation and recreation is authorized in designated areas within the Big Creek and Hahn Marsh Units for day-use only. Authorized activities with special restrictions within each Unit are described below.

All federal, provincial and municipal permits and regulations apply to boating, fishing, waterfowl hunting, and trapping activities.

Note: Conditions of access and special restrictions are reviewed annually and are subject to change.

If there is a discrepancy between the information presented in this document and the notice, the notice prevails, as it is the legal instrument authorizing the activity.

6.2.1 Big Creek Unit

Signs and notices authorizing activities are located in the Big Creek Unit at the viewing tower parking lot located at 737 Highway 59 (Figure 3), and in public areas.

Authorized activities with special restrictions:

The following public access and authorized activities are allowed in designated areas within the Big Creek Unit between sunrise and sunset daily, and do not require a *Canada Wildlife Act* permit:

- Entry to the Big Creek Unit and designated parking lot at the main entrance at 737 Highway 59 (Figure 3).
- Picnicking (no fires or charcoal barbecues).
- Walking, skiing and snowshoeing on the designated trail on top of the dike. The portion of the walking trail from the viewing tower and parking lot (737 Highway 59) to the southern viewing tower is open year-round (Figure 3). Access to the rest of the trail is only authorized from May 15th to September 15th (Figure 3).
- Bird, wildlife watching and photography (on designated trail and two viewing towers).
- Boating (maximum speed 8 km/hr) and sport fishing (no lead sinkers/jigs and no

spears) in the Big Creek Channel is permitted year-round, and is subject to federal and provincial regulations. Overnight boat mooring is prohibited. No fishing in the impoundment (diked North and South Cells) and no fishing from shore or dikes.

- Water access to wetlands adjacent to the Big Creek Channel (including boating and fishing) is prohibited from September 16th to May 14th, except for persons authorized to hunt waterfowl at the Big Creek Unit.
- Small boat access to the Big Creek Channel (north of the Big Creek bridge) at 881 Highway 59 year-round.
- Public access or use of the wildlife culverts (aquatic and terrestrial) is prohibited.
- Public access to the impoundment is prohibited at all times.
- Waterfowl hunting from blinds (4) in designated hunting area, opens on Waterfowler Heritage Day and closes December 20th. Hunting is permitted only on Mondays, Wednesdays, Fridays and Saturdays, ½ hour before sunrise until ½ hour after sunset. Conditions of access and use permits are administered by the Long Point Provincial Park and the Long Point Waterfowl Management Unit (LPWMU). Hunters must obtain a daily "A" Zone permit from the Long Point Waterfowl Management Unit Office (located within Long Point Provincial Park). Refer to Appendix 2 for description of conditions of access and special restrictions for waterfowl hunting.

Refer to Figure 3 for the location of the Big Creek Unit main entrance, public parking lot, water access, designated trails and viewing towers.

6.2.2 Hahn Marsh Unit

Public access to the Hahn Marsh Unit is from the parking lot at 2330 Lakeshore Road only. Signs and notices authorizing the activities below are located in the Hahn Marsh Unit parking lot (Figure 4), and in public areas.

There are no authorized public access points on the perimeter of the Hahn Marsh Unit. There are no designated trails within the Hahn Marsh Unit. Entry to the Hahn Marsh Unit is prohibited from September 16th to May 14th except for persons authorized to hunt waterfowl (the third Saturday in September until December 20th). The Hahn Marsh Unit is closed in winter (December 21st to May 14th).

Authorized activities with special restrictions:

The following public access and authorized activities are allowed in designated areas within the Hahn Marsh Unit between sunrise and sunset daily, and do not require a *Canada Wildlife Act* permit:

- Entry to the Hahn Marsh Unit via laneway at 2330 Lakeshore Road and parking lot (Figure 4) from May 15th until September 15th.
- Picnicking (no fires or charcoal barbecues).
- Walking, bird and wildlife watching, photography in the Hahn Marsh Unit, as posted.

- Boating (non-motorized boats only) and sport fishing (no lead sinkers/jigs and no spears) in the Hahn Access Channel between May 15th and September 15th.
- Access to the Hahn Marsh Unit via the parking lot and Hahn Access Channel, allowing visitors to enter the Unit by foot or non-motorized boat to the area surrounding the Hahn Access Channel (as per posted signage and guidelines on-site).
- Hunting sites are available on a first-come first-served basis.
- Waterfowl hunting from ECCC-CWS blinds (four at this time) in designated hunting area, opens on Waterfowler Heritage Day and closes December 20th. Hunting is permitted Monday to Friday, ½ hour before sunrise until noon, and on Saturday ½ hour before sunrise until ½ hour after sunset. No Sunday hunting is allowed. Conditions of access and use are administered by ECCC-CWS, are posted in the public parking lot, and are available from the Ontario regional ECCC-CWS office. Access to the Hahn Marsh Unit is from the parking area only. Hunters using the Hahn Marsh Unit must park their vehicle in one of four parking spaces. Each parking space corresponds to a blind and shooting point in the marsh. Refer to Appendix 2 for description of conditions of access and special restrictions for waterfowl hunting. Overnight camping in parking lot is allowed for a maximum of two consecutive days during the waterfowl hunting season, and is prohibited at all other times.

Refer to Figure 4 for the location of the Hahn Marsh Unit entrance, public parking lot, and water access to the Hahn Access Channel.

For greater certainty, fires and charcoal barbecues, overnight camping, pit blinds, and use of motorized vehicles are prohibited in accordance with the *Canada Wildlife Act* and *Wildlife Area Regulations*. There is no public access to the beach and dunes at the Big Creek NWA. Visitor groups of more than 20 people and commercial activities require a permit.

Periodic visits by ECCC staff (particularly during periods of high use) will occur, and enforcement actions will be taken when required.

6.3 RESEARCH

Environment and Climate Change Canada may support research activities within the NWA if their results are likely to provide data and information on topics of interest, including waterfowl and migratory bird population monitoring, habitat supply and quality, protection or recovery of species at risk, habitat restoration, the effects of climate change and variability on water-level management, the effects of invasive and non-native species on habitat and wildlife, and public engagement activities to support stewardship of the NWA.

Canada Wildlife Act permits are required under the *Wildlife Area Regulations* to conduct research and monitoring in the Big Creek NWA. All research requests must be made in writing. Refer to Appendix 3: Canadian Wildlife Service (Ontario) Environment and Climate Change Canada Conditions for Conducting Research in National Wildlife Areas. To apply for a permit to

conduct research in Big Creek NWA and to receive instructions concerning guidelines for a research proposal, please contact:

Environment and Climate Change Canada - Canadian Wildlife Service
Ontario Region Permit Office
335 River Road
Ottawa, Ontario, K1V 1H2
Telephone: 613-990-8355
Fax: 613-990-8400
Email: ec.wildlife.ontario.ec@canada.ca

Upon completion of the activity, permit holders are required to submit all data/information collected as a result of a permit to ECCC–CWS.

6.4 AUTHORIZATIONS

Permits and notices authorizing an activity may be issued only if the Minister is of the opinion that the activity is scientific research relating to wildlife or habitat conservation, or the activity benefits wildlife and their habitats/will contribute to wildlife conservation, or the activity is not inconsistent with the purpose for which the NWA was established and is consistent with the most recent management plan. The Minister may also add terms and conditions to permits in order to minimize the impact of an activity on wildlife and wildlife habitat. A permit request may be denied or a permit may be revoked if the terms and conditions are not met.

All requests for permits or authorizations must be made in writing at least seven weeks prior to the date of requirement to the following address:

Environment and Climate Change Canada - Canadian Wildlife Service
Ontario Region Permit Office
335 River Road
Ottawa, Ontario, K1V 1H2
Telephone: 613-990-8355
Fax: 613-990-8400
Email: ec.wildlife.ontario.ec@canada.ca

For further information, please consult the Environment and Climate Change Canada Policy when Considering Permitting or Authorizing Prohibited Activities in Protected Areas Designated Under the *Canada Wildlife Act* and *Migratory Birds Convention Act, 1994* (December 2011) (Environment Canada 2011a). This policy document is available on the Environment and Climate Change Canada Protected Areas website at: https://www.canada.ca/en/environment-climate-change/services/wildlife-habitat.html.

Depending on the type of activity, other permits or authorizations may be required to undertake an activity in the Big Creek NWA or adjacent lands and waters.

It is the responsibility of permit applicants/authorized visitors to obtain all additional permits, authorizations and protocols that may be required by: federal legislation (i.e., *Migratory Birds Convention Act, 1994*, *Species at Risk Act, Fisheries Act*), provincial legislation (i.e., *Fish and Wildlife Conservation Act*, *Endangered Species Act, 2007*), Animal Care Committee protocols, Norfolk County, and landowners (i.e., permission to access private land) prior to commencement of the activity (refer to Appendix 1 for a partial list of legislation).

For example, *Species at Risk Act* permits may be required for activities affecting species at risk, their residences, and/or any part of its critical habitat.

Contact federal and provincial permitting offices for more information.

Federal:

Canada Wildlife Act, Wildlife Area Regulations, Migratory Birds Convention Act, 1994, and *Species at Risk Act:*

Environment and Climate Change Canada - Canadian Wildlife Service
Ontario Region Permit Office
335 River Road
Ottawa, Ontario, K1V 1H2
Telephone: 613-990-8355
Fax: 613-990-8400
Email: ec.wildlife.ontario.ec@canada.ca

Fisheries Act and Species at Risk Act:

Fisheries and Oceans Canada
Central and Arctic Region
501 University Cr
Winnipeg, MB R3T 2N6
Telephone: 519-383-1813 or
Toll-Free 1-866-290-3731
Fax: 519-464-5128
Email (research permits): fwisar@dfo-mpo.gc.ca
Email (Construction/development SAR permit): fisheriesprotection@dfo-mpo.gc.ca

Fish and Wildlife Conservation Act; *Endangered Species Act*

Ontario Ministry of Natural Resources and Forestry
Natural Resources Information Centre
300 Water St
Peterborough ON K9J 8M5
Telephone: 1-800-667-1940 (toll-free)
TTY: 1-866-686-6072
Email: nrisc@ontario.ca

6.5 EXCEPTIONS

The following activities will be exempt from the requirements for permitting and authorizations:

- Activities related to public safety, health or national security, that are authorized by or under another Act of Parliament or activities that are authorized under *Health of Animals Act* and the *Plant Protection Act* to protect the health of animals and plants;
- Activities related to routine maintenance of NWAs, to the implementation of management plans, and enforcement activities conducted by an ECCCC officer or employee.

7.0 HEALTH AND SAFETY

Visitors to the Big Creek NWA may encounter severe weather (i.e., wind, heat, storms), dense vegetation, uneven ground, biting insects (including the blacklegged tick (*Ixodes scapularis*) that is capable of carrying Lyme disease-causing bacterium), and access to the marshes and open water areas can be difficult. In general, authorized visitors must seek and heed expertise to operate in these environments.

Management activities directed at improving health and safety and reducing the risk of a hazardous occurrence in the NWA can include the following:

- Installation of signs identifying safety precautions for authorized visitors;
- Repair of damaged roads, parking areas and trails.
- Posting of public notices within the community and tourist operations;
- Contaminated site assessment and remediation;
- Removal of abandoned building materials and debris;
- Preparation of an NWA emergency response plan for fire and spill response;

Site visits by ECCC–CWS staff will be conducted at the Big Creek Unit weekly, and at the Hahn Marsh Unit at least twice per month, to monitor facilities and infrastructure, general site and habitat conditions, human use, and prohibited activities. Periodic formal assessments of all facilities and infrastructure will be performed by federal agencies.

ECCC–CWS works with Environment and Climate Change Canada's Contaminated Sites Program to conduct site audits in order to identify contaminants, assess risks and remediate environmental contaminants on federal lands. Phases I, II and III site assessments of the Big Creek NWA were completed by Environment and Climate Change Canada's Contaminated Sites Program between 2009 and 2011 to assess legacy issues (i.e., vacant structures, waste and debris) (DST Consulting Engineers Inc. 2009; Franz Environmental Inc. 2011). Issues identified in the 2011 Phase III report that require remedial actions will be implemented on a priority basis. Legacy issues are resolved in coordination with Environment and Climate Change Canada's Contaminated Sites Program.

All reasonable efforts will be made to protect the health and safety of the public, including adequately informing visitors of any known or anticipated hazards or risks. Furthermore, Environment and Climate Change Canada staff will take all reasonable and necessary precautions to protect their and their co-workers' health and safety. However, visitors (including researchers and contractors) should make all reasonable efforts to inform themselves of risks and hazards, and should be prepared and self-sufficient. Because natural areas contain some inherent dangers, proper precautions should be taken by visitors, recognizing that ECCC staff neither regularly patrol, nor offer services for visitor safety in NWAs.

The designated point of access to the ECCC-CWS NWA office located at the Big Creek Unit is at 695 Highway 59 (Figure 2).

The designated point of public access to the Big Creek Unit is at the main entrance and public parking lot at 737 Highway 59, 0.5 km north of the ECCC-CWS office (Figure 2).

In case of emergency at the Big Creek NWA, call 911 immediately.

In the case of environmental emergencies, contact will be made with the Canadian Environmental Emergencies Notification System by calling the following 24-hour telephone:

Ontario Spills Action Centre
Ontario Ministry of the Environment
Telephone: 416-325-3000 or 1-800-268-6060
Refer to: https://www.canada.ca/en/environment-climate-change/services/environmental-emergencies-program/contacts-province.html

Any emergency should be reported immediately to the appropriate responding authorities. Reports should include the date, time, nature of the incident, contact names and information of the reporting party (for follow-up information), and other relevant details. Multiple authorities should be advised, if the situation warrants, as soon as possible. Refer to Appendix 4 for a list of contacts.

Non-emergency issues related to security or health and safety issues for Big Creek NWA should be reported to:

Environment and Climate Change Canada – Canadian Wildlife Service
Ontario Region
4905 Dufferin Street
Toronto ON M3H 5T4
Telephone: 1-800-668-6767
Email: ec.enviroinfo.ec@canada.ca

8.0 ENFORCEMENT

The management of NWAs is based on three Acts and the regulations thereunder:

- *Migratory Birds Convention Act, 1994*, and *Migratory Birds Regulations*
- *Canada Wildlife Act* and *Wildlife Area Regulations*
- *Species at Risk Act*

To promote compliance with the *Canada Wildlife Act*, *Wildlife Area Regulations*, *Migratory Birds Convention Act, 1994,* and *Migratory Birds Regulations* (refer to Appendix 1); ECCC-CWS posts signs along the NWA boundaries and at main access points to the Big Creek and Hahn Marsh Units to identify authorized activities within each NWA and any conditions placed on those activities. ECCC-CWS also posts signs within the Big Creek and Hahn Marsh Units to mark areas where entry is prohibited.

ECCC–WED is responsible for the enforcement of federal and provincial wildlife laws, and will perform on-site inspections and investigations, patrol the NWA to promote compliance, and prevent prohibited activities within the NWA. ECCC–WED officers monitor compliance with the federal *Canada Wildlife Act*, *Wildlife Area Regulations*, *Migratory Birds Convention Act, 1994*, *Species at Risk Act*, the *Fisheries Act* and the provincial *Fish and Wildlife Conservation Act, 1997* and Ontario's *Trespass to Property Act*, and will initiate investigations when required. ECCC–CWS Ontario staff provide details from site inspections to ECCC–WED that may require enforcement action.

9.0 PLAN IMPLEMENTATION

Details of management plan implementation will be developed through ECCC's annual work planning process and will be implemented as human and financial resources allow. Refer to Table 5 for a summary of priority actions for implementation 2020-2029.

Table 5: Implementation Strategy Timeline for Big Creek National Wildlife Area (2020-2029)

Activity	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Regular site inspection to monitor signs, threats, non-native and invasive species, and visitor use.	x	x	x	x	x	x	x	x	x	x
Review collaborative arrangements, agreements and permits, revise and renew as appropriate.	x	x	x	x	x	x	x	x	x	x
Review public outreach and education.	x	x	x	x	x	x	x	x	x	x
Prepare annual report on public access (authorized and unauthorized visits), and incidents of illegal activities (number, nature, mitigation).	x	x	x	x	x	x	x	x	x	x
Monitor and survey species at risk, marshbirds and amphibians using established protocols (MMP, etc.).	x	x	x	x	x	x	x	x	x	x

Activity	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
General wildlife inventories every five years of migratory bird use (waterfowl, waterbirds, landbirds, and shorebirds), species at risk (presence/absence), and using established protocols.		x					x			
Assess habitat quality and extent (forest, shrub thicket, marshes, swamp, beach and dunes, ponds, watercourses, and nearshore waters) against objectives using key indicators of ecological integrity.	x				x				x	
Wetland and water quality monitoring using CHAMP.			x			x			x	
Continue ECCC-CWS Decadal migrant waterfowl surveys (2010) - Lake Erie (includes Big Creek Unit, Hahn Marsh Unit).										x

9.1 MANAGEMENT AUTHORITY AND MANDATE

Environment and Climate Change Canada, Canadian Wildlife Service, Ontario is responsible for site management of Big Creek NWA.

9.2 MANAGEMENT PLAN REVIEW

Evaluation of this management plan will take the form of a review of data obtained from the monitoring, surveys, and research projects and collaborative agreements outlined below. Monitoring, surveys, and research at the Big Creek NWA will be completed within the limits imposed by financial and human resources. The data collected will be reviewed annually and used to inform future management at the NWA. Furthermore, these data will be used to evaluate federal contributions towards accomplishing the mandates specific to ECCC-CWS for which the protected area was established.

This Management Plan will be reviewed 5 years after its formal approval by ECCC-CWS and every 10 years thereafter.

Information may be appended to the document as required to aid in site management and decision-making.

10.0 COLLABORATORS

ECCC-CWS works with local landowners, communities, government and non-government agencies, and organizations to protect and conserve wildlife species and their habitats in the NWA, and contribute to conservation of the broader Big Creek watershed and Long Point region.

Current and past contributors include: Bayou Hunt Club, DFO, numerous provincial agencies, Norfolk County, LPRCA, Upper Thames River Conservation Authority, private landowners, DUC, Long Point Provincial Park, Long Point Waterfowl, Long Point Waterfowlers' Association, Long Point World Biosphere Reserve Foundation, Bird Studies Canada, NCC, Ontario Federation of Anglers and Hunters, Norfolk Field Naturalists, McMaster University, McGill University, and the University of Waterloo.

Environment and Climate Change Canada will collaborate with Bayou Hunt Club, Long Point Provincial Park and other provincial agencies, LPRCA, and NCC (who manage protected areas adjacent to the Big Creek National Wildlife Area) to ensure that management approaches are compatible and mutually supportive.

ECCC-CWS works closely with provincial agencies, DUC, LPRCA, in the management of the area. For example, through collaborative implementation of water level and sediment management in the NWA and broader Big Creek wetland complex.

ECCC-CWS works closely with DFO, OMNRF, and LPRCA to identify and monitor aquatic species (i.e., fish, mussels, crustaceans, benthic communities) in managed and coastal wetlands, channels and ponds in the Big Creek NWA and adjacent waters, with an emphasis on species at risk.

Informal collaborative arrangements have been established with local landowners, local agencies, and private organizations to monitor and contribute to protecting and conserving wildlife species and their habitats.

ECCC-CWS is open to collaborations with: Universities and research centres to fill scientific knowledge gaps, the province to implement species at risk recovery measures (particularly for species under provincial jurisdiction) and non-government organizations and municipal authorities to increase public awareness of the objectives of the NWA.

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https://wildlife-species.canada.ca/species-risk-registry/sar/index/default_e.cfm
The American Ornithologists' Union (AOU) Nomenclature:
http://www.aou.org/checklist/north/index.php

APPENDIX 1: LEGISLATION

Federal Legislation

Canada Wildlife Act (R.S.C., 1985, c. W-9)
http://laws-lois.justice.gc.ca/eng/acts/W-9/index.html

Fisheries Act (R.S.C., 1985, c. F-14)
http://laws.justice.gc.ca/eng/acts/F-14/

Migratory Birds Convention Act, 1994 (S.C. 1994, c. 22)
http://laws-lois.justice.gc.ca/eng/acts/M-7.01/

Species at Risk Act (S.C. 2002, c. 29)
http://laws-lois.justice.gc.ca/eng/acts/S-15.3/page-1.html

Species at Risk Act – Listing
http://www.registrelep-sararegistry.gc.ca/default.asp?lang=En&n=CA7DCECA-1

Species at Risk Public Registry
http://www.sararegistry.gc.ca/default.asp?lang=En&n=24F7211B-1

Wildlife Area Regulations (C.R.C., c. 1609)
http://laws-lois.justice.gc.ca/eng/regulations/C.R.C.,_c._1609/index.html

Provincial Legislation – Ontario

Endangered Species Act, 2007, S.O. 2007, c. 6
http://www.ontario.ca/laws/statute/07e06

O. Reg. 230/08: SPECIES AT RISK IN ONTARIO LIST
http://www.ontario.ca/laws/regulation/080230

Fish and Wildlife Conservation Act, 1997, S.O. 1997, c. 41
http://www.ontario.ca/laws/statute/97f41

Trespass to Property Act, R.S.O. 1990, c. T.21
http://www.ontario.ca/laws/statute/90t21

APPENDIX 2: CANADIAN WILDLIFE SERVICE (ONTARIO) ENVIRONMENT AND CLIMATE CHANGE CANADA CONDITIONS FOR WATERFOWL HUNTING IN BIG CREEK NATIONAL WILDLIFE AREA

Waterfowl hunting is authorized with special restrictions in designated areas in the Big Creek and Hahn Marsh Units of the Big Creek National Wildlife Area, subject to federal[3], provincial and municipal permits and regulations.

Public notices outlining conditions of access and restrictions for visitors and waterfowl hunters are posted at entrances and in public use areas in association with NWA identification signs, and are also available from the Ontario regional ECCC-CWS office[4] and Long Point Waterfowl Management Unit (Ontario Parks Long Point Provincial Park Office)[5]. Waterfowl hunting, conditions of access and special restrictions within each Unit are described below.

Note: Conditions of access and special restrictions are reviewed annually and are subject to change.

If there is a discrepancy between the information presented in this document and the notice, the notice prevails, as it is the legal instrument authorizing the activity.

ECCC-Wildlife Enforcement Division will monitor the NWA for compliance with these and all other waterfowl hunting regulations. Cooperation is appreciated to ensure hunters continue to enjoy hunting in this area. Noncompliance may result in charges and loss of hunting privileges in the Big Creek National Wildlife Area.

Big Creek Unit

Waterfowl hunting at the Big Creek Unit is under the jurisdiction of ECCC-CWS and authorized in cooperation with Long Point Provincial Park, Ontario Federation of Anglers and Hunters, and the Long Point Waterfowlers' Association. The permit application process (to hunt at the Big Creek Unit) and blinds are managed by the Long Point Provincial Park under the "A" Zone regulations of the Long Point Waterfowl Management Unit operating out of the Long Point Provincial Park maintenance compound. As of 2018, Hunters (in the Big Creek Unit) are subject to the following conditions and restrictions; these may be subject to change and the onus is on users to be aware and conform to any subsequent changes:

1. Hunters must obtain a daily "A" Zone permit from the Long Point Waterfowl Management Unit Office (located within Long Point Provincial Park).

2. For guidance on what game birds may be hunted in the Big Creek Unit, hunters must

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[3] Federal regulations: *Migratory Birds Convention Act, 1994,* the *Migratory Birds Regulations* and the *Migratory Birds Hunting Regulations* for Ontario

[4] Email: ec.wildlife.ontario.ec@canada.ca

[5] Website Contact: http://lpwaterfowlers.wixsite.com/lpwa/contact

consult and abide by Long Point Waterfowl Management Unit rules and restrictions, subject to all federal and provincial permits and regulations.

3. Hunters must check in and check out at the Long Point Waterfowl Management Unit Office.

4. Waterfowl hunting is permitted only on Mondays, Wednesdays, Fridays and Saturdays, ½ hour before sunrise until ½ hour after sunset.

5. Waterfowl hunting season at the Big Creek NWA opens on Waterfowler Heritage Day and closes on December 20th.

6. Access to the designated hunting area is from the bridge at Big Creek Channel, Highway 59.

7. Hunters must access blinds only by water, using small motorized or non-motorized boats (maximum speed 8 km/h).

8. All shooting must take place from the blind. Cutting of vegetation and construction or placement of hunting blinds is prohibited.

9. Harvested waterfowl must be checked in at the Long Point Waterfowl Management Unit office after the hunt.

10. All garbage including spent shell casings must be removed from the blind and surrounding area.

11. Boats may not be left in the ECCC-CWS channel behind any of the ponds as per the entry prohibited signs.

12. Hunters retrieving downed birds behind the entry prohibited signs may not be in possession of a firearm and under no circumstances are hunters or retrieving dogs permitted to access diked wetland impoundments (North and South Cells).

13. Fires and charcoal barbecues, pit blinds, and motorized vehicles are prohibited at all times.

14. Dogs allowed off leash only during active waterfowl hunting and/or retrieval.

15. All municipal, provincial and federal regulations apply. Noncompliance may result in charges and loss of hunting privileges in the Unit.

Hahn Marsh Unit

Waterfowl hunting in the Hahn Marsh Unit of the Big Creek National Wildlife Area is under the jurisdiction of ECCC-CWS. The permitting process to hunt at the Hahn Marsh Unit and blinds are managed by ECCC-CWS. A public notice outlining restrictions and conditions of access for visitors and waterfowl hunters is posted in the public parking lot and is available from the Ontario regional ECCC-CWS office.

There is no charge to hunt in the Hahn Marsh Unit and hunting sites are available on a first-come, first-served basis. Hunters are subject to the following conditions and restrictions, which may be subject to change in subsequent years:

1. Hunters using the Hahn Marsh Unit must park their vehicle in a parking space corresponding to a blind and shooting point in the marsh. **Access to the Unit is from the parking area only.**

2. Hunting is allowed on all days except Sundays during the open season: Monday to Friday, ½ hour before sunrise until 12:00 PM (hunters must be out of the marsh by 1:30 pm), and on Saturday ½ hour before sunrise until ½ hour after sunset.

3. Waterfowl hunting season at the Big Creek NWA opens on Waterfowler Heritage Day and closes on December 20th.

4. A maximum of 2 hunters is allowed per blind at any one time.

5. A member of the hunting party must stay with a vehicle in line to reserve hunting privileges.

6. Hunters must pick up their decoys and equipment when leaving the shooting point and allow any hunters lined up for that position to hunt that point in the afternoon (Saturdays) or the next day.

7. Hunters may not use the Unit for more than 2 consecutive days, after which hunters must leave the Unit for 2 consecutive days. Overnight camping is not allowed except for waterfowl hunters in designated parking spaces during open season.

8. All shooting must take place from the blind. Cutting of vegetation and construction or placement of hunting blinds is prohibited.

9. Only Ducks (other than Harlequin Ducks), Canada Geese and other geese may be hunted as per Migratory Birds Hunting Regulations in the Southern District, subject to all federal, provincial permits and regulations.

10. All garbage including spent shell casings must be removed from the blind and surrounding area.

11. Dogs allowed off leash only during active waterfowl hunting and/or retrieval.

12. You are permitted to only possess and use lead-free ammunition while waterfowl hunting.

13. Fires, pit blinds, and motorized boats and motorized vehicles are prohibited at all times.

14. All municipal, provincial and federal regulations apply. Noncompliance may result in charges and loss of hunting privileges in the Unit.

Federal and provincial permits and regulations apply to boating, fishing, waterfowl hunting, and trapping activities.

For greater certainty, overnight camping, fires and charcoal barbecues, pit blinds, and motorized vehicles are prohibited in accordance with the *Canada Wildlife Act* and *Wildlife Area Regulations*. Periodic visits by Environment and Climate Change Canada staff (particularly during periods of high use) will occur, and enforcement actions will be taken when required.

APPENDIX 3: CANADIAN WILDLIFE SERVICE (ONTARIO) ENVIRONMENT AND CLIMATE CHANGE CANADA CONDITIONS FOR CONDUCTING RESEARCH IN NATIONAL WILDLIFE AREAS

Permission under the *Wildlife Area Regulations* of the *Canada Wildlife Act* to undertake research at National Wildlife Areas may be given subject to the following conditions:

1. All requests for research must be accompanied by a written proposal outlining the objectives; project duration; collection of data and specimens and measurements if any, number of participants, funding sources, location where work is to be undertaken, benefits to the National Wildlife Area (NWA), potential detractors and proposed mitigation measures. All proposals may be subject to a review by the Animal Care Committee of either Environment and Climate Change Canada or the submitting institution.
2. No research shall be undertaken without a permit issued under the Canada Wildlife Act - Wildlife Area Regulations, and the research must be consistent with the NWA management plan for the site and other relevant legislation (i.e., Species at Risk Act, Migratory Birds Convention Act, 1994).
3. All researchers must conform to regulations in effect regarding the NWA.
4. All researchers are responsible for obtaining all permits (i.e., Species at Risk Act, Fisheries Act), approvals, and permissions (i.e., land managers, landowners), prior to commencement of the research project.
5. Copies of raw data (field books and maps), preliminary reports of the research activities and a copy of the final manuscript must be provided to Environment and Climate Change Canada, Canadian Wildlife Service (ECCC-CWS) Ontario at the end of each field season.
6. Priority will be given to researchers whose work has direct management implications for the NWA and species at risk.
7. Applications to undertake a minor research study must be submitted to the ECCC-CWS Ontario office, in writing, prior to commencement of the project**. Minor proposals without problems or issues require at least seven weeks for review, processing and issuance of a permit.** Major proposals (that may require expert review, are multi-year, etc.) require a longer review period (minimum six months).
8. A statement must be provided to ECCC-CWS Ontario on why the research project cannot be undertaken elsewhere.
9. Any proposed work is subject to the Canada Labour Code, Part II (subject to the strictest safety certification, training, operational experience and mandatory use of appropriate safety equipment).

Note:

The Minister may add terms and conditions governing the activity in order to protect and minimize the effects of the authorized activity on wildlife and their habitats.

All projects and activities in the NWA are subject to environmental screening and, if necessary, to further steps in the Environmental Assessment and Review Process (Environment and Climate Change Canada).

APPENDIX 4: CONTACTS FOR BIG CREEK NATIONAL WILDLIFE AREA, ONTARIO.

Contacts for BIG CREEK NATIONAL WILDLIFE AREA, Ontario **Administered by Environment and Climate Change Canada-Canadian Wildlife Service (Ontario)** **Big Creek Unit** 42°59' N / 80°46' W **Hahn Marsh Unit** 42°58' N / 80°53' W	
Emergency Contacts	
In case of emergency, dial 911. General inquiries should be directed to local telephone numbers, not 911. **NOTE:** **THE CIVIC ADDRESSES FOR BIG CREEK NATIONAL WILDLIFE AREA** **Environment and Climate Change Canada** • **Canadian Wildlife Service Office: 695 Highway 59** • **Big Creek Unit, viewing tower parking lot: 737 Highway 59** • **Big Creek Unit, water access to Big Creek at bridge: 881 Highway 59** • **Hahn Marsh Unit entrance (access road and parking lot): 2330 Lakeshore Road**	
Any life-threatening emergency	911
Police-fire-ambulance	911
Ontario Provincial Police (Tillsonburg)	519 688-6540
Marine and Air Search and Rescue (Emergency Only)	1-800-267-7270
Royal Ontario Mounted Police (RCMP) Ontario Division	519-640-7267
To report a spill to air, land, or water, call Ontario Spills Action Centre, 24/7	**1-800-268-6060 or** 416-325-3000
Poison Control Centers (Emergencies)	1-800-268-9017
Environment and Climate Change Canada - Ontario	
Canadian Wildlife Service (Ontario) Region Office	1-800-668-6767
Canadian Wildlife Service (Ontario) Permit Office	905-336-4464
Canadian Wildlife Service (Ontario) Big Creek National Wildlife Area Office – 695 Highway 59, Port Rowan ON N0M 1E0	519-586-3241
Wildlife Enforcement Directorate (Ontario)	905-336-6410
General Contacts	
Ontario Ministry of Natural Resources and Forestry (Conservation Officer)	1-877-847-7667
Ontario Ministry of Natural Resources and Forestry (General Inquiry)	1-800-667-1940
Ontario Ministry of Natural Resources and Forestry Aylmer area office	519-773-9241
Ontario Ministry of Natural Resources and Forestry Long Point Provincial Park (Office) 350 Erie Blvd. Long Point, Ontario	519-586-2133
Norfolk County (Delhi ON)	519-582-2100 or 519-428-0020
Long Point Region Conservation Authority (Tillsonburg ON)	519-842-4242
Norfolk General Hospital (Simcoe ON)	519-426-0130