Management Plan for
Morrison Marsh Nature Reserve
Denman Island, British Columbia

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Executive Summary

In 2005, the Islands Trust Fund acquired the 51.73 hectare (127.77 acre) property now known as the Morrison Marsh Nature Reserve as a result of a generous donation by the property owner at the time.

Islands Trust Fund policy requires that a management plan be developed for all properties that it owns or manages. In October 2006, Taara Environmental was retained to develop a management plan for the Morrison Marsh Nature Reserve.

The property is characterized by third growth Douglas-fir forest and retains the headwaters of Denman Island's largest freshwater marsh. Rocky outcrops, several streams and additional smaller wetland complexes are scattered throughout the reserve, providing high biodiversity values to the property. Four blue-listed species are known to exist on the property and an additional two blue-listed species are thought to occur. A potential five rare plant communities are expected to develop on the property as it is allowed to mature ecologically.

The property contains several old logging roads that are used recreationally by the local community for walking and nature appreciation. Some use of the reserve by mountain bikes and all-terrain vehicles has caused damage to sensitive rocky outcrop areas and cultivation of domestic crops and browsing by domestic cattle has caused damage in some of the wetlands within the reserve. Signage and the use of barriers to prohibit these activities within the reserve may be required.

The acquisition of the reserve is viewed favorably by the majority of residents who provided comment and input into the management planning process and there was a general consensus that the property be used for low impact recreational enjoyment.

Acknowledgements

The authors would like to thank the Denman Conservancy Association and Islands Trust Fund staff for their assistance in providing background materials and for their input into the management plan. A special thank you goes out to the individual who had the foresight to donate this property for the future enjoyment and appreciation of Denman Island residents.

Thank you to all residents of Denman Island and other stakeholder groups who provided comments in reference to the management of the Morrison Marsh Nature Reserve and review of this plan as it progressed.

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1.0 Introduction

The islands between Vancouver Island and the mainland of British Columbia are recognized as a special place with a unique natural environment and rural character. In recognition of the unique attributes of this area, the Provincial Government established the Islands Trust in 1974. The Islands Trust is a local government created with a special legislated provincial mandate *'to preserve and protect the trust area and its unique amenities and environment for the benefit of the residents of the trust area and of British Columbia generally, in cooperation with municipalities, regional districts, improvement districts, other persons and organizations and the government of British Columbia'* (*Islands Trust Act*).

In 1990, through the enactment of a section of the Islands Trust Act, the Islands Trust Fund (ITF) was established to carry out the *'preserve and protect'* mandate of the Islands Trust. The vision of the Islands Trust Fund is *'to create a legacy of special places, protecting both natural and cultural features in perpetuity in order to sustain the unique character and environment of the Islands Trust Area.'* The goal of the Islands Trust Fund Board is to establish protected areas on all major and many of the associated islands within the Islands Trust Area (The Islands Trust Fund Plan 2003-2007).

Morrison Marsh Nature Reserve was donated for conservation purposes to the Islands Trust Fund in 2005 with a Conservation Covenant registered to the Denman Conservancy Association (DCA) (Denman Conservancy Association, 2007). The property located at the southern end of Denman Island protects the headwaters of Denman's largest freshwater wetland and provides an important link in a protected areas network on the island, connecting to Boyle Point Provincial Park to the south and undisturbed forest lands to the east. The 51.73 hectare (127.77 acres) property provides low impact recreational opportunities for residents of Denman Island and provides habitat for several endangered and threatened faunal species and five potential endangered plant communities.

Taara Environmental was retained by the Islands Trust Fund to prepare a management plan for the Morrison Marsh Nature Reserve in October 2006.

1.1 Islands Trust Fund Management Plans

Islands Trust Fund management plans are used to provide long term direction and guidance for the protection of values and features of significance on Islands Trust Fund properties. The Islands Trust Fund requires that management plans are developed for all properties that it acquires.

Generally, management plans will address the following:

- The purpose and objectives for the site;
- Background information including the site history and local and regional context;

- Environmental inventory;
- Management issues such as the extent and nature of protection required, appropriate uses and level of use, research guidelines, risk management, special needs at the site; and
- Strategies and actions to achieve the purpose and objectives of the site and to address management issues and needs (Islands Trust Fund, 2003).

1.2 Nature Reserve Purpose

The purpose of establishing the Morrison Marsh Nature Reserve is as follows:

- To preserve and protect the natural values of the site;
- To allow natural succession of the reserve's ecosystems to occur unimpeded; and
- To protect the site in accordance with the objectives of the Islands Trust and Islands Trust Fund.

1.3 Nature Reserve Objectives

The Islands Trust Fund objectives for the management of the Morrison Marsh Nature Reserve are as follows:

- To preserve the natural features and functioning of the site;
- To allow for continued low impact pedestrian use and enjoyment of the site;
- To ensure that permitted uses do not negatively impact or cause harm to the ecological attributes of the site;
- To protect, and enhance where necessary, the natural successional processes of the plant and animal communities at the site; and
- To provide for educational and research opportunities where deemed appropriate.

2.0 Site Information

The following section provides a brief overview of the Morrison Marsh Nature Reserve including its location and context within a regional and local protected areas network and outlines its unique attributes and features.

2.1 Location

Morrison Marsh Nature Reserve is located in the southern portion of Denman Island north of Boyle Point Provincial Park (Figure 1). Access to the property is from an easement off of the eastern end of Greenhill Road. Existing access from this point currently crosses over the private property to the south of the reserve.

Trails also enter the property from the south from Boyle Point Provincial Park and off of East Road through the Crown land parcel to the east of the property. Additional access

from the private property to the north has been closed off by the property owner, although local use of these trails has persisted.

Figure 1. Regional Context Map

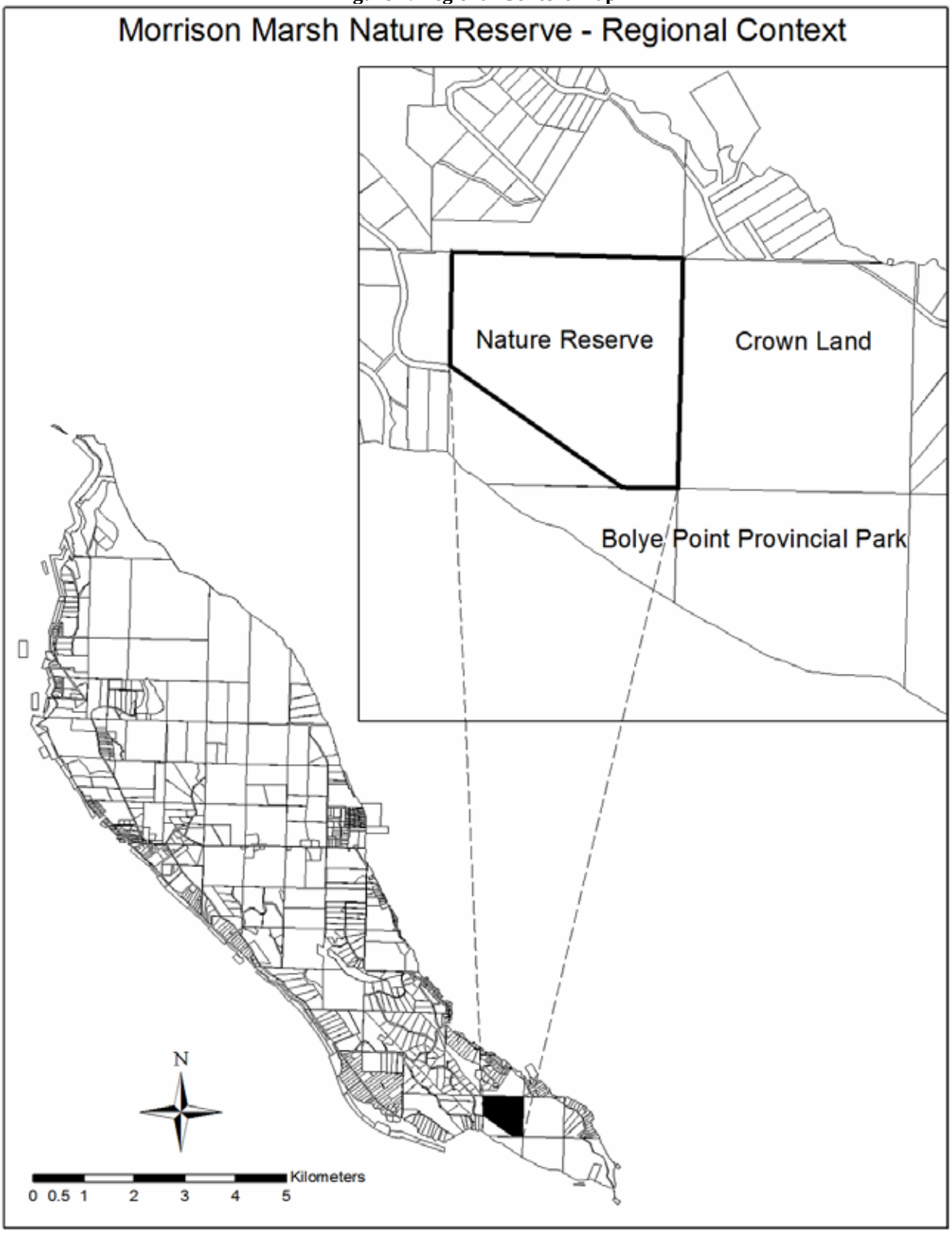
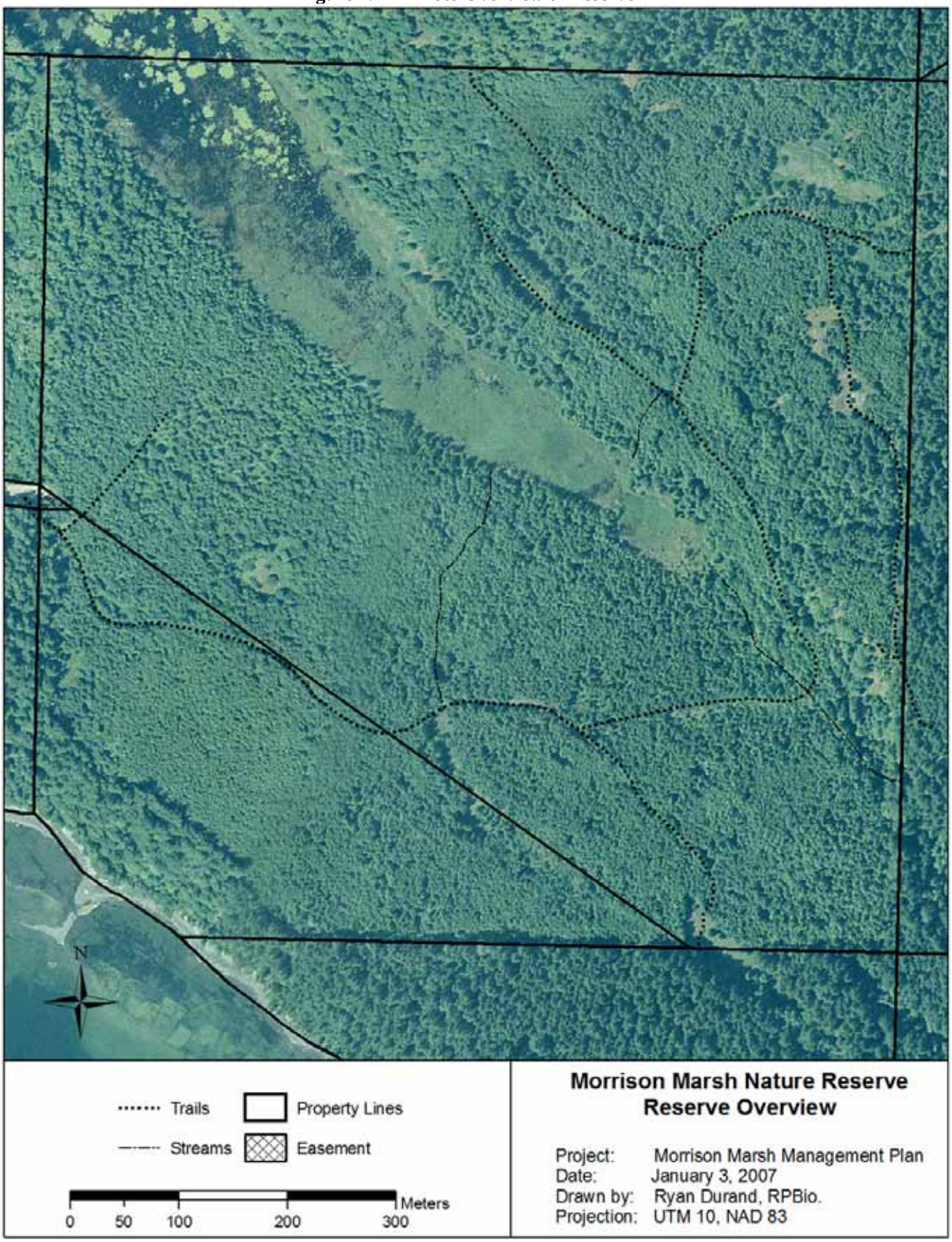


Figure 2. Air Photo Overview of Reserve



2.2 Site Description

Morrison Marsh Nature Reserve is a 51.73 hectare (127.77 acre) property which contains the southern headwaters of Morrison Marsh and Boyle Creek, as well as an extensive network of additional wetland areas, rocky outcrops and upland forest.

The site was logged in 1979 and replanted in 1980 by Weldwood of Canada and presently contains maturing third-growth Douglas-fir dominated forest. The property is also characterized by the southern headwaters of Morrison Marsh and additional smaller wetland pockets and rocky outcrops.

The property is accessible by an old logging road off of Greenhill Road which crosses over private property to the south of the reserve before entering the Nature Reserve approximately midway along its southern border. Trails also enter the property from Boyle Point Provincial Park to the south and from East Road and the Crown land parcel to the east of the reserve. Partially overgrown skid roads cross the property in several locations.

The northwest portion of the property slopes downward to the centre of the property which acts as a basin area with scattered wetlands and seepage areas. The eastern portion of the property slopes upward to a ridge overlooking the property and Lambert Channel and Hornby Island to the east (Wilson, 2005).

2.3 Legal Description

Morrison Marsh Nature Reserve includes those lands with Parcel Identification Number 026-532-913 Lot A Section 7 Denman Island Nanaimo District Plan VIP80177. The property is currently zoned F (forestry) which allows for park uses.

2.4 Local and Regional Context

Denman Island is located between Hornby Island and the central east coast of Vancouver Island along the Georgia Strait. Courtney, Comox and Nanaimo are the closest urban centers, although more rural communities exist both on the island itself and the nearby Vancouver Island east shore. Denman Island has approximately 1,200 year-round residents, as well as a larger seasonal population with summer cottages, travelers, and tourists.

Morrison Marsh Nature Reserve is one of several protected areas in the region. In addition to Boyle Point Provincial Park along its southern border, Fillongley Provincial Park can be found along Denman's eastern shoreline and an additional three Provincial Parks are found on nearby Hornby Island and Sandy Island (Ministry of Parks, 1990). In addition to Provincial Parks, the island has several additional properties that are protected by either the Islands Trust Fund or the Denman Conservancy Association. These acquisitions include Inner Island Nature Reserve, Central Park Nature Reserve, Winter Wren Wood, Lindsay-Dickson Forest and recent court settlement lands which include

conservation covenants on Komas Bluffs and Railway Grade Marsh, and an additional 156 acres of lands under title to the Denman Conservancy Association (Denman Conservancy Association, 2007).

2.5 Site History

Denman Island was used seasonally by the Pentlach Peoples and Comox Peoples of Vancouver Island for summer fishing. Evidence of village sites and use has been found in both the southern and northern portions of the island. Morrison Marsh may have attracted early use by indigenous peoples for hunting of waterfowl and deer as well as the gathering and harvesting of bulbs. The Pentlach Peoples were nearly extinguished by the introduction of European diseases in the mid-1800s and the remaining population integrated with the nearby Comox Peoples (Comox Museum, 2006).

European settlement of the island began in the 1870's, with a primary focus on forestry, quarrying and agriculture. Many of the marshes on the island were drained and farmed for 'swamp hay' or reed canarygrass. Windy Marsh; once connected to Morrison Marsh north of McFarlane Road, and the northern portions of Morrison Marsh show evidence of this past agricultural activity. Many of the smaller wetlands within the reserve and large patches of the shoreline of Morrison Marsh are dominated by reed canarygrass (Balke, 2004).

The property has also been logged several times with the most recent activity occurring in 1979 by Weldwood of Canada. The site was replanted in 1980.

In 1985, Ducks Unlimited Canada and the former Ministry of Environment, Lands and Parks in cooperation with shoreline residents installed a variable crest weir and outlet channel to control water levels in Morrison Marsh. The weir was designed to maintain the marsh to a depth of 0.8 to 0.9 meters; however a beaver dam downstream of the weir has kept the marsh at a depth higher than that originally intended for over the past ten years (Ducks Unlimited Canada, 2007).

In 1998 Silva Ecosystem Consultants identified Morrison Marsh as a significant wetland and recommended its protection as part of a proposed Protected Areas Network (PAN) for Denman Island. The Denman Conservancy Association identified the Morrison Marsh South property as a target in their 1999 'Island Legacy Project'.

The property was purchased in 2000 from 4064 Investments Limited by a private owner with the intention of placing a conservation covenant over the entire parcel with two covenant areas, the smaller to provide for residential use. In 2005, under Section 99 of the *Land Title Act*, the owner chose to subdivide the property and the larger of the created parcels was donated for conservation purposes to the Islands Trust Fund, while the smaller portion of the property was retained for potential future residential use. A conservation covenant was registered on the donated parcel in November 2006 and is held by the Denman Conservancy Association (Willis, 2006).

2.6 Current Use

The property has long been used by local residents for walking, bird watching and nature appreciation. The trail network of former skid roads connect to additional walking and hiking trails in Boyle Point Provincial Park and the Crown land parcel to the east of Morrison Marsh Nature Reserve.

A recent visit to the property showed evidence of motorized vehicle access and mountain bike use from the trail systems on the vacant Crown land parcel to the east of the reserve. Infrequent use by horseback riders has also been documented. In addition, evidence of past cultivation of domestic crops along the shoreline of Morrison Marsh and other smaller wetlands within the reserve boundary has damaged these sensitive areas.

Local residents have also reported occasional use of the property by wood and salal harvesters. Hunting occurs to the north of the property and may also take place on reserve lands. In addition, Morrison Marsh attracts recreational canoe use and kayakers along its length due to the amount of open water artificially maintained by a beaver dam downstream of the weir installed by Ducks Unlimited Canada (Ducks Unlimited Canada, 2007).

2.7 Adjacent Land Use

Morrison Marsh Nature Reserve is located in the southern portion of Denman Island to the northwest of Boyle Point Provincial Park. Boyle Point Provincial Park lies on the southeastern boundary of the nature reserve. This day use park provides low impact recreational opportunities along several trail systems. Also along the southern boundary of the reserve, is the smaller portion of the parent parcel that was subdivided prior to the donation of the reserve. This property is currently undeveloped, but is zoned to allow for residential development if and when the parcel is sold.

To the east of the property is a vacant Crown land parcel that is held as a gravel reserve in favor of the Ministry of Transportation and Highways. It is currently used by local recreational users for walking, nature appreciation, all-terrain vehicles and mountain biking. This property was under consideration as an addition to Boyle Point Provincial Park by the former Ministry of Environment, Lands and Parks in the 1990's after strong community support for its protection. This property and adjacent Boyle Point Provincial Park contain some of the last mature forest stands on Denman Island and are two of few properties that have not been logged due to a lack of accessibility and difficult terrain (Balke, Date Unknown).

To the north and west of the nature reserve are private properties zoned Rural Residential (R2) with a permitted average lot size of four hectares (10 acres) (Denman Island Local Trust Committee, 2006). The property along the northern boundary of the reserve has in the past been used to access the reserve from the north end. The current property owner has fenced off access from this location, but local use has persisted.

2.8 Connectivity

Denman Island is located at the northern end of the Coastal Douglas-fir biogeoclimatic zone. The Coastal Douglas-fir biogeoclimatic zone is one of the rarest ecosystems in Canada, found only on the Gulf Islands and parts of Vancouver Island. Denman Island has been extensively logged or fire damaged and very little old growth forest remains. Boyle Point Provincial Park and the Crown land parcel to the east of Morrison Marsh Nature Reserve contain what is left of Denman's older forests; having escaped past logging activity because of their inaccessibility. Morrison Marsh Nature Reserve serves as an important buffer for these forest ecosystems and will one day mature to provide similar habitat features. In addition, Morrison Marsh is recognized as a significant wetland and contains the most expansive areas of open water on the island. Much of its shoreline is protected by a Development Permit Area by the Islands Trust to protect the marsh from physical alterations. A number of shoreline residents have also entered into a voluntary stewardship program in cooperation with the Denman Conservancy Association to protect the ecological values of their properties. Morrison Marsh Nature Reserve will protect the headwaters of this vital freshwater marsh at its southern end where Boyle Creek provides much of its water intake (Bradley *et. al*., 1998).

3.0 Environmental Inventory

The following section provides a description of the nature reserve's physical and natural attributes and outlines the reserve's unique features. For more specific ecological information, please refer to the Morrison Marsh Nature Reserve Baseline Inventory (Balke, 2006). Information contained in the following section was obtained during fieldwork conducted in early November 2006, as well as from previous studies conducted by Jennifer Balke (R.P.Bio.) and the Denman Conservancy Association. In addition, information on the status of flora, fauna and ecological communities was obtained from the British Columbia Conservation Center database.

3.1 Geology and Physiology

Denman Island is underlain by sediments of the Nanaimo Group, deposited approximately 87 to 60 million years ago. The Nanaimo Group is further subdivided into numerous formations; of which the Morrison Marsh Nature Reserve is categorized under the Cedar District and the De Courcy Formations.

The property is underlain by fossiliferous shale, part of the upper Cedar District Formation and exposed along the shores of Baynes Sound south of the nature reserve. This fossiliferous shale is overlain by thick sandstone of the De Courcy Formation. This sandstone is the most common rock unit exposed in the Morrison Marsh Nature Reserve. Conglomerate from the De Courcy Formation is also found underlying the reserve. Conglomerate exists in scattered small outcrops and in larger exposures to the northeast of Morrison Marsh (Trueman, 2001).

Glacial striations orientated in a south-easterly direction, were observed in two locations on the property. These marking were left from glaciers that filled the Georgia Strait to a depth of greater than one kilometer as recently as 14,000 years ago. These glaciers also left some scattered erratic boulders from the Coast Mountains of the lower mainland or Vancouver Island. Several erratic boulders are found on the property (Trueman, 2001).

The topography and drainage of the Morrison Marsh Nature Reserve is characterized by a gentle dip from the western boundary toward the center of the reserve to a rise in the eastern boundary. This rise is defined by a ridge system where the line of demarcation between the conglomerates underlying the northeast of the property meets the sandstone underlying the remainder of the property (Trueman, 2001). This topography greatly influences the drainage and pattern of seepage and wetland areas on the property.

3.2 Soils

Surficial materials within the Morrison Marsh Nature Reserve consist of primarily a thin layer of silty-sandy soils with bedrock found close to the surface. Thicker layers of soil exist in proximity and in relation to wetland depressions.

A survey of soils in the marsh area as recorded in Denman Islands Official Community Plan indicate that soils in the southeast end of the marsh are considered 'peatland' and consist of fibrous peat up to fifty centimeters thick in areas. The northern portion of Morrison Marsh is classified as 'shallow water' and 'fen' (Denman Conservancy Association, 2006).

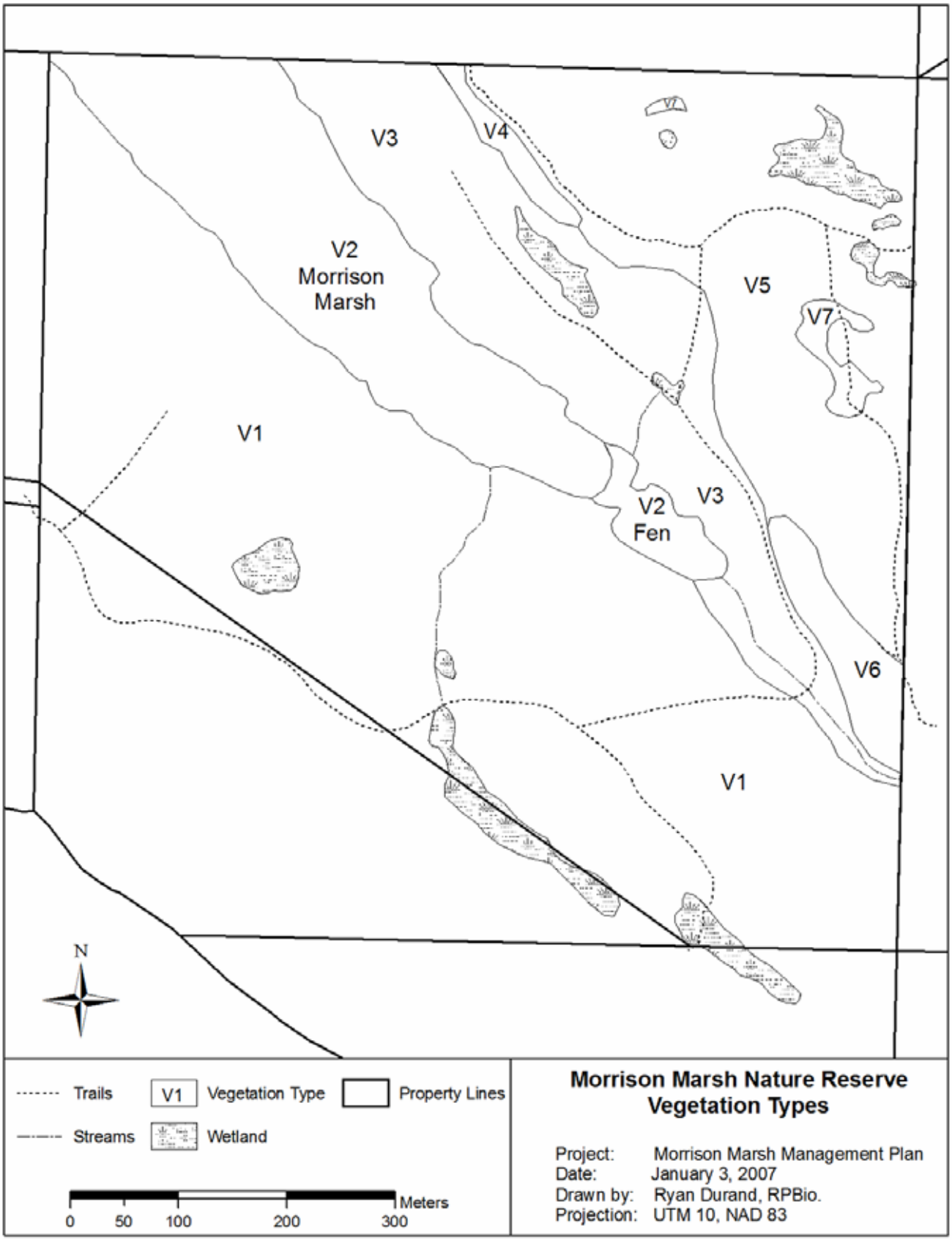
3.3 Ecosystems

The following section contains descriptions of the seven basic vegetation types identified on the reserve (Table 1). Figure 3 contains maps of the vegetation types and Appendix B contains detailed information as to the inventory methodology as well as lists of floral species that were identified.

Table 1. Summary of Vegetation Types

Veg. Type	Site Series	Description
1	CDFmm01/02/06	Pole/sapling to young conifer forest with pockets of broadleaf, wetlands, and rocky outcrops.
2		Unclassified shallow open water and unclassified fen.
3	CDFmm06/11/14 and Ws52/53	Wet, young broadleaf to mixed forests and wetlands on lower slopes.
4	CDFmm01	Pole/sapling to young conifer forest on steep bluff.
5	CDFmm01/02/14	Mosaic of pole/sapling to young conifer to mixed forests on upper and crest of slope with frequent wetlands and rocky outcrops.
6	CDFmm01	Young mixed forest on steep bluff above Boyle Creek.
7		Various wetlands (unclassified marsh).
8	CDFmm02	Open rocky areas dominated by moss and lichen with some arbutus and Douglas-fir.

Figure 3. Vegetation Types



3.3.1 Vegetation Type 1

Vegetation Type 1 encompassed the majority of the southwestern portion of the reserve. It encompassed the moderate northeastern slopes (average of 15 degrees) from the property boundaries to the edge of Morrison Marsh and Boyle Creek. Several wetlands of various sizes, intermittent streams, rocky outcrops and roads also occurred in this area. Old overgrown skid roads and stumps of various sizes were observed throughout the area.

This vegetation type was characterized by a thick cover (crown closure of 70%) of even aged, third growth pole/sapling to young Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*) with a generally sparse shrub and herbaceous layer and moderate to thick moss layer (Table 7, Appendix B). A suppressed layer of pole/sapling western red cedar (*Thuja plicata*), western hemlock (*Tsuga heterophylla*) and grand fir (*Abies grandis*) occurred sporadically throughout the area and increased in abundance and size on the lower slopes. Bigleaf maple (*Acer macrophyllum*), arbutus (*Arbutus menziesii*) and white pine (*Pinus monticola*) were also present, but typically uncommon and restricted to microhabitats such as rocky outcrops. Pockets of red alder (*Alnus rubra*) occurred in many areas, particularly in the vicinity of the wetlands, streams and other areas of high soil moisture. In many areas conifer regeneration was suppressed due to thin soils on rocky outcrops and disturbances from past logging activities.

The shrub layer was generally sparse, but thick occurrences were present in openings. Shrub species included the various conifers previously mentioned, as well as Pacific dogwood (*Cornus nuttallii*), salal (*Gaultheria shallon*), dull Oregon grape (*Mahonia nervosa*), red huckleberry (*Vaccinium parvifolium*), evergreen blackberry (*Rubus laciniatus*), oceanspray (*Holodiscus discolor*), English holly (*Ilex aquifolium*), and trailing blackberry (*Rubus ursinus*).

Herbaceous vegetation was dominated by sword fern (*Polystichum munitum*) with occurrences of broad-leaved starflower (*Trientalis borealis*), sweet-scented bedstraw (*Galium triflorum*), vanilla-leaf (*Achlys triphylla*), and various grass species. Many other species are likely present but were not identified due to the time of year. A single saprophyte, Indian-pipe (*Monotropa uniflora*), was also observed.

Moss was abundant on the coarse woody debris, tree trunks and decaying organic material on the ground. Common species included step moss (*Hylocomium splendens*), Oregon beaked moss (*Eurhynchium oreganum*) and electrified cat's-tail moss (*Rhytidiadelphus triquetrus*).

The BEC site series for Vegetation Type 1 was primarily CDFmm01 on the upper slopes, while lower slopes will likely mature with characteristics of the wetter and richer CDFmm06. There is also the potential for stands of CDFmm02 to occur on the dry rocky outcrops on the slope crest.

It is expected that this vegetation type will mature into a mosaic of different ecosystem types due to differences in soil depth and the generally water shedding upper slopes and

water receiving lower slopes. The main forest cover is expected to be Douglas-fir with lesser amounts of co-dominant western red cedar and western hemlock. Big leaf maple and grand fir will occur sporadically, while red alder will remain as a dominant disclimax species along streams and wetlands while dying out in most other areas. Arbutus will occur sporadically in the dry open rocky outcrops on the upper slopes, but will be limited by the in growth of re-planted Douglas-fir.

The upper slopes will likely contain a very think cover of salal with lesser occurrences of the other previously mentioned shrub and herbaceous species, particularly sword fern. Mosses will continue to be dominated by the current species, but may decrease in total cover in response to an increase in the salal layer. The lower slopes will be dominated by a mix of salal and sword fern and will contain a higher number and abundance of other species due to the more available water and nutrients in the soil.

3.3.2 Vegetation Type 2

Vegetation Type 2 encompassed the portion of Morrison Marsh that occurred in the reserve. It contained two distinct areas; the larger shallow open water to the north and small fen to the south.

This northern portion of the vegetation type was dominated by the artificially controlled open water of Morrison Marsh (Table 8, Appendix B). It contained a variety of shrubs, such as hardhack (*Spiraea douglasii*), and numerous sedge and rush species around the perimeter. Reed canarygrass (*Phalaris arundinacea*) was a common occurrence. An inventory of aquatic vegetation was beyond the scope of the inventory. The marsh contained important waterfowl habitat and peripheral ecotones are likely critical bird habitat.

The northern portion of Morrison Marsh was considered to be an unclassified, modified open water wetland. Before the water levels were raised by Ducks Unlimited Canada, it was dominated by hardhack and sedges with characteristics similar to the south end of the marsh. Shallow open water was scarce and contained limited populations of pond weed (*Potamogeton* spp.), yellow pond lily (*Nuphar lutea*) and bladderwort (*Utricularia vulagris*) (Balke, 2006).

The southern portion of the vegetation type appeared to be less influenced by the raised water levels. It was dominated by a dense cover of sedges, mainly slough sedge (*Carex obnupta*)), soft-stemmed bulrush (*Schoenoplectus tabernaemontani*) and reed canarygrass. Several stunted Sitka spruce (*Picea sitchensis*) occurred in clumps and western red cedar, western hemlock and red alder occurred in transitional areas to riparian forests. Raised areas in the wetlands (mainly old logs) contained sporadic hardhack and unidentified moss species.

The natural succession of the marsh is difficult to predict and is dependant on the artificial water levels. Other similar wetlands on Denman Island contain significantly less shallow open water (generally in irregular small patches), are dominated by a thick cover

of hardhack and emergent vegetation, and contain various conifer species. As long as the water levels remain elevated, the marsh is not likely to significantly change.

3.3.3 Vegetation Type 3

Vegetation Type 3 encompassed the toe and lower slopes (with a range of 5 to 15 degrees) of the northeastern portion of the reserve and the riparian forests along Boyle Creek. It contained several streams, wetlands and old roads. Evidence of past logging activity was common and included stumps of various size and age and overgrown skid roads.

This vegetation type was characterized by relatively open (crown closure of 50%) young red alder, and lesser occurrences of bigleaf maple, western hemlock, western red cedar and Douglas-fir (Table 9, Appendix B). A coniferous understory of Douglas-fir, western red cedar, western hemlock and grand fir occurred throughout the area, particularly on upper slopes. It contained numerous seepage sites where the fluctuating water table has resulted in the development of water tolerant species such as slough sedge.

The shrub layer included frequent individuals or clumps of English holly along with western red cedar, western hemlock and grand fir saplings. Other species included dull Oregon grape, red huckleberry, red elderberry (*Sambucus racemosa* ssp. *pubens*) and salal.

The herbaceous layer was dominated by sword fern and various grass and sedge species. It is expected that numerous other species occur during other times of the year. Moss was thick on the largely organic substrate and frequent coarse woody debris. Common species included Oregon beaked moss, coastal leafy moss (*Plagiomnium insigne*) and palm tree moss (*Leucolepis acanthoneuron*).

The BEC site series for Vegetation Type 3 likely includes CDFmm11 or Ws52/53 on the toe to lower slope and gradually changes to CDFmm06 on the mid slopes. Several mid slope depressions contain wetlands with characteristics of CDFmm14 or Ws52/53.

Over time it is expected that the lower slopes will contain a diverse layer of conifers with pockets of red alder in wet areas and sporadic bigleaf maple. On the mid slopes red alder will be limited to the wetlands and the canopy will be primarily Douglas-fir, western red cedar and grand fir, with lesser occurrences of western hemlock and bigleaf maple. The shrub layer will contain limited amounts of salal and thick patchy areas of dull Oregon grape while the herbaceous cover will continue to be dominated by sword fern. Moss species will continue to diversify and form abundant mats on coarse woody debris and the forest floor.

3.3.4 Vegetation Type 4

Vegetation Type 4 encompassed a small, steep (30 degrees or more) southwestern facing bluff located near the northern property line. The bluff was characterized by shallow, loose soils with frequent small rocky outcrops.

This vegetation type was dominated by a thick closed canopy (crown closure of 70%) stand of even aged pole/sapling to young Douglas-fir that was undergoing early stages of self thinning (Table 10, Appendix B). Rare occurrences of bigleaf maple, grand fir and western hemlock also occurred in the canopy.

The shrub layer was generally sparse with common thick patches in small canopy openings. Dull Oregon grape was the dominant species with sporadic occurrences of salal, English holly and red huckleberry. The herbaceous layer was generally absent, with patches of sword fern in canopy openings and infrequent occurrences of twinflower (*Linnaea borealis*) and sweet scented bedstraw. It is expected that other herbaceous species would be identified during the spring and summer, but total cover will remain low. The moss layer was mainly restricted to coarse woody debris with Oregon beaked moss the most commonly identified species.

The BEC site series for Vegetation Type 4 was determined to be CDFmm01. Over time, this area is expected to mature into a coniferous canopy primarily composed of Douglas-fir with lesser occurrences of western red cedar and western hemlock. Arbutus may occur, but due to the lack of open rocky areas it is unlikely. The stand will continue to undergo self thinning which will open the canopy and allow for an increased cover of shrubs, herbs and moss. However, the thin soils and dry conditions will prevent the establishment of many species.

3.3.5 Vegetation Type 5

Vegetation Type 5 included the upper slopes and crest of the northeastern and eastern portions of the reserve. This vegetation type contained a mosaic of ecological and terrain features. It included wetlands in shallow to large depressions, small rocky outcrops, and thick pole/sapling to young conifer and mixed forests on northern, southwestern and eastern aspects. Several old roads ran though the area and evidence of past logging was common.

The area was generally dominated by a moderate to thick canopy (crown closure of 60%) of pole/sapling Douglas-fir, with sporadic occurrences of other conifers, red alder and rare occurrences of arbutus (Table 11, Appendix B). Shrub species primarily included salal and dull Oregon grape, along with Douglas-fir, western red cedar and western hemlock saplings. Shrub cover ranged from very thick in open canopy areas, to absent under thick, closely spaced pole/sapling stands.

Herbaceous vegetation varied due to the irregular forest cover and abundant rocky outcrops. The main ground cover was sparse to thick pockets of sword fern and various

grass and sedge species in depressions. Mosses were abundant on decaying woody debris and thin soils, and included Oregon beaked moss, step moss and electrified cat's-tail moss.

The BEC site series for this vegetation type included CDFmm01, 02 and 14. The majority of the area is expected to mature into CDFmm01, with 02 occurring on open rocky areas and 14 occurring in depressions with fluctuating water tables.

Over time much of the Douglas-fir will undergo self thinning. While fir will remain the dominant forest cover, significant amounts of western red cedar and western hemlock are expected to compete for co-dominant layers. Pockets of red alder will remain in depressions and around wetlands, while arbutus and bigleaf maple will remain infrequent and limited to dry rocky areas. The shrub layer is expected to continue to be dominated by moderate to thick salal and dull Oregon grape, while sword fern will continue to be the primary herbaceous species.

3.3.6 Vegetation Type 6

Vegetation Type 6 encompassed the steep (45º) southwestern facing bluff located in the eastern portion of the reserve directly above Boyle Creek. The bluff contained near vertical bedrock outcrops at the crest, with loose rock and thin soils on the steep slopes.

It was dominated by a young mixed forest with a highly irregular structure (40% crown closure) due to the bedrock outcrops and unstable soils. Primary species included Douglas-fir and bigleaf maple (Table 12, Appendix B). Shrubs were generally sparse with clumps of dull Oregon grape and salal the most common species. Herbaceous vegetation was limited due to the time of year and unstable soil with clumps of sword fern being the dominant species. Moss was primarily restricted to decaying woody debris and was mainly composed of Oregon beaked-moss.

The BEC site series of this vegetation type was classified as CDFmm01, with the possibility that the crest of the slope will tend towards CDFmm02 (Douglas-fir / arbutus). This vegetation type is not expected to significantly change over time. The existing tree species will likely continue to mature and dominate with a greater cover of Douglas-fir. Shrubs, herbs and mosses will continue to occur in relatively sporadic clumps due to the highly unstable slopes and thin soils.

3.3.7 Vegetation Type 7

Vegetation Type 7 contained a small open rocky outcrop towards the northeastern corner of the reserve. This vegetation type was situated on the crest of the slope and was slightly sloping (about 5 degrees) to the west. A walking trail (on an old logging road) ran through the middle of this vegetation type.

The area was dominated by mosses and lichens with infrequent occurrences of young arbutus and Douglas fir (Table 13, Appendix B). The shrub layer was restricted to

patches of thick salal while herbaceous species were largely absent, with the exception of unidentified grass species. It is expected that many early flowering herb species also occur.

The BEC site series for this vegetation type was classified as a CDFmm02 based on the extremely poor and dry soil conditions and abundant exposed bedrock. The forest structure is not expected to significantly change, with arbutus and Douglas-fir forming an irregular, patchy cover. The area is expected to remain an open rocky outcrop covered in moss and lichen species. However, if not already present, the area is highly susceptible to the introduction of invasive species. As well, erosion from use by hikers, mountain bikers and other recreational uses may occur. Past disturbance by motorized vehicles (likely all-terrain vehicles) was noted off the existing marked trail.

3.3.8 Vegetation Type 8

Numerous small to moderate sized wetlands occur in the reserve. The wetlands were generally dominated by herbaceous vegetation and often contained a substantial amount of reed canarygrass (Table 14, Appendix B). Tree species were generally absent with the exception of trembling aspen (*Populus tremuloides*) in one area. Other tree species included Sitka spruce (*Picea sitchensis*), red alder, Douglas-fir, western hemlock and western red cedar.

Shrubs occurred in small pockets on hummocks, woody debris, and on edges of the wetlands. Species included dull Oregon grape, hardhack, English holly, salal, and rose.

Due to the multiple historic disturbances of the wetlands, specific ecosystem classifications were not attempted; however they were previously classified as marshes (Balke, 2006).

The various wetlands contain important wildlife habitat for a variety of birds, amphibians and small mammals. As well, they are likely used by ungulates and other mammals as browsing sites and water sources. Over time most of the areas are likely to become overgrown with reed canarygrass which will reduce overall floral biodiversity and impact faunal habitat potential. Many of the wetlands will likely shrink in size and change considerably in floral composition as the peripheral forests evolve and mature.

3.4 Invasive Species

Ten invasive weeds were identified on the reserve (Table 2). In addition to the identified species, it is likely that numerous other herbaceous species (such as the unidentified grass and thistle species) are present along the trail system and other disturbed areas. Spring and summer inventories are required to create a comprehensive list of species and their respective locations.

Figure 4. Invasive Species

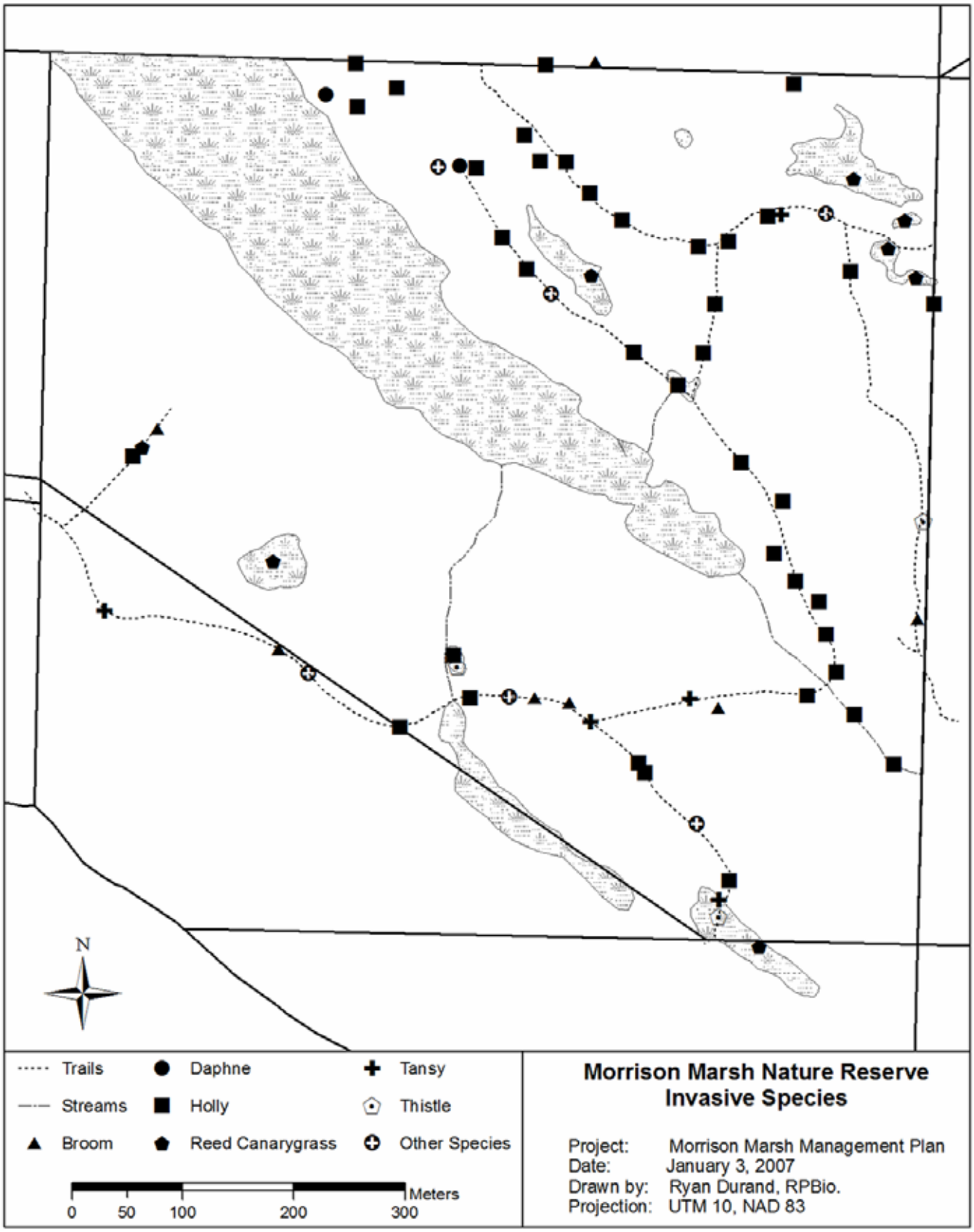


Table 2. Invasive Floral Species

Common Name	Scientific Name	Severity	General Locations
Canada thistle*	*Cirsium arvense*	Unknown	
common tansy	*Tanacetum vulgare*	Moderate	Sparse to extensive coverage along most trails.
English holly	*Ilex aquifolium*	High	Common throughout reserve, but most abundant adjacent to trails in Vegetation Type 3.
hairy cat's ear	*Hypochaeris radicata*	Low	Common along trails and open rocky areas.
herb-robert*	*Geranium robertianum*	Unknown	
grass species		Unknown	Common along trails, open rocky areas, and wetlands. Not known if observed species are native or introduced.
laurel-leaved daphne	*Daphne laureola*	Low	Individual plants found in two locations in Vegetation Type 3 on the northeastern edge of Morrison Marsh.
oxeye daisy	*Leucanthemum vulgare*	Moderate	Common along trails and open rocky areas.
reed canarygrass	*Phalaris arundinacea*	High	Dominant species in many small wetlands, wet spots and in thick clumps on edges of Morrison Marsh.
ribwort plantain	*Plantago lanceolata*	Low	Common along trails and open rocky areas.
Scotch broom	*Cytisus scoparius*	Moderate	Several small clumps and numerous individuals along trails and some open rocky areas.
thistle species		Moderate	Common in most wetlands and sporadically along trails.

*Identified by Balke, 2006. The severity and distribution of these species are unknown.

The following section prioritizes the identified invasive species based on the severity (how well established) of the species, the ability of the species to become further established in the reserve (based on existing and predicted ecological conditions), and the potential impact of the species on native biodiversity. Using those criteria, the invasive species have been categorized as high, medium and low priority in terms of the need for active management.

High Priority Species

- *English holly*. With the exception of Morrison Marsh, this small ornamental tree was observed throughout the reserve. In particular, it was extensively established along the trail in Vegetation Type 3. English holly out-competes native vegetation and readily reproduces via root suckers and berries that are often spread by birds. Although a valuable avian food source, the bright red berries are poisonous to humans (Municipality of Saanich, 2005).

- *Reed canarygrass*. This highly invasive species was observed in the majority of the small wetlands and in sporadic clumps on the edges of Morrison Marsh. It was

also located in wet disturbed areas throughout the reserve. In several wetlands it formed the dominant species to the detriment of native sedges and rushes. Reed canarygrass has little wildlife value and is capable of out-competing native vegetation as thick monocultural mats.

- *Scotch broom*. While restricted to dry open areas (mainly along the trail system), this species has the potential to out-compete native vegetation and form thick monocultures. It produces millions of seeds that remain viable in the soil for years. With the exception of open rocky outcrops, it is expected that over time most of the broom will die out as forest stands mature and reduce available light.

Medium Priority Species

- *Canada thistle and unidentified thistle species*. This species was previously identified in the reserve. It is unknown to what extent it exists, but dead thistles that could not be identified were observed on the trails and old roads and throughout many of the wetlands.

- *Common tansy*. Restricted to disturbed locations along the edge of the trails, this herbaceous species is unlikely to become extensively established in the reserve. It is, however, capable of forming thick coverage and may out-compete native vegetation in open rocky areas. Over time it is expected that the majority of it will die out as forest stands mature. There is also the potential that some of the plants identified as common tansy are in fact the much more invasive tansy ragwort (*Senecio jacobaea*), particularly in areas with richer soil.

- *Laurel-leaved daphne*. Highly invasive and toxic, this small shrub is capable of out-competing native vegetation and forming thick monocultures. While palatable to some bird species, all parts of the plant are skin and eye irritants and the berries are poisonous. Two individual plants were observed on the north eastern shore of Morrison Marsh. It has the potential to become extensively established throughout the reserve (Municipality of Saanich, 2005).

- *Oxeye daisy*. A rhizomatous perennial, oxeye daisy can grow to one meter in height. It is not readily grazed by ungulates due its disagreeable taste (Cranston *et. al.*, 1999). This vigorous species can remain dormant in the soil for up to six years and can be an issue in open areas and grasslands. Its distribution in the reserve was restricted to trail edges and openings in the tree canopy. Over time, this species will likely be shaded out by increased tree cover or persist to be restricted to along trail edges.

Low Priority Species

- *Hairy cat's ear*. A perennial herb with a woody stem, hairy cat's ear is a shade intolerant species introduced from Eurasia. It generally inhabits areas that have been disturbed or on exposed mineral soils. It was found along trails and in drier

areas of the reserve, such as rocky outcrops. This species was not well spread and is not considered to be invasive (Klinkenberg, 2006).

- *Herb-robert*. Herb-robert is an annual herb of Eurasian descent which is common along south coastal British Columbia. It is common to open forests and was found along trails, wetlands and rocky outcrops within the reserve. Due to its biology, it is not considered to be an invasive species.

- *Grass species*. Several unidentified grass species were observed in dry rocky outcrops and wetland areas throughout the reserve. These are likely exotic varieties introduced by past agricultural and logging activity. In wetland areas, these grasses will likely persist.

- *Ribwort plantain*. Ribwort plantain is an annual herb of Eurasian descent. It is commonly found in dry areas and disturbed sites (Klinkenberg, 2006). It was found in small quantities along trails and rocky outcrops. There was no indication that this species was increasing in density or locale within the reserve and it is not considered invasive.

Methods of Introduction and Distribution

Invasive species are introduced and spread via a variety of vectors. Many species are common pioneer species that become established in exposed soil after disturbances. Others are introduced from a variety of sources, such as recreational users (hikers, horses, dogs, ATVs, etc.), wildlife, and birds. The cows that inhabit the adjacent farm to the north of the reserve may introduce additional species. Evidence of frequent cow use in the wetlands and trails was observed in the northeastern corner of the reserve.

3.5 Rare Plants, Animals and Ecological Communities

The reserve has a high potential for the occurrence of rare species and ecological communities. However, due to past disturbances that likely temporarily extirpated many species from the reserve, recruitment from adjacent mature forests and wetlands may take time. For example, Balke notes eight rare or unusual floral species that are known to occur in the adjacent Crown land parcel to the east of the reserve and Morrison Marsh. Five rare birds and amphibians are known to inhabit or utilize the reserve (Table 3). As well, one bird species and one fish species are considered to have the potential to occur on or utilize the area (Balke, 2004).

Table 3. Rare Animals

Common Name	Scientific Name	BC Status	BC List	COSEWIC Status
band-tailed pigeon	*Columba fasciata*	S3S4B	Blue	
coastal cutthroat trout*	*Oncorhynchus clarki clarki*	S3S4	Blue	
great blue heron	*Ardea herodias fannini*	S3B, S4N	Blue	SC (Schedule 3, 1997)
red-legged frog	*Rana aurora*	S3S4	Blue	SC (Schedule 1, 2004)

Townsend's big-eared bat*	*Corynorhinus townsendii*	S2S3	Blue	
western screech-owl**	*Otus kennicottii*	S4	Yellow	

*These species have not been confirmed to occur on the reserve but are known in the area.

**Sub-species of this owl are considered rare. As the observed individual was not captured, it is possible that it was a rare sub-species.

Five rare ecological communities may occur, as forest stands mature, on the reserve based on BEC site series identified on the reserve (Table 4) (BC Conservation Data Centre, 2006).

Table 4. Potential Rare Ecological Communities

Site Series	Common Name	Scientific Name	BC Status	BC List	Veg. Type(s)
CDFmm/00	trembling aspen / Pacific crab apple / slough sedge	*Populus tremuloides / Malus fusca / Carex obnupta*	S1S2	Red	7
CDFmm/01	Douglas-fir / dull Oregon-grape	*Pseudotsuga menziesii / Mahonia nervosa*	S2	Red	1,4,5,6
CDFmm/02	Douglas-fir - arbutus	*Pseudotsuga menziesii - Arbutus menziesii*	S2	Red	1,5,8
CDFmm/11	red alder / skunk cabbage	*Alnus rubra / Lysichiton americanus*	S2S3	Blue	3
CDFmm/14	red alder / slough sedge [black cottonwood]	*Alnus rubra / Carex obnupta [Populus balsamifera ssp. trichocarpa]*	S1	Red	3,5

3.6 Wildlife and Wildlife Habitat

The reserve contains excellent wildlife habitat and is inhabited by a variety of species (Table 5, adapted from Balke, 2006). In particular, Morrison Marsh and the numerous small wetlands provide habitat opportunities for a variety of aquatic and semi-aquatic species such as reptiles, amphibians and small mammals as well as permanent water sources for other wildlife. The diverse assemblage of habitat types present on the reserve (wetlands, streams, conifer forests, mixed forests, broadleaf forests, and rocky outcrops) are favorable to many species that require a variety of ecotypes, particularly as forest stands mature. As well, the adjacent mature forests to the east and south provide connectivity to additional habitat and recruitment sources.

Table 5. List of Wildlife Species

Common Name	Scientific Name
Mammals	
beaver	*Castor canadensis*
black-tailed deer	*Odocoileus hemionus*
mink	*Mustela vison*
raccoon	*Procyon lotor*
red squirrel	*Tamiasciurus hudsonicus*
river otter	*Lontra canadensis*
Amphibians	

Pacific tree frog	*Pseudacris regilla*
rough-skinned newt	*Taricha granulosa*
red-legged frog	*Rana aurora*

The reserve contains an abundant supply of woody debris (including old stumps) of various sizes and states of decay which provide potential habitat for amphibians, reptiles, small mammals and invertebrates. Rocky outcrops, steep rocky slopes, and rock piles form favorable reptile habitat in many parts of the reserve.

Deer browse and bedding sites were observed throughout the reserve. In many areas browse was noted on species such as English holly that are unfavorable food sources and likely indicate that the area is over populated.

Boyle Creek and Morrison Marsh provide potential fish habitat and may be inhabited by species such as the blue listed coastal cutthroat trout (*Oncorhynchus clarki*) (Balke, 2006).

3.7 Bird Species

Numerous bird species have been observed in the reserve (Table 6, adapted from Balke, 2006). In particular, Morrison Marsh is important habitat for at least ten species of waterfowl and many other species. The reserve also contains a variety of ecotypes that are favorable to a wide range of species. As well, the reserve has an abundant supply of small to medium sized standing dead trees and stumps which provide excellent woodpecker and flicker habitat.

Of significance is the lack of large snags and veteran trees commonly used as roosting and perching sites for raptors and other large birds. Suitable trees likely exist on adjacent properties and will eventually occur in the reserve.

Table 6. List of Bird Species

Common Name	Scientific Name	Common Name	Scientific Name
American robin	*Turdus migratorius*	mallard	*Anas platyrhynchos*
bald eagle	*Haliaeetus leucocephalus*	marsh wren	*Cistothorus palustris*
barred owl	*Strix varia*	northern flicker	*Colaptes auratus*
blue grouse	*Dendragapus obscurus*	northwestern crow	*Corvus caurinus*
bufflehead	*Bucephala albeola*	pied-billed grebe	*Podilymbus podiceps*
bushtit	*Psaltriparus minimus*	pileated woodpecker	*Dryocopus pileatus*
Canada goose	*Branta canadensis*	red-breasted nuthatch	*Sitta canadensis*
chestnut-backed chickadee	*Parus rufescens*	red-winged blackbird	*Agelaius phoeniceus*
common raven	*Corvus corax*	ring-necked duck	*Aythya collaris*
dark-eyed junco	*Junco hyemalis*	song sparrow	*Melospiza melodia*
Fox sparrow	*Passerculus iliaca*	spotted towhee	*Pipilo erythrophthalmus*
golden-crowned kinglet	*Regulus satrapa*	trumpeter swan	*Cygnus buccinator*
great blue heron	*Ardea herodias fannini*	varied thrush	*Ixoreus naevius*
hooded merganser	*Lophodytes cucullatus*	western screech owl	*Otus kennicottii*
Hutton's vireo	*Vireo huttoni*	winter wren	*Troglodytes troglodytes*

4.0 Public Information Session and Input

A public consultation meeting on the management of the Morrison Marsh Nature Reserve was held on the afternoon of November 18th, 2006 at the Denman Island Community Hall. The meeting was advertised in the local community newspaper, the Hornby-Denman Island Grapevine, November 9th and additional notices were posted at key locations throughout the community. In addition, personal invitations were sent prior to the meeting to Islands Trust local trustees and Islands Trust Fund staff, members of the Denman Conservancy Association, Islands Trust planning staff, Ducks Unlimited Canada, Comox-Strathcona Regional District parks staff, BC Parks and Comox First Nation through electronic correspondence or by telephone.

The meeting was attended by seventeen individuals, in addition to two staff members from Taara Environmental and a staff member of the Islands Trust Fund. Materials regarding information on the reserve's history and significant features, an aerial photograph and ecological maps of the reserve were presented and attendees were given the opportunity to provide input at the meeting, as well as by submitting a survey (attached as Appendix C) both at the meeting, and alternatively from the project website. Written comments were received until January 15th, 2007 and ten completed surveys were submitted.

In general, community and stakeholder input was favourable toward the acquisition of Morrison Marsh Nature Reserve and its protection as such. In addition, several community members expressed a desire for a more comprehensive management planning process for Morrison Marsh in its entirety. The need for a more comprehensive management plan for Morrison Marsh is beyond the scope and resources of this management planning process, but will be forwarded to Ducks Unlimited Canada and the British Columbia Ministry of the Environment for their consideration.

5.0 Management Plan

The following section provides an overview of the management issues as identified by the consultant, the Islands Trust Fund, residents and additional stakeholders as identified in Section 4.0 above, and provides options and management strategies to address those issues.

5.1 Issues and Discussion

Based on input from the community and sources as listed in Section 4.0, the following management issues regarding the Morrison Marsh Nature Reserve have been identified:

- Trail use and location
- Trail maintenance and safety
- Permitted uses
- Disturbance to waterfowl nesting and breeding

- Exotic and invasive species
- Water quality and flooding
- Protection of sensitive ecosystems and species at risk
- Fire management
- Connectivity to adjacent lands and land uses
- Education and research
- Capacity

5.1.1 Trail Use and Location

Currently there are several access points and trail systems leading into and out of the Morrison Marsh Nature Reserve from adjacent properties with varying levels of use. The majority of the trail system has originated from old skid roads from past logging activity and may or may not be in the most suitable locations in reference to ecological sensitivity or terrain characteristics. In addition, several trails lead onto private property which may inconvenience adjacent land owners and increase liability for these landowners if the use of these trails continues.

Several of the existing trails within the reserve are of concern due to their location within sensitive areas and/or the routes crossing over or onto private property. The existing trail leading into the reserve from the end of Greenhill Road (photo point 1) currently crosses through the private property to the south of the reserve which was subdivided off prior to the reserve being donated. This parcel was subdivided from the reserve for the purpose of potential future residential development and is currently for sale by the current owner. It is unknown whether the new property owner would agree to allow for continued use of the trail by the public and for this reason, the relocation of this trail should be given consideration. The Islands Trust Fund currently holds an easement to allow for access to the reserve from the end of Greenhill Road (Figure 2). The terrain in this area is relatively flat and characterized by third growth Douglas-fir dominated forest. It would not be difficult to re- route the trail system to follow the property line and connect to the existing trail when it enters the property approximately mid-way along its southern boundary. The newly constructed trail would have to avoid the small wetland in this area, but could be routed to the south of this sensitive area. Private property signs should be erected at the entrance to the existing trail system to alert visitors who continue to use this access and an additional sign erected where the existing trail enters the nature reserve to alert visitors to where they leave private property and enter into reserve lands.

The trail leading through the southern portion of the property currently crosses over a stream approximately mid-way along its length (photo point 5). This stream crossing is currently managed by a large culvert. This trail continues on to where the property lines of both the private property to the south and Boyle Point Provincial Park boundaries meet the boundary of the nature reserve. At this junction, the trail crosses over a sensitive wetland system (photo point 8). Remnants of the original trail system bypassing this wetland along its northwestern edge, was observed during field work and efforts to re-route the existing trail to its original location is encouraged.

A secondary trail or skid road leading toward Morrison Marsh dead ends off of the southern trail (photo point 2 and 3) and is located just off of the end of Greenhill Road as you enter the reserve. This trail is partially overgrown and appeared to receive little pedestrian traffic. It is recommended that this trail be closed and allowed to regenerate naturally.

The second main trail leads from the southern trail shortly before the first trail leads southward toward Boyle Point Provincial Park (midway between photo point 6 and 7). This second trail heads northward and climbs in elevation before swinging southward toward the east-ridge and eventually leading off of the property into the Crown land parcel to the east. The trail forks shortly after it dips back toward the southern portion of the property and the upper fork leads onto the East Road and the other continues in a southerly direction before connecting to trails on the Crown land parcel to the east. The trail passes over Boyle Creek and during field visits in November 2006, the culvert in this location had become plugged with debris which had caused localized flooding of the trail. Periodic monitoring and cleaning of the culvert at this location should mitigate future problems at this site. Additionally, where the trail dips before rising in elevation (photo point 13 and 14), run off from the hillside was causing sheet erosion to occur along the trail. Installing a water bar in the vicinity may assist in alleviating further damage to the trail during the wetter winter months.

The access to the second main trail from the end of East Road runs past several small wetland complexes in the northeastern corner of the nature reserve. This access has been gated to prohibit entry by motorized vehicles. Evidence of erosion from past vehicle entry was observed in this area. Considerable damage to the wetlands has occurred from the use of the area for browsing by domestic cattle (photo points 22 and 27). This access point should continue to be gated to deter further trespass by motorized vehicles and signage indicating the intent and nature of the reserve should be posted to alert visitors that motorized vehicle use is not permitted. The use of this area for browsing by domestic cattle should be brought to the attention of adjacent landowners and appropriate measures taken to deter the use of the nature reserve for browsing. Use of nature reserve lands by domestic animals causes damage to sensitive ecosystems by trampling of vegetation and the possible introduction of exotic species through transport in feces and the body of the animal. The keeping of or use of the nature reserve for this purpose is not permitted in Islands Trust Fund properties, and if the activity continues, bylaw enforcement may be required (Denman Island Local Trust Committee, 2006).

The second main trail continues southward from this location to connect to additional trail systems in the Crown land parcel to the east. As the trail leads over one of several rocky outcrops in this area, further damage was observed (photo point 31) from motorized vehicle use on the sensitive and thin soils found here. Signage should be posted at the access point (photo point 30) where this trail enters the Crown land reserve to alert visitors that they are entering (or leaving) reserve lands and that motorized vehicles are prohibited within reserve boundaries.

As the second main trail connects to the Crown land parcel to the east (photo point 30), a steep secondary trail forks off of the main trail, and leads visitors up to the bluff that over looks the property (photo point 29). This trail is steep and contains loose rock which could pose a considerable safety risk to visitors. However, the vista is well loved by local residents and users of the trail system. Where the trail leads to the vista should be clearly marked as potentially unsafe for all or parts of the year. Additionally, the relocation of this trail with a setback of an additional five to ten meters from the current trail and cliff edge would lower the risk associated with this vista considerably.

Two additional secondary trails lead off of the second main trail to the west. The first of these dead ends (photo point 17) and the other leads onto the private property found to the north of the nature reserve (photo point 19). The first of these secondary trails is partially overgrown and should be left to regenerate naturally, as its use may encourage visitors of the reserve to travel further into the sensitive ecological communities surrounding Morrison Marsh and the marsh itself. The second of these trails should also be closed to discourage trespass onto the private property to the north. Signage should be used at the access point onto this property to assist in alerting visitors that they are entering private property at this point (photo point 19).

5.1.2 Trail Maintenance and Safety

Trail maintenance and safety includes the clearing of brush along trails, the removal of downed trees across trails, maintenance of culverts and stream crossings and other actions as deemed appropriate and necessary to keep trails cleared and safe for pedestrian use.

Denman Island receives heavy rains and winds at certain times of the year, which may result in downed trees, as well as increased trail vulnerability to erosion. During the winter months, trails may be impassable due to wind or water damage. Periodic monitoring of trail conditions by local recreational users or by Islands Trust Fund staff should occur at a minimum of once a year. Additionally, signage at key access points to the nature reserve should provide a contact number for users of the site to report any unsafe conditions so that remedial action can occur.

There are two culverts along the trail system that will require periodic maintenance to reduce erosion and water damage from blocked streams. In addition, it is recommended that a water bar be installed between photo points 13 and 14, where seepage and drainage from the adjacent hillside is causing erosion and pooling of water along the trail system. Often, users of a trail will bypass areas that experience periodic flooding and cause the trail system to widen at those locations causing soil compaction and damage to adjacent vegetation.

Another issue experienced during heavy rains and winds is blow down of trees across trails which can increase the safety hazard to trail users and in specific circumstances deem a trail impassable. In instances where blow down has occurred and the trail has been made impassable, it is recommended that only that part of the tree that lies across the trail is removed and that the remainder of the tree is left as it lies to further contribute

to the biodiversity of the reserve as downed woody debris, if deemed safe to do so. Downed woody debris contributes to biodiversity by providing cover for small mammals and amphibians and adding to structural diversity in the forest ecosystem.

Trail damage from past motorized vehicles and mountain bikes was observed in several locations within the reserve, primarily along rocky outcrops that are thin soiled and adversely sensitive to such activity. Due to the nature of these ecosystems, it would be difficult to restore native vegetative cover by artificial means without disturbing the system further. It is hoped that over a longer period of time these sites will regenerate naturally. Because these areas are vulnerable to the introduction of invasive and/or exotic species, damaged areas should be periodically monitored and these associated plants removed. Barriers to motorized vehicles and mountain bikes should be erected at key access points, as resources permit.

5.1.3 Permitted Uses

Based on public input and consultation with local stakeholders, the following activities will be permitted to continue within the Morrison Marsh Nature Reserve. Permitted activities are considered to be low impact and are deemed compatible with the intent of the nature reserve and the protection of its ecological features and attributes. If one or more of these activities is observed to cause damage or no longer meets the intent of the nature reserve, the Islands Trust Fund reserves the right to re-examine the activity and prohibit its use, if warranted, in the future. If an activity or use is not mentioned below, it is considered to not be a permitted use of the reserve and as such is prohibited within reserve boundaries. Please refer to the conservation covenant registered on title and held by the Denman Conservancy Association for additional restrictions.

Pedestrian Use
Pedestrian use of the trail systems within the reserve will be permitted to continue. This activity includes walking, as well as access by wheelchairs or other devices used by those with motor impairments. Trails may not be maintained to a standard that allows access to all parts of the reserve. Pedestrian use will be restricted to established trails.

Wildlife Viewing
Wildlife viewing includes bird watching, botany or the study of plants within the reserve. Bird watching and nature appreciation is a popular activity and can contribute substantial knowledge of the wildlife and plant species utilizing the reserve. The removal or relocation of plants, animals and/or other animate or inanimate objects from reserve boundaries is strictly prohibited unless removed or relocated with the written permission of the Islands Trust Fund.

Photography
Nature photography, much like wildlife viewing and nature appreciation, is growing in popularity and is considered to be a low impact activity. This activity is expected to grow as the natural attributes of the reserve continue to mature and assume old-growth characteristics, providing more unique images.

5.1.4 Disturbance to Waterfowl Nesting and Breeding

Morrison Marsh is a significant over-wintering and breeding habitat for waterfowl along the Pacific flyway. Several blue-listed species and regionally rare species are known to use the marsh for both breeding and for over-winter foraging and protection. Over-winter foraging for trumpeter swans (blue-listed) and other duck species occurs from October to March. By spring, most migrant species have left for their respective breeding grounds farther north or in central Canada. Resident waterfowl generally breed from April to June and protection of marsh habitat during this time is critical (Canadian Wildlife Service, 2007).

Within the nature reserve there is essentially no access to the sensitive shoreline of Morrison Marsh. The trail system as it currently exists does not come into close proximity to the marsh and trail construction in this area is not encouraged.

Canoe and kayak use of the open waters of Morrison Marsh by residents and visitors is a growing activity. Most users put their boats in at McFarlane Road or from residences along the shorelines of the marsh. Canoe and kayak use within the waters of Morrison Marsh contained within the nature reserve is prohibited. Docking or mooring on the shoreline of that portion of Morrison Marsh within the reserve is strictly prohibited as to avoid disturbance to wildlife. Access and use of Morrison Marsh during the breeding season from April to June will be discouraged through signage on site. In addition, the community may wish to post signage on McFarlane Road alerting visitors who use this access of the same to discourage recreational use of the marsh during this sensitive time.

Other wetlands within the nature reserve may also support waterfowl breeding and special care and consideration should be given to these smaller systems as well.

5.1.5 Exotic and Invasive Species

A comprehensive list of exotic and invasive species as observed during field visits and from past literature is included in Table 2 of this report. In addition, a general discussion of priority species is included in Section 3.4. This section will discuss in more detail management options for those species listed as high to medium priority. Those species listed as low priority are assumed to be adequately managed by natural successional processes, as these shade intolerant species are relatively scattered and in low quantity throughout the reserve, or alternatively the costs of removal in regards to materials and labor outweighs the benefit of management. For example, several smaller wetland complexes have a high degree of non-native grasses limiting the value of these wetlands. However, the cost of removing such species may cause more damage than benefit through soil and seed bank disturbance.

The following discusses removal methods for the high and medium priority species within the Morrison Marsh Nature Reserve. Due to the intent of the nature reserve's creation to protect native plants and biodiversity, biological and chemical control has not been included in this discussion. In addition, the disposal of exotic and invasive species

must be done in as careful a manner as possible to avoid their spread and establishment in other locations. Local disposal facilities should be sought with expertise in the handling of invasive plant material. It is not advisable that removed plants be composted.

English Holly (Ilex aquifolium) and Scotch Broom (Cytisus scoparius)
English holly is widespread throughout the reserve and spreads through the suckering of its root system or by berries transported by wildlife. Berries are poisonous if ingested. Young plants can be mistaken for native dull Oregon grape. Methods of removal are similar to that of Scotch broom.

Scotch broom was not as widespread in the reserve; however, it has the potential to become a more widespread problem. This species fixes its own nitrogen and is prolific in open areas and long lived in the seed bank.

Removal of broom is best done in the late summer and early winter. This is when most native wildflowers have gone dormant and before the seedpods on broom plants have opened. Young plants can be hand pulled. Larger plants require cutting below the root crown with either loppers or a pruning saw. Removal during the wetter months can result in re-sprouting of the plant the following season.

Because English holly can spread via its berries, and Scotch broom can leach toxins and suppress native plant growth, it is recommended that removed plants and debris is piled on tarps and carefully removed. Care and consideration should be taken to avoid disturbance of soil during removal (Municipality of Sannich, 2005).

Reed Canarygrass (Phalaris arundinacea)
In British Columbia, reed canarygrass is primarily of the native variety, although it is difficult to distinguish from European varieties. Reed canarygrass grows vigorously and was observed to be eliminating other species in the smaller wetlands within the reserve. Control methods for reed canarygrass include burning, covering of the plants to deplete oxygen and mowing, none of which have been proven to be highly successful. Due to the potential damaging effect these methods may have on existing native species, they will not be considered further. Hand pulling in small areas can be effective if done several times a year for a series of five years. This is only practical in the smaller wetlands with high biodiversity values (Canadian Wildlife Service, 2003).

Canada Thistle (Cirsium arvense), Common Tansy (*Tanacetum vulgare) and Oxeye Daisy (Leucanthemum vulgare)*
Canada thistle, common tansy and oxeye daisy are all common in disturbed open areas, such as rocky outcrops and trails within the reserve. Each of these species is spread by seed and/or rhizomes in their root systems. Frequent and repetitive hand removal will eventually remove light to moderate infestations (Canadian Wildlife Service, 2003). Hand cutting common tansy at its base or mowing of larger infestations will starve the root system of this species.

Laurel Leaved Daphne (Daphne laureola)
The daphne plant and berries are poisonous to people and most animals. It was found along the shoreline of Morrison Marsh in two locations. Removal of the plant is best achieved in the summer and may require repeated visits. The plant should be cut close to the ground and transported in an open vehicle to avoid the noxious fumes it produces. Gloves must also be worn, as the plant is known to be a skin and eye irritant (Municipality of Sannich, 2005).

5.1.6 Water Quality and Flooding

Several residents are concerned with the artificially high water levels within Morrison Marsh and the frequency of flooding and loss of property that has occurred as a result of high water levels. Ducks Unlimited Canada in cooperation with the Ministry of the Environment and local residents, installed a variable crest weir to control water levels in Morrison Marsh in 1985. The weir is located on private property adjacent to McFarlane Road and on the immediate edge of the marsh. It controls water flow from the marsh into a stream that drains to the east through a ditch that runs roughly parallel to McFarlane Road. For over the past ten years, beaver activity has resulted in the construction of a dam downstream of the control mechanism, resulting in the water levels to be maintained at a higher level. Although the property owner at the outlet removes the beaver dam on an on-going basis, the costs and resources for removing the dam on a regular basis remains an obstacle to adequately addressing the issue over the long term (Ducks Unlimited Canada, 2006).

As a result of higher water levels, old septic systems that were built adjacent to the marsh and have begun to degrade are contributed to poor water quality in localized areas of the marsh (Unknown Resident, 2006). Degraded water quality may cause illness or losses in wildlife and may result in an increase in nutrients within the marsh eco-system, upsetting the ecological balance in reference to aquatic vegetation and invertebrates.

Although the Islands Trust Fund has no direct control over water levels on Morrison Marsh, high water levels impact the reserve through the potential loss of shoreline property over the long term. In addition, the ecological balance of plant life and aquatic species will change over time as a result of increased or decreased clarity and depth of water. These changes, as a result of artificial high water levels, may result in a natural environment which may or may not be as highly valued for biodiversity and use by wildlife.

The Islands Trust Fund should cooperate with landowners, local government and Ducks Unlimited Canada in developing a long term strategy to manage beaver activity to mitigate the negative impact high water levels have had on shoreline residents. The Islands Trust should also be encouraged to; through its permitting process, address out-dated and insufficient septic systems on shoreline properties.

5.1.7 Protection of Sensitive Ecosystems and Species at Risk

Several blue-listed species are known to occur in the Morrison Marsh Nature Reserve or have the potential to exist within the reserve based on observations of adjacent properties. These include band-tailed pigeon, great blue heron, western screech owl (regionally rare sub-species), Townsend's big-eared bat, red-legged frog and cutthroat trout. There are no known occurrences of rare flora species within the reserve, but a more comprehensive summer inventory of plant species may result in the identification of rare species. Several rare flora species are known to occur on the vacant Crown land parcel to the east.

Protection and conservation of blue-listed avian species is achieved through continuing to allow the forest system within the reserve to mature. Both band-tailed pigeon and western screech owl favor mature conifer forest as habitat. There is no known heron colony within the boundaries of the reserve, but the shoreline of Morrison Marsh contains habitat values favourable toward the establishment of a heron colony. Allowing wildlife trees to stand and minimizing disturbances in the vicinity of the marsh by prohibiting pedestrian traffic and the mooring of boats, should protect these habitat values. Townsend's big-eared bat is not a resident of the reserve, but may potentially use parts of the reserve for forage. The preferred forage for this bat is moth species, generally associated with forest ecosystems. As the forest ecosystems mature within the reserve, additional preferred habitat may become available for this species.

Conservation of the wetlands and riparian areas within the reserve are of the utmost importance for the protection of red-legged frog and cutthroat trout within the reserve, as well as the conservation of ground water and surface water quality. Of concern in these areas is the protection of the shoreline of Morrison Marsh by restricting access to this sensitive area by visitors to the reserve and watercraft. Trail systems within the reserve do not access this sensitive area and the mooring or docking of watercraft is prohibited within reserve boundaries. The protection of the smaller wetland systems within the reserve is more difficult to achieve. Several of these smaller systems have been used for the cultivation of domestic crops and wetlands in the northeastern corner of the property are currently being damaged by browsing domestic cattle. Holes left from the cultivation of crops should be filled to avoid trapping small mammals and invertebrates. These areas should also be periodically monitored to ensure that the cultivation of crops has not resulted in the introduction of exotic or invasive species. Domestic cattle should be kept out of reserve boundaries in cooperation with the landowner or physical obstructions such as fencing will need to be used.

Rocky outcrops within the reserve add to structural biodiversity within the reserve and may potentially contain rare or threatened flora. These sites are currently threatened by the establishment of invasive species and have been disturbed by mountain bikes and all-terrain vehicles. Obstructions to exclude recreational vehicles from entering reserve lands may be required. Gating of entry ways has not been met with success in most instances, and the use of physical barriers such as large boulders or concrete can be costly to install and are not always effective. Another method used by the British Columbia Forest Service is to rough up the ground at entry ways so that vehicle passage is made difficult.

This is achieved with the use of a back hoe, but causes considerable disruption to the seed bank and soil. If this option is necessary to deter access by mountain bikers and motorized vehicles, careful monitoring of access sites is required to assure that seed bank disruption does not result in the introduction of undesirable plant species.

5.1.8 Fire Management

The Morrison Marsh Nature Reserve is located in close proximity to residences and Boyle Point Provincial Park. For reasons of public safety and health, fires within the reserve will not be permitted to burn. Fire protection is provided by the Denman Island Volunteer Fire Department and the British Columbia Forest Service.

Any prescribed burning for the management of invasive grass species in wetland areas will be closely monitored and any required permits will be acquired. It is advised that any prescribed burning is observed by those with training in this area and that the equipment required to control burns is on hand at all times to ensure that burns do not result in larger than prescribed fire damage.

5.1.9 Connectivity to Adjacent Lands and Land Uses

Boyle Point Provincial Park and the vacant Crown land parcel to the east of the Morrison Marsh Nature Reserve contain some of Denman Island's last remaining forests with old-growth characteristics. Morrison Marsh Nature Reserve provides an important buffer to these forest ecosystems and in time will provide similar old-growth characteristics. The nature reserve has the potential to contain five rare or red-listed plant communities if these ecological communities are permitted to continue to mature.

Additionally, the reserve contains the headwaters of Morrison Marsh, which is Denman Island's largest freshwater wetland and is vital for the continued conservation of groundwater resources on the island, as well as a significant area for over-wintering and breeding waterfowl. Many residents along the shoreline of Morrison Marsh have entered into voluntary stewardship agreements to protect the ecological value of their shoreline properties and the Islands Trust has established a Development Permit Area around the marsh to protect it from development. Shoreline residents should continue to be encouraged to be wise stewards of their properties and enter into conservation covenants where deemed appropriate.

Another smaller wetland along the southern boundary of the reserve is partially contained within the private property to the south of the reserve that was created during sub-division of the larger parent parcel. The new property owner should be encouraged to place a protective covenant on the two wetlands within their property boundaries or alternatively, the Islands Trust Fund should seek inclusion of these areas within the reserve as resources permit or opportunity arises. The Islands Trust Fund and/or the Denman Conservancy Association could also seek to designate the wetlands to be included within a Development Permit Area (DPA) with the Islands Trust.

5.1.10 Education and Research

Morrison Marsh has been the subject of research by Ducks Unlimited Canada and the Ministry of the Environment since 1985. These groups have conducted waterfowl census, monitoring of duck boxes and observations of marsh flora and fauna since a weir was installed to control water levels. In addition, local naturalists have conducted annual swan counts and bird counts. An inventory of local flora was conducted in 1993 (Balke, 2006).

Research, such as the activities as listed above, contributes to the knowledge required to adaptively manage our natural heritage and to observe when human activity is negatively impacting natural heritage values. Although the Islands Trust Fund manages its properties to be in as natural of a state as possible, permitted recreational activities and adjacent land uses can result in negative impacts. Educational and research activities will be permitted to continue provided that such research meets the intent and purpose of the nature reserve and does not result in harm to natural heritage values within reserve boundaries. The Islands Trust Fund will be notified of all research activities that take place on the property.

5.1.11 Capacity

The Islands Trust Fund has limited staffing capabilities to undertake long term management of the properties it owns and has in the past relied heavily upon local groups and organizations to undertake management and monitoring activities under various partnership arrangements. The Denman Conservancy Association (DCA) has provided the impetus for the protection of the Morrison Marsh Nature Reserve and has donated long volunteer hours and funding into the background research and legalities with the previous landowner toward its long term conservation. The DCA is prepared to take on a management role in regards to Morrison Marsh Nature Reserve and currently holds a conservation covenant on the property (Denman Conservancy Association, pers. comm., 2007).

Monitoring of Islands Trust Fund properties occurs on an annual basis and a proposed monitoring route is included as an appendix to this report. Yearly monitoring of this property is deemed adequate to assess the success and/or lack of success of most proposed management actions. Including a phone number on signage within the reserve, in which the Islands Trust Fund can be contacted in specific circumstances where safety hazards and/or damage to areas of the nature reserve have been observed, will allow for those issues to be addressed outside of the annual monitoring schedule as the need arises and will reduce the need for frequent staff visits.

In regards to the implementation of management actions, such as the relocation of trails and invasive species removal, additional volunteer labour could be sought. This could include utilization of secondary school or college students in nearby communities on Vancouver Island. Students are often eager volunteers in their own communities and practical experience in the field is often a positive benefit to round out curriculum in biology, forestry or geography. Comox First Nation may also be interested in providing

opportunities for its youth to acquire the skills required for trail construction and plant removal. Staff requirements for supervision and the initial teaching of these skills would be a requirement in this regard, as would the provision of needed equipment.

5.2 Management Strategies

The following section outlines the priorities for management and recommendations as outlined above. General management direction for the Morrison Marsh Nature Reserve is to allow for natural ecological processes to continue without human intervention unless intervention is required for safety reasons.

Immediate Management Strategies
Immediate management strategies are intended to be completed within one year, or as soon as resources permit.

Action Item 1: Erect signage at access points off of Greenhill Road, East Road, Boyle Point Provincial Park and the Crown land parcel to the east (boundary between photo points 4 and 5, photo point 24, photo point 30 and photo point 8) to indicate where the nature reserve boundary begins and list permitted uses.

Action Item 2: Re-route the trail entering Boyle Point Provincial Park along the southern boundary of the reserve to by-pass the wetland (photo point 8) and resume its original path as intended.

Action Item 3: Unplug the culvert across Boyle Creek to allow for safe water passage.

Action Item 4: Contact the landowner to the north of the reserve to initiate discussions regarding the exclusion of cattle from reserve lands in the northeastern corner.

Action Item 5: Erect signage at the trail to the bluff indicating that a safety hazard exists and that use of the trail and the risk associated is assumed by the user of the trail and not by the Islands Trust Fund until more permanent safety precautions can be taken, such as the relocation of the trail.

Short-term Management Strategies
Short-term management strategies are intended to be initiated within the first two years, or as resources permit.

Action Item 6: Close all secondary trails as discussed in Section 5.1 through use of barriers or signage.

Action Item 7: Examine possible routes to relocate the southern main trail to within the boundaries of the nature reserve and establish permanent entrance trail.

Action Item 8: Install a water bar between photo points 13 and 14 to assist in controlling erosion and run off damage to the trail system in this location.

Action Item 9: Examine the possible relocation of the bluff trail (photo points 29 and 30) to distance it from the edge to increase safety in this location and re-establish the trail within a safe distance from the bluff.

Action Item 10: Examine potential barrier methods to exclude use of mountain bikes and motorized vehicles within reserve boundaries if this issue persists despite signage and install barriers where required.

Action Item 11: Begin a removal strategy for invasive plants, such as English holly, Scotch broom and Laurel-leaved daphne.

Action Item 12: Fill holes left from cultivation of domestic crops along the shorelines of Morrison Marsh and other small wetland systems within reserve boundaries.

Action Item 13: Conduct a summer inventory of the flora of the Morrison Marsh Nature Reserve to identify potential additional rare or threatened species and invasive species. The results of this inventory may determine additional actions items within this plan.

Medium-term Management Strategies

Medium-term management strategies are those that should be initiated within three to five years, or as resources permit.

Action Item 14: Erect signage on the shoreline of Morrison Marsh to indicate to water craft users that mooring or docking of boats within the reserve is strictly prohibited as is the use of the reserve for this activity.

Action Item 15: Provide educational materials and/or signage indicating the breeding season of area waterfowl and the sensitivity to disturbance between the months of April to June.

Action Item 16: Begin a removal strategy for invasive plants, such as Canada thistle, common tansy and oxeye daisy.

Long-term Management Strategies

Long-term management strategies are those that should be initiated within five to ten years, or as resources permit.

Action Item 17: Seek a removal strategy for reed canarygrass once methods for its removal are better understood.

Action Item 18: Seek long term additional capacity to ensure long term management of the Morrison Marsh Nature Reserve and surrounding environments.

Action Item 19: Continue to work with adjacent landowners on private land stewardship initiatives and resume discussions in regards to the long term protection of shoreline along Morrison Marsh and the wetland partially contained on the private property to the south.

Action Item 20: Cooperate with landowners, local government and Ducks Unlimited Canada in addressing issues in reference to water levels and the potential degradation of water quality from area septic systems.

6.0 Conclusion

The Morrison Marsh Nature Reserve was donated to the Islands Trust Fund by a donor with a long term vision for its natural conservation value and significance to the Denman Island community. In time, this property will protect in perpetuity the headwaters of Morrison Marsh and several rare and endangered plant communities.

Morrison Marsh has long been the focus of conservation initiatives by the Denman Island Conservancy, Islands Trust, Ducks Unlimited Canada, the Provincial government and shoreline residents. The acquisition of this property contributes substantially to the protection and conservation of this resource and the natural heritage of Denman Island.

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8.0 Appendices

Appendix A. Environmental Inventory Data

A basic inventory of the reserve was conducted on November 11th and 12th, 2006. The inventory was completed following the Islands Trust Fund Natural Area Protection Tax Exemption Program (NAPTEP) guideline and the provincial Biogeoclimatic Ecosystem Classification (BEC) system.

Previous studies used for the inventory included the Baseline Inventory prepared by Jenny Balke (2006) that is attached as Schedule B to the conservation covenant. GPS data from the Morrison Marsh South Covenant Project Science Team (DCA, 2006) were used to produce maps of the reserve.

Methodology

A basic inventory of indicator species from each vegetation type was completed. Data were collected from $40m^2$ plots for shrubs, herbs and mosses, while tree data were collected from visual approximations of one hectare plots (where possible). The species lists are not considered to be comprehensive.

Note that the vegetation species and percent cover indicated in the following descriptions are a reflection of the time of year in which the survey was completed. Herbaceous vegetation was identified, but percent cover was generally not estimated as it was not considered to be accurate. As well, crown closure was estimated based on the expected full summer canopy cover.

Classification of the vegetation types to the BEC site series level was completed. However, due to the disturbance history and successive replanting the classification was generalized and is expected to change as the forest stands mature. As well, classification was based on slope position, azimuth and indicator vegetation. Soil moisture and nutrient regimes were estimated from the previously described features as soil pits were not dug.

Floral Species Lists

The following tables contain floral species identified in each vegetation type.

Table 7. Species List for Vegetation Type 1

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	15	25m	20-40cm
arbutus	*Arbutus menziesii*	A3	<1	10-15m	7.5-20cm
bigleaf maple	*Acer macrophyllum*	A3	<1	10-15m	7.5-20cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A3	50	10-15m	7.5-20cm
grand fir	*Abies grandis*	A3	5	10-15m	7.5-20cm

red alder	*Alnus rubra*	A3	5	10-15m	7.5-20cm
western hemlock	*Tsuga heterophylla*	A3	10	10-15m	7.5-20cm
western redcedar	*Thuja plicata*	A3	5	10-15m	7.5-20cm
western white pine	*Pinus monticola*	A3	<1	10-15m	7.5-20cm
Shrubs (*invasive)					
baldhip rose	*Rosa gymnocarpa*				
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*		10		
dull Oregon grape	*Mahonia nervosa*		5		
English holly*	*Ilex aquifolium*		<1		
evergreen blackberry	*Rubus laciniatus*		<1		
grand fir	*Abies grandis*		<1		
oceanspray	*Holodiscus discolor*		<1		
red huckleberry	*Vaccinium parvifolium*		<1		
salal	*Gaultheria shallon*		45		
trailing blackberry	*Rubus ursinus*		<1		
western hemlock	*Tsuga heterophylla*		5		
western redcedar	*Thuja plicata*		<1		
Herbs (*invasive)					
broad-leaved starflower	*Trientalis borealis*				
indian-pipe	*Monotropa uniflora*				
sweet-scented bedstraw	*Galium triflorum*				
sword fern	*Polystichum munitum*		35		
twinflower	*Linnaea borealis*		<1		
vanilla-leaf	*Achlys triphylla*				
Moss and Lichen					
electrified cat's-tail moss	*Rhytidiadelphus triquetrus*		10		
Oregon beaked moss	*Eurhynchium oreganum*		20		
stepmoss	*Hylocomium splendens*		30		
unidentified mosses			15		

Table 8. Species List for Vegetation Type 2

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
red alder	*Alnus rubra*	A2	<1	3-10m	10-30cm
western hemlock	*Tsuga heterophylla*	A2	<1	3-10m	10-30cm
western redcedar	*Thuja plicata*	A2	<1	3-10m	10-30cm
Sitka spruce	*Picea sitchensis*	A2	5	3-10m	10-30cm
Shrubs (*invasive)					
hardhack	*Spiraea douglasii*		5		
red alder	*Alnus rubra*		<1		
Sitka spruce	*Picea sitchensis*		5		
Herbs (*invasive)					
horsetail	*Equisetum* sp.		<1		
reed canarygrass*	*Phalaris arundinacea*		5		
skunk cabbage	*Lysichiton americanus*		<1		
slough sedge	*Carex obnupta*		90		
soft-stemmed bulrush	*Schoenoplectus tabernaemontani*		<1		
Moss and Lichen					
unidentified mosses			5		

Table 9. Species List for Vegetation Type 3

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
bigleaf maple	*Acer macrophyllum*	A2	<1	20m	20-30cm
red alder	*Alnus rubra*	A2	40	20m	20-30cm
western hemlock	*Tsuga heterophylla*	A2	5	20m	20-30cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A3	<1	5-10m	10-15cm
red alder	*Alnus rubra*	A3	<1	5-10m	10-15cm
western hemlock	*Tsuga heterophylla*	A3	5	5-10m	10-15cm
western redcedar	*Thuja plicata*	A3	<1	5-10m	10-15cm
Shrubs (*invasive)					
dull Oregon grape	*Mahonia nervosa*		<1		
English holly*	*Ilex aquifolium*		5		
grand fir	*Abies grandis*		<1		
red elderberry	*Sambucus racemosa* ssp. *pubens*		<1		
red huckleberry	*Vaccinium parvifolium*		<1		
salal	*Gaultheria shallon*		<1		
western hemlock	*Tsuga heterophylla*		10		
western redcedar	*Thuja plicata*		5		
Herbs (*invasive)					
sweet-scented bedstraw	*Galium triflorum*				
sword fern	*Polystichum munitum*		25		
unidentified grass					
unidentified sedges					
Moss and Lichen					
coastal leafy moss	*Plagiomnium insigne*		20		
Oregon beaked moss	*Eurhynchium oreganum*		30		
palm tree moss	*Leucolepis acanthoneuron*		15		
unidentified mosses			25		

Table 10. Species List for Vegetation Type 4

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	20	15m	30cm
bigleaf maple	*Acer macrophyllum*	A3	<1	5-10m	10-15cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A3	60	5-10m	10-15cm
grand fir	*Abies grandis*	A3	<1	5-10m	10-15cm
western hemlock	*Tsuga heterophylla*	A3	<1	5-10m	10-15cm
Shrubs (*invasive)					
dull Oregon grape	*Mahonia nervosa*		25		
English holly*	*Ilex aquifolium*		<1		
red huckleberry	*Vaccinium parvifolium*		<1		
salal	*Gaultheria shallon*		<1		
trailing blackberry	*Rubus ursinus*		<1		
Herbs (*invasive)					
sweet-scented bedstraw	*Galium triflorum*				
sword fern	*Polystichum munitum*		20		
twinflower	*Linnaea borealis*				
Moss and Lichen					
Oregon beaked moss	*Eurhynchium oreganum*		50		
unidentified mosses			50		

Table 11. Species List for Vegetation Type 5

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
bigleaf maple	*Acer macrophyllum*	A2	<1	10-20m	20-40cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	45	10-20m	20-40cm
red alder	*Alnus rubra*	A2	5	10-20m	20-40cm
western hemlock	*Tsuga heterophylla*	A2	<1	10-20m	20-40cm
arbutus	*Arbutus menziesii*	A3	<1	10m	5-20cm
bigleaf maple	*Acer macrophyllum*			10m	5-20cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A3	30	10m	5-20cm
red alder	*Alnus rubra*	A3	5	10m	5-20cm
western hemlock	*Tsuga heterophylla*	A3	<1	10m	5-20cm
western redcedar	*Thuja plicata*	A3	<1	10m	5-20cm
Shrubs (*invasive)					
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*		5		
dull Oregon grape	*Mahonia nervosa*		15		
English holly*	*Ilex aquifolium*		<1		
oceanspray	*Holodiscus discolor*		<1		
red alder	*Alnus rubra*		5		
red huckleberry	*Vaccinium parvifolium*		<1		
western hemlock	*Tsuga heterophylla*		5		
western redcedar	*Thuja plicata*		5		
salal	*Gaultheria shallon*		30		
trembling aspen	*Populus tremuloides*		5		
Herbs (*invasive)					
bracken fern	*Pteridium aquilinum*				
sword fern	*Polystichum munitum*		15		
twinflower	*Linnaea borealis*				
grass species					
Moss and Lichen					
electrified cat's-tail moss	*Rhytidiadelphus triquetrus*		5		
Oregon beaked moss	*Eurhynchium oreganum*		40		
stepmoss	*Hylocomium splendens*		5		
unidentified mosses			15		

Table 12. Species List for Vegetation Type 6

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
bigleaf maple	*Acer macrophyllum*	A2	15	15-20m	20-50cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	20	15-20m	20-50cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A3	10	10m	5-20cm
red alder	*Alnus rubra*	A3	<1	10m	5-20cm
western hemlock	*Tsuga heterophylla*	A3	<1	10m	5-20cm
Shrubs (*invasive)					
bigleaf maple	*Acer macrophyllum*		<1		
dull Oregon grape	*Mahonia nervosa*		10		
English holly*	*Ilex aquifolium*		<1		
red elderberry	*Sambucus racemosa* ssp.		<1		

	pubens				
red huckleberry	*Vaccinium parvifolium*		<1		
salal	*Gaultheria shallon*		5		
Herbs (*invasive)					
bracken fern	*Pteridium aquilinum*				
stinging nettle	*Urtica dioica*				
sword fern	*Polystichum munitum*		15		
thistle	*Cirsium* sp.				
unidentified grass					
Moss and Lichen					
Oregon beaked moss	*Eurhynchium oreganum*		10		
unidentified mosses			5		

Table 13. Species List for Vegetation Type 7

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
arbutus	*Arbutus menziesii*	A2	5	15m	20cm
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*	A2	10	15m	15cm
Shrubs (*invasive)					
dull Oregon grape	*Mahonia nervosa*		5		
English holly*	*Ilex aquifolium*		<1		
ocean spray	*Holodiscus discolor*		5		
rose	*Rosa spp.*		<1		
salal	*Gaultheria shallon*		15		
Herbs (*invasive)					
grass species					
hairy cat's ear*	*Hypochaeris radicata*				
twinflower	*Linnaea borealis*				
Moss and Lichen					
electrified cat's-tail moss	*Rhytidiadelphus triquestrus*		10		
lanky moss	*Rhytidiadelphus loreus*		5		
Oregon beaked moss	*Eurhynchium oreganum*		10		
step moss	*Hylocomium splendens*		5		
unidentified moss and lichens			50		

Species data contained in Table 14 were taken from the 2006 Morrison Marsh Baseline Inventory. Percent covers are not included as the list is a generalization of all the wetlands (except Morrison Marsh) that occur on the reserve.

Table 14. Species List for Vegetation Type 8

Common Name	Scientific Name	Layer	% Cover	Height	DBH
Trees (A1 – Veterans, A2 – Main Canopy, A3 – Sub-canopy)					
Douglas-fir	*Pseudotsuga menziesii* var. *menziesii*				
Pacific crab apple	*Malus fusca*				
red alder	*Alnus rubra*				
Sitka spruce	*Picea sitchensis*				
trembling aspen	*Populus tremuloides*				
western hemlock	*Tsuga heterophylla*				
western redcedar	*Thuja plicata*				

Shrubs (*invasive)					
dull Oregon grape	*Mahonia nervosa*				
English holly*****	*Ilex aquifolium*				
hardhack	*Spirea douglasii*				
ocean spray	*Holodiscus discolor*				
rose	*Rosa spp.*				
salal	*Gaultheria shallon*				
western redcedar	*Thuja plicata*				
Herbs (*invasive)					
aster species	*Aster spp.*				
bedstraw	*Galium spp.*				
Canada thistle*	*Cirsium arvense*				
coastal strawberry	*Fragaria chiloensis*				
deer fern	*Blechnum spicant*				
Gairdner's yampa	*Perideridia gairdneri*				
grape fern	*Botrychium multifidum*				
hairy cat's ear*	*Hypochaeris radicata*				
herb-robert*	*Geranium robertianum*				
large-leaved avens	*Geum macrophylum*				
northern water horehound	*Lycopus uniflorus*				
small-flowered bulrush	*Scirpus microcarpus*				
thistle species	*Cirsium spp*				
trailing blackberry	*Rubus ursinus*				
yerba beuna	*Satureja douglasii*				
Moss and Lichen					
	Dicranum spp				
electrified cat's-tail moss	*Rhytidiadelphus triquestrus*				
Oregon beaked moss	*Eurhynchium oreganum*				
step moss	*Hylocomium splendens*				

Appendix B. Public Input Survey

Morrison Marsh Nature Reserve

Let us know what you think! Please fill out the following survey on the Morrison Marsh Nature Reserve and return to Taara Environmental at the address below.

1.) Have you ever visited the Morrison Marsh Nature Reserve? YES NO

If YES, how often do you visit the reserve? _____

2.) As a visitor to the Morrison Marsh Nature Reserve, please list the activities that you enjoy pursuing at the reserve (eg. walking, wildlife viewing, mountain biking, research, other…)

3.) What are the special features most important to you in the Morrison Marsh Nature Reserve? Please list and indicate locations on the map provided

4.) Are there any activities that you think are incompatible with the protection of the natural features of the Nature Reserve?

5.) Have you viewed wildlife while visiting the Morrison Marsh Nature Reserve, or special plant species? Please list below

Please provide any additional comments you may have on this special place below

Please return completed surveys to Taara Environmental at 46054 King Avenue, Chilliwack, BC V2P 3B5, additional copies of this survey are available on our website at www.taara.ca/projects.html

Appendix C. Photos

Photographs were taken during the vegetation inventory on November 11th and 12th, 2006 with a Pentax *stD 6.1 megapixel Digital SLR Camera (Table 15). Photos were not taken from marked locations and a tripod was not used. Focal length and all other variables were adjusted as required to document the given feature. Locations of all photos were mapped with a differential GPS with an accuracy of 1 to 5 metres.

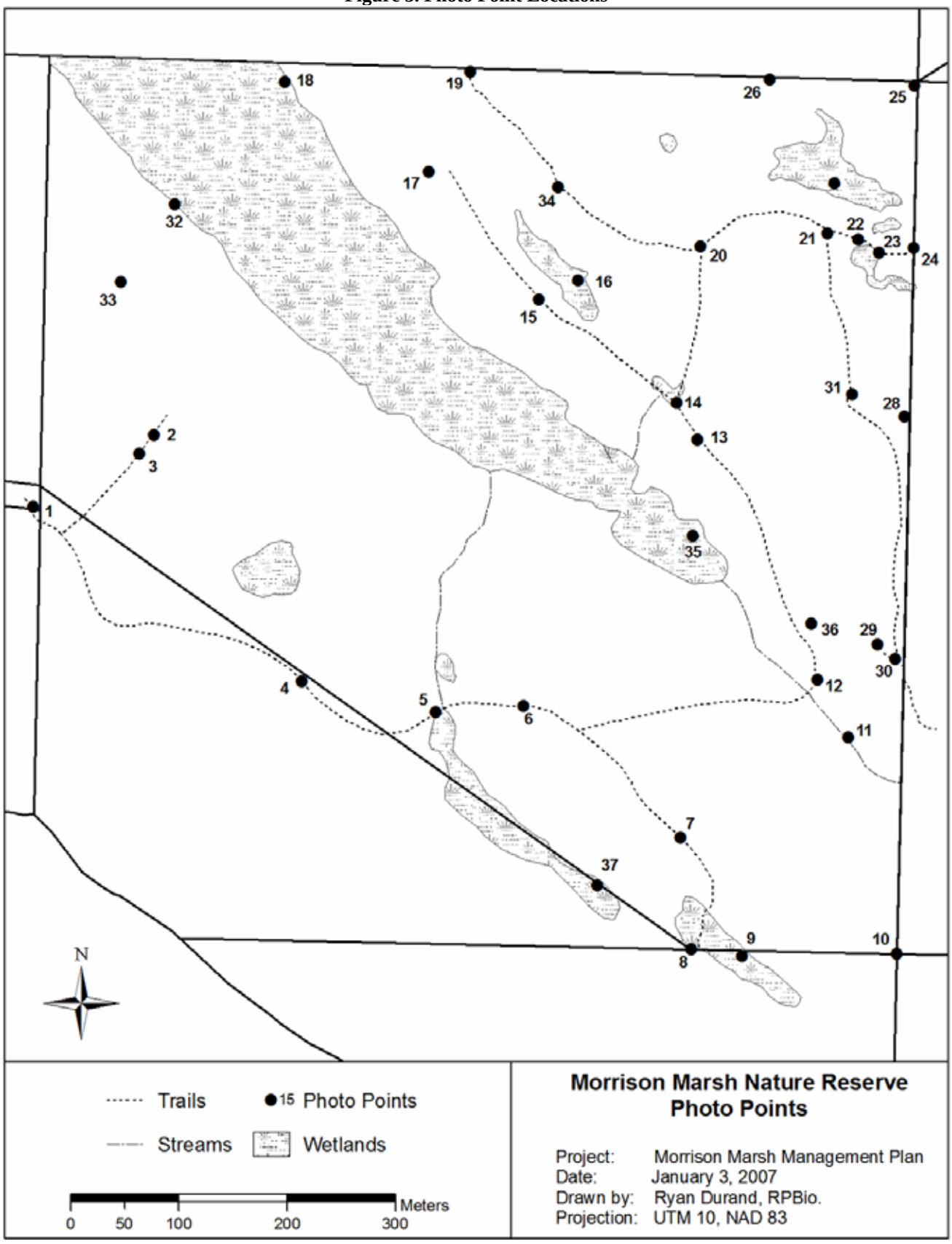
Where applicable, the general direction in which the photo was taken is given. Note that *NA* indicates that the direction of the photo was not recorded.

Table 15. List of Photos

Photo Point	File Name(s)	Direction	Description
1	937-943		End of road, main access point, and ditch on main access trail to prevent vehicle access. Not on reserve.
2	944	SW	Small patch of Scotch broom and likely other invasive species on overgrown road with little current use.
3	945-948	NW, SE, SW, NE	Wetland, reed canarygrass, and old road where it becomes overgrown.
4	949-950	NW, SE	Trail on approximate property line.
5	951-955	NE, SE, SE, SW, N	Shots of trail, wetland and forest where trail crosses over stream that drains wetland.
6	956-960	E, S, W, N, N	Wide, slightly eroded trail across open rocky areas. Photos show trail, open rocky area and adjacent forest.
7	961-965	SE, SW, NW, NW, NE	Side trail towards Boyle Point Park. Photos show trail and adjacent forest.
8	966-968	SW, NE, NE	Edge of wetland and forest where trail crosses property line into Boyle Point Park.
9	969-972	NW, NE, SE, SW	Wetland at southern property line. Note large patch of reed canarygrass and unidentified thistle species.
10	973-977	SW, NW, N, NE, S	South eastern property corner (at IP marker). Photos show what much of the reserve will look link as the forest mature to a similar structure as adjacent park.
11	978-981	SE, SW, SW, E	Boyle Creek and adjacent forest and steep bluff.
12	982-985	SW, NW, N, E	Main trail as it crosses Boyle Creek at partially blocked culvert. Photos show the trail, Boyle Creek and adjacent forest.
13	986-988	NW, SE, NA	Ephemeral stream down trail from wetland.
14	989-991	NW, N, SE	Trail junction and disturbed wetland that drains down trail. Photos capture trails in all three directions.
15	992-995	SE, E, NW, N	Opening along trail (maybe old landing) covered in invasive weeds including reed canarygrass, broom, etc.
16	996-998	N, SE, SW	Wetland with reed canarygrass and holly.
17	999-1001	SE, SW, NW	End of trail where old road becomes overgrown. Little use on trail past this point. Many introduced species.
18	1002-114	Panorama SE to NW	Multiple overlapping photos of Morrison Marsh panning from SE to NW and several close ups.
19	1022-1023	SW, SW	Access point where small, well used trail enters private property.

20	1024-1026	W, NE, S	Trail junction. Photos main trail and entrance to side trail that leads to private property to the north.
21	1027-1030	W, E, S, NA	Trail junction. Photos show main and side trail where trail crosses open rocky area. Close up of minor erosion on trail in rocky area.
22	1031-1032		Evidence of recent and past cow use of the trail.
23	1033-1036	W, S, NA, NW	Chain blocking main trail, reed canarygrass dominated wetland, and recent cow disturbances.
24	1037-1041	SE, SW, SW, N, E	Access point where main trail crosses eastern property line. Photo of property line to SW and N. 2 photos of trail to SW, and 1 of adjacent property to E.
25	1042-1045	S, SW, NW, NE	North eastern property corner at IP marker. Photos show corner of property, property to north with recent logging and property to east.
26	1046-1049	W, N, NE, S	Northern property line. Photos of property line to W and E, recent logging on northern property and forest stands along northern edge of the reserve.
27	1050-1053	W, N, E, S	Reed canarygrass / aspen wetland. Not well shown in photos, but abundant evidence of cow trails, browse and scat in wetland.
28	1054-1057	N, SW, S, E	Eastern property line. Photos show different forest structure between reserve and adjacent crown land.
29	1058-1065		Various photos of vista from end of bluff trail looking towards the NW. Also various close ups showing the steep bluff and potential danger of trail.
30	1066-1068	N, W, SE	Access point where trail crosses eastern property line and eventually leads to Boyle Point Park.
31	1069-1073	S, SW, NW, N, S	Open rocky outcrop of Veg. Type 7. Photos show open areas and the trail in both directions. Also close up of trail edges marked with logs.
32	1074-1085	Panorama NW to SE	Panorama of Morrison Marsh from western edge. Poor quality due to rain.
33	1086-1089		Various shots of typical forest stand of Veg. Type 1.
34	1090-1094		Various shots of typical forest standsof Veg. Type 4.
35	1095-1099		Various shots of fen located in the south of Morrison Marsh, Veg Type 2.
36	1100-1103		Various shots of typical forest stand of Veg. Type 6.
37	1104-1113		Close ups of grape fern and wetland.

Figure 5. Photo Point Locations



Appendix D. Proposed Monitoring Route

The following section and map (Figure 6) describe key monitoring points on the reserve. If the recommendations presented in this management plan are enacted, then the monitoring route will require revisions. As well, general observations (such as trail condition) are required in addition to the 24 key sites.

Key monitoring sites (list numbers correspond to numbered sites on Figure 6) are as follows:

1. Access point. Ensure sign is visible and in good condition. Ensure that vehicle access remains blocked.

2. Invasive weeds. Determine if Scotch broom patch is expanding and/or if management of the weed is working. Also check to see if the side trail is still being used.

3. Invasive weeds. Determine if Scotch broom patch is expanding and/or if management of the weed is working. This site is just outside the boundary of the reserve so any management must be done in consultation with landowner.

4. Access point. Trail enters reserve at this point.

5. Culvert and wetland. Check to see if culvert requires maintenance (blocked culvert, evidence of flooding over trail, etc). Visually assess general condition of trail and wetland.

6. Invasive weeds. Determine if Scotch broom patch is expanding and/or if management of the weed is working.

7. Trail condition. Even if a new trail has been created to bypass the wetland, check to ensure that the wetland is not being further impacted by trail use. Visual inspection of wetland and abundance of and/or new invasive species should be done.

8. Access point. Ensure sign is visible and in good condition.

9. Invasive weeds. Determine if Scotch broom patch is expanding and/or if management of the weed is working.

10. Culvert and Boyle Creek. Check to see if culvert requires maintenance. Visually assess general condition of trail and creek.

11. Wetland and trail condition. Check if drainage problems from small wetland persist and determine if additional management is required. Check general condition of trail to ensure safety. Check side trail and assess usage.

12. Invasive weeds. Determine if Scotch broom patch is expanding and/or if management of the weed is working.

13. Invasive weeds. Determine if laurel leaved daphne is expanding and/or if management of the weed is working.

14. Morrison Marsh. Visual inspection of the marsh to check for any obvious management concerns. Depending on time of year, look for signs of recreational users that may be disturbing breeding or nesting waterfowl.

15. Trail condition. Check if side trail to adjacent private property is still being used and suggest additional management methods to restrict use if necessary.

16. Access point. Ensure sign is visible and in good condition.

17. Livestock. Check for signs of cow use in wetland and trail.

18. Access point. Ensure sign is visible and in good condition. Check for signs of cow use on trail.

19. Livestock. Check for signs of cow use in wetland.

20. Livestock. Check for signs of cow use in forest. Also visually assess adjacent land use to north and east to determine potential issues.

21. Trail condition. Determine if trail braiding is occurring through sensitive open rock and moss area. Check if users are staying on marked trail and recommend additional management options if disturbances are noted. Check for new invasive species, such as Scotch broom, in open areas.

22. Invasive weeds. Determine if Scotch broom patch is expanding and/or if management of the weed is working.

23. Access point. Ensure sign is visible and in good condition.

24. Trail condition. Check general condition of trail to bluff vista and determine if hazard has increased. Ensure “danger” signs are visible and in good condition.

Figure 6. Proposed Monitoring Route