Fish and Wildlife Compensation Program

Moberly Marsh Habitat Restoration Seed Funding Report

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Final Report

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EXECUTIVE SUMMARY

This report summarizes the results of the FWCP seed funding project to identify potential habitat restoration and conservation options in Moberly Marsh. Moberly Marsh is located 11km northwest of Golden, British Columbia in Burges and James Gadsden Provincial Park. The marsh provides habitat for amphibians, reptiles, birds, furbearers, bears, and ungulates and it is one of the few known historical sites for the Northern Leopard Frog (*Lithobates pipiens;* NLF) in British Columbia. As a historical site for NFL, Moberly Marsh is considered a high potential site for their reintroduction.

Moberly Marsh has been operated to maximize waterfowl production under permit with BC Parks since the early 1970's. Recently, DUC have determined that Moberly Marsh is not achieving their objectives for waterfowl productivity and have proposed to remove most of their pumping infrastructure to reduce operating costs. They also propose to breach several of the dykes to reduce the risk of dyke failure.

Considering the high wildlife and conservation values of Moberly Marsh and the reintroduction potential for NLF, a seed funding grant was submitted to the Fish and Wildlife Compensation Program. The objectives of the grant were to provide a preliminary habitat assessment and identify conservation values through a field survey, stakeholder engagement, and an information review and to identify potential restoration opportunities. Outcomes of the project included a review of the available literature and data; a field survey; meetings and communication with the various stakeholders; the acquisition of LiDAR data; mapping of broad habitat types; a summary of conservation values; and the identification of conservation and restoration options for Moberly Marsh. Sixteen potential sites for NLF reintroduction and habitat restoration were identified in Moberly Marsh from the LiDAR orthoimagery; however, ground truthing and the collection of hydrological data will be required to fully assess these sites.

During our stakeholder engagement, the owners of the adjacent Elk Spike Ranch expressed an interest in expanding the wetland area on the ranch. This property provides important spring staging habitat for waterfowl and provides the only practical access to Moberly Marsh and Burges and James Gadsden Provincial Park. A conservation agreement with the landowners should be pursued.

A funding application was submitted in 2017 to collect the field data, continue with stakeholder engagement, and prepare restoration prescriptions.

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1. INTRODUCTION

Moberly Marsh is a complex of managed wetlands in the Columbia River floodplain located 11km northwest of Golden, British Columbia (Figure 1). The marsh is comprised of three managed wetland compartments (Braul, Sime, and Bergenham) constructed in the 1970's by Ducks Unlimited Canada (DUC) for waterfowl production. Moberly Marsh encompasses much of Burges and James Gadsden Provincial Park (BJGPP) and includes private land (12.3 ha; Elk Spike Ranch) and the Columbia Wetlands Wildlife Management Area (16.2 ha; CWWMA; Table 1). The marsh provides habitat for amphibians, reptiles, birds, and mammals and is one of the few historical sites for the Northern Leopard Frog (*Lithobates pipiens;* NLF) documented in British Columbia. The NLF Recovery Team is considering these marshes for NLF reintroduction.

Recently, DUC has proposed to decommission several of the existing water control structures and breach the existing dykes in Moberly Marsh. Citing high pumping costs and dyke maintenance, DUC have determined Moberly Marsh is not meeting their objectives for waterfowl production and are seeking to downsize their management activities. This is to be achieved by removing most of the pumping infrastructure and breaching the dykes so they do not pose a future hydrologic risk to the marshes (Figure 1).

A seed funding grant was submitted to the Fish and Wildlife Compensation Program to identify conservation and restoration options that would be complementary to the reintroduction of NLF following the DUC decommissioning.

2. PROJECT ACTIVITIES

The following activities were under taken for this project:

- Communication with stakeholders
- Information gathering
- Acquisition of LIDAR Imagery
- Field survey
- Summarize the restoration and conservation options
- Preparation and submission of a proposal for Year 2.

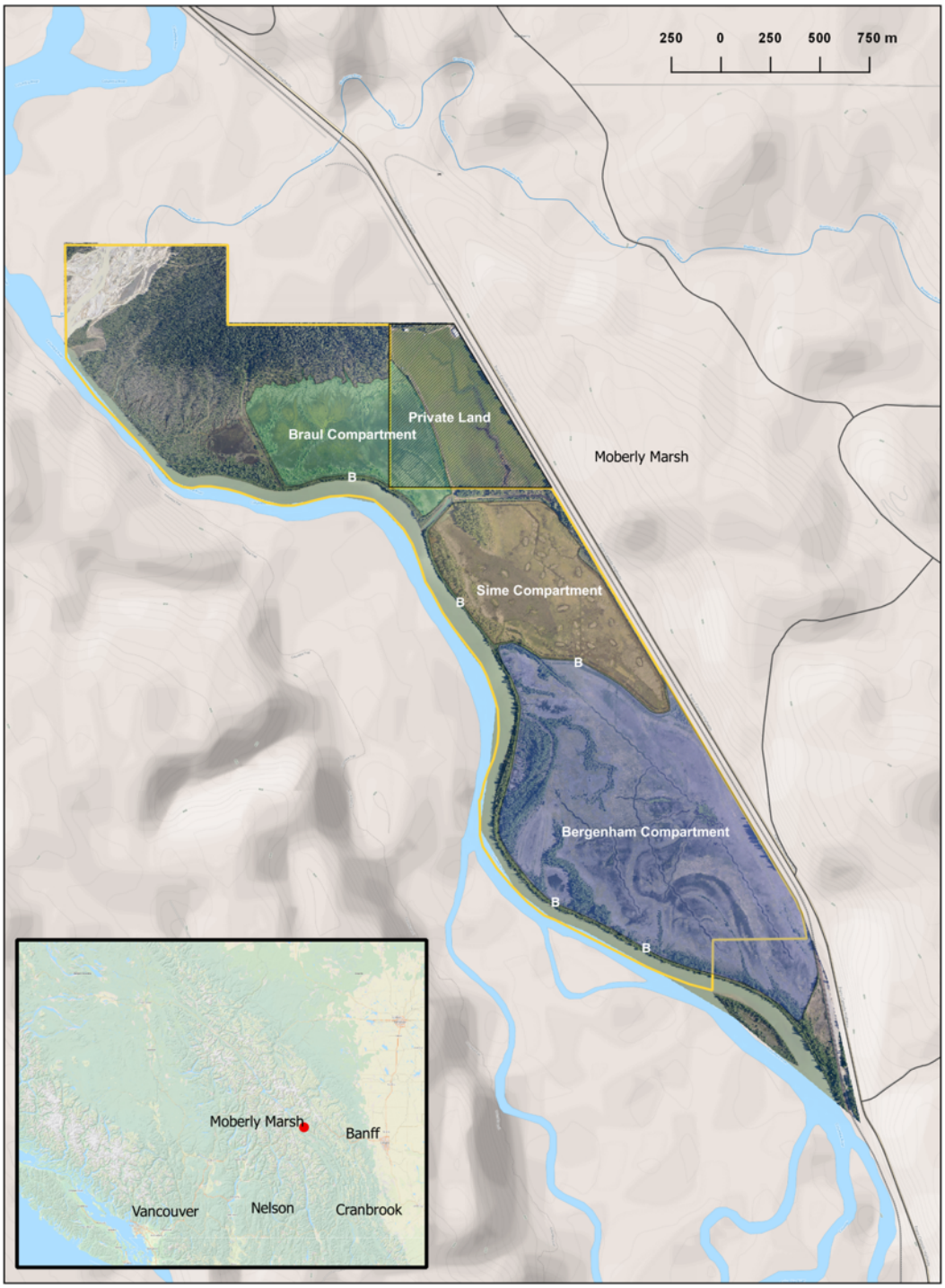

Figure 1. **Map showing the location of Moberly Marsh. The wetland compartments and private land are overlain on LIDAR Imagery (Scale 1:40,000). The boundary of Burges and James Gadsden Provincial Park is marked in yellow. The location of dyke breaches proposed by Ducks Unlimited are identified by the letter "B".**

Table 1. Area (ha) of Burges and James Gadsden Provincial Park, wetland compartments, and private land.

Land Designation/Compartment	Area (ha)
Burges and James Gadsden Park	404.9
Braul Compartment	46.9
Sime Compartment	63.0
Bergenham Compartment	160.8
Dykes	12.8
Unmanaged Land	97.8
Columbia and Blaeberry River Channels	52.1
Columbia Wetlands Wildlife Management Area within the Bergenham Compartment	16.2
Private Land (Elk Spike Ranch)	60.0
Private Land within the Braul compartment	12.3

3. METHODS

3.1. Stakeholder Engagement and Information Gathering

Stakeholder engagement was accomplished through meetings, phone calls, emails, conference call, and a field session.

Relevant reports and data for this project were provided by DUC, BC Parks, or were obtained through searches of the following online data sources:

- BC Conservation Data Centre: http://www2.gov.bc.ca/gov/content/environment/plants-animals-ecosystems/conservation-data-centre/explore-cdc-data
- BC Species and Ecosystem Explorer: http://a100.gov.bc.ca/pub/eswp/
- Cross-Linked Information Resources (CLIR): http://www.env.gov.bc.ca/clir/, which searches:
    - Species Inventory Database (SPI)
    - Ecocat
    - EIRS Biodiversity e-Library
    - Ministry Library
- eBird: http://ebird.org/
- Ducks Unlimited IWWR Online Library: http://ducks.kohacatalog.com/
- Royal BC Museum Online Database: http://royalbcmuseum.bc.ca/collections
- Canadian Museum of Nature Online Database: http://collections.nature.ca/

3.2. Field Assessment

Four LGL biologists and local naturalist and rare plant specialist Bryan Kelly-MacArthur conducted a preliminary habitat assessment of Moberly Marsh on July 12, 2016. In total, 28 km of ground was covered over the course of the day. Due to limited access, the survey was confined to the western edges of the Sime and Bergenham compartments; however, access in the Braul compartment was considerably better, resulting in greater survey effort in this compartment.

Dominant vegetation in the various compartments were recorded and wildlife and rare plants observations were georeferenced. Unfortunately, the weather was poor at the time of the survey and was not ideal for wildlife observations. The dyke and habitat between the wetland compartments and the Columbia River (which offers potential over-wintering habitat for NLF) was assessed to determine if movement between the habitats is impeded by steep topography.

3.3. LIDAR Acquisition and Habitat Mapping

MLNRO provided additional funding for the acquisition of LiDAR (**LI**ght **D**etected **A**nd **R**anging) data and high-resolution aerial imagery for Moberly Marsh. Virgil Hawkes of LGL Limited coordinated the collection of the data with Terra Remote Sensing. The data was collected on May 25, 2016 at a density of 4 LiDAR points per square meter, providing 20 cm pixel resolution.

Utilizing high-resolution imagery, general habitat types of the park and adjacent private land were manually digitized. The general habitat types included wetland, riparian, forest, dyke, agricultural land, and river channel. Potential NLF frog breeding habitat was also identified from the imagery.

3.4. Summarize conservation values and restoration options

Using information from the previous tasks, we summarized the conservation values and identified potential restoration options that would be complementary to the reintroduction of NLF and the conservation of other wildlife and wetland values.

4. PROJECT OUTCOMES

4.1. Stakeholder Communications and Engagement

Communication between LGL Limited, Wildsight, BC Parks, DUC, NLF RT, and Ministry of Forests, Lands, and Resource Operations (MFLRO) has been ongoing since the fall of 2015. Conference calls to determine the status of the DUC decommissioning were held in the fall of 2015, and in the spring of 2016. In person meetings were held with BC Parks, Wildsight, and the private landowner in the spring of 2016. BC Parks requested to lead a field consultation session with local stakeholders on April 28, 2016. LGL Limited held a field survey on July 12, 2016 and local naturalist and Wildsight representative Bryan Kelly-MacArthur participated in the outing. Further communication with the owners of Elk Spike Ranch, DU, BC Parks, MNLFRO, Wildsight, and local naturalists occurred in 2017.

4.2. Information Summary

Reports, documents, and information on the wildlife, flora, and environs of Moberly Marsh and BJGPP reviewed are listed in Table 2. Two key documents include the Waterfowl Habitat Management Plan for Moberly Marsh (Hennan 1980) and the Park purpose statement and zoning plan (MWALP 2003). Most of the available wildlife information is from FWCP amphibian surveys; however, eBird records submitted by Douglas Leighton (and others) provide an important source of reliable bird data. Hennan (1980) also provided a summary of waterfowl productivity, wildlife use, and historical information.

Henan (1980) reported that during the mid-1880's and early 1900's, buffalo, cattle, and horses were grazed on the area and in some years hay was cut. In 1906, there was an attempt to ditch, and drain the area for agriculture; however, these efforts were largely unsuccessful to flooding in later years. Major floods were observed in 1894, 1914, 1948, and 1972. In 1964, Burges and

James Gadsden donated 550 acres (223 ha) to the province. Designated a "Class A" provincial park by Order-in-Council #1813, the wetlands were recognized as a wildlife management area and nature study area. In 1971, John and Caroline Bergenham donated approximately 30 acres (12 ha) to the province requesting it to be integrated in to the development of Moberly Marsh. Dyke construction and began in 1972 and the Bergenham and Sime Compartments were completed in 1979.

Table 2. Table of information reviewed.

Year	Author	Title and Description
General		
1980	Hennan	Waterfowl Habitat Management Plan for Moberly Marsh (D.U. File No. 82-N-1). The plan provides the basis for agreement between Ducks Unlimited (Canada) and the British Columbia Fish and Wildlife Branch for to maintaining and enhancing waterfowl production and staging habitat. Some waterfowl data presented.
2000	Golden Museum	Golden Memories 2000. First Nations use of Moberly Marsh in the 1890's.
2003	MWLAP	Burges and James Gadsden Provincial Park: purpose statement and zoning plan. This plan states the management objectives for the park, identifies management issues, and identifies management actions.
Amphibian Reports and Data Sources		
1967	CNM	CMN catalogue record # 9876. Northern Leopard Frog specimen collected by Francis and Joyce Cook from Moberly Marsh, 8 miles NW of Golden.
1995	Orchard and Ohanjanian	A biogeographical survey of the herpetofauna of the Columbia River Valley in Southeastern British Columbia.
1996	Ohanjanian and Teske	Herpetological survey of 87 wetlands in the Columbia Basin, Fish and Wildlife Compensation Area. Results of amphibian regional amphibian survey. RALU observed.
2005	Ohanjanian et al.	An amphibian inventory of the East Kootenays with an emphasis on *Anaxyrus boreas*. Results of amphibian regional amphibian survey. No amphibians observed.
2014	BC Parks	Long-term Ecological Monitoring Program. 2014 data from an amphibian survey. Data available via WSI. *Rana luteiventris* (Columbia Spotted Frog, *Anaxyrus boreas* (Western Toad), and *Pseudacris regilla* (Pacific Chorus Frog).
Bird Reports and Data Sources		
2003	Cooper and Beauchesne	Short-eared Owl and American Bittern Inventory in the Columbia Basin. Results from region wide surveys. Neither species detected in 2003.
2005	Douglas Leighton	Recent Range Expansion of Sandhill Cranes (*Grus canadensis tabida*) In Southeastern British Columbia. This paper discusses the taxonomy, origin, size, growth, habitat requirements, breeding chronology, and conservation of Sandhill Cranes at Bummer Flats and Moberly Marsh.
2009	Machmer	Great Blue Heron and Bald Eagle inventory and stewardship in the Columbia Basin (2008-2009). Basin wide surveys for Great Blue Heron.
2014	BC Parks	Long-term Ecological Monitoring Program. 2014 data from a waterfowl survey. Data available via WSI. 4 species of waterfowl identified. BUFF, CAGO, HOME, LESC.
2017	eBird	eBird: online database of bird distribution and abundance. Data from 1992 to 2016. Records for 200 species observed. Primary contributor is Douglas Leighton.

*Source title are underlined.

Amphibian data from Ohanjanian and Teske (1996) and BC Parks (2014) report the occurrence of *Rana luteiventris* (Columbia Spotted Frog), *Anaxyrus boreas* (Western Toad), and *Pseudacris regilla* (Pacific Chorus Frog) in Moberly Marsh and BJGPP. A historical record for NLF from 1967 (NCM 2016) indicates their presence in BJGPP, which is prior to the construction of the DUC

Moberly Marsh project. Northern leopard Frogs have not been observed in more recent surveys of Moberly Marsh (Orchard and Ohanjanian 1995; Ohanjanian and Teske 1996; Ohanjanian et al. 2005). During the 1970's and 80's, NLF declined across western North America resulting the expiration of many know populations (COSEWIC 2009). The causes of decline in NLF have been attributed to the fungus *Batrachochytrium dendrobatidis*, environmental contamination, habitat change, and the invasive species (e.g., fish and bullfrogs) (Adama and Beaucher 2007; COSEWIC 2009).

Avian data provided in Hennan (1990) indicates that Canada goose, Redhead, Mallard, Ring-Necked Duck, Northern Pintail, (Lessor) Scaup, American Wigeon, Bufflehead, Shoveler, Hooded Merganser, Blue-Winged Teal, Ruddy Duck, Green-Winged Teal, Wood Duck, Cinnamon Teal, Red-Necked Grebe, Horned Grebe, Pied-billed Grebe, Great Blue Heron, American Coot, and Common Goldeneye were known or probable breeders. Contributions to the eBird online database by avid naturalists such as Douglas Leighton document the occurrence of over 200 species (eBird 2017). Mr. Leighton has also reported the successful breeding of Sand Hill Cranes in Moberly Marsh (Leighton 2005). Great Blue Heron use the wetlands frequently and single nests have been observed (Ellen Zimmerman, pers. comm.). Infrequently reports of Short-eared owl and American Bittern were noted by Cooper and Beauchesne (2003).

Hennan (1980) reported that beaver, muskrats, mule deer, black bear, elk, and moose occur in the Moberly Marsh. Red fox, coyote, wolves, grizzly bear, and river otter have also been observed. Mink, weasel, and several small mammal species (e.g., red squirrel, deer mice, meadow vole, redback vole, and shrews) are likely abundant.

4.3. Field Observations

Although high rainfall and cool temperatures during the survey reduced the sightability of amphibians and other wildlife, we confirmed the presence of two species of amphibians and four species of rare plants. Three adult *R. luteiventris* were observed in the unmanaged wetland to the west of the Braul compartment and an adult *A. boreas* were observed at the north end of the Braul compartment. The four species of rare plants included *Carex crawei* (Crawe's Sedge, blue listed; Figure 2), *Eleocharis elliptica* (Slender Spike-Rush, blue listed), *Gentianopsis macounii* (Macoun's Fringed Gentian, blue listed), and *Liparis loeselii* (Yellow Widelip Orchid, red listed; Figure 2). These species were observed in close proximity to each other together at two locations in the Braul compartment. A pair of Sandhill Cranes (*Grus canadensis*) were observed on the adjacent private land (Elk Spike Ranch). Habitat observations made during the field survey are included in Section 4.5.

4.4. LiDAR Imagery and Habitat Mapping

The processed imagery and data was received from Terra Remote Sensing in late-July 2016. This data was provided to the MLNRO on DVD in September of 2016. Specifications of the LiDAR acquisition were provided by Terra Remote Sensing (2017). The orthoimagery was used to delineate the area of the wetland compartments in Moberly Marsh and adjacent jurisdictions (e.g., private land and to delineate broad habitat types (Table 3). At 20 cm resolution, the Lidar data will be a valuable in determining preparing wetland enhancement/restoration prescriptions.

Figure 2. Images of the blue listed *Carex crawei* (left) and red listed *Liparis loeselii* (right) from Moberly Marsh, July 12, 2016.

Table 3. Breakdown of broad habitat types by compartment for Moberly Marsh, Burges and James Gadsden Provincial Park, and the adjacent private land.

Habitat	Braul*	Sime	Bergenham**	Other***	Park Total	Private Land
Marsh	40.8	56.0	135.1	8.0	213.9	16.0
Riparian	6.1	7.0	25.7	55.8	92.1	1.7
Forest	.	.	.	36.8	36.8	0.6
River channel ǂ	.	.	.	52.1	52.1	0
Dyke	.	.	.	12.0	10.0	0.8
Agricultural	.	.	.	.	.	28.0
Unknown				-		12.9 ǂǂ
Total	46.9	63.0	160.8	164.7	404.9	60

* Includes 12.3 ha of private land (Elk Spike Ranch).

** Includes 17.8 ha of the CWWMA

*** refers to the habitat outside of the three Moberly compartments but within the park.

ǂ includes the Columbia River and Blaeberry river channels

ǂǂ portion of the private land located on the east side of the TransCanada Highway.

4.5. Habitat Descriptions

Table 3 provides a breakdown of the general habitat types in Moberly Marsh and BJGPP. Moberly Marsh is a complex of riparian and marsh habitats. The riparian habitat includes stands of Black Cottonwood (*Populus balsamifera trichocarpa*) and Trembling Aspen (*Populus tremuloides*) and deciduous shrub communities dominate by willow (e.g., *Salix bebbiana*, S. *lucida*, S. *maccalliana*, and *S. exigua*.). Marsh habitat consists primarily of stands of *Phalaris arundinacea,* Cattail (*Typha latifolia*) and Bulrush (*Schoenoplectus tabernaemontani*) and shallow open water habitat dominated by *Potamogeton natans, Nuphar luteal, Myriophyllum sp.,* and *Utricularia sp.* The following subsections describe the habitats in each wetland compartment.

4.5.1. West Braul Wetland

The West Braul wetland is a small wetland located west of the Braul compartment (Figure 3; Figure 4). Approximately 8 ha of shallow open water habitat is surrounded by riparian habitat dominated by Salix (*Salix bebbiana, S. lucida,* and *S. maccalliana.*). As this wetland occurs outside the dykes, water levels are not managed; however, a deep channel created during the construction of the dyke runs its length. One of the two clusters of rare plants (*C. crawei*, *G. macounii*, and *L. loeselii*) observed during the field survey is located at the northern east corner of this wetland.

Adult *R. luteiventris* were observed during the field survey. *Rana luteiventris*, *A. boreas*, and *P. regilla* were documented by BC Parks in 2014 (BC Government 2016a) at their long-term monitoring site located at the north end of the dyke. The wetland appears promising as amphibian breeding habitat; however, inundation from cool water during spring freshet may impede tadpole development particularly for species that require longer developmental periods such as NLF**.** Amphibian breeding and post-breeding surveys would be useful for assessing amphibian use of this wetland. Unless the decommission of dyke and pumping infrastructure adversely affects this wetland, habitat enhancement or restoration measures are not recommended for this unit.

4.5.2. Braul Compartment

The Braul compartment is 46.9 ha of which 12.3 ha are privately owned and are part of Elk Spike Ranch (Figure 3). The Braul compartment includes 35.4 ha of shallow open water marsh, 5.4 ha of fen, and 6.1 ha of riparian habitat. The open water wetland is comprised of two vegetation communities: *Carex saxatilis* and *Schoenoplectus tabernaemontani* dominate the western portion of the compartment and the eastern portion is dominated by *Typha latifolia* and *S. tabernaemontani* (Figure 5). The eastern portion of the compartment was previously ditched to improve waterfowl habitat. These deeper channels contain *Nuphar luteal*, *Myriophyllum spicatum*, and *Potamogeton natans*. A fringe of riparian habitat dominated by *Salix sp.* occurs along the south, east, and west margins.

Apparently, the Braul compartment does not function effectively as a permanent wetland, and during dry years much of the marsh dries out. It has been suggested a gravel seem may have been unearthed during construction. Water enters the compartment along the north edge through seepage channels from the alluvial fan of the Blaeberry river and from a 4-way water control structure and pump adjacent the Sime compartment and Columbia River (Figure 3).

Rana luteiventris, *A. boreas*, and *Amybystoma macrodactylum* (northern long toed salamander) likely breed in the Braul compartment. Water temperature are likely too cool for NLF to breed; however, continuous temperature data would be useful in confirming this. Preliminary plans indicate that DUC intend to breach the Braul compartment along the Columbia River (Figure 3). A breach in the dyke may result in a more natural flood regime; however, its effect on wildlife use

of the compartment is difficult to predict. Continuous hydrological data (depth and water temperature) of the compartment is required before to determine if restoration or enhancement actions are appropriate.

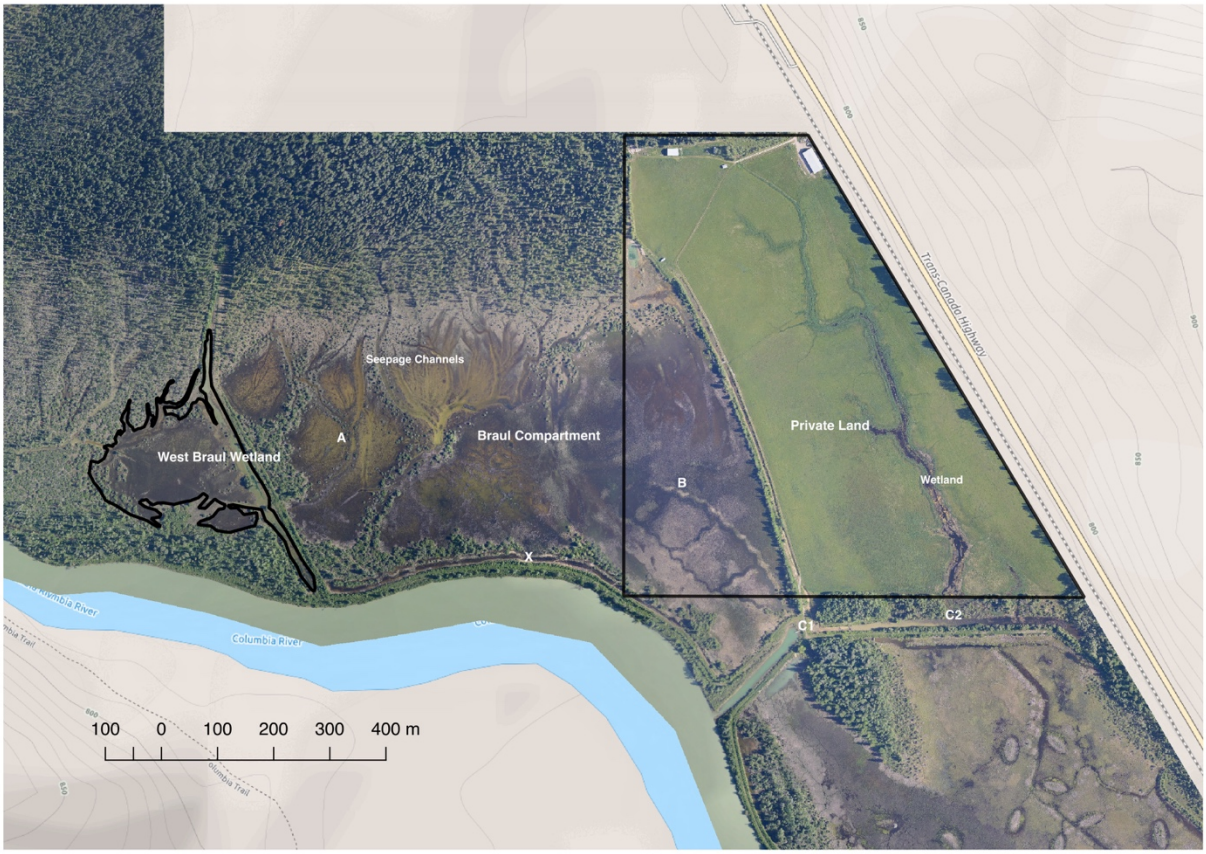

Figure 3. Orthoimage of the west Braul wetland, Braul compartment, and private land (Elk Spike Ranch). A portion of the private land (12.3 ha) extends into the Braul compartment and 4 hectares of wetland occurs on private land. Two distinct wetland communities occur in the Braul compartment (A and B). Ditching can be seen in the southeast portion of the wetland. Seepage channels can be seen at the wetland forest interface. "X" denotes the location of a potential breach. C1 and C2 denote the location of water control structures.

Figure 4. Image of the west Braul wetland.

Figure 5. Image of the Braul compartment showing the prominence of *Carex saxatilis* and *Schoenoplectus tabernaemontani.*

4.5.3. Sime and Bergenham Compartments

The Sime and Bergenham compartments are 63.0 and 160.8 ha, respectively. These compartments comprise 83 per cent of the wetland habitat in Moberly Marsh and 55 percent of the land in the park. Approximately 16.8 ha of the Bergenham compartments is in the Columbia Wetlands Wildlife Management Area. The Bergenham and Sime compartments have been the focus of waterfowl management by DUC. Between 1971 and 1979, sixty-three small islands made from spoil piles and twenty-five large (15 m x 30 m) nest islands were constructed in the Sime Compartment. In the Bergenham compartment, extensive ditching was undertaken for brood rearing and migratory stopover habitat (Hennan 1980; Figure 6).

Despite the different manipulations in the compartments, the habitats in the two compartments are similar and include wet meadow dominated by reed Canarygrass, cattail marsh, shallow open water marsh, and riparian habitats (Figure 7). Extensive stands of Reed Canarygrass, cattail and bulrush dominated both compartments. *Nuphar luteal*, *Myriophyllum spicatum*, *Potamogeton natans*, and *Utricularia spp.* occur in deep ponds and channels created from ditching and the construction of the nest-islands. Sixteen potential NLF breeding sites were identified from the orthoimagery (Figure 6); however, further information (particularly water depth, water permanence, and spring and summer temperatures) is required to assess their suitability. Continuous water level and temperature data would be useful in assessing these ponds and for preparing wetland prescriptions for enhancing breeding ponds. Potential enhancement opportunities include the management of bulrush, cattails, and Reed Canarygrass, and the expansion and/or creation of shallow ponds.

In addition to breeding habitat, NLF also require aquatic overwintering habitat and summer upland foraging habitat (Adama and Beaucher 2006; NLFRT 2012). Northern Leopard Frog overwinter underwater in well-oxygenated waterbodies such as ponds, streams, and rivers. The Columbia River will provide suitable overwintering habitat. Based on our observations during the field survey, the dyke, adjacent forest, and river bank will not impede amphibian movement between the marshes and the Columbia River. For summer foraging habitat, NLF prefer low vegetation (5–30 cm tall) near water, which they require as escape habitat. They tend to avoid thick dense tall vegetation, such as Reed Canarygrass, and heavily wooded areas (Adama and Beaucher 2006). From our field survey and interpretation of the orthoimagery, much of the potential summer foraging habitat appears to be overgrown with Reed Canarygrass although suitable habitat may exist along the margins of the wetland compartments, and nest islands. More intensive field surveys are required to identify potential summer foraging habitat and development prescriptions to restore these habitats where possible

Figure 6. Orthoimage of the Sime and Bergenham compartments. Nest islands in the Sime unit and extensive ditching in the Bergenham unit are noted. The letter "B" identifies the location of the proposed dyke breaches; "p" identifies ponds of interest for NLF reintroduction.

Figure 7. Image showing a deep pond in the Sime compartment dominated by *Nuphar luteal* and *Potamogeton natans* surrounded by dense stands of *Typha latifolia*.

4.5.4. Private land (Elk Spike Ranch)

Elk Spike Ranch (formerly the Braul property) is located at the north end of Moberly Marsh and is approximately 60 ha in area. The ranch is comprised of two parcels that are bisected by the TransCanada Highway and include an agricultural field (28.0 ha) and a portion of the Braul compartment (12.3 ha) (Figure 3). The agricultural field is cultivated for hay (with alfalfa); however, approximately a third of the field is not cultivated due to the ingrowth of Reed Canarygrass (Brian Amies, land owner, personal communication). A wetland channel bisects the hayfield occupying approximately 4 hectares. Water in the channel can be controlled from a stop gate at the south end of the property.

During spring, snowmelt floods the hayfield providing excellent staging habitat for waterfowl. Local naturalist Douglas Leighton has data indicating that waterfowl use in the spring is concentrated on the flooded hayfield rather than the adjacent compartments of Moberly Marsh (per. comm.). Mr. Leighton suggests that maintaining the field for agricultural haying is key to its value as waterfowl staging habitat. In addition to waterfowl, the hayfield and margins are utilized by many other species of wildlife including ungulates, bears, small mammals, raptors, owls, and migrating songbirds. A pair of Sandhill Cranes (*Grus canadensis*) were observed on the private land during our field survey. During the field survey, a second cluster of rare plants (*C. crawei*, *G. macounii*, and *E. elliptica*) was located at northwest corner of the private land.

Elk Spike Ranch provides the only viable access to BJGPP and Moberly Marsh. The landowners have been generous in providing access to the BJGPP and Moberly Marsh to local

naturalists and resource managers. The landowners have expressed an interested in expanding the wetland area on the ranch to enhance habitat for wildlife. Soil excavated to expand wetlands would be used to improve the surrounding agricultural land by raising low areas that currently support dense stands of Reed Canarygrass. Spring amphibian surveys and continuous water level and temperature data would be useful in assessing the existing wetland as amphibian habitat and in preparing detailed wetland prescriptions. On a cautionary note, haying and other motorized activities can cause mortality for wetland dependant species and needs to be considered (e.g., Saumure et al 2007). Prior to proceeding with the wetland restoration or creation on the ranch, a conservation agreement should be prepared to ensure the conservation values and investments are protected while allowing the continued use of the land for agriculture.

4.6. Summary of Conservation Values

Table 4 lists many of the conservation values of Moberly Marsh. It is not anticipated that the reintroduction of NLF into Moberly Marsh would not negatively affect any of these values. In considering restoration and conservation options, maintaining or enhancing existing values is important and must be considered. Any physical works in BJGPP will require an Environmental Impact Assessment and this process should help ensure that existing environmental values are not compromised (MWLP 1999).

Table 4. Summary of conservation values.

Valued Component	Description
Waterfowl	Important for waterfowl staging. Value is enhanced by adjacent agricultural field. Low overall waterfowl production
Birds	High value neotropical migrant nesting and stop over habitat. High value marsh bird habitat. High value staging habitat for waterfowl. Low value nesting habitat for Short-eared owl and American Bittern. High value habitat for Sandhill Cranes.
Rare Plants	High value rare plant habitat. Four species observed in July 2016: *Carex crawei* (blue listed), *Eleocharis elliptica* (blue listed), *Gentianopsis macounii* (blue listed), and *Liparis loeselii* (red listed).
Mammal	High value habitat for Elk, Deer, Black and Grizzly Bear, Muskrat, Beaver, River Otter, and Wolf.
Amphibians	Moderate to high value habitat for *Anaxyrus boreas, and Rana luteiventris*. Needs to be confirmed with surveys. Moderate habitat value for *Pseudacris regilla.* Moderate to high potential value for *Lithobates pipiens*. Museum specimen collected from Moberly Marsh by Fred Schueler in 1973.
Recreation and Education	Excellent birdwatching and educational opportunities along existing network of dykes although access is limited by through private land or illegal crossing of CPR tracks. Moderate canoeing, snowshoeing, and cross-country skiing (classic) opportunities. Improved access would greatly enhance recreational and educational values. Shooting, Hunting or Trapping is not permitted in the Park.

4.7. Restoration and conservation opportunities

Several restoration and conservation opportunities were identified under the seed funding project:

1. Restore or enhance wetlands in the Sime and Bergenham compartments. The terrestrial wetlands in these compartments are overgrown with reed Canarygrass, the shallow water aquatic wetlands are overgrown with cattails, and many of the ponds appear too deep to function as breeding ponds for NLF. Sixteen sites were identified from the orthoimagery that could potentially serve as NLF breeding ponds; however, ground truthing and hydrological data is required to confirm their suitability and for the developing restoration prescriptions, where required.
2. Enhance and expand wetlands on Elk Spike Ranch. The landowners are amenable to expanding the existing wetland channel by excavating adjacent ground surrounding the existing channel. The soil removed from the excavation would be used to raise some of the depressions in the hayfield to improve drainage.
3. Explore land conservation options for Elk Spike Ranch. The agricultural activity on Elk Spike Ranch enhances the conservation value of Moberly Marsh and BJGPP, and the hydrology and ecosystem function of both the agricultural land and the marshes are inextricably linked. In addition, the existing network of dykes in the park provide a unique opportunity to for wildlife viewing and exploring the natural richness of the Columbia Wetlands. As Elk Spike Ranch provides the only viable access to both the BJGPP and Moberly Marsh, the general public cannot access “Class A” provincial park without consent from the land owners. Improved access to the park would open educational and recreational opportunities consistent with BC Parks mandate.

5. NEXT STEPS

The status of the DUC dyke and infrastructure decommissioning has changed since the submission of the seed funding proposal. Initially planned for 2016, decommissioning was postponed allowing for the completion of an Environmental Impact Assessment (Brett Yeates, BC Parks, personal communication). The decommissioning was rescheduled for 2018, contingent on permitting and funding, and may take several years to complete. Unfortunately, this uncertainty complicates restoration planning and NLF reintroduction and will likely result in delays in both. The recommended next steps include the following:

1. Continue communication between the Northern Leopard Frog Recovery Team, BC Parks, DUC, Elk Spike Ranch, local naturalists, and other stakeholders.
2. For BJGPP/Moberly Marsh:
    a. Work with DUC and BC Parks to coordinate the decommissioning of DUC infrastructure with restoration activities.
    b. Conduct field surveys to ground truth the suitability of spring breeding ponds and summer foraging habitat for NLF. Identify restoration opportunities to manage vegetation (Reed Canarygrass and Cattail).
    c. Collect continuous hydrological data (water temperature and depth) at potential breeding sites and identify restoration opportunities to create, expand, or enhance potential breeding ponds.
    d. Initiate a level 1 Environmental Impact Assessment for restoration activities in BJGPP.
    e. Complete restoration prescriptions for projects identified from items a through e, above.

3. For Elk Spike Ranch:
    a. Conduct a field assessment of the wetland habitat on Elk Spike Ranch
    b. Identify restoration opportunities and prepare restoration prescription(s).
    c. Pursue a conservation agreement with the owners of Elk Spike Ranch.

The implementation of restoration prescriptions will follow the competition of the prescriptions and, where required, regulatory approval.

6. REFERENCES

Adama, D. B. and M.A. Beaucher. 2006. Population monitoring and recovery of the northern leopard frog (*Rana pipiens*) in southeast British Columbia. Report to the Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC. 28 pp.

BC Government. 2016a. 2014 data from BC Parks' Long Term Ecological Monitoring Program. B.C. Ministry of Environment. Victoria, B.C. URL: http://www.env.gov.bc.ca/wildlife/wsi/siwe.htm (accessed Aug 20, 2016).

BC Government. 2016b. Wildlife Species Inventory Data. Victoria, B.C. URL:

http://www.env.gov.bc.ca/wildlife/wsi/siwe.htm (accessed Aug 20, 2016).

Canadian Museum of Nature CMN). 2016. CMN catalogue record number 9876. Canadian Museum of Nature website: http://nature.ca/collections-online (accessed Aug 20, 2016).

COSEWIC. 2009. COSEWIC assessment and update status report on the Northern Leopard Frog *Lithobates pipiens*, Rocky Mountain population, Western Boreal/Prairie populations and Eastern populations, in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 69 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Cooper, J. M. and S. M. Beauchesne 2003. Short-eared Owl and American Bittern Inventory in the Columbia Basin, 2003. Unpublished report Columbian Basin Fish and Wildlife Compensation Program. Nelson, B.C.

Dulisse, J. and D. Hausleitner. 2010. 2009 East Kootenay Amphibian Survey. Report prepared for the Fish and Wildlife Compensation Program. Nelson, BC. 25 pp.

eBird. 2017. eBird: An online database of bird distribution and abundance. Ithaca, New York. Available: http://www.ebird.org. Accessed: February 21, 2017.

Environment Canada. 2012. Recovery Strategy for the Northern Leopard Frog (*Lithobates pipiens*), Rocky Mountain population in Canada [Proposed]. Species at Risk Act Recovery Strategy Series. Environment and Climate Change Canada, Ottawa. 2 parts, 23 pp. + 47 pp.

Golden and District Historical Society. 2000. Golden Memories 2000. Published by the Golden and District Historical Society. 420pp.

Green, D. M., P. T. Gregory, and B. Matsuda. 2006. Amphibians and Reptiles of British Columbia. 2nd Edition. Royal British Columbia Museum, Victoria, BC.

Hennan, E. 1980. Waterfowl Habitat Management Plan for Moberly Marsh (D.U. File No. 82-N-1). Unpublished report for Ducks Unlimited (Canada) and the B.C. Fish and Wildlife Branch. 11pp.

Leighton, D. 2005. Recent Range Expansion of Sandhill Cranes (*Grus Canadensis Tabida*) In Southeastern British Columbia. Wildlife Afield 2(2): 64 – 74.

Machmer, M. M. 2009. Great Blue Heron and Bald Eagle inventory and stewardship in the Columbia Basin (2008-2009), Fish and Wildlife Compensation Program, Nelson, BC.

Ministry of Water, Lands, and Air Protection (MWLAP). 1999. BC Parks Impact Assessment Process Part 1 Policy. April 1999. BC Parks. Victoria, BC.

Ministry of Water, Lands, and Air Protection (MWLAP). 2003. Burges and James Gadsden Provincial Park: purpose statement and zoning plan. February 2003. BC Parks. Victoria, BC.

Northern Leopard Frog Recovery Team. 2012. Recovery plan for the Northern Leopard Frog (Lithobates pipiens) in British Columbia. Prepared for the B.C. Ministry of Environment, Victoria, BC. 47pp.

Ohanjanian, I. A., and I. E. Teske. 1996. Herpetological survey of 87 wetlands in the Columbia Basin, Fish and Wildlife Compensation Area. Unpublished report for the Columbian Basin Fish and Wildlife Compensation Program. Nelson, B.C.

Ohanjanian, I. A., D. Adama, and A. Davidson. 2006. An amphibian inventory of the East Kootenays with an emphasis on Bufo boreas, 2005. Herpetological survey of 87 wetlands in the Columbia Basin, Fish and Wildlife Compensation Area. Unpublished report for the Columbian Basin Fish and Wildlife Compensation Program. Nelson, B.C.

Orchard, S.A., and I.A. Ohanjanian. 1995. A biogeographical survey of the herpetofauna of the Columbia River Valley in Southeastern British Columbia. Unpublished report for the Columbian Basin Fish and Wildlife Compensation Program. Nelson, B.C.

Saumure, R. A., T. B. Herman, and R. D. Titman. 2007. Effects of haying and agricultural practices on a declining species: The North American wood turtle, *Glyptemys insculpta*. Biological Conservation 135:565–575.

Terra Remote Sensing. 2017. Kinbasket Lake LiDAR Project report. Submitted to LGL Limited environmental research associates. 72 pp.