Yaqan Nukiy Wetland Restoration Project
2018 Construction Report

Common Mallard

Restored Wetland #3

December 29, 2018

Thomas R. Biebighauser

Summary

Wetlands and uplands were restored during the month of December, 2018 for the Yaqan Nukiy Wetland Restoration Project. The Yaqan Nukiy Wetland Restoration Project is a 3-year program of work funded largely by the Aboriginal Fund for Species at Risk (AFSAR), Fish and Wildlife Compensation Program, and the British Columbia Wildlife Federation. Construction was completed in 2018 for the first year of the project.

The 2018 Yaqan Nukiy Wetland Restoration Project improved habitat for waterfowl, elk, mule deer, white-tailed deer, moose, grizzly bear, cougar, and a diversity of wading bird, amphibian, reptile, and mammal species within the Kupi Marsh on Lower Kootenay Band lands near Creston, British Columbia.

Actions were taken to provide habitat for Species at Risk, focusing on the Northern leopard frog, Western painted turtle, and Western toad. Features were added to restored wetlands and uplands to provide specific habitat for Species at Risk, including snags for little brown bat roosting, logs for Western painted turtle basking, mud for Barn Swallow and the Black Swift to use for building nests, ephemeral wetlands that do not support the American bullfrog or fish that the Northern leopard frog and Western toad may use for breeding.

A diversity of wetlands was restored with varying depths and hydroperiods, much like that found naturally in riparian ecosystems not altered by humans. The wetlands were built with gradual slopes, and contain varied edges with peninsulas, pits, mounds, ridges, and naturally appearing islands. Compacted soils within and surrounding the restored wetlands were loosened to increase plant survival and growth, and to control erosion. The loosened soils may be used for burrowing by the Short-eared owl, Northern leopard frog, Western painted turtle, and Western toad.

Drained wetlands dominated by reed canary grass were restored to function as natural ecosystems, without the use of dams, diversions, ditches, water control structures, pipes, wells, or pumps. The restored wetlands were built so they would not be damaged by floodwaters or by burrowing animals. These ecosystems were built to require little, if any maintenance.

Areas of sandy-loam texture soil were placed on high ground near the restored wetlands to provide the Western painted turtle with nesting sites. Areas of saturated, exposed soils were restored in association with the wetland restoration projects to provide the Barn Swallow and Black Swift with mud needed for building nests, and butterflies with essential minerals.

Productive and diverse grasslands were shaped from the soils removed from restoring the wetlands. The soils in these grasslands were loosened to provide excellent growing conditions for wildflowers. The wildflowers can be expected to support a diversity of insects, providing critical foraging habitat for the little brown bat, Common Nighthawk, Bank Swallow, and Barn

Swallow. The grasslands may also provide nesting habitat for waterfowl, and foraging habitat for the Northern leopard frog.

The project can be expected to survive climate change as the wetlands were restored with the same components as natural ecosystems, with no need for human intervention to keep them functioning. Native species of grasses, wildflowers, shrubs, and trees will be planted and seeded over the project area.

Introduction

The Kupi Marsh historically contained a diversity of wetlands and riparian meadows. The large area was regularly inundated by the Kootenay River and the Goat River South. The floodplain was historically modified for farming, and was greatly modified by the construction of dams to create a large impoundment in 1967.

Ditches were dug to drain wetlands within the Kupi Marsh. Long and high dams were built to create a large impoundment, separating the natural floodplain from the Kootenay River and the Goat River South. The intent of building the dams was to flood the natural wetlands and meadows with deep water. As part of impoundment construction large and long ditches were dug to move water into and out of the area. A pump and water control structure were installed so that water could be added to the Kupi Marsh from the Kootenay River. A culvert and gate were installed so that the entire Kupi Marsh could be drained.

The Kupi Marsh Impoundment failed to contain water as planned. This was primarily due to water leaking under the dam. The author determined that the dam was built from sand, and on top of sand. Massive amounts of water are leaking through and beneath the dam.

Over the year's managers have determined that it is not possible to fill the Kupi Marsh using the pump. Water entering the Kupi Marsh soon leaves the area. The cost of electricity needed to operate the pump is expensive, and can exceed $4,000.00/month.

The gate on the culvert used to drain the area is broken in the open position, draining the Kupi Marsh. The culvert is temporarily blocked with a stump and mud packed around it. The culvert is rusted, and the structure continues to drain the Kupi Marsh.

The Lower Kootenay Band does not plan on removing the dam surrounding the Kupi Marsh. The dam is part of a road system that provides access to the area. The Kupi Marsh is used for livestock grazing, and the roads are used to manage cattle.

Kupi Marsh Impoundment Design

The Yaqan Nukiy Wetland Restoration Project took place within a failed impoundment totaling approximately 105-heactares called the Kupi Marsh. The impoundment was constructed in 1967. Here are the main actions taken to build the impoundment:

1. A dam approximately 2-meters high and 2,576m long was built to flood natural wetlands and hayfields with deep water.
2. The dam was also built to prevent the Kootenay River and Goat River South from flooding the area.
3. The dam was built with steep side slopes.
4. The dam was built using a dragline.
5. Soil used to build the dam was obtained from either side of the dam being built.
6. A variety of soil textures including sand, silt, and clay were used to build the dam. The texture of soil used in the dam was the same as the texture of soil within reach of the dragline on either side of the dam being built.
7. The dam was not cored, and is based on sand, vegetation, and topsoil.
8. A pump was installed to flood the impoundment using water from the Kootenay River.
9. Deep and long ditches were dug to move pumped water into the impoundment.
10. Ditches were dug to connect natural wetlands with the pumped water. An irrigation system was designed so that water could be added into the upper end of the impoundment, or the lower end of the impoundment.
11. Ditches were dug so that the entire impoundment could be drained, including the natural wetlands within the impoundment.

The Kupi Marsh Impoundment is not functioning as designed:

1. The slopes of the dam are too steep to maintain by mowing.
2. The dense growth of vegetation on the dam makes it almost impossible to inspect for holes dug by muskrat and beaver.
3. The dam contains numerous muskrat burrows.
4. The impoundment does not hold water as planned.
5. Water may be pumped into the impoundment from the Kootenay River.
6. The long channels where soil was removed by the dragline to build the dam contain water.
7. The dam will breach during a flood, on the average of once every 10-years. The breaches cause damage to the dam and road that must be repaired.
8. The dam provides road access to the area. The roads are used by Lower Kootenay Band Members, and by contractors.
9. It has become expensive to pay for the electricity to operate the pump.
10. The natural wetlands within the impoundments are drained by the ditch system when the pump is not operating.
11. The natural wetlands are dominated by dense growth of cattails due to reduced water levels.
12. The fields are dominated by reed canary grass.

Methods

The Yaqan Nukiy Wetland Restoration Project was designed by Thomas R. Biebighauser, Norm Allard, and Irene Manley. Tom Biebighauser prepared a written design for the project that included photos, maps, estimated budget, and recommendations.

The Kupi Marsh is dominated by dense stands of cattails and large fields of reed canary grass. The reed canary grass is growing in old fields. The old fields appear to have been managed for hay. Ditches had been dug and wetland basins filled and leveled to create the hayfields. The ditches were still functioning when the project was designed. Wetlands were restored primarily in the old fields dominated by reed canary grass.

Here is a summary of the steps taken to restore wetlands within the Kupi Marsh:

1. Possible wetland and upland restoration areas were identified by examining aerial photos, and the Kupi Marsh impoundment on the ground.
2. Drainage and irrigation ditches were identified.
3. Wetland restoration areas were located near ditches.
4. Test holes were dug in each wetland area using heavy equipment prior to construction to confirm the presence of soils high in clay.
5. Elevations were recorded using a laser level. The boundary of each wetland restoration area was adjusted so there would be no more than a 40cm change from upper to lower edge. This was done to reduce how much soil would need to be moved, and to restore a naturally appearing and functioning wetland without building a dam.
6. Soil removed from restoring each wetland was used to fill drainage ditches, and cover reed canary grass. The filling of drainage ditches allowed for the restoration of more and larger wetlands than what was planned for 2018.
7. Sedges and bulrushes, if present within planned wetland restoration areas, were removed using the excavator and saved for later planting around each restored wetland.
8. Heavy equipment was used to remove the reed canary grass and roots of the reed canary grass growing within each planned wetland restoration area.
9. Shallow, open-water wetlands were also built in areas dominated by dense growths of cattails.
10. The reed canary grass was buried with soil removed from digging each wetland.
11. Soil removed from digging each wetland was spread so it would be from 30-40cm higher than original ground. Observations showed that this ground elevation was likely to support a diversity of native plants, and not reed canary grass.
12. Shallow-water wetlands were built to produce a diversity of aquatic plants that are high in sodium. These aquatic plants are expected to provide important minerals to deer, elk, and moose.
13. The wetlands were generally dug to be deepest in the center.
14. Wetlands were built to have various sizes, depths, shapes, and features including pits, mounds, pools, peninsulas, ridges, and islands.

15. Core trenches were dug across ditches, filled with clay, and compacted to maintain water in wetlands restored by filling ditches.
16. Core trenches were dug and filled with clay along the lower edge of wetlands where needed to interrupt sand layers that could drain a wetland.
17. Compacted soils within and surrounding each restored wetland were loosened using an excavator or ripper attachment on the dozer.
18. Channels containing water were reshaped to appear as natural wetlands.
19. Large diameter logs with attached root masses were placed within the restored wetlands to provide basking sites for the Western painted turtle, and loafing sites for waterfowl. Historically logs would have been deposited in the wetlands by the flooding of the Kootenay River and the South Goat River. The dams constructed for the Kupi Marsh Impoundment now prevent floodwaters and large woody debris from entering the area.
20. The large woody debris placed in the restored wetlands was obtained by removing nonnative trees growing in managed agricultural fields on Yaqan Nukiy lands. Hybrid poplar trees and their root masses were removed using an excavator. The tree trunks and root masses were transported to each wetland area using a large off- road dump truck.
21. Snags were placed within and around the restored wetlands to provide birds with perches and bats with roosting habitat. These snags were also obtained by removing nonnative hybrid poplar trees from agricultural fields.

Wetlands were restored so they would fill naturally with water from precipitation, and from snowmelt. The wetlands were restored so that there would be no need to fill them by pumping.

The wetlands were restored using heavy equipment. A Request for Price (RFP) contract document was prepared and distributed to local contractors to review and provide an estimate for the heavy equipment with skilled operators needed to complete the project.

The heavy equipment contract for restoring the wetlands was awarded to Shopa's Excavating Ltd.

Shopa's Excavated Ltd.
Box 119
Creston, BC VOR160
shopasexcavating@gmail.com
250-402-3467 Lloyd Shopa, Owner, Cell Phone

Shopa's Excavating Ltd. provided the following heavy equipment with skilled operators to restore the wetlands:

Excavator
John Deere 200D
62-inch wide bucket (1-yard^3)
Thumb Attachment

50,000lbs
Serial Number: FF200DX51024
Year: 2007

Excavator
Caterpillar 314 LCR
90 HP Net
31,085lbs

Dozer
Caterpillar D6R
Low Ground Pressure
Serial Number: WCB00131
Year: 2006

Dozer
Caterpillar D6C
Year: 1977

Rock Truck
Volvo A30C
Serial Number: A30CV60155
Year: 2000
21-yard^3 capacity

Heavy Equipment Operators

- Dwight Evan
- Ted Krane (tmkrane@yahoo.ca)
- Lloyd Shopa (shopasexcavating@gmail.com)
- Murray Tamas (mtamas@tru.ca)

Yaqan Nukiy Wetland Restoration Project
Heavy Equipment Hours Worked

Date	John Deere 200D Excavator	Cat D6R Dozer	Volvo A30C Rock Truck	Cat 314 Excavator
Monday, December 3, 2018	9	9	9	0
Tuesday, December 4, 2018	9	1	9	0
Wednesday, December 5, 2018	9	9	9	0
Thursday, December 6, 2018	9	9	9	9
Friday, December 7, 2018	9	9	9	9
Saturday, December 8, 2018	9	9	9	9
Sunday, December 9, 2018	9	9	9	3
Monday, December 10, 2018	9	7	9	0
Tuesday, December 11, 2018	9	5.5	9	0
Wednesday, December 12, 2018	9	5	9	0
Thursday, December 13, 2018	9	9	9	0
Friday, December 14, 2018	9	9	9	0
Saturday, December 15, 2018	9	9	9	0
Sunday, December 16, 2018	9	9	9	0
Monday, December 17, 2018	9	9	9	4
Tuesday, December 18, 2018	9	5	9	4
Wednesday, December 19, 2018	9	9	0	9
Thursday, December 20, 2018	9	9	0	9
Friday, December 21, 2018	7	8	0	7
Total Hours	169	148.5	144	63
BWCF Invoice	56	56	56	18.35
FWCP Invoice	42	41	41	0
AFSAR Invoice	71	51.5	47	44.65

Tom Biebighauser was on site directing heavy equipment operators in the completion of the Yaqan Nukiy Wetland Restoration Project. Norm Allard assisted on a daily basis with the project. Their duties involved:

- Surveying and marking each restoration site prior to construction.
- Being onsite every hour heavy equipment was working to manage construction.
- Monitoring elevations, adjusting perimeters, determining where soil removed would be spread.
- Monitoring safety
- Explaining the operation to visitors

The progress rate for restoring wetlands was very high for this project:
Heavy equipment progress rate = (137,595m² shallow water wetlands restored) ÷ (524.5 total heavy equipment hours worked) = 262m² wetland restored/hour heavy equipment worked.

This progress rate is almost double that recorded for similar wetland restoration projects completed by the author in British Columbia.

Actions taken to improve habitat for rare species:

American Badger: Habitat for the badger was improved by placing the soil removed from building the wetlands into naturally appearing upland that were not compacted. In addition, areas

of compacted soil were loosened using the rough and loosen technique. The loosened upland soils may be colonized by the Columbian ground squirrel. This practice was used with success on the Big Ranch near Sparwood to increase habitat for the badger. The Yaqan Nukiy Wetland Restoration Project is also distant from roads, which may reduce possible mortality by vehicles.

Bank Swallow: Ephemeral and perennial water wetlands of various shapes, sizes, and surrounded by open land were restored to provide foraging habitat for the Bank Swallow. Large wetlands were restored for use by the Bank Swallow as communal nocturnal roost sites during post-breeding, migration, and wintering periods. A diversity of grasses and wildflowers will be sown and planted on soil removed from building wetlands to maintain a diversity of insect populations for food. Large open fields will be maintained by livestock grazing that contain few shrubs and trees.

Barn Swallow: Ephemeral and perennial water wetlands of various shapes, sizes, and depths that are surrounded by open land were restored to provide foraging habitat for the Barn Swallow. Wetlands were restored that contain mudflats the Barn Swallow may harvest for building nests. A diversity of grasses and wildflowers will be sown and planted on soil removed from building wetlands to maintain a diversity of insect populations for food. Large open fields will be maintained by livestock grazing that contain few shrubs and trees.

Black Swift: Ephemeral and perennial water wetlands of various shapes, sizes, and depths that are surrounded by open land were restored to provide foraging habitat for the Black Swift. Wetlands were restored that contain mudflats the Black Swift may harvest for building nests. A diversity of grasses and wildflowers will be sown and planted on soil removed from building wetlands to maintain a diversity of insect populations for food. Large open fields will be maintained by livestock grazing that contain few shrubs and trees.

Common Nighthawk: Ephemeral and perennial water wetlands of various shapes, sizes, and depths that are surrounded by open land were restored to provide foraging habitat for the Common Nighthawk. A diversity of grasses and wildflowers will be sown and planted on soil removed from building wetlands to maintain a diversity of insect populations for food. Large open fields will be maintained by livestock grazing that contain few shrubs and trees.

Horned Grebe: Wetlands containing open water were established to provide a diversity of fish, crustaceans, and insects the Horned Grebe uses for food. Ephemeral wetlands were also restored in sunlit locations of different sizes, depths, and at various elevations that do not support fish so they will contain a diversity of invertebrates the Horned Grebe uses for food. A diversity of plants will be established within and surrounding the restored wetlands that may be used for nesting by the Horned Grebe. A diversity of ephemeral wetlands was restored that are supplied primarily with surface water, not groundwater. The warmer water contained in these wetlands will support a greater diversity of invertebrates used by the Horned Grebe for food.

Little Brown Myotis: A diversity of wetlands were restored to provide water and foraging habitat for the species. Wildflowers will be planted to increase habitat for pollinators, providing an improved food resource for the Little Brown Myotis.

Northern leopard frog: A diversity of ephemeral wetlands, seasonal marshes, and open-water marshes containing shallow water were restored in sunlit fields to provide suitable habitat for the Northern leopard frog. A diversity of wetlands was restored that are supplied primarily with surface water, not groundwater. The warmer water contained in these wetlands will promote the development of Northern leopard frog larvae. Shallow bays of water in sunlit locations were created in restored wetlands for larval development. Wet-meadow wetlands were restored to provide foraging habitat for Northern leopard from adults and juveniles. Zones of deep water containing loosened soils were developed over springs emerging in the bottom of restored wetlands to provide hibernation sites for the Northern leopard frog. These deep zones of water are not expected to freeze in the Winter and should contain higher levels of oxygen. Islands and ridges containing loosened soils were placed in the wetlands to provide hiding and resting sites. The project is distant from roads, which may reduce possible mortality by vehicles.

Short-eared Owl: Ephemeral and perennial water wetlands of various shapes, sizes, and depths were restored that are surrounded by open land to provide foraging habitat. Compacted soils were loosened so they may be used by small mammals for burrowing. A diversity of grasses and wildflowers will be planted and sown on soil removed from building wetlands to maintain a diversity of insect populations for foraging. Large open fields will be maintained for foraging and nesting by livestock grazing.

Western toad: Ephemeral wetlands, seasonal marshes, and open-water marshes containing shallow bays in sunlit locations were restored to provide habitat for Western toad breeding and juvenile development. The ephemeral wetlands would not contain fish or provide breeding habitat for the American bullfrog, which may affect Western toad breeding success. A diversity of wetlands was restored that are supplied primarily with surface water, not groundwater. The warmer water contained in these wetlands will promote the development of larvae. Wet-meadow wetlands were restored to provide foraging habitat for adults and juveniles. The project is distant from roads, which may reduce possible mortality by vehicles.

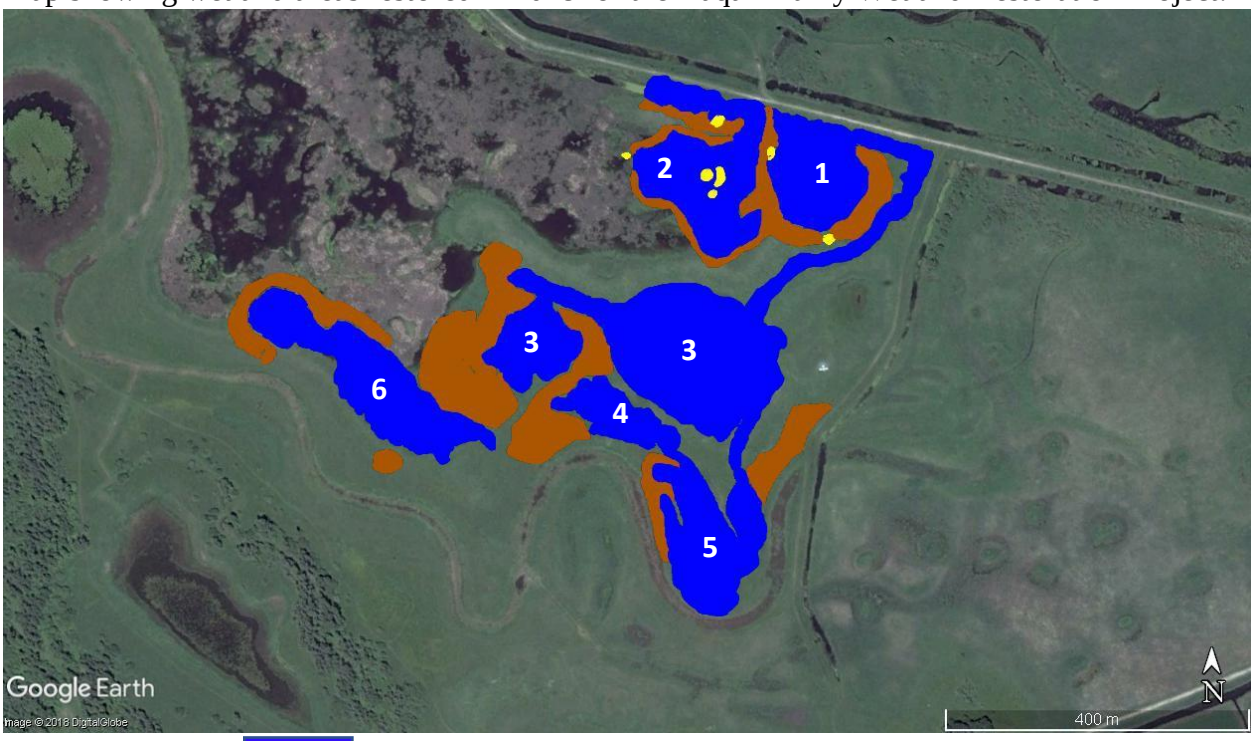
Western painted turtle: A diversity of ephemeral wetlands, seasonal marshes, and open-water marshes containing shallow bays were restored to provide habitat for Western painted turtle. Islands and ridges were developed in the wetlands to provide basking sites for turtles. Zones of deeper water containing loosened soils were established in the bottoms of restored wetlands over the emergence of springs to provide hibernation sites for turtles. These zones are not likely to freeze and should contain higher oxygen levels. Logs were placed in restored wetlands to provide turtles with basking sites. We were not able to identify locations where the Western painted turtle could lay eggs before the project was completed, therefore, soils high in sand were shaped into ridges in sunlit areas to provide turtles with nesting habitat. Nesting sites will be kept

open and not planted to trees, shrubs, or grasses. The project is distant from roads, which may reduce possible mortality by vehicles.

Sandhill Crane: Seasonal water marshes and wet-meadow wetlands were restored to provide foraging habitat for the Sandhill Crane. Uplands were formed from the soil removed from restoring the wetlands to support a diversity of insects including grasshoppers the Sandhill Crane uses for food. Sandhill Cranes are making extensive use of restored wetlands and associated uplands on the Cherry Meadows property, owned by the Nature Conservancy of Canada, near Cranbrook.

Results

Map showing wetland areas restored in 2018 for the Yaqan Nukiy Wetland Restoration Project.



Wetland restored:
Upland area established:
Turtle nesting area established:

2018 Accomplishments	**Area (m^2)**
Wetland areas restored	
Yaqan Nukiy Wetland 1 Restored • Ditches filled with soil • Islands formed • Shallow water zones for shorebirds • Shallow bays and ephemeral pools created • Turtle nesting mounds created • Deep zones created for overwintering Northern leopard frog and Western painted turtle	14,784
Yaqan Nukiy Wetland 2 Restored • Ditches filled with soil • Islands formed • Shallow water zones for shorebirds • Shallow bays and ephemeral pools created • Sedges and rushes transplanted • Turtle nesting mounds created • Deep zones created for overwintering Northern leopard frog and Western painted turtle	22,414
• Yaqan Nukiy Wetland 3 Restored • Ditches filled with soil • Islands formed • Shallow water zones for shorebirds • Shallow bays and ephemeral pools created • Sedges and rushes transplanted • Deep zones created for overwintering Northern leopard frog and Western painted turtle	53,616
Yaqan Nukiy Wetland 4 Restored • Ditches filled with soil • Islands formed • Shallow water zones for shorebirds • Shallow bays and ephemeral pools created • Deep zones created for overwintering Northern leopard frog and Western painted turtle	7,236
Yaqan Nukiy Wetland 5 Restored • Ditches filled with soil • Islands formed • Shallow water zones for shorebirds • Shallow bays and ephemeral pools created • Deep zones created for overwintering Northern leopard frog and Western painted turtle	17,847
Yaqan Nukiy Wetland 6 Restored	21,698

• Ditches filled with soil • Islands formed • Shallow water zones for shorebirds • Shallow bays and ephemeral pools created • Deep zones created for overwintering Northern leopard frog and Western painted turtle	
Total wetland area restored in 2018	137,595
Planned total	20,000
Upland Habitat Improvement	
Upland Area 1	1,462
Upland Area 2	937
Upland Area 3	5,343
Upland Area 4	3,500
Upland Area 5	8,879
Upland Area 6	4,167
Upland Area 7	2,818
Upland Area 8	6,122
Upland Area 9	230
Upland Area 10	9,828
Upland Area 11	5,566
Upland Area 12	925
Total upland area established in 2018	49,777
Planned Total	20,000
Turtle Nesting Habitat Established	
Turtle Nesting Area 1	863
Turtle Nesting Area 2	104
Turtle Nesting Area 3	147
Turtle Nesting Area 4	141
Turtle Nesting Area 5	128
Turtle Nesting Area 6	48
Turtle Nesting Area 7	33
Total nesting habitat area established in 2018	1,464
Total turtle nesting areas established in 2018-19	7
Planned Total	1

A diversity of wetlands was restored by the project of various shapes, sizes, and depths to provide for wildlife habitat needs. The restored wetlands are expected to provide migrating and nesting habitat for waterfowl, shorebirds and other wetland birds.

The restored wetlands are expected to help maintain the Kupi Marsh in an open-land condition supporting native sedges and grasses. The restored wetlands will inject water into the ground, making restored wet-meadows too wet for tree and shrub survival and growth.

The shallow ephemeral wetlands that were restored will support a diversity of aquatic plants that are high in sodium. These aquatic plants will provide important minerals to deer, elk, and moose.

The wetlands were built so they do not become dominated by reed canary grass, cattails, or watershield. They have features such as; fluctuating water levels, varied bottom elevations, and irregular deep and shallow zones that will support a diversity of plants and animals.

The restored wetlands were built to require no maintenance. The wetlands were built without the use of dams, pipes, water control structures, diversions, or pumps that would require maintenance. The wetlands are expected to appear and function as natural wetlands, without the need to add water using pumps, or the construction and maintenance of dams.

The restored wetlands will capture snowmelt and runoff, and slowly inject this water into the ground, recharging groundwater. This natural sub-irrigation will moisten soils around the wetlands, changing dry areas into productive wet-meadows containing a diversity of sedges and rushes. The sedges and rushes will improve habitat for moose, elk, and deer.

The restored wetlands were not built to provide habitat for fish. Therefore, they should contain a high density and diversity of invertebrates, providing outstanding habitat for waterfowl and shorebirds. Swans, the Long-Billed Curlew, Sandhill Crane, and a diversity of other birds can be expected to use the restored wetlands.

Efforts were made to control nonnative plants as part of this project. Heavy equipment was cleaned of soil before work began on the site. The soils will be sown to native plants. The project area will be examined for nonnative plants regularly following construction. Nonnative plants that are found will be controlled as part of each inspection.

Significant Accomplishments

The Grant Application for the AFSAR Yaqan Nukiy Wetland Restoration Project lists restoring 4 wetland and upland-sites totaling 4-hectares in 2018-19. We were able to exceed this planned accomplishment by restoring 6-wetland/upland sites totaling 18.7-hectares in 2018. While planning to build one nesting site for the Western painted turtle, we were able to build seven. Here are the main reasons why we were able to accomplish so much:

1. The Fish and Wildlife Compensation Program provided an additional $25,000 for heavy equipment use to restore wetlands in 2018.
2. A large dump truck was used to efficiently move soil long distances, compared to only pushing the soil with a dozer.
3. The soil removed to restore wetlands was also used to fill ditches. Filling these ditches restored large wetlands that had been drained. The basins for these restored wetlands

were in place and did not have to be excavated for this project. We had not planned on filling ditches to restore wetlands when the project was designed.

4. We focused on restoring wetlands in the Kupi Marsh for 2018-19, saving the cost of moving heavy equipment to the Skinku Marsh and the Tanal Marsh.
5. An area of sandy-loam texture soil was identified near Wetland 2 during construction. An excavator and dump truck were used to create turtle nesting areas near Wetland 1 and Wetland 2 using this soil.
6. The heavy equipment operators were highly skilled and productive.
7. We were able to build open-water wetlands in areas dominated by cattails, and in areas dominated by reed-canary grass.
8. Tom Biebighauser and Norm Allard were onsite working in partnership with heavy equipment operators every day.

Visitors

The Yaqan Nukiy Wetland Restoration Project was visited on December 19, 2018 by the following individuals:

- Marc-Andre Beaucher (Creston Valley Wildlife Management Area)
- Leigh Anne Isaac (Vast Resource Solutions Inc.)
- Irene Manley (Ministry of Forests Lands and Natural Resource Operations, Fish and Wildlife Compensation Program)
- Julia Shewan (Creston Valley Wildlife Management Area)
- Amy Waterhouse (Ministry of Forests Lands and Natural Resource Operations, Fish and Wildlife Compensation Program)

Norm Allard and Tom Biebighauser led the group on a tour of the project.

Students from the Yaqan Nukiy Independent School visited the Yaqan Nukiy Wetland Restoration Project on December 12 and 14, 2018. Norm Allard and Tom Biebighauser led the students in activities involving wetland restoration and Species at Risk.

Funding Used

The following tables summarize the funding spent by agencies and organizations on the Yaqan Nukiy Wetland Restoration Project in 2018:

AFSAR Funding Used

Item	Units/Hours	Price/Unit	Cash Cost
Heavy equipment contract supervision by BWCF (Thomas R. Biebighauser)	**67**	**$ 130.00**	**$ 8,710**
John Deere 200D Excavator Use	**71.00**	**$ 183.75**	**$13,046**
CAT D6R LGP Dozer Use	**51.50**	**$ 210.00**	**$10,815**
Volvo A30C Rock Truck Use	**47.00**	**$ 210.00**	**$9,870**
Cat 314 Excavator Use	**44.65**	**$ 173.25**	**$7,736**
		Total	**$50,177**

British Columbia Wildlife Federation Funding Used

Item	Units/Hours	Price/Unit	In-Kind Contribution	Cash Cost
Heavy equipment contract supervision by Thomas R. Biebighauser				$12,446.98
Volunteer project assistance by Thomas R. Biebighauser	48	$ 70.00	$ 3,360.00	
John Deere 200D Excavator Use	56.00	$ 183.75		$10,290
CAT D6R LGP Dozer Use	56.00	$ 210.00		$11,760
Volvo A30C Rock Truck Use	56.00	$ 210.00		$11,760
Mobilization John Deere 200D	1.00	$ 420.00		$420
Mobilization Cat D6R LGP Dozer	1.00	$ 630.00		$630
Volvo A30C Rock Truck Mobilization	1.00	$ 420.00		$420
Logs (Cat 314 Excavator Mobilization)	1.00	$ 420.00		$420
Logs (Cat 314 Excavator Use)	18.35	$ 173.25		$3,179
		Total	$3,360	$51,326

Fish and Wildlife Compensation Program Funding Used

Item	Units/Hours	Price/Unit	Cash Cost
John Deere 200D Excavator Use	42	$ 183.75	$7,718
CAT D6R LGP Dozer Use	41	$ 210.00	$8,610
Volvo A30C Rock Truck Use	41	$ 210.00	$8,610
		Total	$24,938

Funding available

The following funding is available for use on the Yaqan Nukiy Wetland Restoration Project. This funding must be spent by March 31, 2019:

BWCF = $1,019.00 (wheat and grass seed purchase)
Additional funding may be available by contacting Neil Fletcher.

FWCP = $0.00

AFSAR
$1,413.00 Heavy Equipment Contract for Restoring Wetlands and Grasslands
$2,760.00 Native plant seed mix
$1,650.00 Logs for improving habitat
$1,500.00 Wheat for erosion and nonnative plant control
$500.00 Gravel and sand
$7,823.00 Total AFSAR funding available for 2018-19

Photographs

Typical view of the Kupi Marsh before restoration. The restoration areas were dominated by dense growths of reed canary grass

The reed canary grass provides poor quality habitat for wildlife and poor-quality forage for livestock.

A system of ditches like the one shown were dug to move water into and out from the Kupi Marsh Impoundment. The ditches were also dug to drain natural wetlands within the area.

Restored Wetland 3

Restored Wetland 5

Restored Wetland 5

Restored Wetland 5

Restored Wetland 5

Restored Wetland 5

Wetland 1 filling with water from snow melting

Wetland 2 filling with water from snowmelt.

Ditch before restoration near planned Wetland 1

Ditch restored as part of Wetland 1

An excavator, off-road dump truck, and dozer were used to restore wetlands.

Reed canary grass and its roots are removed from each wetland restoration site.

Here the excavator loads the dump truck with soil removed from shaping a wetland basin.

A large off-road dump truck was used to move soil removed from restoring the wetlands.

Here Wetland 4 is being shaped by the excavator.

Soil removed from building wetlands was shaped into naturally appearing uplands.

The ripper attachment on the dozer was used to loosen compacted soils over large areas.

The excavator was also used to loosen soils compacted by the dump truck.

This photo shows an upland area created by covering reed canary grass with soil removed from building a wetland. The soils were loosened using the ripper on the dozer.

Large mounds of sandy-loam texture soil were placed near Wetland 1 and Wetland 2 to provide the Western painted turtle with nesting sites. The soils in these mounds were not compacted.

Here the excavator shapes a turtle nesting mound near a restored wetland area.

Mounds to provide the Western painted turtle with nesting habitat were placed on high ground and in sunlit locations near restored wetlands.

The large woody debris placed in restored wetlands was obtained by felling nonnative hybrid poplar trees located on Yaqan Nukiy lands.

The excavator is used to load hybrid poplar trees with root masses attached onto the large off-road dump truck.

The dump truck was used to transport large woody debris to the wetland restoration areas.

The excavator places large woody debris in a restored wetland to provide the Western painted turtle with basking sites, and waterfowl with loafing sites.

An excavator places a snag near a restored wetland.

The shattered bark on this snag provides bats with suitable roosting sites.

A pile of large woody debris is placed in Wetland 5.

The dump truck and dozer build a core trench across a ditch to restore Wetland 3.

The dozer fills a ditch with soil removed from restoring a filled wetland.

Recently restored oxbow shaped wetland.

Techniques were developed for establishing shallow, open-water wetlands from areas dominated by cattails.

The dozer removes cattails to build a portion of Wetland 6.

This shallow water wetland was established from an area dominated by cattails.

This wetland was also made from an area dominated by cattails.

The excavator spreads native sedges around the perimeter of a restored wetland. The dump truck was used to transport the sedges that were salvaged from a ditch that was filled.

The school bus from the Yaqan Nukiy Independent School transported students to the Yaqan Nukiy Wetland Restoration Project site for two-days of field trips.

Norm Allard explains the use of a laser level to students.

Students from the Yaqan Nukiy Independent School learned how to take elevations using a laser level.

Learning how to record an elevation with a survey rod and laser level.

Students used a penetrometer to measure soil compaction, an important concept to understanding where turtles and frogs may burrow.

A class takes a break on a basking log placed in a restored wetland.

Students discover that turtle nest mounds may also be used for sliding.

This photo shows a cattleguard damaged by the Yaqan Nukiy Wetland Restoration Project.

A cross-section dug in the dam surrounding the Kupi Marsh Impoundment. Photos shows where the dam has been built from sand.

The entire Kupi Marsh Impoundment was designed to be drained by this culvert. The gate on the culvert is broken, and the culvert is rusted. The culvert is temporarily blocked with mud and a stump. The culvert may be permanently blocked in a future restoration project.

Recommendations

1. Purchase native seed and plants using funding available from AFSAR and the BCWF. This funding must be used by March 31, 2019.
2. Seed and plant the restored wetlands and associated uplands with native flowering species to improve habitat for the little brown myotis, Bank Swallow, Barn Swallow, Black Swift, Common Nighthawk, and Short-eared Owl.
3. Seed upland areas with a mixture of native plants to improve habitat for wildlife, reduce the potential for colonization by nonnative plants, and provide forage for livestock.
4. Provide an update of this project to the Chief and Council of the Lower Kootenay Band. Consider having Tom Biebighauser assist with the update.
5. Give a presentation to the Lower Kootenay Band Community on the Yaqan Nukiy Wetland Restoration Project. Consider having Tom Biebighauser assist with the presentation.
6. Post this report on the website for the Lower Kootenay Band.
7. Avoid seeding and planting the turtle nesting mounds.
8. Try not to drive near the wetlands or over the restored uplands in rubber-tired vehicles and they may become stuck, and leave behind ruts that can cause erosion and not grow plants.
9. Consider replacing the cattleguard that was damaged by the project.
10. Restore a population of Northern Leopard Frogs in the restored wetlands by translocating eggs or larvae.
11. Control cattails to provide sedges and bulrushes time to colonize the restored wetlands.
12. Control nonnative plants that may appear.
13. Monitor Species at Risk use of the restored habitats.
14. Inspect the project area following snowmelt in the Spring and control any erosion that may be found.
15. Restore wetlands and uplands within the Skinku Marsh and the Tanal Marsh in 2019-21.
16. Prepare a new funding proposal for restoring open-water wetlands and streams in areas dominated by cattails within the Kupi, Skinku, and Tanal Marsh areas. This project may include permanently blocking the culvert draining the Kupi Marsh, and rebuilding Hidden Lake.

This report was prepared by:

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