Reeve Slough Salmon Habitat Reconnection Project

Final Project Report - Conceptual Design

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nhc

BROWN & OAKES ARCHAEOLOGY

McTAVISH RESOURCE & MANAGEMENT CONSULTANTS LTD.

KL environmental

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March 28, 2025

Acknowledgments

The authors of this report acknowledge the traditional, ancestral, and unceded territory of the kʷikʷəƛ̓əm (Kwikwetlem First Nation) and would like to thank those who contributed to this report.

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Executive Summary

Introduction

Kwikwetlem First Nation (KFN) is embarking on a process that will see Reeve Slough reconnected to the Coquitlam River. As part of the reconnection project, environmental restoration will be undertaken to support primary project goals, including:

- The creation and enhancement of habitats for fish, and other target species such as the Barn Owl and Western Painted Turtle, and
- Reducing groundwater levels in the Kwikwetlem First Nation's setɬamékmən cemetery adjacent.

Purpose of the Document

The purpose of this document is to support the conceptual design proposal for the Kwikwetlem First Nation Reeve Slough Reconnection Project developed by Northwest Hydraulic Consultants (NHC). As part of the concept development, this document communicates the overall vision for the project, recognizing and amplifying the social, cultural, and ecological co-benefits of undergoing hydraulic engineering to reconnect the Reeve Slough to the skʷx̌əma:ɬ stáĺ əẇ (Coquitlam River).

As a non-technical document, it uses descriptive graphics to convey a vision and intention for the restored Slough water body and landscape. It can be read in conjunction with the hydrotechnical engineering concept design prepared by NHC, or as a stand-alone document.

A Collaborative Project

Great care was taken by the Kwikwetlem First Nation team members and the consulting team to accommodate elements of cultural and archaeological significance in this historic and culturally important landscape, with the expert input and advice of Brown and Oakes Archaeology. In addition, environmental restoration proposals were carefully guided and integrated holistically into the concept design by KL Environmental and McTavish Consultants. Representatives from Fisheries and Oceans Canada (DFO) ensured that reconnection and environmental restoration proposals would meet fish habitat goals and be acceptable to the relevant Permitting Agencies.

Proposed Concept Design

The restoration goals are to improve habitat for fish and other target species, and to reduce the ground water level in the cemetery adjacent. To meet these goals the concept design includes the following restoration proposals:

1. **Reconnect the Reeve Slough** to the skʷx̌əma:ɬ stáĺ əẇ (Coquitlam River) at two points: upstream and downstream.
2. **Localized grading and modifications** to the Reeve Slough bed to create a channel that ensures tides move in and out of the Slough.
3. **Installation of a culvert** at the Old Pitt River Rd and re-establishment of the cemetery procession route.
4. **Aquatic, foreshore, and riparian enhancements** that support critical habitat and integrate traditional/medicinal planting.

Image: Artists impression of the culvert as part of the Restored Reeve Slough by LEES+Associates

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Introduction

After several years of extensive technical analyses at the Reeve Slough, Kwikwetlem First Nation (KFN) is embarking on a process that will see Reeve Slough reconnected to the sḵʷx̌əmaːɬ stáĺ əẇ (Coquitlam River). Northwest Hydraulic Consultants (NHC) have produced a conceptual design proposal and are undergoing the permitting process for the Kwikwetlem First Nation Reeve Slough Reconnection Project. Concurrent with this work, there are a series of changes being implemented on-site at the adjacent kʷikʷəx̌əm setɬamékmən Cemetery.

The purpose of this landscape concept package is to support and interpret the hydro-technical concept design and environmental enhancement proposals for the restoration of Reeve Slough. It communicates the overall vision for the project, recognizing and amplifying the social, cultural, and ecological co-benefits of undertaking the hydro-technical engineering modifications to the Reeve Slough.

As a non-technical document, it uses descriptive graphics to convey a vision and intention for the restored Slough water body and landscape. It can be read in conjunction with the hydro-technical engineering concept design prepared by NHC, or as a stand-alone document.

This document has been created in collaboration with KL Environmental Consultants and McTavish Resource & Management Consultants.

Project Goals

- *Improve habitat for fish and other target species.*
- *Reduce the ground water level in the cemetery adjacent.*

The project aligns with Priority Action COQ.RLR.HB.13.01 Improve rearing capacity for Chinook Salmon and Steelhead - Priority 1. The outcome through improving rearing habitat capacity for salmon is to sustain and restore habitat capacity and population viability of Chinook and Coho Salmon and Steelhead

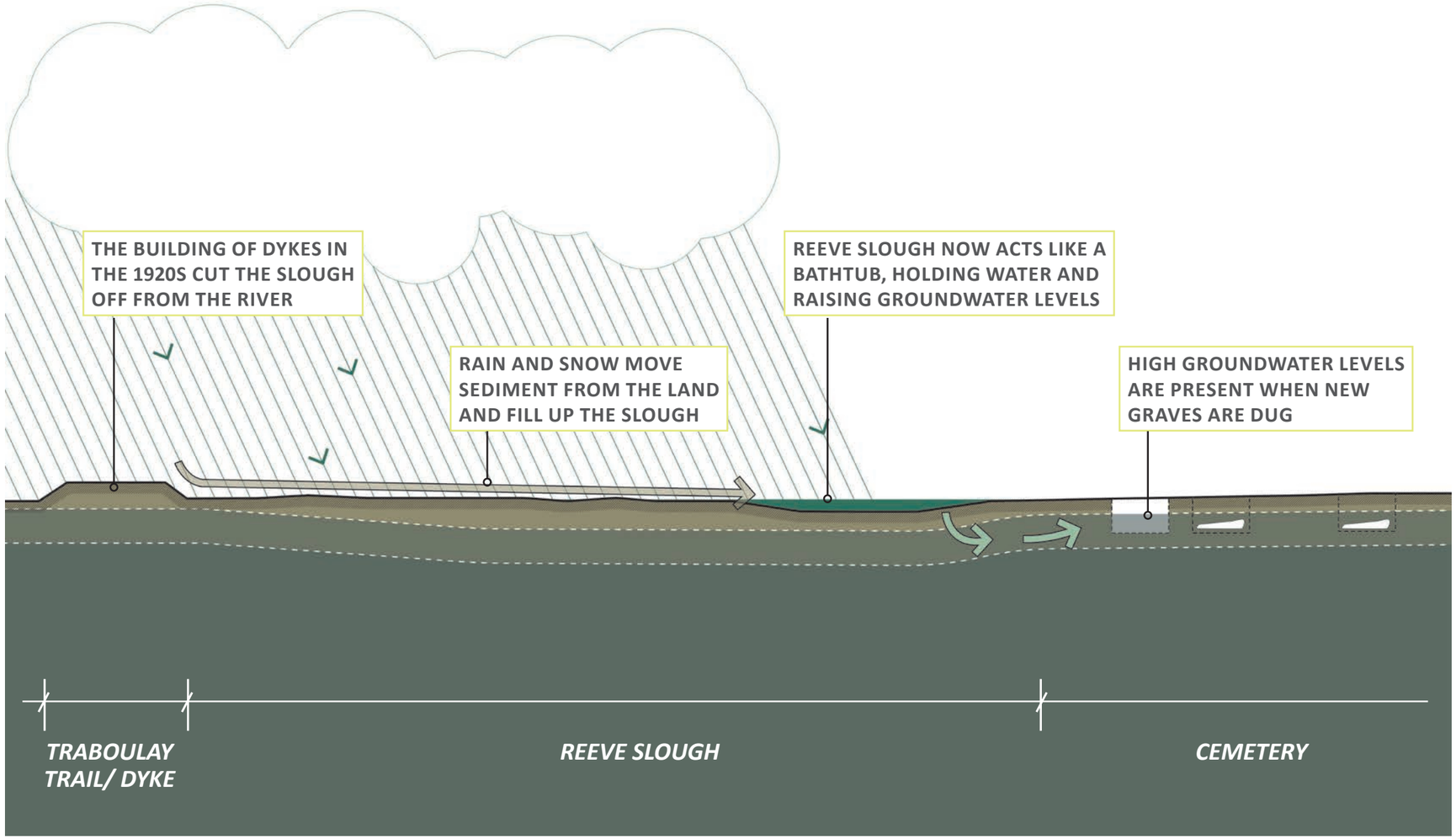
Context

The Reeve Slough is a historic off-channel of the Coquitlam River. Since the area was colonized, construction of the Coquitlam Dam and a standard dyke (along with other development) has increased flooding and sedimentation in the River, causing the Slough to become disconnected from the River. The Slough is also one of the largest parcels of critical salmon habitat in region, as well as an important cultural site for the Kwikwetlem First Nation. The adjacent traditional and active kʷikʷəƛ̓əm set̓ámékmən Cemetery experiences serious issues with high water tables year round that interfere with grave site excavations and ceremony. The disconnection of the Slough is causing issue for both critical habitat and cultural practices.

Hydrometric monitoring and feasibility studies have been conducted to determine how to address rising water tables in the Reeve Slough. It was found that the Slough was acting as “bathtub” which retained water throughout the year, without an opportunity to drain or flush.

Hydrological Diagram

This diagram describes the effect of the dykes on water levels within the current conditions at Reeve Slough.



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Proposed Concept Design

The restoration goals are to improve habitat for fish and other target species, and to reduce the ground water level in the cemetery adjacent. To meet these goals the concept design includes the following restoration proposals:

1. Reconnection to the River at Two Points.

Two points of connection to the sḵʷx̱ʷəmaːɬ stál̓ əẇ (Coquitlam River) are proposed. The upstream (north) connection is made by joining with the existing, adjacent Poco Slough that feeds into the River. The downstream (south) connection occurs at the historic outlet, informed by traditional knowledge, historical aerial photos, and careful hydro-technical analysis.

2. Installation of a Culvert at Old Pitt River Rd.

A proposed culvert installed under the Old Pitt River Road creates the northern connection to Poco Slough. The road is used as a cemetery procession route, which will be re-established after the culvert is installed. The culvert has an open bottom, meaning a more natural bed surface extends along the culvert. This offers the potential for rocks, sand, mud and other habitat-enhancing elements to be laid within. Design of this culvert will ensure safe and encouraged passage for salmon as well as reflecting an aesthetic design intent fit for a cemetery procession route.

An illustrated vision for the culvert connection is provided on page 5.

3. Localized Grading and Modifications.

Between the two river connection points, localized grading and modifications are proposed to create a channel, end to end. An area mid-way through the Slough has been identified as specifically requiring sediment removal and management. The channel depth allows for the tide to rise from the downstream connection into the Slough, even at the lowest low tides of the year. This creates a consistent flow of water in and out of the Slough. The movement of water is considered “low flow” meaning water moves slowly, decreasing the need for erosion control.

Groundwater levels in the cemetery will no longer be permanently high as a result of the connection of the Slough to sḵʷx̱ʷəmaːɬ stál̓ əẇ (Coquitlam River).

4. Aquatic, Foreshore, and Riparian Enhancements.

Habitat enhancements at key places along the modified Slough include restorative planting that centres traditional/medicinal plants and those which support critical habitat. Three key places for environmental restoration are indicated on this drawing, however additional and exact locations of restoration activities will be expanded on in the detail design phase.

- HIGH WATER
- EXISTING CEMETERY
- TARGETED RESTORATION AREA
- RIVER CONNECTIONS
- CHANNEL ENHANCEMENTS
- EXISTING DYKE
- CEMETERY PROCESSION ROUTE / OLD PITT RIVER RD
- PROPOSED CULVERT

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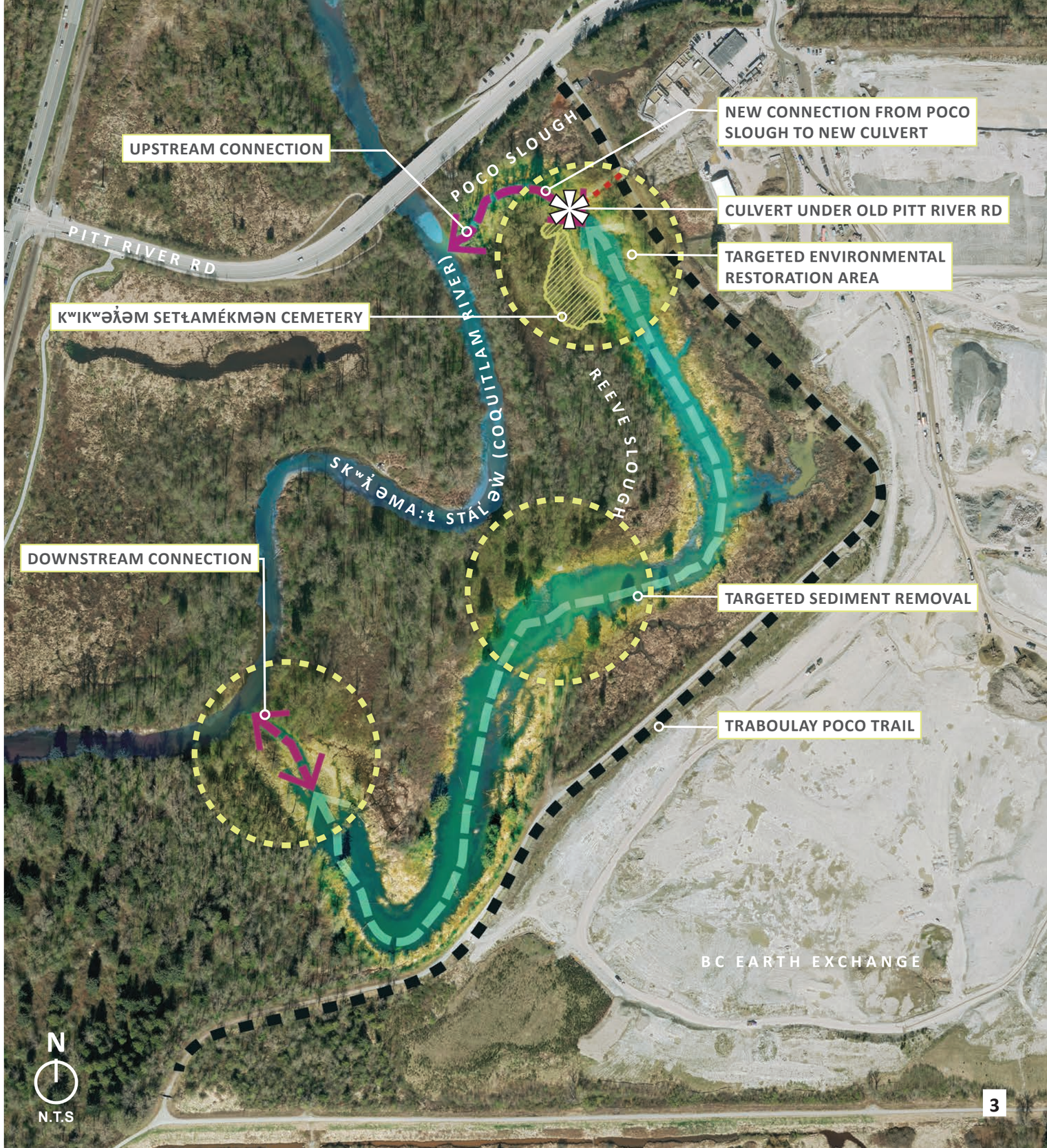


Ecological Zone Plan for Restoration Opportunities

Legend

- **KFN CEMETERY PROGRAMMING**
- **RIPARIAN ZONE** (30m BUFFER)
- **TRADITIONAL/MEDICINAL PLANTS**
- **MEADOW PLANTING**
- **SEMI-AQUATIC**
- **AQUATIC**
- **HIGH WATER LINE** (+3.0m)
- **DYKE**
- **TREE CANOPY**

1. **CEMETERY PROCESSION DRIVEWAY**
2. **CEMETERY GATE** (PROPOSED)
3. **BURIAL GROUND**
4. **SPLIT RAIL FENCE**
5. **CULVERT** (PROPOSED)
6. **UPSTREAM CONNECTION** (PROPOSED)
7. **ENHANCED CHANNEL** (PROPOSED)

This diagram focuses on the northern half of Reeve Slough. It shows the interdependent relationship between the potential to restore habitat in Reeve Slough and the Cemetery adjacent as part of the cultural restoration goals of Kwikwetlem First Nation. As such, this area is suggested as a priority zone for restoration.

The precise extents and locations for enhancements within each ecological zone will be identified as part of the Detailed Design phase that will be part of a future project stage in summer 2025. Ecological enhancements will be broken down into multiple phases for implementation.

Riparian Zone

A 30m buffer from the high water line will be enhanced with targeted planting of species that thrive in riparian (river side) conditions, and include elements that support habitat creation such as large woody debris; riprap sediment traps; muddy, sandy and gravel beds; and slope stabilization.

Aquatic and Semi-Aquatic Zones

The modifications to create the **enhanced channel** will improve drainage and water flow, while also providing variable habitats including basking beaches and resting area, and shallow, moderate, and deep pools that support the different life stages for fish/turtles/amphibians.

The channel varies in width where possible to ensure a more natural appearance at low water levels. Banks at the **upstream connection** will be enhanced with sediment and velocity control, willow staking, bank restoration and bioengineering.

KFN Cemetery Programming

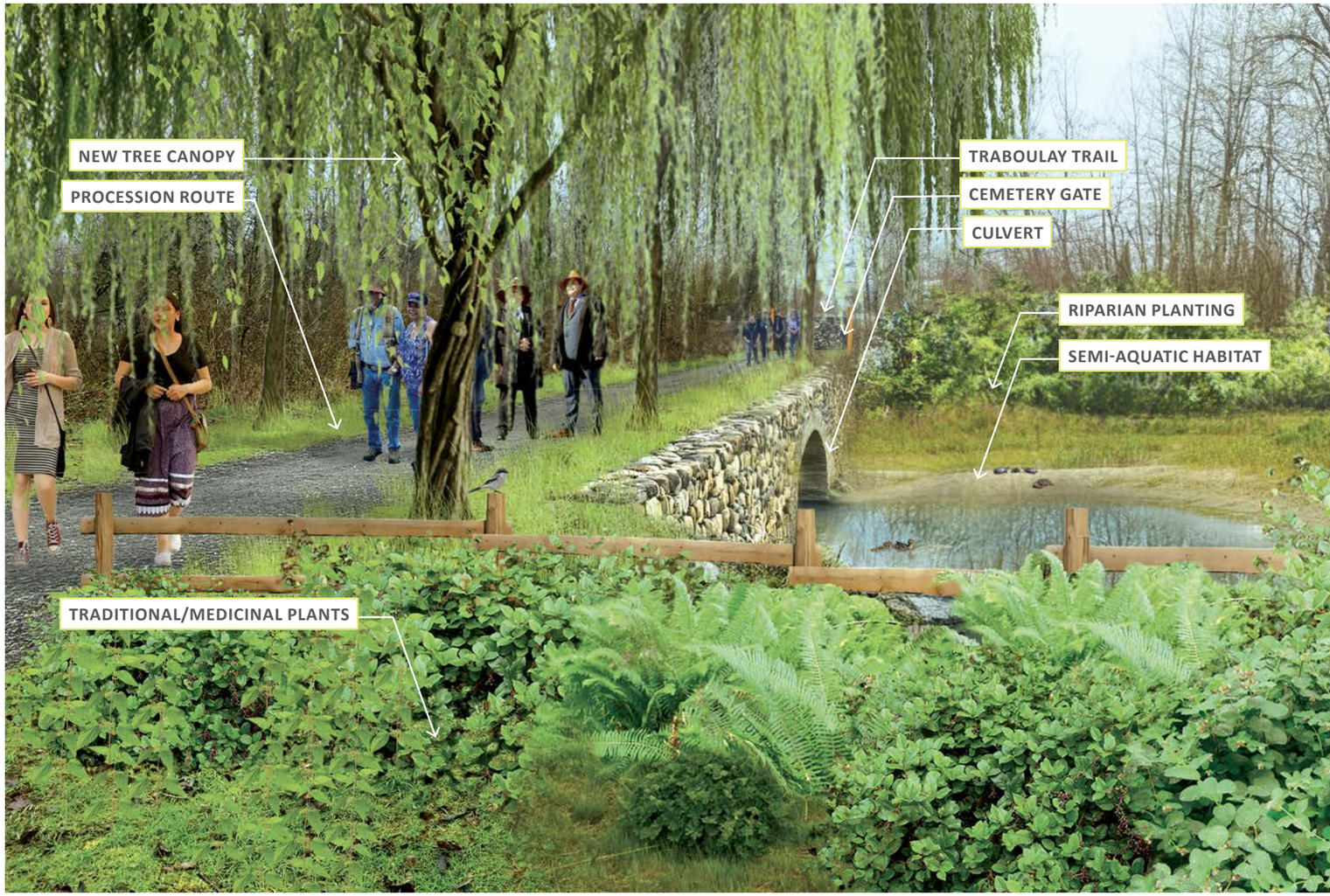
After the culvert is installed, the **procession driveway** will be planted with willow trees that provide shade and overhanging vegetation supportive of salmon habitat while providing a sense of arrival and initiation into ceremonial space. Materials that are reflective of the surrounding natural environment such as boulders and rocks are used to stabilize banks as necessary. Rocks from the surrounding area are used to clad the headwall of the culvert.

The riparian zone transitions to a **traditional and medicinal** planted buffer between the Slough and the cemetery, giving way to a naturalized **meadow** in the burial grounds.

Visualization of the Proposed Culvert at the Cemetery Procession Route

Existing Condition

Proposed



This visualization shows how the cemetery procession driveway and culvert can be designed together to improve cultural spaces and ecological conditions. The first image shows the existing condition of the Slough, noting how Old Pitt River Road and the Traboulay Trail create a barrier for water to flow. The image on the right shows how water can pass through the culvert. New tree canopy provides shading that is beneficial to both people and salmon, while also creating a sense of arrival along the re-established procession route. Natural materials like stone and rock from the skʷx̌əmaːɬ stáĺ əẇ (Coquitlam River) are used to form the headwall of the culvert, making it feel like part of the place. The banks of the Slough are shown as planted with riparian-friendly species and traditional/medicinal plants like ferns, berries, and stinging nettle, among others.

Restoration Planting Concept

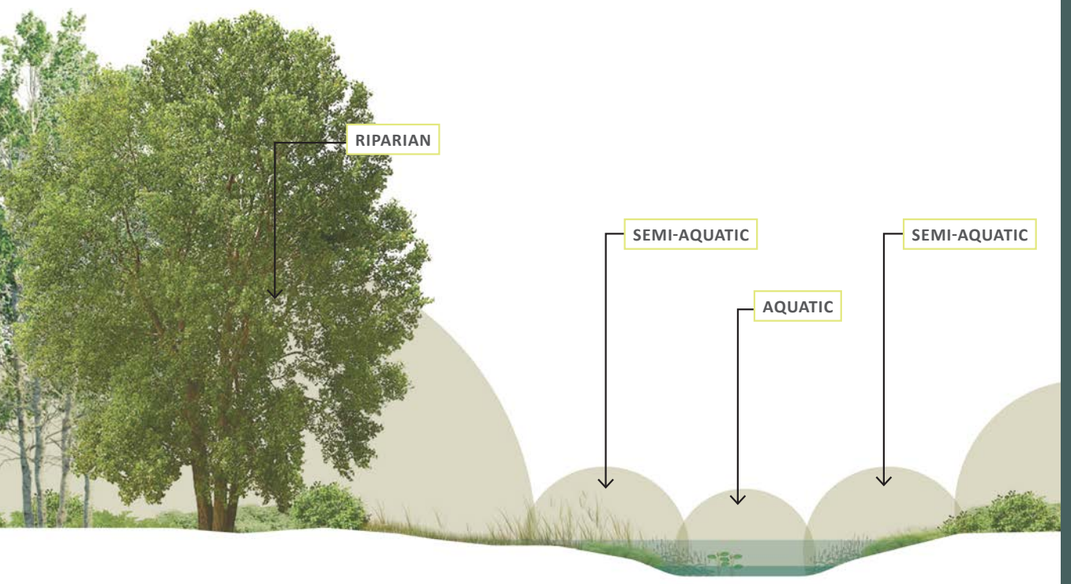
The following plant selection has been informed by the Kwikwetlem First Nation Reeve Slough Ethnobotany Report. Where possible, species noted as priority plants for KFN are selected. Plant species are selected that will thrive in the new tidally-influenced Slough and that support target species habitat restoration.

The typical cross section illustrated below describes the planting strategy according to water levels. The final planting plan will be developed in collaboration with KFN and work towards providing co-benefits of habitat restoration, beautification, and reinforcing cultural tradition.

An initial species palette is provided. The following list of plants is not extensive, and will be further developed in collaboration with KFN members and environmental consultants during Detail Design.

A colour coding system has been applied that indicates plant species that align with specific cultural and habitat restoration priorities.

- **KFN CULTURAL PRIORITY**
- **BARN OWL HABITAT**
- **WESTERN PAINTED TURTLE HABITAT**
- **SALMON HABITAT**



Typical cross section of proposed planting zones in Reeve Slough.

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Riparian

Black cottonwood
Populus balsamifera var. trichocarpa

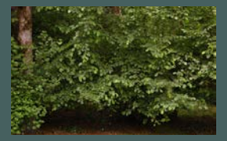
Red alder
Alnus rubra

Western red cedar
Thuja plicata

Cascara buckthorn
Rhamnus purshiana

Salmonberry
Rubus spectabilis

Red elderberry
Sambucus racemosa



Beaked hazelnut
Corylus cornuta var. californica

Thimbleberry
Rubus parviflorus

Pacific bentgrass
Agrostis avenacea

California oatgrass
Danthonia californica

Osoberry
Oemleria cerasiformis

Sword fern
Polystichum munitum

Licorice Fern
Polypodium glycyrrhiza

Lady Fern
Athyrium filix-femina

Semi-Aquatic

Sedges
Carex spp.

Silverweed
Potentilla anserina

Wapato
Sagittaria latifolia Willd. var. latifolia

Skunk cabbage
Lysichiton americanum

Aquatic

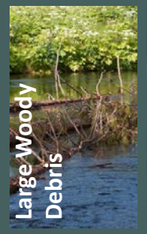
Yellow pond-lily
Nuphar polysepalum

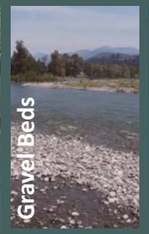
Smartweed
Polygonom sp.

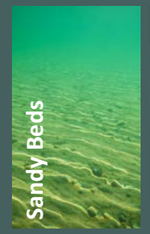
Dortmann's cardinal flower
Lobelia dortmanna

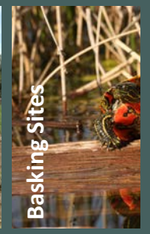
Priority Species for Habitat Restoration

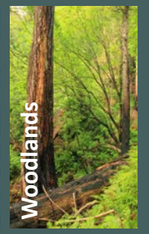
A selection of target species has been identified as priority for habitat restoration at Reeve Slough. Some of the specific habitat requirements are listed below, and are under consideration and expansion as the project moves forward.





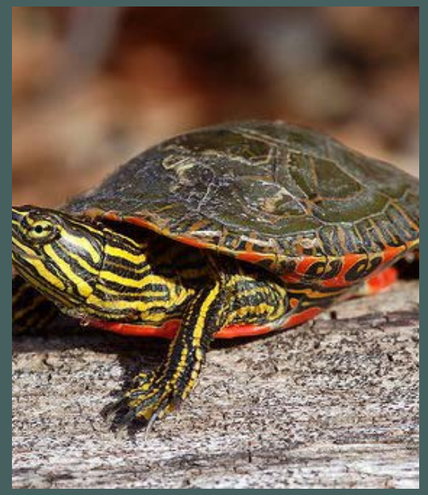






Coho and Chinook Salmon

- Prefer small to medium-sized streams with cool, clear water and gravel substrates for nesting.
- Require shaded, low-velocity pools with abundant cover, such as overhanging vegetation and woody debris.
- Utilize rivers and tributaries for upstream migration; access to these habitats is crucial for their life-cycle.



Western Painted Turtle

- Prefer slow-moving rivers, ponds, and lakes with muddy or sandy bottoms and abundant aquatic vegetation.
- Require access to sunny, flat surfaces like logs or rocks above the waterline for thermo-regulation.
- Seek sandy or gravelly upland areas near water for egg-laying, typically in late spring or early summer.

Barn Owl

- Favor large, open structures such as barns, silos, or hollow trees for roosting and nesting.
- Prefer open habitats like fields, grasslands, and wetlands with abundant small mammal prey.
- Typically occupy home ranges of 1,000 to 2,500 hectares, depending on prey availability.

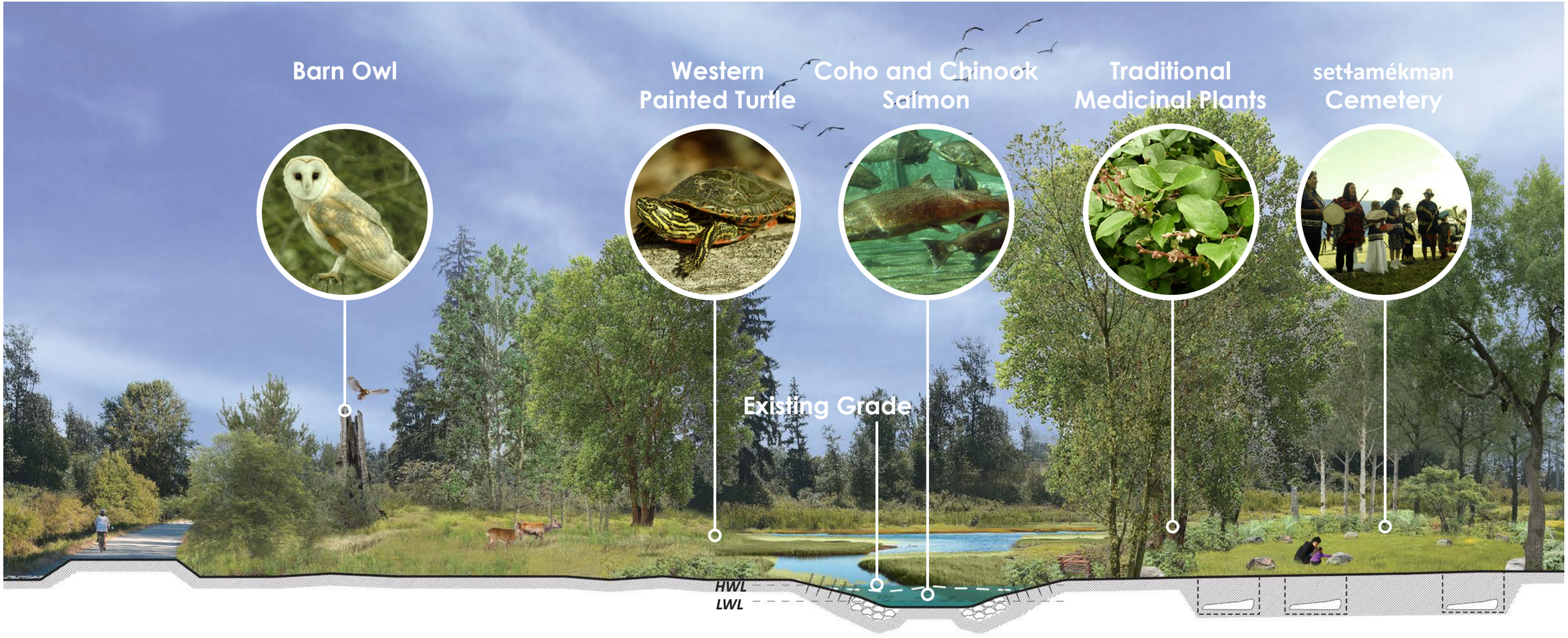
Habitat Restoration

The existing Slough has been dramatically altered as a result of historical dyking and municipal water management projects. This has resulted in fish barriers, sedimentation and loss of overall habitat for many different target species that would use this area for parts of their life cycle. This project has the potential to restore key habitat for many different species that are important to the natural cycle and KFN.

Many different target species live in the vicinity of Reeve Slough depending on the time of year. This includes both aquatic and terrestrial species. The overall approach is to create a diversity of conditions in order to accommodate a range of habitat. This includes varying depths of pools and channels, habitat microsites (i.e. logs, large rocks, shaded areas), using fish/turtle friendly construction material, fish friendly culverts, and many more types of bioengineering.

By integrating the traditional knowledge of KFN and the Subject Matter Experts, the Reeve Slough Restoration project strives to bring back conditions similar to those before settlement.

Illustrative Section of the Restored Reeve Slough



DYKE

RIPARIAN

Riparian planting occurs within 30m of the high water line. Opportunities for enhancing barn owl and Western painted turtle habitat occur in this zone.

NEW CHANNEL MODIFICATION

Aquatic and semi-aquatic habitat is restored and enhanced for fish.

Water levels go up and down as the tide flows in and out, releasing pressure on cemetery groundwater levels.

TRADITIONAL PLANTS

Plants selected for this area reflect KFN cultural priorities while supporting riparian restoration.

CEMETERY

The presence of groundwater in the burial grounds decreases.

Project Schedule and Next Steps

Spring 2025: Permit Applications

Once Kwikwetlem First Nation Senior Leadership has approved the hydro-technical engineering and environmental restoration concept design, the environmental consultants KL Environmental, supported by McTavish Resource & Management Consultants, will submit the design package as part of the application to the Province for approval and permits under the Water Sustainability Act. These permits, and all other relevant environmental and archaeological permits will be in place by Spring 2026.

Brown & Oakes Archaeology and KFN Guardians will undertake field services for the preparation of the archaeological impact assessment. This work will include a systematic survey of the project area and focused subsurface testing at the culvert, new channel and other ground disturbance locations.

Summer 2025: Detailed Design

Detailed Design work will begin in the summer of 2025, resulting in Tender-ready Construction Document Packages.

Spring 2026: Tender Period

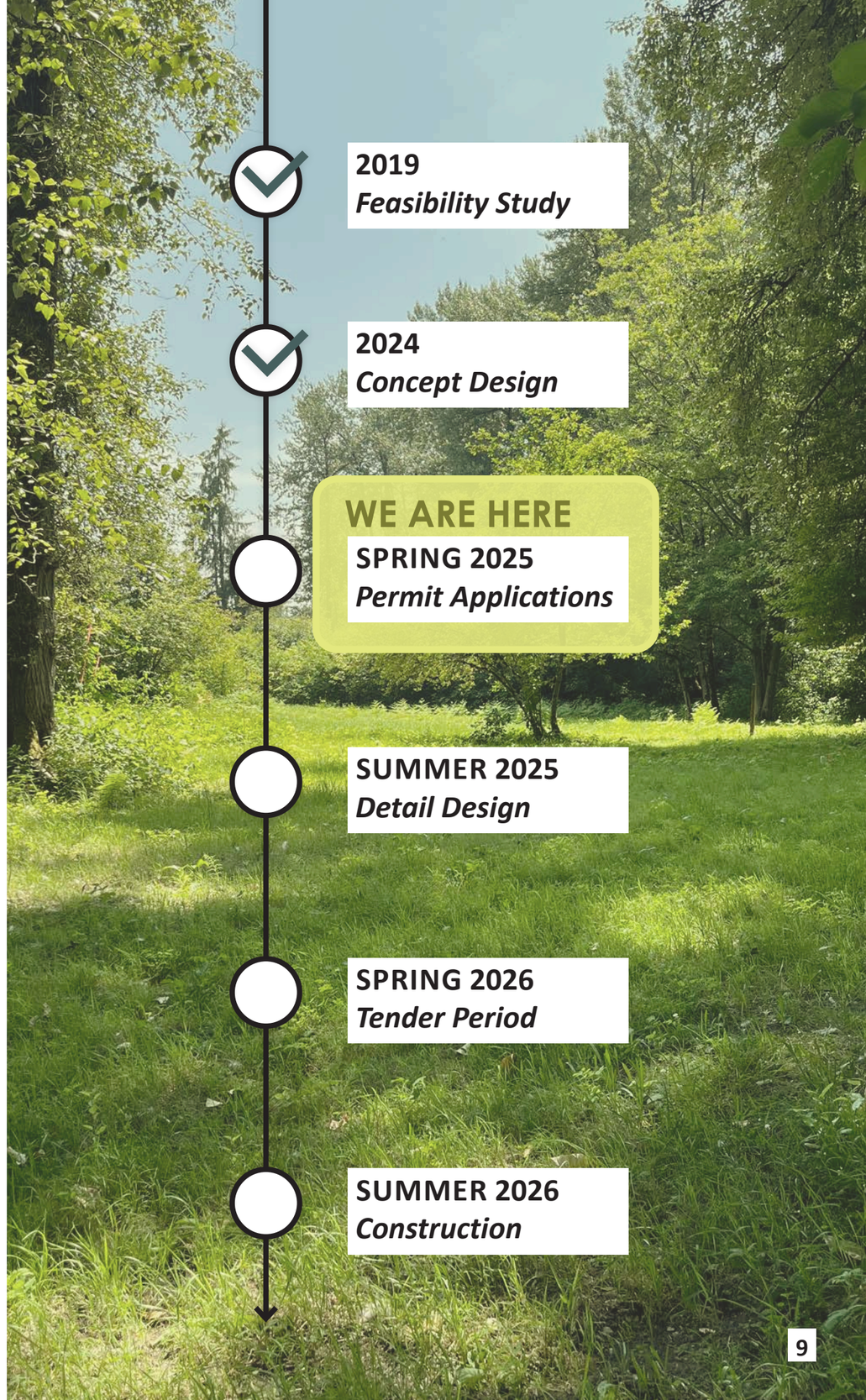
The first phase of work for the reconnection and environmental enhancement of Reeve Slough will be tendered in the Spring of 2026. The expectation is that a suitably qualified contractor will be appointed, ready to undertake the work in the Summer of 2026.

Summer 2026: Construction Period

Construction work to connect Reeve Slough to the Coquitlam River, along with the first phase of environmental restoration and enhancement, is expected to begin in the fish window, starting in August or September 2026.

Conclusion

When the detailed design stage and once work has been completed, Reeve Slough will be a flagship project and further demonstration that environmental restoration of river and adjacent natural landscapes led by KFN and other Nations can be successfully achieved as part of climate change and environmental goals shared by adjacent municipalities and agencies in the lower mainland. The benefits to people and wildlife will not escape notice , and Reeve Slough will serve as a platform for future cultural and environmental restoration projects within KFN and further afield.



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