

Draft Conceptual Design for Wilson Farm North Tidal Channels

Port Mann Highway 1 Compensation Project

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December 18, 2009

Ms. Robin Taylor
Environmental Manager
Port Mann Highway 1 Project
Transportation Investment Corporation
201-145 Schoolhouse Street
Coquitlam, BC V3K 4X8

Dear Robin:

Re: Draft Conceptual Design for Wilson Farm North Tidal Channels

We have prepared a conceptual design for the Wilson Farm North Tidal Channel project. The design includes a plan view (Figure 1) and five typical cross sections for the various enhanced, new and swale channels (Figure 2, Figure 3 and Figure 4, resp.). General planting notes (Table 1) are described and candidate plant species (Table 2) and riparian planting plans (Figure 5 to Figure 8) are proposed for the typical cross sections.

Design Objectives

Preparation of this tidal channel design for the improvement of fish habitat was based on several underlying objectives that relate primarily to protection of the existing high quality wildlife habitat within Wilson Farm North. Maintaining large patch size areas of old-field habitat is critical for ensuring continued use of Wilson Farm North by raptors that prey on Townsend's vole. To meet this objective our conceptual design maintains a large tract of old-field habitat that is unfragmented by wetted channels (though we expect raptors and herons to continue to use areas between and adjacent to the new channels because suitable vole habitat will persist there). In addition, it is important that the design protects existing mature trees and shrubs that are providing important habitats for songbirds and other wildlife. To implement the vegetation protection measures, the centre line of the new channel alignments will be laid out in the field by the design team's biologists and engineers to minimize impacts on existing shrubs and trees. In addition, we propose to

Established in 1971

Ontario British Columbia Alberta Yukon Newfoundland USA Russia

establish riparian vegetation such as native grasses, shrubs and trees, along the new and enhanced channels to improve wildlife habitat suitability there. We will also describe, in a future document, channel and tidal gate design criteria and specifications and seasonal operational plans that provide flood protection and flexibility in water level management (e.g., water level drawdown of the channels, spring, fall/winter, and summer operational regimes for the tidal gate, etc.) to ensure old-field habitat conditions are maintained and to allow, for example, scheduled mowing/brushing in accordance with CFRP plan objectives.

Specific Design Elements

Enhanced Channels

We propose to enhance the existing perimeter ditch and the eastern ditch that runs SE-NW by excavating a portion of the channel deeper and creating a low elevation submerged bench (Figure 1 and Figure 2). Two approaches will be used to construct the enhanced channels. First, the western and diagonal sections of the existing ditches will remain within their current straight channel boundaries. However, as a variation to the proposed cross section drawing, we propose to alternate the deeper portion of the channel to either the left or right bank in these enhanced sections to provide some localized sinuosity within the existing channel boundaries. Second, on the NW and N ditch, the channel has in-filled and is currently quite narrow and only wetted intermittently. We propose to enhance that section of existing ditch by constructing a meandering channel with the same cross-section characteristics as Figure 2. Where the channel is moved away from the existing dyke and pathway at proposed meander bends, the existing ditch would be in-filled with spoil excavated from the enhanced channel alignment and lower riparian benches would be created to provide discontinuous sections of riparian vegetation adjacent to the pathway.

The existing channel along the dyke varies in wetted width between ~8–12 m. As proposed, the enhanced channels would have a wetted width of about 10 m at high water mark. Water levels in the enhanced channels would fluctuate with regular tidal frequencies between elevations of ~0.3 and ~0.8 m geodetic. The deepest portion of the channel would have a minimum water depth of ≤ 0.8 m at low tide and ~1.3 m at high tide. The bench would have a minimum water depth of ~0.1 m at low tide and ~0.6 m at high tide. Keeping the bench submerged at low tide will prevent potential fish mortalities

caused by stranding. The deeper water and regular flushing caused by tidal fluctuations should inhibit the establishment of reed canary grass within the channel.

Spoil from the channel excavations would likely be handled in several ways: 1) side cast into low-elevation spoil areas adjacent to the enhanced channels; 2) used to in-fill the existing ditch; and 3) as fill for designated uses by Metro Vancouver Parks or others.

Total length of existing ditches that would be enhanced is ~2946 m. Total proposed length of enhanced channel after construction would be approximately 3018 m. Re-construction of the existing ditches will result in a total footprint channel area of ~3.0 ha, an increase of 0.6 ha from the existing ditch footprint area.

New Channels

We propose to construct new meandering channels at three locations in Wilson Farm North (Figure 1):

- 1) A new channel that connects the existing north ditch to the diagonal ditch on the eastern portion of the property;
- 2) A new groundwater channel along the toe of the slope of Shaughnessy Street; and
- 3) New meandering tributary channels within the western portion of Wilson Farm North.

New channels would have a wetted width of ~8 m at the high water mark (Figure 3). Water levels in the new channels would fluctuate with regular tidal frequencies between elevations of ~0.3 and ~0.8 m geodetic. The deepest portion of the channel would have a minimum water depth of ≤ 0.8 m at low tide and ~1.3 m at high tide. Similar to the proposed enhanced channel, the deeper water and regular tidal flushing should inhibit the establishment of reed canary grass within the new channels.

A groundwater channel is proposed for the eastern portion of Wilson Farm North near the toe of the slope adjacent to Shaughnessy Street. The groundwater channel would feed cooler water into the perimeter channel, potentially improving water quality for juvenile fish. The channel could also provide potentially high-quality overwintering habitat and summer rearing refugia for fish such as coho salmon fry. However, development of the groundwater channel is subject to further investigations of feasibility. Feasibility assessments will include investigations of the locations and water chemistry

of existing storm drain outfalls from Shaughnessy Street, monitoring of groundwater levels using piezometers, and ground truthing of a potential channel alignment.

Spoil from the channel excavation would likely be: 1) side cast into low elevation spoil areas adjacent to the new channels; or 2) used as fill for designated uses by Metro Vancouver Parks or others.

Total length of the proposed new channels is ~1485 m. All new channels would be located within existing old field habitat. Construction of the new channels, i.e, 1) the channel connecting the existing north and diagonal ditches, and 2) the new westerly tributary channels, will comprise a total footprint channel area of ~1.2 ha.

Swale Channel

A 240 m long swale channel is proposed along the east side of the field that was rehabilitated recently by Metro Vancouver Parks (Figure 1 and Figure 4). The intent of constructing the swale channel is to evaluate the effectiveness of this type of channel at providing fish habitat as well as improving land drainage. Therefore, the swale channel will be designed similar to a sloping (~0.2-0.5% gradient) agricultural drainage swale and will function as both an agricultural drain and aquatic habitat. The shallow 5 to 1 slopes of the swale and seeding to grasses will provide easy access for equipment and allow for regular maintenance of the old field grasses during the summer. Only the lower 160 m of the swale channel will be wetted regularly during a portion of the tidal cycle. At a high tide, wetted channel width would be ~6 m and water depth between 10 and 25 cm. At low tide, the swale would be dewatered. Above the influence of the tidal fluctuations, the swale would slope gently up to the existing ground surface and function to capture runoff from the surrounding lands. The entire channel would also provide food and nutrients to the aquatic habitats downstream.

Construction of the 240 m long swale channel will comprise a total footprint area of ~0.14 ha. The new swale channel would be located within existing old field habitat.

Ponds

Two ponds are proposed near the tidal gate inlet (Figure 1). The ponds would be ~30-50 m long and ~25-30 m wide with residual depths at low tide of ~1 m. The ponds would also function as sedimentation ponds and be designed to allow for maintenance and removal of accumulated sediments. In addition to providing fish rearing habitat, the ponds would benefit birds, amphibians and other wildlife that inhabit Wilson Farm North.

Construction of the two ponds will comprise a total footprint area of ~0.20 ha. The new ponds would be located within existing old field habitat.

Water Management Structures

Four existing access crossings will be maintained (Figure 1). In some cases, the culverts will need to be replaced as they have either collapsed or are plugged with debris. The conceptual design also includes the installation of an overshot-slucice gate culvert on the east-west berm to allow greater flexibility in water and land management within Wilson Farm North. The overshot-slucice gate culvert allows for the discharge of water from the Wilson Farm North channels to the southerly pump station when water levels exceed 0.8 m. These higher water levels could potentially occur when the tidal gate is closed during the Fraser River freshet and there is a coincident heavy rainstorm. Ensuring excess waters are removed through the pump station will reduce the risk of flooding in Wilson Farm North. The slucice gate will also allow for a reduction in water levels in Wilson Farm North channels during mid to late summer to facilitate mowing or to meet other specific wildlife or vegetation management needs. Overall, the overshot-slucice gate culvert will ensure long-term flexibility in water and land management within Wilson Farm North.

A potential equipment crossing is also proposed on the east side of Wilson Farm North to provide access for ongoing maintenance of the old field habitat. The culvert crossing would allow access for equipment over the new channel proposed for construction.

Riparian Plantings

Planting plans for the proposed habitat compensation project will complement the existing vegetation on Wilson Farm North. The recommended plant species will be beneficial to existing wildlife, will provide a source of food and nutrients for fish, and will ensure bank and channel stability. General planting notes (Table 1), candidate plant species (Table 2) and riparian planting plans (Figure 5 to Figure 8) are proposed for the various channel types described above. Riparian vegetation along the swale channel will be grasses to maintain and be consistent with Metro Vancouver's recommended vegetation for existing old field habitat. The swale riparian plan will be similar to the design for the new loop channel (Figure 7).

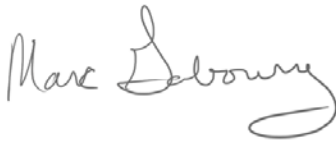
Closing

We believe the proposed conceptual design addresses the objectives set by Metro Vancouver Parks and other key stakeholders concerned with Wilson Farm North. Notably, we believe the design conserves old-field habitat and, at the same time, incorporates elements that will create high-quality fish rearing habitat and ecological diversity.

The enhancement of the existing ditches and construction of the new channels, swales and ponds will result in the conversion of old-field habitat to aquatic habitat. It is estimated that ~4.5 ha of aquatic habitat will result from the proposed project, an increase of ~2.2 ha over the existing aquatic habitat. Consequently, 3.3% of the ~66.0 ha of existing old field habitat area will be converted to aquatic habitat.

Please contact me if you have any questions or comments on the proposed conceptual design.

Regards,



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Figure 1. Proposed Conceptual Plan for Wilson Farm Tidal Channel Project.

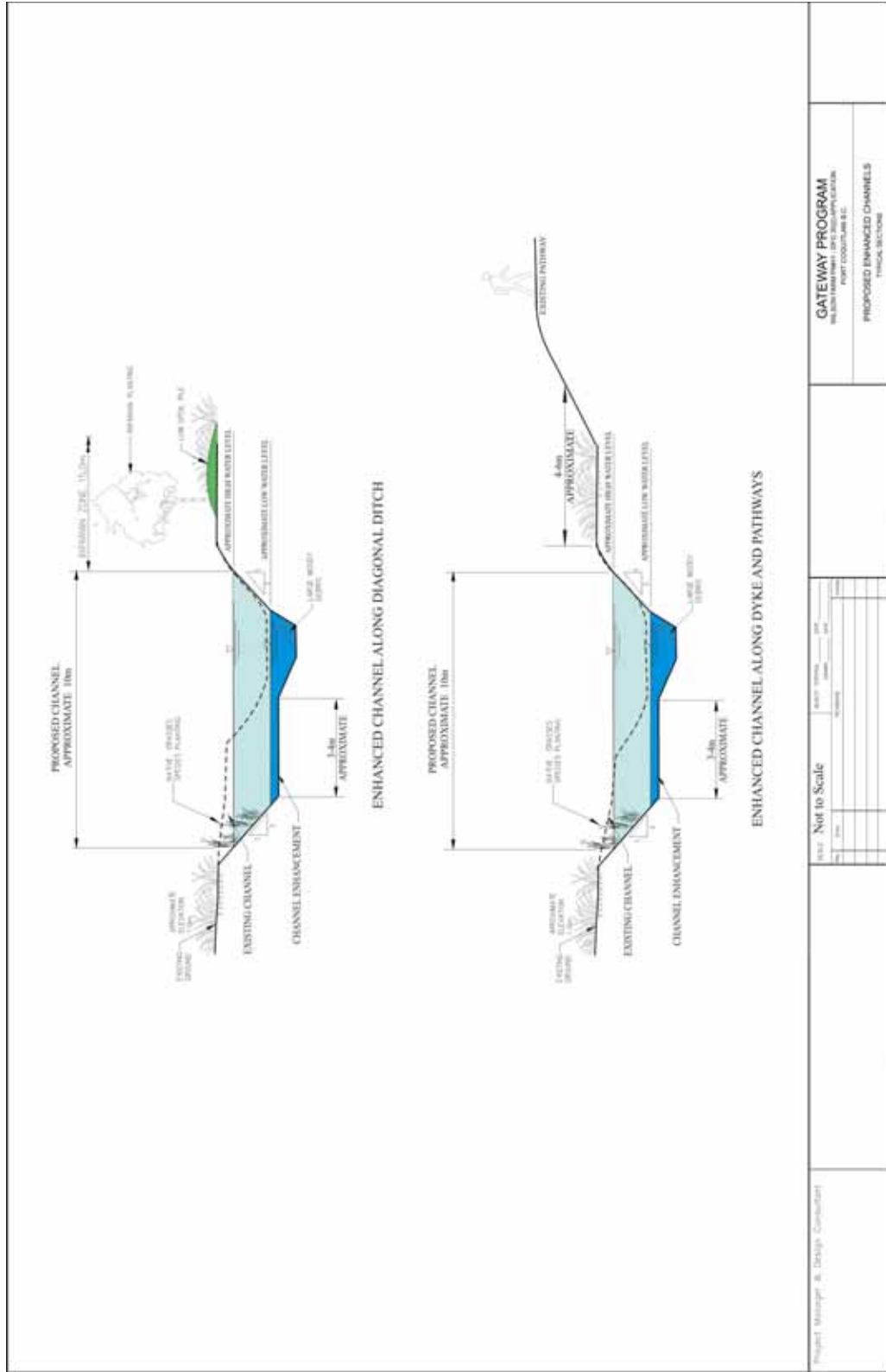


Figure 2. Typical channel cross sections proposed for the enhanced channels on Wilson Farm Tidal Channel Project. Modified after Delcan drawings, January 2009.

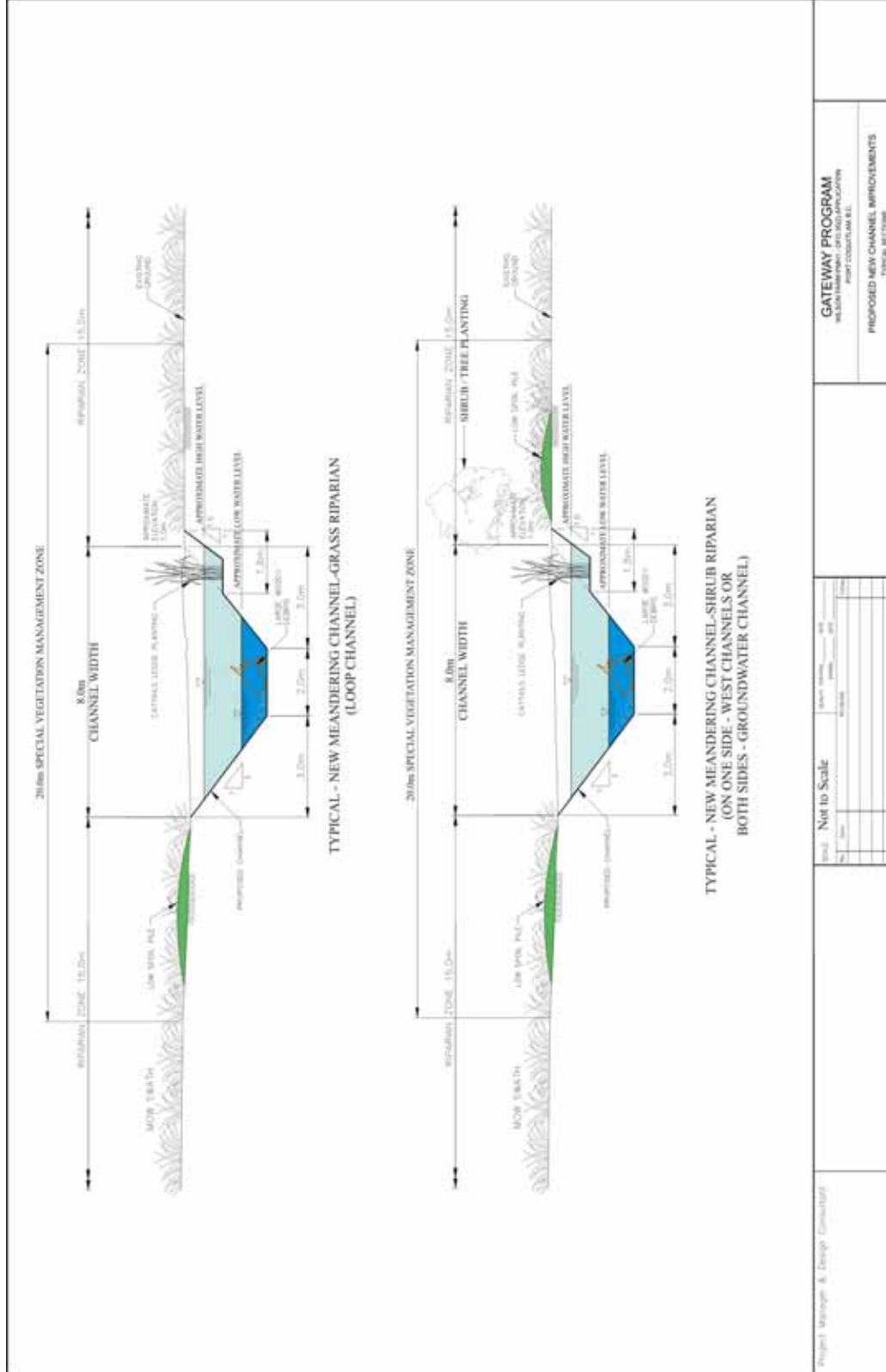


Figure 3. Typical channel cross sections proposed for the new meandering channels on Wilson Farm Tidal Channel Project. Modified after Delcan drawings, January 2009.

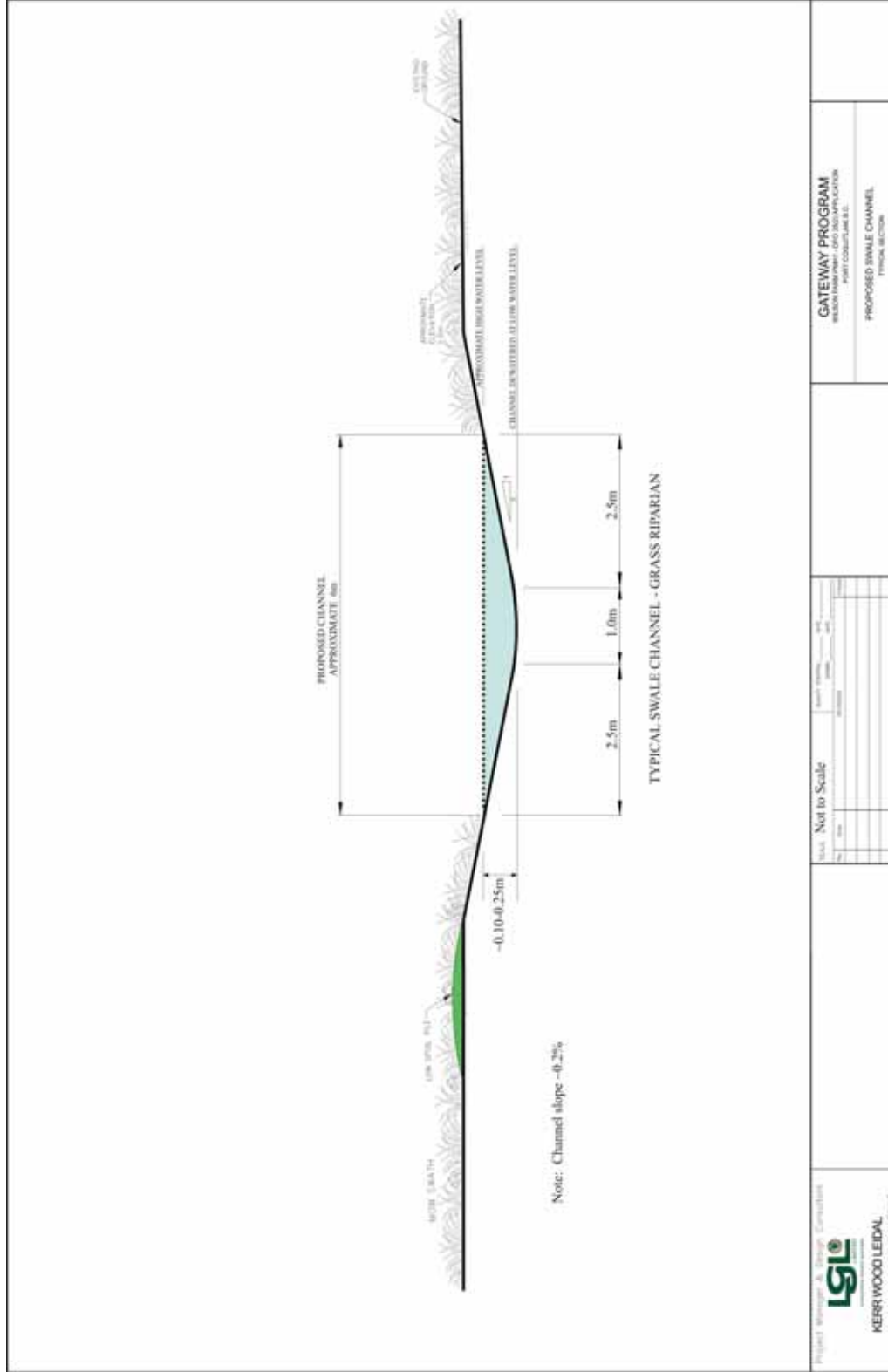


Figure 4. Typical channel cross section proposed for the swale channels on Wilson Farm Tidal Channel Project.

Table 1. General planting notes for Wilson Farm North Tidal Channel Project.**General Planting Notes:**

- Invasive plants within the proposed planting areas will be managed either through removal or deep burial prior to planting. Reed canary grass will not be treated as an invasive on this site, but will be managed to improve survival of shrub planting.
- Planting within reed canary grass had proven to be unsuccessful at Colony Farm. Reed canary grass is to be dug-out in localized planting sites. Establish ground cover immediately with seeding and/or protective materials such as biodegradable erosion control.
- Seeding grasses such as local grasses have shown to improve establishment of trees and shrubs. Seeding reduces surface erosion, enhances soil absorption and stability. The seed mix will be based on site specific conditions. The mix could include shrub and tree seed. Seeding is to occur in the spring (March - April) or fall (September – October). All exposed (disturbed) soils are to be seeded.
- Minimize the area of disturbed soil where possible. All works completed are to be completed following Best Management Practices to avoid, limit, or mitigate impacts to water quality, and quality of aquatic & riparian habitats. Avoid work during predictable periods of wet weather, and coordinate the work to minimize the amount of time that soils are subject to erosion.
- Provide watering for plant establishment for a minimum of two years.
- The planting layout is to consider park values. Open views into the fields are preferred, as well as for sight lines for raptors. Additional perching places, such as large trees would be desirable.
- On-site soils from the excavation of channels will be mixed (turned-over) and re-used for planting areas. Likely, soil layers would not be able to be separated during excavation. All proposed planting is in native soils - no imported top soil is proposed.
- For soil fertility, perhaps legumes such as lupines could be included in the planting.
- All tree and shrub species shall be native to the local area and where available, of guaranteed nursery stock for successful transplanting. All plant materials shall conform to the BCLA/BCNTA Landscape Standard.
- When nursery stock is used, the correct botanical name should be used to order planting stock and tags should be left attached for field identification.
- Purchased plant stock should be a minimum of 2 years old, and if transplanting an entire area, planted no greater than 2.0 meters apart for all stock.
- Salvage native plants wherever possible for replanting of the disturbed area, which can also be counted as replacement vegetation.
- Fruiting trees and shrubs should be planted to promote re-colonization by seed and provide wildlife food sources.
- Stock should be planted in the fall (September to October) or spring (March to April) depending on local conditions.
- To ensure success of the transplants, at least 80% should survive within the first year of planting.
- Additional fertilizing may be required to establish vigorous vegetative cover throughout the first year of growth. If fertilizer is deemed beneficial during the monitoring period, a slow release fertilizer such Nutricote T40, may be applied in the spring (as per the manufacturer's specifications) with written approval of the project field supervisor.
- Project monitoring will be conducted for 5 years after completion of the channel rehabilitation works.
- Monitor for animal intrusion. Protective measure such as fencing or tree guards may be required.
- Maintenance during the 5 year monitoring period shall include documenting and assessing dead and dying plant species, soil erosion, invasive species, pest damage and plant competition. Recommendations on the required maintenance to be meet rehabilitation objectives will be provided as necessary, following each visit. Beaver damaged plants will not be replaced - a mix of woody species is provided to minimize loss.

Table 2. Proposed candidate plants for Wilson Farm North riparian zone.***Candidate Plants for Wilson Farm North Riparian Zone Enhancement***Old Field Habitat

Grass species mix as used on the Wilson Farm in the past, as recommended by Canadian Wildlife Services.

New Channel Enhancement: Cattail Ledge

Typha latifolia Cattail

New Channel Enhancement: 2:1 side slopes

Grass species mix as used on the Wilson Farm in the past, as recommended by Canadian Wildlife Services.

Riparian Zone: trees and shrubs in hedgerows

<i>Betula papyrifera</i>	birch
<i>Cornus stolonifera</i>	red osier dogwood
<i>Corylus cornuta</i>	hazelnut
<i>Crataegus douglasii</i>	hawthorn
<i>Lonicera involucrata</i>	fly honeysuckle
<i>Populus balsamifera</i>	black cottonwood
<i>Physocarpus capitatus</i>	Pacific ninebark
<i>Rhamnus purshiana</i>	casacara
<i>Rosa nutkana</i>	Nootka rose
<i>Salix scouleriana</i>	Scoulers willow
<i>Sorbus aucuparia</i>	mountain ash
<i>Spiraea douglasii</i>	hardhack
<i>Symphoricarpos alba</i>	snowberry

Riparian Zone: trees and shrubs in forested areas

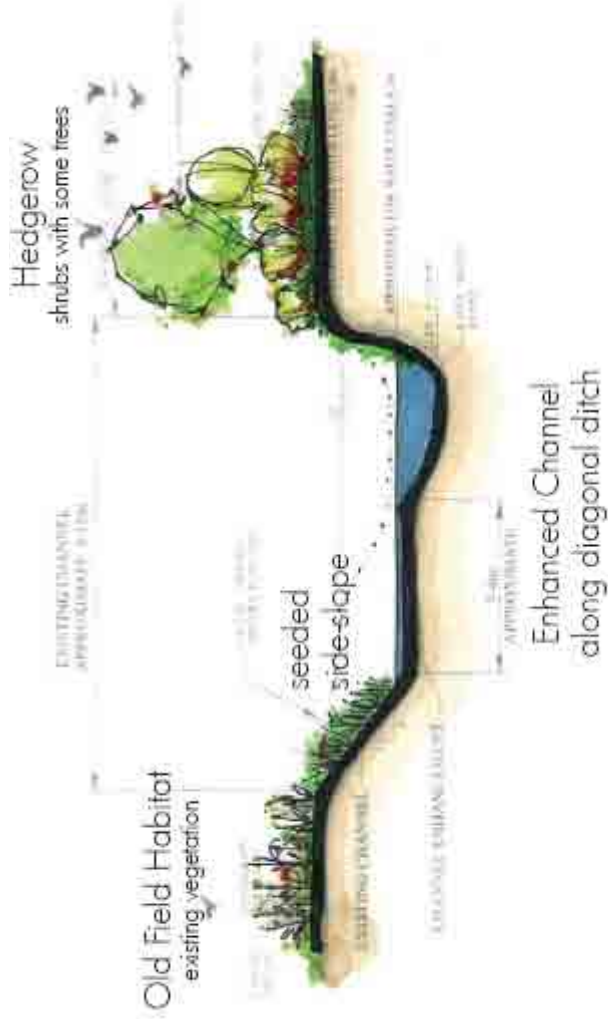
<i>Acer circinatum</i>	vine maple
<i>Acer glabrum</i>	Douglas maple
<i>Amelanchier alnifolia</i>	saskatoon
<i>Mahonia aquifolium</i>	Oregon grape
<i>Oemleria cerasiformis</i>	Indian plum
<i>Pinus contorta</i>	pine
<i>Prunus emarginata</i>	cherry
<i>Pseudotsuga menziesii</i>	Douglas-fir
<i>Rosa gymnocarpa</i>	baldhip rose

Riparian Zone: trees and shrubs in wetland areas

<i>Alnus rubra</i>	red alder
<i>Cornus stolonifera</i>	red osier dogwood
<i>Malus fusca</i>	Pacific crabapple
<i>Rubus spectabilis</i>	salmonberry
<i>Salix lucinda</i>	Pacific willow
<i>Spiraea douglasii</i>	hardhack
<i>Thuja plicata</i>	Cedar
<i>Viburnum edule</i>	high bush cranberry

Riparian Zone: in channel bench planting

<i>Salix spp.</i>	willow
<i>Carex obnupta</i>	slough sedge
<i>Carex stipata</i>	saw-beak sedge
<i>Juncus ensifolius</i>	dagger-leaved rush
<i>Scirpus lacustris</i>	hard-stemmed bulrush
<i>Scirpus microcaprus</i>	small-fruited bulrush



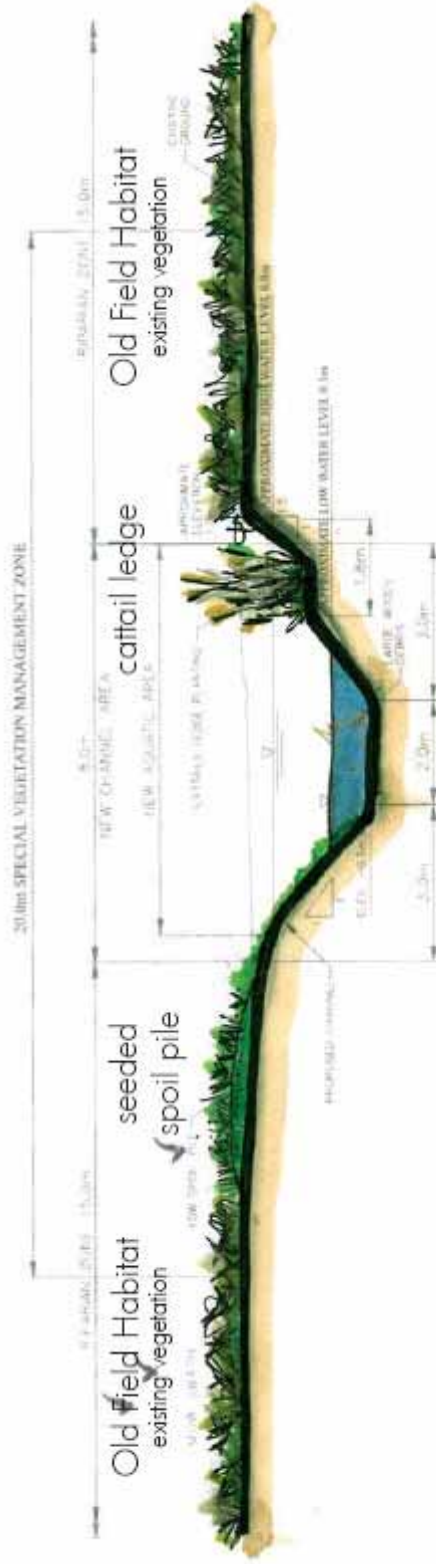
- Riparian Zone: hedgerows**
- Betula papyrifera birch
 - Cornus stolonifera red osier dogwood
 - Corylus cornuta hazelnut
 - Crataegus douglasii hawthorn
 - Lonicera involucrata fly honeysuckle
 - Populus balsamifera black cottonwood
 - Physocarpus capitatus Pacific ninebark
 - Rhamnus purshiana cascara
 - Rosa multiflora Nooska rose
 - Salix scouleriana Scotlers willow
 - Sorbus aucuparia mountain ash
 - Spiraea douglasii hardhack
 - Symphoricarpos alba snowberry

Grass species mix as used on the Wilson Farm in the past, as recommended by Canadian Wildlife Services.

- Riparian Zone: in channel bench planting**
- Salix spp. willow
 - Carex obnupta slough sedge
 - Carex stipata saw-beak sedge
 - Juncus ensifolius dagger-leaved rush
 - Scirpus lacustris hard-stemmed bulrush
 - Scirpus microcapus small-fruited bulrush



Figure 6. Proposed riparian plantings for the enhanced channel along the diagonal ditch.



Typical New Meandering Channel
Grass Riparian
(loop Channel)

Old Field Habitat: seeded

Grass species mix as used on the Wilson Farm in the past, as recommended by Canadian Wildlife Services.

Figure 7. Proposed grass riparian plantings for new meandering channels (loop channel).

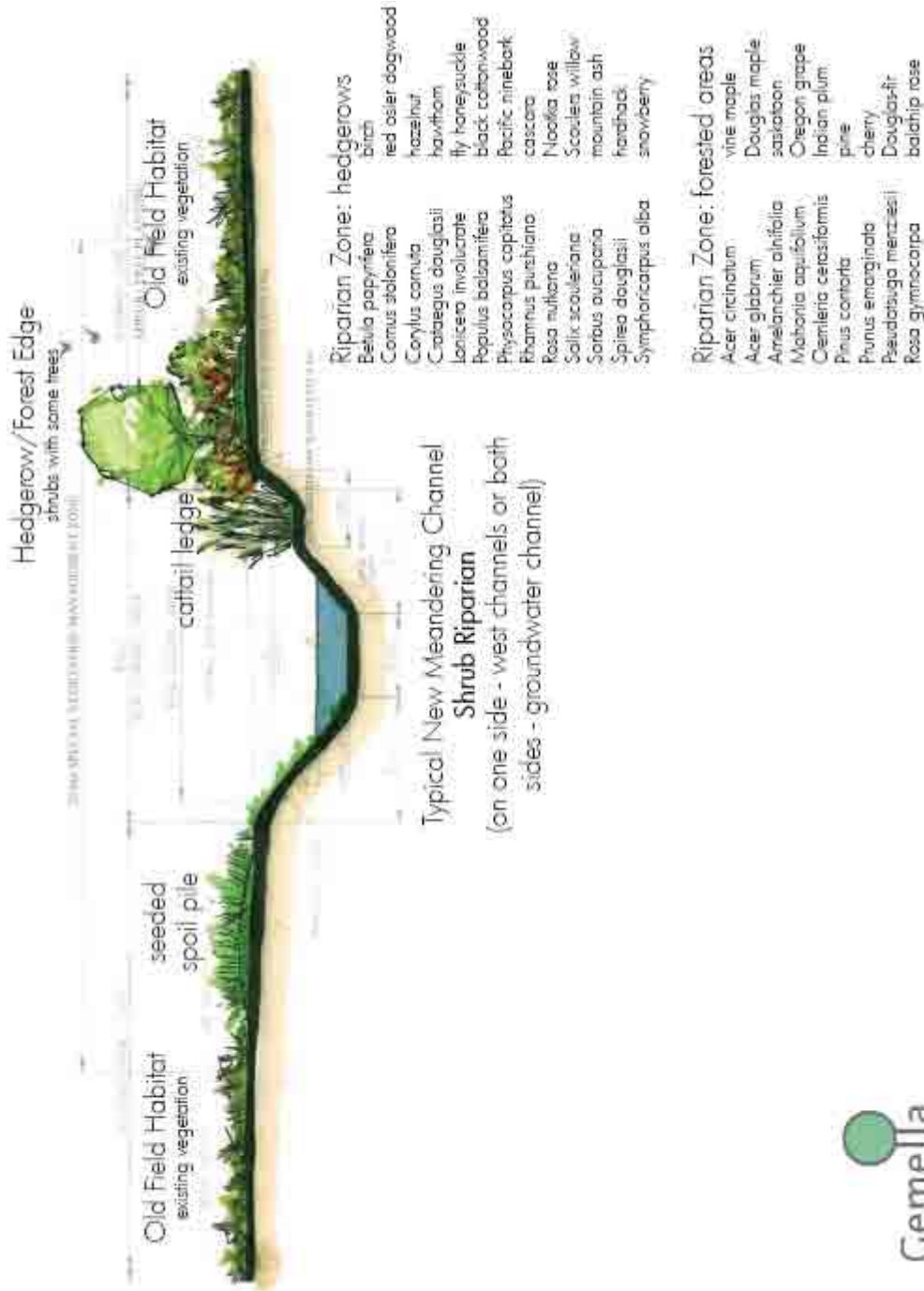


Figure 8. Proposed shrub and grass plantings on riparian zones of new meandering channel.

