



Port Mann / Highway 1 Project

Transportation Investment Corporation

TAC Environmental Achievement 2012

Wilson Farm Habitat Enhancement Project at Colony Farm Regional Park

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| Construction: | <i>Kiewit Flatiron General Partnership</i> <i>Quantum Murray Environmental</i> <i>Kwikwetlem First Nation</i> <i>CNN Services and Musqueam Indian Band</i> |

The Port Mann Highway 1 Project is a \$3.3 B highway infrastructure improvement project which is being delivered by the Transportation Investment Corporation (a Crown agency associated with the BC Ministry of Transportation and Infrastructure). Work includes the construction of a new 10-lane Port Mann Bridge and 37 km of widening and new interchanges from McGill Street to 216th Street in Langley. Significant environmental habitat enhancements are being implemented as an inherent component of these infrastructure improvements. A project team, including Hatch Ltd. environmental staff, was assembled by the Transportation Investment Corporation (TI Corp) to oversee the design and construction of this enhancement work.



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The Wilson Farm Habitat Enhancement Project, located within Metro Vancouver's Colony Farm Regional Park, is the largest environmental enhancement undertaking performed as part of the Port Mann Highway 1 (PMH1) improvements and is also among the largest habitat compensation works ever undertaken for a BC transportation project. The park is located near the confluence of the Coquitlam River with the Fraser River, just upstream of the Port Mann crossing (see **Photos 1, 2**). This 65 ha site was high intertidal habitat prior to its conversion to farmland in the early 1900's when dikes were constructed to prevent tidal flows from the Coquitlam River from entering the site. The Wilson Farm Habitat Enhancement Project was based on re-introducing tidal flows into an existing network of agricultural drainage and providing access for young salmon and other fish for the first time in over 100 years.

The project includes constructing channels and ponds, installing tide and sluice (overshot) gates, riparian planting and upgrading the existing pump station for "fish-friendly" operation. The design for this work was initiated in 2008 and was complete in early-2011 with onsite construction of the work being performed during the period of August-October 2011. ***The project created approximately 3.8 ha of tidally-influenced aquatic habitat and 12.5 ha of associated riparian habitat.***

During planning and implementation of the Wilson Farm Habitat Enhancement Project, a number of institutional and technical challenges were encountered. To overcome these challenges, innovative solutions were developed to optimize the objectives for fish and wildlife habitat. A summary of the details associated with these solutions is as follows:

Turning Challenge into Opportunity: During the CEAA/BCEAA environmental review of the PMH1 project, compensation requirements for the project were found to exceed the available habitat adjacent to the Project corridor. Given that it is an existing major highway, with long culvert crossings and established highway drainage, opportunities to create habitat within the corridor were also limited by adjacent urban development, and challenging soil conditions. Consequently, Fisheries and Oceans Canada (DFO) allowed PMH1 to consider meaningful and significant habitat opportunities in areas outside the immediate influence of PMH1, and therefore, somewhat outside the hierarchy of preferences approach DFO typically requires for infrastructure developments. This led to a feasibility screening of over 30 potential sites throughout the Lower Fraser River area to identify sites that would:

- ✓ meet DFO criteria for habitat compensation
- ✓ be cost-effective
- ✓ provide long-term fish habitat that would be low maintenance and productive.

Representatives from local First Nations, DFO and the PMH1 project team collaborated to bring forward a number of off-corridor concepts. LGL Ltd., on behalf of Musqueam First Nation, prepared a report (2008) that identified sites that would assist in restoring

Lower Fraser River coho salmon populations. On behalf of PMH1, Coast River Environmental Ltd. screened the site proposals and six proposals (including Wilson Farm) appeared acceptable to DFO and were considered feasible¹. Of the proposals examined, Wilson Farm would contribute the largest area of environmental habitat. Situated within a protected area that has a habitat conservation mandate, the envisioned habitat enhancements suited the sustainability objectives of Metro Vancouver for this park. Existing physical limitations included the absence of a fish-accessible connection to the tidally-influenced Coquitlam River, low dissolved oxygen levels in the channel system, and low aquatic diversity. TI Corp considered it a priority candidate, but in order to proceed, it would need at minimum, acceptance by Metro Vancouver and the Kwikwetlem First Nation.

Addressing agency and public concerns: The Wilson Farm project area is situated in a portion of the park designated for wildlife management, under the park's Land Use Plan. Since park establishment in 1995, the management focus had been on terrestrial/avian species. Colony Farm Regional Park also has a very active contingent of environmental stewards. Further to this, Metro Vancouver is conscious of its public trust responsibilities and therefore, is cautious of any proposals that would physically change the park. TI Corp recognized that its delivery team would have to include acknowledged experts in fisheries and wildlife habitat requirements that could guide it through the planning, design and approval phases of the proposed work. TI Corp retained LGL Ltd as the design lead and to provide expertise in fish habitat design and wildlife management. The team included Kerr Wood Leidal (hydraulic modeling and engineering), Gemella Design (landscape design), Talisman Environmental (agrology) and Brown and Oakes (archaeology). Metro Vancouver Parks had an excellent database of existing conditions which were augmented by design-specific assessments of fish and wildlife presence, water quality and rare plants carried out by Coast River Environmental Services.

A collaborative design process began in 2008 and continued to 2011. Design consultation and approvals included four public meetings, three stakeholder workshops, three multi-agency meetings, and numerous additional meetings with First Nations, stewardship groups, DFO, Metro Vancouver and others.

The key feature of the design was creating a tidal connection through the dike. Self-regulating side-mounted tide gates have been increasingly favoured for this application, as they have proved to have better fish accessibility than top-mounted gates (see **Photo 3**). In addition, an improved connection was needed through the substandard dike that

¹ Five of the six Musqueam /LGL Ltd. proposals have been or will be constructed by TI Corp as part of the PMH1 Project. Off-corridor works will contribute about half of the necessary habitat compensation for the PMH1 Project.

separates the north portion of Wilson Farm from the area drained by the pump station. An overshoot/sluiice gate was designed to accommodate this function and provide a failsafe overflow mechanism (see **Photo 4**). To ensure that fish are able to exit Wilson Farm throughout the year, even when the tide gates are closed during freshet, a fish-friendly upgrade to the existing pump station is underway. The upgrade includes installing roto-dynamic pumps (commonly used in sewage treatment plants!) and reconstruction of the existing outfall to provide for the safe entry of the fish into the Coquitlam River.

DFO had suggested that the design emulate agricultural drainage by adding straight drainage channels. This initial concept would provide a large area of aquatic habitat spanning more than 100 ha of the park. Although the design appeared visually to be quite intrusive, in actuality, it would have been typical of farm drainage development carried out throughout the Lower Mainland. The design team's interpretation of DFO's suggestion is shown in **Figure 1**.

However, initial feedback to the preliminary design concept from MV and the local stewardship groups was less than enthusiastic and MV requested that TI Corp consider a more "modest" design that minimized perceptible change to the existing conditions. A design strategy was formulated to:

- 1) minimize loss of old field habitat;
- 2) maintain large central patch size to old field habitat;
- 3) coordinate with ongoing vegetation management within central portion of old field habitat;
- 4) meet objectives of the Sustainability Plan for Colony Farm;
- 5) construct 'meandering' rather than straight channels, especially where new channels are built.

In accordance with the design strategy, proposed channels within the central portions of the Wilson Farm fields were eliminated from the concept and replaced with enhancements of existing perimeter ditches, thereby significantly reducing disturbance to central core of old field habitat. A relatively small amount of new channel habitat was proposed that would provide hydraulic connection between the existing perimeter ditches. This new channel habitat included the construction of:

- a "groundwater channel" which was designed to intercept cooler groundwater entering the site from higher elevations
- a "loop channel" which included several deep pools
- several meanders at selected locations on the existing channel network

To refine the design and obtain input from the stewardship groups associated with the park, two design workshops were held with several subsequent bilateral meetings. Participants at these workshops and meetings included representatives from First Nations, federal, provincial and local governments, and stewardship groups as well as

the design team's managers and technical specialists. The Kwikwetlem First Nation (KFN), as strong advocates for fish habitat restoration, requested that the design include additional new ponds to provide rearing habitat for salmonids. MV supported this addition as the ponds would act as 'sediment traps' to facilitate future maintenance and limit disturbance caused by ditch cleaning operations. KFN strongly supported the groundwater channel design feature. At the request of DFO, field swales were incorporated into the design to improve drainage, facilitate nutrient flushing and function as spring salmonid habitat and modifications were made to the tide gate design to enhance fish access. Numerous wildlife features were added in consultation with Colony Farm Park Association and Burke Mountain Naturalists. Consensus on design features was assisted by DFO, notably one of their habitat restoration biologists, Matt Foy.

In 2010, the design had evolved to optimize aquatic and terrestrial habitat function and to meet the criteria outlined by Metro Vancouver (see **Figure 2**).

Balancing aquatic and wildlife habitat objectives: Stewardship groups voiced strong concerns about potential impacts of the project on old field habitat, which is becoming increasingly rare in the Lower Fraser lowlands. Design consultation involved numerous iterations of the design concept prior to progressing to detailed design. As consultation progressed, the design trended towards optimizing the balance of fisheries habitat with upland values for songbirds, raptors and great blue herons. To ensure that the design incorporated features that were consistent with the parks management objectives, Metro Vancouver provided a list of design objectives including the following:

- Surplus material excavated from channel/pond construction to be kept on site to construct berms and other elevated area for trees and shrubs;
- Trees to be planted intermittently and not blocking the public's viewing opportunities into fields
- Plantings, slopes and landscaping on channel and ditch edges were to be designed to be beneficial to wildlife as well as fish (see **Figure 3**)
- Monitoring and documenting of the effects of the project on the site. Necessary remedial work would be planned based on the results of fish sampling, bird monitoring, water exchange and sedimentation.

Much of existing vegetation in the Wilson Farm north area was reed canarygrass, interspersed with red elderberry and small groves of birches and some planted trees (see **Photo 5**). This old-field habitat is used by certain raptors (e.g., northern harrier hawks and short-eared owls) to hunt small mammals such as Townsend's voles (see **Photo 6**). A small mammal study conducted by BC Institute of Technology (Hazell *et al.*, 2008) found that Townsend's voles were more fecund in fields rehabilitated with forage mix grass species, but had better survival in reed canarygrass fields. Conversely, raptors and other predators had poorer hunting success in reed canary grass.

Colony Farm is located on the Coquitlam River floodplain and therefore drainage is a significant challenge, particularly as a result of long-term natural subsidence, field elevations are typically at or below adjacent river levels. The park is also located in the Agricultural Land Reserve, which constrains soil management options. Therefore, it was considered beneficial to retain all excavated soils and redistribute to level low-lying areas and thereby improve field drainage (see **Photo 7**). Similarly, elevated berms were designed to improve drainage for shrubs and trees and provide areas of high ground for wildlife (see **Photo 8**). As noted earlier, field swales were added to improve drainage (see **Photo 9**).

The final design included vegetation features that mimicked characteristics of old-field habitat, rather than a shrub/tree-dominated riparian zone typical of fisheries habitat designs. Through use of existing channels, the design minimized disturbance of old field habitat (see **Figure 2**).

Design considerations for channel margins had to achieve a reasonable balance between the life history requirements of bird species present in the park and those for rearing salmon (coho and Chinook). As is typically required on habitat projects, a native species mix for riparian plantings was designed. However, the planting density was much lower than is typical. Species considered for planting were evaluated in light of Metro Vancouver's considerable experience with plantings in the park as well as recommendations from Colony Farm Park Association and Burke Mountain Naturalists. For example, marsh benches, which increase aquatic habitat diversity and productivity by providing areas for establishment of emergent and submergent vegetation, were also intended to provide shallow water foraging sites for waders, such as Great Blue Herons (see **Figure 3**).

Institutional Challenges: In addition to technical challenges, some of which have been described above, the Wilson Farm Enhancement Project had its share of institutional and permitting challenges, although they arose from quarters not typically encountered on transportation projects. Typically, habitat compensation is scrutinized by the federal and provincial agencies having jurisdiction, i.e., DFO and the Ministry of Environment. However, DFO had been actively engaged in the design process and was supportive of the project. DFO voiced this support in public meetings, Metro Vancouver Board meetings and city council meetings. Staff from the Ministry of Environment had also been involved in the design consultation and had few issues during permitting. Strangely enough, it was the local naturalist group that had the strongest objections. However, their input to the design process was invaluable to achieving a project that meets many objectives and has a strong ecologically sound basis.

Wilson Farm Habitat Enhancement Project is located on Metro Vancouver lands and within the City of Port Coquitlam, therefore approvals were needed from both

jurisdictions. The Metro Vancouver process was initiated with a letter of intent between TI Corp and Metro Vancouver Parks and concluded two years later with approval by the Metro Vancouver Board in early 2011. Metro Vancouver staff support for the project was instrumental in the approval. Port Coquitlam's development permit process for habitat works was new and largely untested and the outcome was less than certain. Again, Metro Vancouver staff worked extremely hard to obtain a successful outcome. Development permits were issued in July 2011, just in time for construction to proceed within seasonal fish and wildlife timing windows.

Tight construction timelines: Due to the site's importance for nesting birds and concerns raised by stewardship groups, earthworks did not begin until August 8, 2011. All earthworks were scheduled to be completed by mid-October when it was anticipated that wet weather would hamper equipment movements in the fields. The project schedule was maintained by the following:

- Pre-ordering tide gates and overshot gates that had a long delivery time
- Selecting a skilled contractor with extensive resources and experience
- Selecting equipment that could operate in soft, wet soils
- Using multiple work crews throughout the project site
- Closely coordinating activities through onsite meetings
- Extending hours of work (up to 12 hours per day) and working night shifts

The final task for the construction works was to hydro-seed all areas of exposed soil. Due to the wet weather in October that created very soft soil conditions on site (see **Photo 10**), the use of conventional truck-mounted equipment was proving to be very time consuming and completion of the hydro-seeding within the growing season was in question. This challenge was overcome by innovatively using a helicopter to spread the hydro-seed mixture (see **Photo 11**). Land-based tanks and mixers were set up to fill a 1,000 litre Bambi bucket slung by the helicopter. The Bambi bucket is typically used for fire-fighting, but is easily adapted for this application and could very accurately target areas for seeding (see **Photo 12**). This process was effective in hydro-seeding over ~14 ha in about four days.

Good value: Costs for the Wilson Farm enhancements included design and construction (earthworks, gate structures and an upgraded pump station), commissioning and training, and maintenance plus 5 years of post-construction monitoring. During design consultation, cost control was assisted by keeping the design at the concept stage for 2 years prior to progressing to detailed design. Because of the significant infrastructure benefits for water management, Metro Vancouver treated the drainage improvements as in-kind contributions in lieu of tenure or other property costs. Typical unit costs for creation of aquatic and riparian habitat range from \$50-\$100 / m²; in contrast, preliminary unit costs at Colony /Wilson Farm are about \$35 / m².



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Wilson Farm represents an innovative approach to habitat compensation for major highway developments. This approach should be encouraged, not only to resolve regulatory issues and stalemates, but to provide much needed funding for productive and valuable habitat enhancements that do not currently meet the DFO compensation criteria. In urban areas, such as Metro Vancouver, bona fide habitat compensation is increasing hard to find and is often fraught with feasibility issues, such as land ownership, high costs, difficult access or competing priorities. In the meantime, worthwhile, productive and cost-effective habitat enhancements, such as removal of obstructions, riparian plantings, or channel stabilization initiatives languish year after year due to lack of funding. Transportation agencies could be instrumental in working with DFO representatives across the country to change the paradigm about what constitutes habitat compensation.

References

Hazell, S., F. Ogilvie, and J. Regnier. 2008. Comparison of Townsend's vole (*Microtus townsendii*) populations in managed mix grass and unmanaged reed canarygrass fields: Colony Farm Regional Park, Coquitlam, BC. Student paper, British Columbia Institute of Technology.

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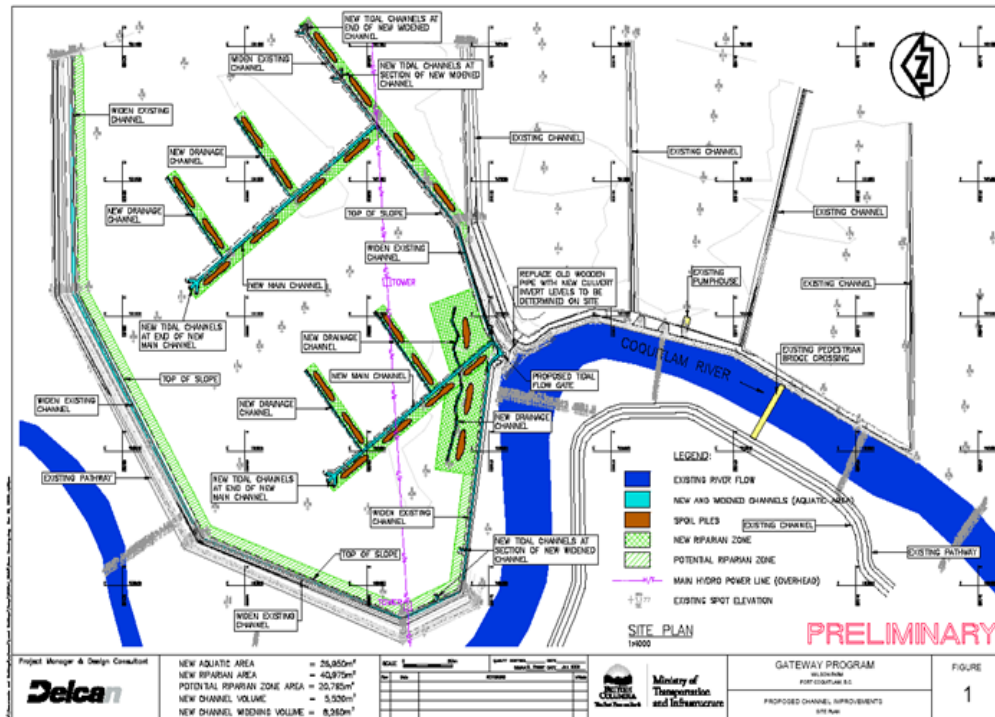


Figure 1: Preliminary Design Concept, March 2009

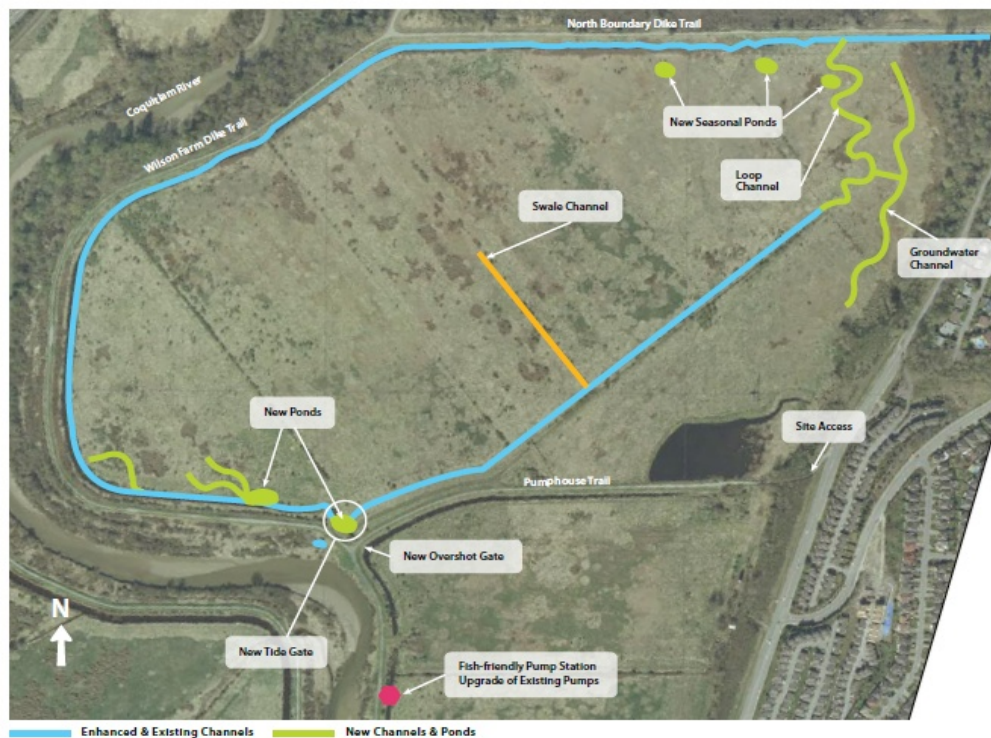


Figure 2: Wilson Farm North Habitat Design, May 2010

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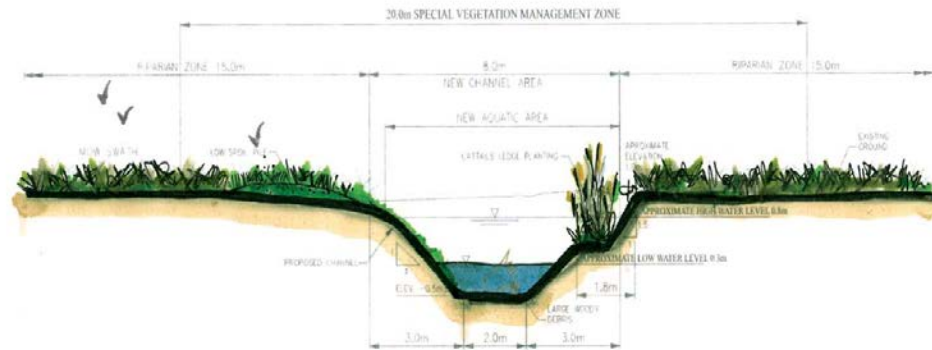


Figure 3: Typical new channel cross-section showing marsh bench feature
(Courtesy Gemella Design)



Photo 1: Port Mann Bridges with Wilson Farm located top right

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Photo 2: Wilson Farm prior to construction (Courtesy KFGP)



Photo 3: Installing the side-mounted self-regulating tide gate

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Photo 4: Wilson Farm tide gate, overshoot gate and pond construction



Photo 5: Wilson Farm old-field habitat - reed canarygrass and red elderberry

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Photo 6: Townsend's vole in old-field habitat
(Courtesy of Delta Farmland and Wildlife Trust)



Photo 7: Leveling to improve field drainage and avoid soil relocation off-site

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Photo 8: Berm planted with shrubs and augmented with coarse woody debris



Photo 9: Newly constructed field swale at Wilson Farm

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Photo 10: Challenging soil conditions in early October



Photo 11: Helicopter hydroseeding at Wilson Farm

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Photo 12: A day's progress of helicopter hydroseeding