VanAqua Wetland at Aldergrove Lake Regional Park

Hydrologic Assessment and Recommendations – Technical Document

Prepared for: Vancouver Aquarium
Metro Vancouver Regional Parks
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Summary

We propose a wetland restoration project in the eastern Fraser Valley that will use and test habitat features designed to reduce bullfrog densities and promote Oregon spotted frogs. The wetland will remove drainage features on old-field habitat and restore a permanent, shallow water marsh ecosystem in the Fraser Valley. This will require site preparation for reed canary grass control, restoration of hydrology through infilling of ditches and plugging of drain tile, pond excavation and water control installation, and follow-up planting and monitoring.

1 Purpose:

Recreate shallow-water and marsh wetland habitat on historic agricultural fields to provide recovery habitat for the endangered Oregon spotted frog and enhance general wildlife biodiversity, with a particular focus on Species-at-Risk.

2 Oregon spotted frog habitat needs:

Oregon spotted frogs require permanent shallow water marshes with complex aquatic / terrestrial structure and semi-dense emergent vegetation. The minimum recommended habitat size for a self-sustaining population of Oregon spotted frogs is 2 – 4 Ha. Restored habitat must incorporate purpose-built breeding habitat, overwintering habitat, and summer foraging habitat. Depth targets will be 0 – 40 cm, with a spillway to avoid ponding deep water in the spring.

3 Aldergrove Lake Regional Park

The identified area of ALRP is a historic wetland that was developed for agricultural purposes. The field has little microtopographical variability and is dissected by dug ditches draining to the south over a total drop of approximately 1 m over 250 m (0.4% slope). Drainage tiles are present in the south field, and are presumably present throughout the site. The constructed drainage features have resulted in a wet field that is dry in late summer. No surface water was present in watercourses through multiple site visits in August 2012. See Appendix 1 for a map of initial survey.

4 Constraints and Opportunities

Invasive species

Reed Canary Grass (RCG) is dominant across the proposed restoration site, and in all surrounding fields. Native plants present are limited to stinging nettle and a few planted willows at the east edge of the field. Several cottonwood trees have also been planted at the south end of the main drainage ditch.

Successful reed canary grass control is crucial to the success of this project. Reed canary grass is a hardy, early to leaf plant species that easily outcompetes native vegetation in shallow wetlands. Though challenging, marsh restoration in the Pacific Northwest must focus on replacing this species with native wetland plants.

Controlling RCG is a multi-step, multi-season process requiring: 1) killing / removal of existing plants and rhizomes; 2) exhausting the seed bank; 3) active restoration (re-seeding); 4) prevention of re-invasion; and 5) continued monitoring and follow-up treatments. Removal of the root mass is most important to prevent re-infestation of the site. Although RCG is aggressive in aquatic conditions where root matter exists, seeds are drowned in permanent water and are slow to establish in low nutrient sites.

The most effective and efficient means of reed canary grass control is application of a glyphosate-based herbicide. This is recommended on sites with no water present, although in the US, an aquatic-approved formulation is being used for marsh restoration in wet meadows. Successful applications require pre-treatment mowing of the existing plants, as well as regular post-application tilling continuing to restoration. Alternatively, excavation of topsoil can be used to remove containing roots ,stems and plants. This is recommended only in sites with active restoration plans as it is costly and results in an abundance of material that must be dealt with on site.

Once the root mat has been destroyed, altering hydrology (raising the water table) becomes a useful control technique. Simultaneous to hydrological restoration, dense seeding and plug planting with a variety of native species is necessary to restore the site. The site currently appears to be nutrient-poor, as demonstrated by a shallow root mat (10 cm) and relatively low plant height (50 cm). This nutrient-poor status must be maintained for the success of the wetland, and will be improved by disallowing manure or fertilizer spreading on fields upstream of the site within ALRP.

Bullfrogs are present in the Gordon's Brook complex, and this project will actively seek to provide shallow marsh habitat that excludes high density colonization by adult bullfrogs. This requirement limits the depth of the desired wetland to approximately 40 cm.

Hydrology and Substrate Variability

The key to providing appropriate Oregon spotted frog habitat that will not be re-invaded by reed-canary grass and bullfrogs is water depth. A desired permanent water depth of 30 - 40 cm should be deep enough to deter RCG and bullfrog invasions, while providing appropriate habitat to Oregon spotted frogs. Winter water depths are less crucial during the bullfrog's long overwintering season (early October – May) and RCG's dormant period (November – early March). Water source and retention structures will be required to ensure stable water levels, and should be designed to allow for human-powered modification.

Test pits indicate that soils are highly variable across the target area, ranging from clay to sand to peat to gravel. Each test pit was significantly different to the other (See Appendix 2). Water seepage lines (permanent low-water line with drainage features present) were deep, and sometimes associated with sand/clay barrier layers within the soil profile.

East of the main drainage ditch, clay and organics overlays sand. While this site should be considered for future restoration works as an ephemeral wetland, it is not suitable for permanent water restoration without deep digging (Test Pits 1, 2, 3).

West of the main drainage ditch, soils consist of peat, organics, loam and clay, with some fine silts / sands to the eastern edge, and a high water table at the north that is at a higher elevation than ground-level farther south. Soils are more appropriate to permanent pond construction, and it is possible at this location to connect into Gordon's brook for additional water provision.

Hydrologic restoration will require us to first disable constructed drainage features (ditches, drain tiles) and reconnect the site to a permanent water source (groundwater at north end / Gordon's Brook). Dug ditches must be plugged to restore the water table, and can be used for spoil deposit. Drain tiles must be identified through excavation and plugged with a clay barrier. A detailed topographic survey conducted in the spring of 2013 of the west field will indicate the most suitable locations for excavation.

Research

Reed canary grass control methods are new to the Fraser Valley, although they have been studied in the US Pacific Northwest for over 15 years. This project could provide a research opportunity to University or College students, as well as restoration professionals, to assess RCG control techniques in the Fraser Valley. A student of BC Institute of Technology Environmental Restoration Program has proposed a research project around reed canary grass control at wetland restoration sites; this location would be ideal for her project.

Additional research opportunities will come from monitoring invasive bullfrog colonization of the wetland as it matures, as will the eventual introduction of endangered Oregon spotted frogs.

Pubic Engagement

Excavated materials can also be used to construct trails on elevated berms that act as water control structures, and provide viewing platforms. Public engagement is an important goal of the project, and low-impact trails will be developed through the site. However, final trail placement will likely be determined at the time of construction and excavation, as the variable nature of subsoils is certain to alter the design in unexpected ways.

5 Restoration Options and Recommendations

Location

Three distinct sites within ALRP were initially considered for restoration. Following discussions with Metro Vancovuer, we chose to focus initial hydrologic exploration in the lower east field directly west of Gordon's Brook (~ 4.5 Ha). This site was chosen as it is large enough to provide a wetland for Oregon spotted frogs, is connectable to Gordon's Brook, has high exposure, and is well placed experientially for park visitors. The site is overlooked by the location of the potential visitor's centre, and directly adjacent to an existing 'habitat' zone.

Hyrdologic and soil assessments indicate that the eastern portion of the lower field (east of the fence line) is most appropriate for restoration. The variable nature of the soils and the presence of field-wide drainage structures requires that the whole 2.5 Ha be impacted by the restoration. Ideally, much of it will not be in permanent water, but will be a wet meadow of native wetland vegetation with pools and pockets of water in wet seasons. This will require reed-canary grass control measures over the full 2.5 Ha.

Hyrdology

Hydrologic restoration will require plugging of ditches and drain tile. Restoring ditches will require permitting from Fisheries and Oceans Canada (DFO), as well as an Instream Works permit from the Ministry of Forests Lands and Natural Resource Operations (MFLNRO).

The southernmost drainage watercourse along 0 Ave may be important to road drainage, and the appropriate agency should be consulted. Plugging this ditch would also restore hydrology to upstream fields on the north side of 0 Ave within ALRP. However, if there is interest in attempting additional

marsh restorations on those fields in the future, the 0 Ave watercourse should not be plugged at this time, so that land-based RCG control techniques can be used prior to hydrologic restoration. To avoid plugging this watercourse, a clay underground 'dam' should be built parallel to the watercourse to ensure water holds in the wetland, with an overflow into the remaining ditch.

The permanent water table at the north end of the field is sufficiently high to provide water to a marsh at the elevation of the main field, particularly if peaty and clay soils prove to underlie the majority of the field. Dependent on the findings of a detailed topographic survey of the site, the constructed marsh is likely to be near to the Gordon's Brook complex, and may also source water from the stream. As the marsh is to be very slow-moving, the removal of the small flows required are not expected to impact Gordon's Brook.

Reed Canary Grass

An integrated pest management approach is needed to control reed canary grass on the site. Initial control through glyphosate application is the most efficient manner of killing leaf, stem and roots, however Metro Vancouver Park Management policies may preclude this possibility. The alternative option is initial control by excavation of topsoil, however this is significantly more costly proposition and will result in a large loss of topsoil from the site, and is much less likely to be successful in eradicating viable root materials. Timelines for each option are shown in Table 1.

Reed canary grass control on site will be an expensive prospect, but will be essential to the long-term success of the project.

Control Stage	***Timing***	***Option 1 – Chemical and mechanical control***	***Option 2 – Excavation and mechanical control***
Initial Control	September 2012 (requires dry fields and watercourses)	Field preparation: mow and hay. Whole 2.5 Ha.	
	October 2012	Apply glyphosate using tractor boom in late summer to resprouting grass (approx. 12" height).	Excavate roots from field – as much as possible in allotted # of days (5 days for whole site). Pile in berms alongside ditches.
Seed bank exhaustion	Spring / Summer, beginning as soon as field is accessible to tractor	Tilling / harrowing at least 6 times in summer 2013. Potential for secondary glyphosate application in early August prior to construction	Tilling / harrowing at least 10 times. Note that berm piles will not be accessible to tractor and will remain a seed source over the summer unless controlled by other mechanical means (weed-whacker?)
Machine Cost		Approx. $ 10,000	Approx. $ 18,000
Hydrologic restoration	August / September 2013	Infill ditches, plug drain tile, create ponds, berms, water flow and water control devices.	
Machine Cost		Approx. $30,000	
Plant restoration	Immediately post-excavation	Seed with native wetland seeds.	
	Fall (October 2013)	Plant riparian / higher elevation berms / islands / trails.	
	Early spring (March 2013)	Plant plugs in depressions	

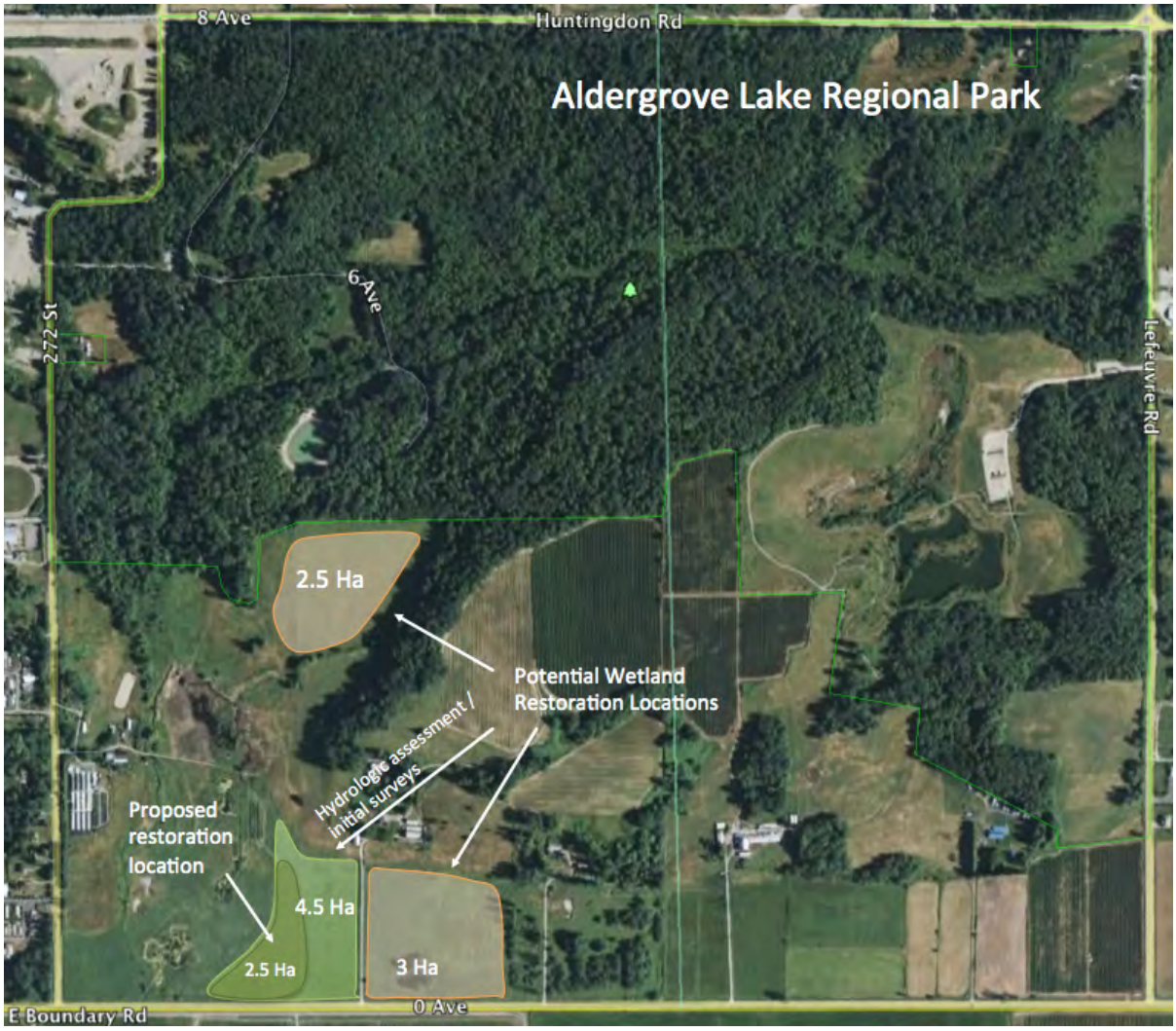
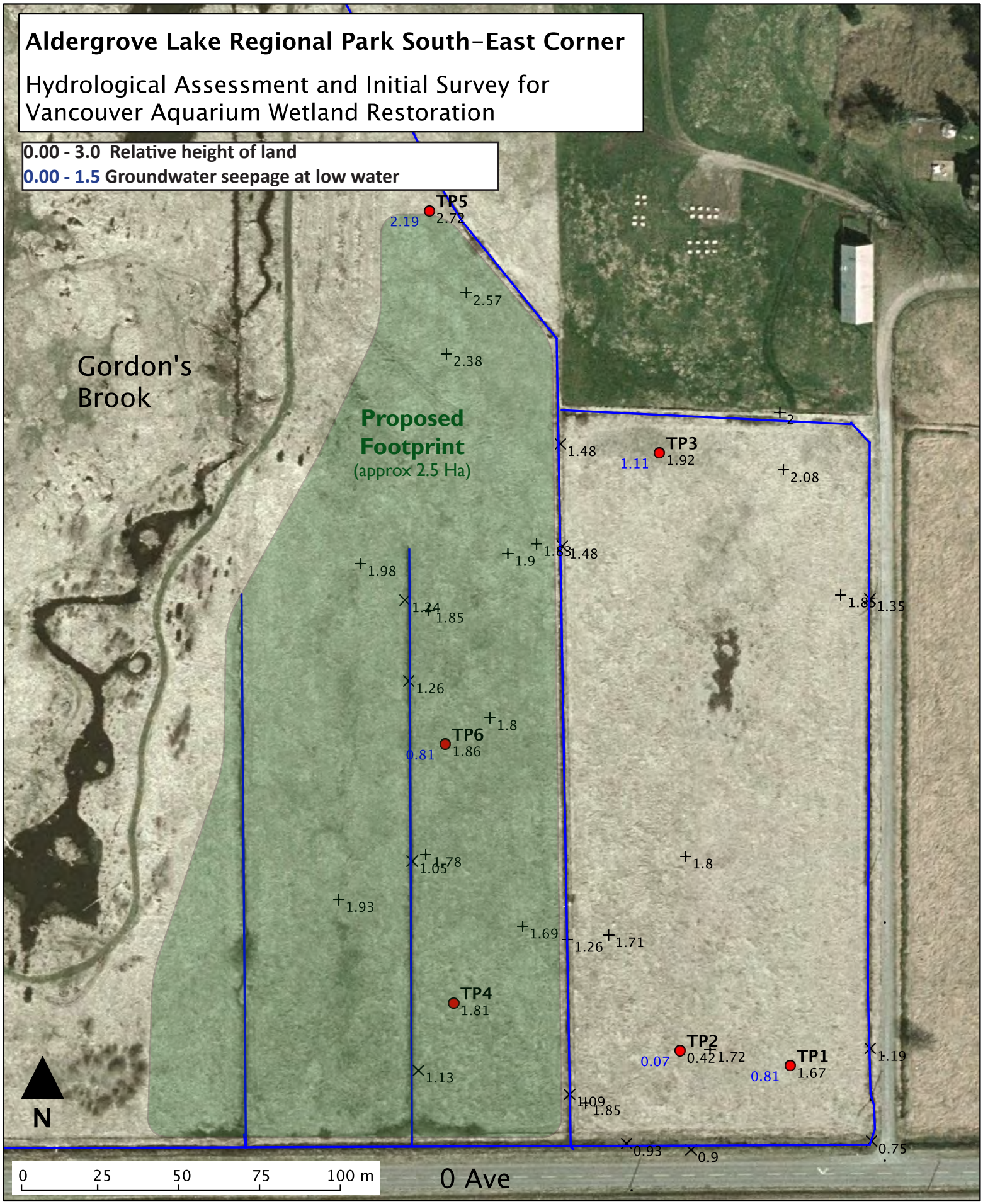
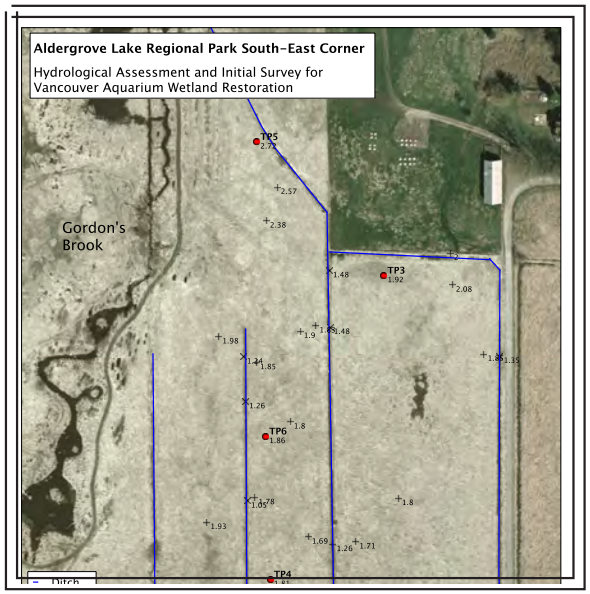


Figure 1. Location of assessed and selected wetland restoration sites in Aldergrove Lake Regional Park.


Aldergrove Lake Regional Park South-East Corner
Hydrological Assessment and Initial Survey for
Vancouver Aquarium Wetland Restoration
0.00 - 3.0 Relative height of land
0.00 - 1.5 Groundwater seepage at low water
Gordon's
Brook
Proposed
Footprint
(approx 2.5 Ha)
TP5
2.19
2.72
2.57
2.38
TP3
1.11
1.92
1.48
2.08
2
1.9
1.48
1.98
1.24
1.85
1.35
1.26
TP6
0.81
1.86
1.8
1.78
1.05
1.93
1.69
1.26
1.71
1.8
TP4
1.81
TP2
0.07
0.42
1.72
TP1
0.81
1.67
1.19
1.13
1.09
1.85
0.93
0.9
0.75
N
0
25
50
75
100 m
0 Ave



Test Pit Profiles Aug 8, 2012

Aldergrove Lake Regional Park South-East Corner

Hydrological assessment for Vancouver Aquarium Wetland

Water level wells installed at Test Pits 1,2,3,5,6.