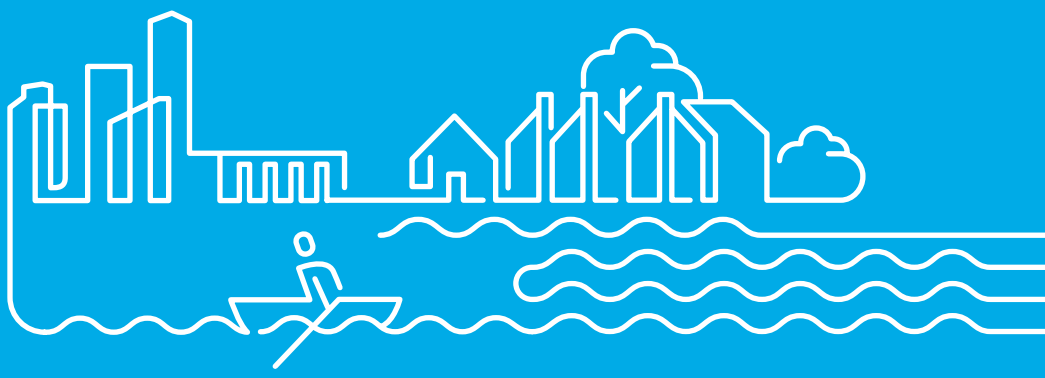
Stage 2: Final Environmental Assessment and Geotechnical and Earthworks Report

Prepared for

Waterfront Toronto

Prepared by

ch2m SM



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Executive Summary

The Port Lands is a 356-hectare (880-acre) area bounded by the Keating Channel/Don River and Lake Shore Boulevard in the north, the Toronto Inner Harbour in the west, Leslie Street in the east and Lake Ontario and Tommy Thompson Park in the south. Formerly the largest natural wetland in Lake Ontario, the area was infilled in the early 1900s to make more land available to serve Toronto's growing industrial sector. While still used for industrial and port purposes today, these brownfield lands are generally underutilized, lack adequate municipal services necessary for other uses and also fall within the flood plain of the Don River. Plans are underway to flood protect and revitalize this valuable part of the city via the Don Mouth Naturalization and Flood Protection Project (DMNP). The future uses following the revitalization include parkland, residential, institutional, community, and commercial land uses.

This due diligence level (Conceptual) assessment covers two work streams in support of due-diligence planning for the Port Lands flood protection and enabling infrastructure engineering, namely: 1) environmental, geotechnical and hydrogeological strategy and 2) civil (earthworks) engineering strategy. The assessment was completed in two stages. Stage 1 was completed in October 2015 based on information and data available at that time. Following Stage 1, additional environmental investigation were conducted by Waterfront Toronto and the landform/architectural design was further developed by Michael Van Valkenburgh Associates Inc. (MVVA). This report summarizes the work streams completed in Stage 2 and updates the reporting from Stage 1 to capture the additional work completed in Stage 2.

Significant changes or developments during the Stage 2 phase of the due diligence planning include:

- Additional environmental characterization data was collected within the project study area and the conceptual site model was revised. These revisions were also used to update other portions of the Stage 1 report, including the remediation report, SMP, and GMP.
- Conceptual design of the River Valley and infrastructure was revised as follows:
  - Grading plan was revised
  - Buried stone amour in the River Valley was replaced with sheet pile.
  - The scope of new project infrastructure was reduced
  - Cost estimates were updated based on new design
- Excavation and fill activity sequences were revised
- Cut and fill volumes were recalculated based on revised grading plan, and the dredged material to construct the sediment basin area is included in Stage 2 report

Report Use

The Stage 2 Report was prepared based on the environmental site characterization data and design information available at the time and as referenced through the report. The future strategies are subject to change as additional data is gathered, the designs progress and implementation plans are further developed.

The Stage 2 Report is intended to provide the strategies for the overall implementation of the earthworks and civil design, as well as the construction activities necessary to complete the project. It is noted that some geotechnical and environmental management plans beyond those documented in the Stage 2 Report have been included in due diligence assessments completed by other members of the due diligence team; these plans are specific to individual design elements. For completeness, strategies developed to manage specific design elements presented in other due-diligence plans should be reviewed in context of the over-arching strategies presented in this report.

Environmental, Geotechnical and Hydrogeological Strategy

Waterfront Toronto (WT) retained CH2M HILL Canada Limited (CH2M) to develop a comprehensive strategy to manage environmental, geotechnical, and hydrogeological conditions that will support the design of the Port Lands flood protection elements and enabling infrastructure.

Conceptual Site Model

The Port Lands was historically reclaimed from the eastern end of Toronto Harbour Commissioners Land by filling Ashbridges Bay between the mouth of the Don River on the mainland and Fisherman's Island to the south between the late 1800s and early 1900s. Initially, the lands were used primarily for heavy industrialized activities dating back to the early 1900s. Numerous environmental investigations and studies have taken place within the area since the 1990s that have identified widespread soil or groundwater contamination as a result of extensive historical industrial activities. The legacy of the Port Lands related to industrial use, infill soils, and former wetland have created the unusual juxtaposition of environmentally and geotechnically poor soils that challenge redevelopment.

In the Essroc Quay area, land is planned to be created early in the revitalization process. This shore infill project, as well as grades changes required for flood protection and construction of public realm features, will require significant quantities of fill soils. It is anticipated to the extent practical the project fill demand will be met through reuse of soils generated by the River Valley excavation. Excavated soil will require processing to achieve environmental and geotechnical properties that meet the project specifications to enable beneficial reuse within the project itself.

To construct the new River Valley through the Port Lands, over 1 million cubic metres (m^3) of soil is expected to be excavated or dredged. The excavated soil will be reused as fill for the construction of flood protection landforms, public realm features and infrastructure within the project footprint, to the extent practicable. Subsurface investigations conducted identified 1 to 5 metres (m) of debris and waste materials intermixed with imported soil overlying the native sediments. Native sediments consist of poorly graded sands, interbedded with discontinuous silt and organic soil layers. Sampling and laboratory analyses of soil within the project area indicate the presence of contaminants such as petroleum hydrocarbons (PHCs); inorganics; volatile organic chemicals (VOCs); and polycyclic aromatic hydrocarbons (PAHs), all contaminants common to the previous industrial uses. PHCs in particular are found to be widespread across the Port Lands, being the main contaminant and found at very high concentrations in some areas. Groundwater is also impacted with the same contaminants. Free-phase petroleum was found floating on the groundwater table in several areas.

Groundwater Management Strategy during Construction

New subsurface infrastructure is planned to be installed at depths below the water table. The high permeability of the soil and shallow groundwater table results in significant volumes of water to be removed during excavation activities. The water encountered or pumped during excavation activities will need to be treated to reduce contaminant levels before it is discharged.

The River Valley excavation depth is expected to be approximately 6 m along much of the route, increasing to approximately 10 m near the downstream portion. These depths include approximately 2 m of excavation below the planned final grade elevations to remove potential contamination and geotechnical unsuitable soil and accommodate placement of channel armouring materials per MVVA's design. The excavation will extend below the water table. Given the shallow groundwater table and soil conditions, pumping water out of the excavation is not expected to be practical. Groundwater is planned to remain in the excavation and wet-excavation techniques are proposed for below groundwater level excavation. The excavation depth will provide sufficient construction depth to build the grade structures, scour protection, wetlands, and other River Valley features. Water quality during

River Valley excavation will be managed in situ to reduce contamination levels within excavation and avoid contaminating newly constructed areas.

Soil Management Strategy during Construction

Soil excavated from the River Valley will be segregated and sorted into soil management streams. Mobile soil processing systems will be established at multiple locations near the excavation area. Soil screening, soil washing (for dry soils), and soil dewatering (for wet soils) will be completed, and soil will be immediately categorized for treatment or direct reuse. The soil will either be directly reused or hauled to the soil processing and stockpiling facility. Soil that does not meet site specific quality standards will be treated at the Soil Processing and Stockpiling Facility to reduce contaminants to target levels before the River Valley soil can be reused. Soil that does not meet specific geotechnical requirements for reuse will also be processed as required prior to reuse. Eighty to eighty-five percent of the soil from the River Valley is estimated to be reusable by the project. Some soil will need to be imported and unsuitable soil will need to be exported from the Port Lands to meet the overall project soil and fill material demands.

Environmental Management Approach

A Community-Based Risk Assessment (CBRA) will be completed to evaluate risks, design soil and groundwater management plans, and develop management measures for the area to protect people and the environment. Contaminant levels in soil and groundwater will be reduced to site-specific values established through the risk assessment process. Potential exposures to residual contaminants in soil, groundwater, and indoor air will be managed by integrating risk management measures within the infrastructure design. These risk management measures will be in the form of physical barriers (hard or fill caps) to isolate residual contaminants, vapour intrusion controls to manage risk with indoor air and site specific health and safety plans for protection of construction workers. Soil management and reuse takes into account the need to use soil to build a protective layer on top of existing soil.

Civil (Earthworks) Engineering Strategy

Waterfront Toronto (WT) retained CH2M HILL Canada Limited (CH2M) to develop a civil (earthworks) engineering strategy to support the design of the Port Lands flood protection elements and enabling infrastructure. The primary scope involves developing and describing a practical approach to construct the new River Valley, flood protection elements and enabling infrastructure, while conforming with the approved environmental assessment, preliminary design prepared by MVVA and environmental strategies developed by CH2M in conjunction with this work.

Digital Elevation Model

CH2M generated a Digital Elevation Model (DEM) with multiple surfaces (digital layers) that represent individual elements of the project and physical site settings. The layers of the project DEM are three-dimensional and georeferenced to support evaluation of the design in context of the site setting. The DEM was the primary tool used to interpret the proposed flood protection and infrastructure design in context of the site setting (soil, geology, hydrogeology and environmental). The DEM was used to estimate the project excavation (cut) and fill volumes of the proposed design relative to current site conditions.

The actual excavation grades required to support construction have not been developed at this stage of design. To accommodate uncertainty in subsurface conditions and early stages of design, an excavation base surface was developed and included in the DEM. The excavation base plan includes approximately 2m of excavation below the planned finished surface grades shown in MVVA's design within the River Valley. In upland areas that require a barrier to provide environmental risk management, the excavation grade was established 1.5m below the finished ground surface to accommodate placement of an

environmental soil barrier system. The excavation base grades were represented in the DEM to estimate the total excavation volume required to achieve the design.

Cut and Fill Balance

The preliminary cut and fill balance of the River Valley excavation and the grade changes for flood protection were estimated based on the preliminary due-diligence level design prepared by MVVA. The cut and fill estimate represents the difference between existing ground surface and the excavation base grades included in the DEM. The values presented represent in-place soil volumes. The estimated volumes also take into consideration potential consolidation of native soils underlying the site in response to the proposed filling plan.

The estimated cut and fill values are as follows:

Bulk Estimated In situ Volumes*	
Volume to Cut (m^3)	1,494,000
Volume to Fill (m^3)	1,068,000

Note:
* Volumes are calculated based on MVVA final grades issued March 21, 2016.

Earthworks Approach and Construction Sequence

The earthworks strategy was developed to be implemented in four phases to support efficient soil management across the project and align with the preliminary project schedule. The phases were developed to proceed sequentially but can be implemented concurrently as needed to achieve the overall project schedule.

The River Valley excavation phases are assumed to be carried out from March, and continuing through November of each year. Some activities may span more than one construction season and will overlap subsequent phases; therefore, there are fewer phases than calendar years in the project. The upland areas outside the River Valley will be filled as required or when fill is generated by River Valley excavation. Several areas of the site are prone to consolidation and settlement of compressible native soils in response to the proposed regrading (additional layers/load). Preloading and surcharging will be necessary to expedite settlement, and reduce post-construction settlement to acceptable values. The estimated fill volume required to achieve the proposed design grades include fill to compensate for the estimated settlement.

Excavation will be completed under two different conditions: 1) dry material excavation above the groundwater table; and 2) wet material excavation, which includes wet materials that are located below the groundwater table and saturated. Much of the material excavated will be loose native sands. The loose sand is not expected to support excavation slopes steeper than 4H:1V below the water table. Because the proposed River Valley morphology design includes slopes as steep as 2H:1V, sheet piling and additional excavation and replacement of materials with structural/granular fill are anticipated to construct stable structures. Removal of soft, geotechnically unsuitable and environmentally contaminated soil will also be required, particularly within the shallower excavation depths.

River Valley excavation can be completed with conventional excavators with buckets up to 2m below the water table. Excavation below the water table will use mechanical dredging equipment. Preliminary dredge planning is based on using a crane-mounted clamshell bucket due to their longer reach span of near 25m, maximum. The dredge crane will be track-mounted and operated on dry land. The dredge will cast excavated soil directly to dump trucks for hauling to the on-site soil processing facility. There, the wet soil will be pumped to a series of hydrocyclones and shaker units, where the sand-sized material will

be segregated and the remaining solids will be sent for additional dewatering in either geotextile tubes or filter presses and remediation of contaminated soils.

Groundwater within the River Valley excavation will be managed in situ. A preliminary Groundwater Management Plan has been prepared as part of the environmental management strategy that describes specific approaches to managing contaminants expected to be encountered during excavation. The excavation methodology and environmental controls required to avoid contaminating newly constructed areas will be further developed as the flood protection design is finalized.

Along the length of the River Valley, construction of several bridge crossings will be coordinated with the main River Valley excavation. For preliminary planning purposes, it is assumed the foundations and bridge decking will be constructed before constructing the River Valley. Outside the River Valley, excavation is also required for reconfiguration of infrastructure alignments. Dewatering or watertight shoring methods will be required to provide suitable temporary dry conditions for subsurface infrastructure installation. Because of the shallow water table and permeable soils, high groundwater pumping rates are expected to maintain dry excavations. Trenchless technologies may be used in select areas as well. The groundwater quality has been impaired by the historical land use activities and will require treatment prior to discharge from the site.

Construction Sequencing

Construction is planned to start with construction of the new North Cherry Street Bridge, infilling the first phase(s) of the Essroc Quay (F1a and possibly F1c), and removing the existing Cheery Street Bridge over the Keating Channel.

River Valley excavation is planned to start from the downstream area of the future Don River (Phase 1 (C1a)). A section is planned to be left behind under the Cherry Street Bridge (Future South Cherry Street Bridge (C4c)) to perform as a plug for the River Valley excavation. Sheet piling is to be carried out along the two sides of the proposed River Valley to perform as a second barrier system in addition to, and in case of failure of, the exposed armored barrier system during flood events. Excavation will progress upstream along the proposed River Valley alignment (C2a) and future Don River Spillway zone (C2B) during the second phase of the project. The excavated River Valley will be opened to Don River flow in the last phase (Phase 4) by excavation of the C4a and C4c areas. Infilling will take place over the identified Fill Zones as per the recommended plan. It should be noted that the filling schedule can be very flexible to accommodate shorter haul distance and pre-loading to offset settlement as well.