Sanitary Grit Residuals Treatment Facility Environmental Impact Assessment Located within Edmonton, Alberta

Stantec

Prepared for:
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Sign-off Sheet

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1.0 INTRODUCTION

EPCOR Water Services (EPCOR) has retained Stantec Consulting Ltd. (Stantec), to complete an Environmental Impact Assessment (EIA) for activities associated with the construction of the proposed Sanitary Grit Residuals Treatment Facility (SGRTF) (the Project) within SW 12-053-24 W4M, Edmonton, Alberta (Study Area, Figure 1, Appendix A).

The SGRTF will be an innovative new facility at the Gold Bar Wastewater Treatment Plant (GBWWTP) that will receive grit slurry collected from the City's sewer systems by hydrovac trucks. The SGRTF will include an enclosed bay for receiving of trucks, and the washing of grit slurry. Wash water effluent will be returned to the GBWWTP for treatment. Screenings and a clean grit product will result that can be disposed of with other grit generated at the GBWWTP. Construction of this facility is scheduled to commence in early 2016, pending project approvals.

The SGRTF will be located within the North Saskatchewan River Valley, and is therefore subject to the North Saskatchewan River Valley Area Redevelopment Plan (City of Edmonton Bylaw 7188). The proposed Project is defined as a major facility under this bylaw, and therefore triggers the requirement for an EIA and a Site Location Study (SLS) to be conducted. This report provides the results of the EIA; the SLS will be submitted under separate cover.

1.1 BACKGROUND

The City of Edmonton (City) initiated actions to review options on the possible processing and disposal of grit slurry collected from the wastewater sewer systems. Historically, the City land treated urban grit slurry collected from sewer systems, and disposed of wastewater grit slurry at the Kennedale Works Yard (Kennedale). However, the practice of disposing wastewater slurry at Kennedale was recently discontinued due to odours and the negative impact on impending developments surrounding the yard. Land treatment of wastewater grit slurry was not considered a viable option due to odours and health concerns related to handling, processing and disposal. Discontinuing the processing and disposal of wastewater grit slurry at the Kennedale yard necessitated the City to find other methods and means to manage this material. The City decided to dispose of the wastewater grit slurry at the Clover Bar Biosolids Storage Lagoons (CBBSL) until a more environmentally sound practice could be implemented.

The City invited EPCOR to review options related to the handling and treatment of wastewater grit slurry at the GBWWTP. EPCOR requested Stantec to develop conceptual level designs and opinions of probable cost for handling and treatment options. A variety of technologies and processes were considered in regards to the integration of a solids receiving and handling system to the GBWWTP. Based on a review of GBWWTP treatment capacity, available land, and future site plans, it was determined that a standalone facility located on the east side of the plant site would be the preferred option.

On April 28, 2015 a scoping meeting was held between representatives from the City, EPCOR, and Stantec. The focus of the meeting was to discuss the scope of the project, confirm the requirements for environmental submissions on the proposed SGRTF, and verify the scope of the required studies. The result of this meeting was a request for this EIA, as well as a Site Location Study that has been submitted under separate cover.

1.2 SCOPE

As discussed in the April 2015 meeting with Sustainable Development, the scope of this EIA is:

- To identify the potential impacts on the physical and biological environment resulting from the following:
  - Construction Access
  - Vegetation Clearing
  - Utility Installation
  - Laydown Area
  - Infrastructure
  - Site Restoration
  - Erosion and Sedimentation Control Measures
  - Operation of the facility
- To evaluate the feasibility of mitigating or preventing adverse impacts, and to predict the residual impacts (if any) associated with the Project after mitigation
- To develop a mitigation plan to prevent significant adverse impacts to the environment from the construction and operation of the Project

This assessment was conducted in accordance with the requirements of the North Saskatchewan River Valley Redevelopment Plan (City of Edmonton 2014) and the Guide to Environmental Review Requirements on the North Saskatchewan River Valley and Ravine System (City of Edmonton 2000). A Site Location Study has also been conducted for this project and will be submitted under separate cover.

2.0 PROJECT DESCRIPTION

The following sections describe the Study Area, provide a rationale for the Project, discuss the Project components and outline the proposed timing of the Project.

2.1 STUDY AREA DESCRIPTION

The proposed SGRTF will be located in the southeast corner of the existing GBWWTP within the existing plant fence line (see Drawing 002, Appendix A). This location is within the North Saskatchewan River (NSR) Valley in Edmonton, Alberta. The Study Area is located between the previously developed GBWWTP infrastructure (a brownfield site that has been extensively disturbed throughout its history) and Gold Bar Park Road (Figure 1, Appendix A). The vegetated area inside the Project footprint is classified as Mixed Deciduous and Evergreen Woodland Alliance (Wheatly and Bentz 2002) and is entirely located within the existing plant fence line. The GBWWTP site is equipped with a variety of existing amenities such as access roads, utilities, laydown areas and infrastructure (see Drawing 002, Appendix A).

A Phase I Environmental Site Assessment (ESA), Phase II ESA and an updated Phase I ESA were conducted on the within the GBWWTP in 2010, 2010 and 2015 respectively. The most recent of these reports was conducted to accommodate the rezoning of the east area of the GBWWTP (where the Study Area is located) from a Metropolitan Recreation Zone to a Public Utility Zone in 2015. No Phase II ESA activities were recommended (AECOM 2015).

2.2 PROJECT RATIONALE

Sanitary grit is removed from the City's collection system by hydrovac trucks. The settled material is a mixture of inorganic and organic materials that can settle and accumulate in the collection system at sanitary lift stations and combined sewer sand traps. The settled debris is often highly odourous and typically contains a significant fraction of inert material such as sand, gravel and stones. The purpose of the proposed Project is to construct a facility to receive and treat these residual solids from the City's wastewater sewer systems and provides a long term solution to the treatment of these materials. In addition, the reuse of this material will be investigated as currently practiced in parts of Europe.

2.3 PROJECT DESCRIPTION

Construction of the proposed Project will require establishment of site access routes and a laydown/staging area. Some vegetation will need to be cleared from the southeast corner of the GBWWTP to allow for the actual construction of the building. Interim erosion and sediment control measures will be installed around storm water sewer catch basins if deemed necessary. Site infrastructure will primarily include the building itself, which will be sized to accommodate the dumping of hydrovac trucks internally within its receiving bay with the building doors closed. Utilities will be constructed to service the facility with typical power, gas, communication, etc. and also to facilitate the function of the facility (i.e. wash water and effluent lines). Following construction of the facility, final site revegetation and restoration will occur. All construction and operating activities will occur within the existing plant boundaries.

The sections below describe these steps in detail, and also provide an overview of the operation of the facility in the context of this environmental review under Bylaw 7188.

2.3.1 Construction Access

Trucks will access the site from the main GBWWTP entrance on 50 Street and travel along the existing South Avenue roadway. Refer to Drawing 002, Appendix A for a map of the GBWWTP site, including the location of the proposed laydown area.

During construction, access will be routed from the existing northwest gate on the west end of the plant. There are two routes that construction traffic shall be directed within the GBWWTP to the SGRTF site. The first route utilizes North Avenue across the bridge spanning Secondary Clarifiers #1-5, and directed south along 45 Street to the SGRTF. Due to maximum vehicle loadings for the bridge, construction vehicles heavier than 42,500 kg will be directed south off North Avenue along 47 Street before heading east along South Avenue to the SGRTF. The use of 47 Street will encounter a high volume of EPCOR and contractor pedestrian traffic (none of these areas are accessible to the public).

During construction of the facility and installation of the pipelines within the access road, traffic can be routed through the laydown area during the period of time when the pipelines are installed.

2.3.2 Laydown Area

The proposed location for the SGRTF is located adjacent to an existing contractor laydown area. This open area on the east side of the GBWWTP and within the plant site boundaries will be used for equipment and material laydown, project office trailers, contractor parking and delivery access (Drawing 002, Appendix A).

2.3.3 Vegetation Clearing

Construction of the SGRTF, and supporting infrastructure, will require the clearing of the vegetation along the inside of the existing plant fence line and of planted trees within the existing plant site. This will result in the clearing of approximately 1,312 m^2 of vegetation (Figure 2, Appendix A). Following tree clearing, a temporary visible barrier such as snow fence will be installed to protect the remaining trees.

2.3.4 Erosion and Sedimentation Control Measures

Given the relatively flat nature of the Study Area, few erosion and sediment control (ESC) measures are anticipated to be required. Construction will be carried out in accordance with the requirements of the City of Edmonton's Erosion and Sedimentation Control Guidelines (City of Edmonton 2005a), and Erosion, and Sedimentation Control Field Manual (City of Edmonton 2005b). The contractor will be required to monitor erosion, and may be required to implement measures such as placement of protection measures around existing catch basins. This will be detailed out in the contractor's Environmental Construction and Operations (ECO) plan that they will be required to develop.

2.3.5 Infrastructure

The SGRTF building has a footprint of approximately 426 m^2, a building height of 6.3 m, and a bay height of 9.4 m. The building will house a waste receiving hopper, a coarse drum screen, a grit slurry pump station, two grit paddle washers and a conveyor system. Excavation is required for the lower level of the building, which will house some of the processing equipment. To limit the disturbance and to preserve the existing green field area bounding the lower level of the SGRTF, the footprint of excavation for the lower level will be retained by a system of shoring of permanent steel soldier piles and timber lagging, which will also act as the exterior formwork of the foundation wall.

The building will be constructed to enclose the truck receiving area and processing equipment in order to control odours released from truck discharges and grit processing operations. The receiving area is sized such that a hydrovac truck can park in the facility, discharge its contents with the door closed, any spills would be contained within the facility itself. The capability will also exist to wash the trucks prior to their leaving the facility. The facility will also be equipped with a dedicated HVAC and odour control system.

The infrastructure associated with the SGRTF is still in the process of detailed design; however, it has been assumed that the final design details on structural elements will not change the evaluation of environmental impacts. Should this assumption prove not to be true, a revised EIA or addendum will be prepared to address revisions.

During construction a temporary trail protection structure/scaffold will be installed to the portion of trail directly adjacent to the project site to provide safe and uninterrupted use of the trail when cranes are operating nearby on the GBWWTP side of the perimeter fence. No tree or brush clearing is anticipated to be required for the installation or removal of this structure. Upon completion of construction, any accidental impacts to this section of trail will be fully restored to conditions prior to construction.

2.3.6 Utility Installation and Site Drainage

A wash water supply line and reject water return line will likely be installed via directional drilling originating near the plant membrane treatment area running south to the north side of the road near the SGRTF. Refer to Drawing 002, Appendix A for the routing.

An existing potable water main is located near the Project site and runs along the access road south of the Bioreactors. A new pipe will tie into the existing 150 mm water main located adjacent to Bioreactor No. 11, extend to the proposed alignment of the wash water and reject water pipelines, and then run parallel to the wash water and reject water lines connecting to the SGRTF (Drawing 002, Appendix A). The potable water main will likely be installed using an open trench methodology.

The power is anticipated to be provided from the existing Electrical Room located on the walkway between the Bioreactors and Secondary Clarifiers. The power and communication cables required will follow the same alignment as the wash water and reject water pipelines and will be installed via open trench methods.

A gas service will be required to supply the proposed heating system. The natural gas service will be supplied from the existing ATCO metering building, located east of the existing Laboratory Building. The service will extend from the metering building, within the perimeter fence, paralleling South Avenue, to the SGRTF using an open trech methodology.

Roof drains will collect the roof drainage with rainwater leaders discharging to grade and collected via the existing storm water sewer catch basins nearby. The remainder of the disturbed site will be regraded to drain to the existing underground storm sewer infrastructure as well.

There are two right of way easements within the undeveloped land to the east of the bioreactors and a number of existing utilities that will be potentially crossed with the installation of the proposed infrastructure. Appropriate crossing agreements will be negotiated as required.

2.3.7 Site Restoration

The area around the SGRTF will be graded to accommodate the existing access road and ensure adequate drainage. A 2.0 m wide gravel pad will be provided on the east, south and west sides of the building to provide access to the HVAC and odour control equipment, and provide sufficient access to the south side of the building. The area between the north side of

the building and across east/west access road will be asphalt pavement to support truck driving. Other areas that support truck movement near the project site will be gravel surfacing. All gravel surrounding the facility will have a minimum 2.0% slope away from the building to provide adequate drainage.

Restoration of the existing east/west access road will be required following the pipeline installation and construction of the facility. Existing external fencing will remain in place for the full duration of the construction. Upon completion of construction, any temporary construction fencing will be removed.

2.3.8 Facility Operation

During operation of the SGRTF additional trucks to the GBWWTP are expected from the transportation of the grit slurry to the facility, and from the transportation of the clean grit offsite. Approximately two additional hydrovac trucks per day are anticipated from the sewer cleaning operations, and since these operations are typically seasonal, increased traffic flow is expected to be from mid-April to late October, weather permitting.

2.4 CONSTRUCTION TIMING

Construction is anticipated to begin in 2016 with the intent for the SGRTF to be operational sometime in 2017.

3.0 ASSESSMENT METHODOLOGY

The following section discusses the methodology employed to complete this EIA.

3.1 DESKTOP REVIEW

The desktop review will include a review of publicly available information that is relevant to the Study Area and the Project. Sources of information will include previously prepared reports historical aerial photographs, and public databases. The following sections outline the methods used to conduct the historical aerial photograph review and database searches.

3.1.1 Historical Aerial Photograph Review

Selected aerial photographs dating from 1950 to 2014 were reviewed. Aerial photographs in approximately five year intervals from 1950 to 2001 were obtained from the Alberta Environment and Parks (AEP) Air Photo Distribution Office. The 2005, 2010 and 2014 photographs were obtained from the City of Edmonton Transportation Services. The aerial photographs were reviewed to identify anthropogenic activities and changes to the natural features within and adjacent to the Study Area over time.

3.1.2 Database Searches

A search within 12-053-24 W4M was conducted through the Alberta Conservation Information Management System (ACIMS) (Alberta Environment and Parks [AEP] 2015a) for historical occurrences of rare plants and rare ecological communities. Species of conservation concern identified via the ACIMS database inquiry are summarized and referenced to the Subnational Status Rank (S Rank) and definition (AEP 2015a). Pertinent life history and habitat requirements for these species are discussed where appropriate.

A search for occurrences of rare wildlife within 1 km of the Study Area was conducted through the Fish and Wildlife Management Information System (FWMIS) (AEP 2015b). Species within a 1 km radius have a higher likelihood of utilizing habitat features within and adjacent to the Study Area boundaries.

3.2 FIELD ASSESSMENTS

The field assessments required for the Project include a rare plant survey, point-count bird survey and an auditory amphibian survey. The spring rare plant survey, site characterization, point-count bird survey, and auditory amphibian surveys were completed in June 2015 and the summer rare plant survey was completed in August 2015.

Scientific names for plant species follow the Integrated Taxonomic Information System (ITIS) (2015). Common names for plant species conform to ACIMS (Alberta Environment and Parks [AEP] 2015a). Otherwise, regulated and listed species naming conventions used scientific and common names within these specific documents: *Species at Risk Act* (S.C. 2002, c. 29) and the Alberta *Weed Control Regulation* (Alta. Reg. 19/2010).

Wildlife species names are adopted from the Birds of North America Online (American Ornithologists' Union 2014) for avian species, and the Integrated Taxonomic Information System (ITIS 2014) for mammal species.

3.2.1 Rare Plant and Site Characterization Surveys

The objective of rare plant and site characterization surveys were to classify the vegetation within the Study Area according to upland and wetland land units based on existing ecological land classifications. The surveys were also conducted to identify sensitive environmental conditions as they pertain to vegetation, as well as, allow for the development of appropriate mitigation, conservation, and management recommendations, as required. Vegetation within the Study Area was assessed using rare plant surveys in conjunction with site characterization surveys. Rankings for rare plants follow AEP guidelines (Alberta Tourism, Parks and Recreation 2014).

During the vegetation assessment, information on plant species and ecological communities of management concern, if present, were collected. Species and communities of management concern include:

- Uncommon communities and or those sensitive to watershed disturbance (e.g. old growth forest, wetlands) identified from upland ecosite phase and wetland class mapping
- Rare plants and rare ecological communities

Noxious and *prohibited noxious* weeds (*Weed Control Act* [S.A. 2008, c. W-5.1])

3.2.1.1 Rare Plant Survey Preparation

Before field data collection was conducted, historical rare plant and rare ecological community records from the Alberta Conservation Information Management System (ACIMS) were searched. Additionally, a list of rare plant species that have the potential to be found in the North Saskatchewan River (NSR) valley was compiled from *Rare Vascular Plants of Alberta* (Kershaw et al. 2001) and historical rare plant records available from ACIMS (ATPR 2015). Habitat information for each rare plant species was researched to determine which species had the highest potential of being located within the NSR valley and provided surveyors with a better understanding of the characteristics and habitats of rare plants that could be found. ACIMS tracking and watch lists were printed for reference in the field.

Vegetation within the Study Area were classified using a Central Parkland Classification (Natural Regions Committee [NRC] 2006) system derived from the following sources:

- *A Preliminary Classification of Plant Communities in the Central Parkland Natural Subregion of Alberta* (Wheatly and Bentz 2002) for uplands
- *Alberta Vegetation Inventory Standards Manual* (Alberta Environmental Protection1991) for agricultural, industrial and settled lands

3.2.1.2 Field Data Collection

Site characterization and rare plant surveys were completed by a rare plant specialist, and were conducted simultaneously at each survey location. Surveys were conducted within the Study Area in two survey intervals to capture different flowering times of target species. Two site characterization and rare plant surveys were conducted on June 12, 2015 (spring survey) and another two on August 11, 2015 (summer survey).

Vegetation data gathered within the Study Area during the site characterization surveys included percent cover of characteristic tree, shrub, herbaceous, and non-vascular species. Additionally, general site information was recorded, including soil moisture regime, slope and aspect, slope position, and structural stage.

Each selected sample site was classified to the appropriate upland or wetland land unit using the Central Parkland Classification system.

At each survey site GPS coordinates were recorded and representative site photos were taken. Notes on ecological communities or conditions that may require special consideration, if present, were also made.

For the rare plant surveys a meander survey within the plant community was completed. A comprehensive species list was compiled at each site until no new species were found. Specimens requiring further examination or species confirmation were collected, with the exception of plants where seed heads or flowers required for identification to species level were unavailable or where plant populations were small (i.e., no more than 1 in 50, Alberta Native Plant Council 2006).

For bryophytes (mosses and liverworts), all microhabitat types present at a site were examined for presence of species. If present, sampling of bryophytes by microhabitat is the recommended protocol of the Alberta Biodiversity Monitoring Protocol (Doubt and Belland 2000). Species that could be identified on the basis of macroscopic features were noted. Species that required microscopic examination for correct species identification were collected. As collections are required to define almost all rare bryophyte species, determination of population size and extent is not possible.

3.2.1.3 Plant Identification

Plant specimens collected in the field requiring further examination were identified. Collected vascular plant species were identified by a botanist while collected bryophytes were identified by a bryologist.

Comprehensive species lists were then referenced to ACIMS tracking and watch lists and *SARA* (*Species at Risk Act*. S.C. 2002, c. 29) to ensure all plants considered to be rare were identified.

3.2.2 Weed Identification

Occurrences of species identified as *prohibited noxious* (Schedule 1) or *noxious* (Schedule 2) in the *Weed Control Regulation* were also included at each survey site. Occurrences of these species were recorded on a weed survey form taken from the *R&R / 03-4 Weeds on Industrial Development Sites – Regulations and Guidelines* (Alberta Environment 2003).

3.2.3 Breeding Bird Survey

A modified fixed-radius point count sampling survey procedure (Bibby et al. 2000 was used to document bird species diversity and abundance). Surveys were preceded by two minutes of silence to minimize any disturbance caused by the arrival of observers.

Surveys consisted of two consecutive five minute periods where all birds heard vocalizing, or observed within 100 m of the point, were recorded. The two independent survey periods can be used to support an estimate of detectability, and the longer survey period is important for detecting quieter or more secretive species. Surveys were conducted twice within the breeding bird season on June 12, 2015 and June 19, 2015.

Surveys were not conducted when wind speeds were above 20km/h (i.e. Beaufort 3), or during periods of strong rain as these conditions tend to decrease bird activity and hinder the ability of observers to effectively detect birds. Incidental observations of birds detected outside the 100 m point count radius during the survey were also recorded and were included in the species list of birds observed. The species list was includes incidental observations.

3.2.4 Amphibian Survey

The amphibian survey was conducted in accordance with standard protocols (Alberta Environment and Sustainable Resource Development 2013).The amphibian survey consisted of a two minute period of silence to reduce disturbance impacts associated with the arrival of observers followed by a five minute listening period where all amphibian species detected were recorded. The amphibian survey was conducted at wind speeds below 20 km/h (i.e., Beaufort 3) and conditions not exceeding a light rain to optimize the ability of observers to effectively hear all amphibians vocalizing. Incidental wildlife species encountered during the amphibian survey

were also recorded. Surveys were conducted three times within the breeding season on May 21, 2015, May 26, 2015 and June 4, 2015.

3.3 ASSESSMENT OF POTENTIAL EFFECTS AND MITIGATION

The anticipated effects of the Project were characterized based on their likelihood of occurring before mitigation measures have been applied, the duration of the effect, the magnitude of the effect, and its spatial extent (Noble 2006). Definitions of spatial extent, duration, and likelihood are provided in Table 3-1. Based on the nature of the construction activities, the location of the Project, and the Study Area characteristics, specific environmental elements, as listed below, were assessed. Specific definitions for magnitude are particular to the environmental element being considered. For example, vegetation effect magnitude relates to total area of vegetation disturbance and existing species composition, since this may have an effect on revegetation success, post-construction species composition of revegetated areas, and invasion by non-native and/or weedy/undesirable species. Specific definitions for each environmental element are needed because these variables are not applicable to other environmental elements. The definitions of magnitude are provided in Table 5-1 and are based upon generally accepted knowledge and professional judgment.

Table 3-1 Effect Characterization Definitions

Parameter	Definition
Likelihood of Occurrence	Low – there is <25% chance of the effect occurring Moderate – there is between 25 to 75% chance of the effect occurring High – there is >75% chance of the effect occurring
Duration	Short – direct effect is measurable for 1-5 years Medium – direct effect is measurable for 6-15 years Long – direct effect is measurable for 16+ years
Magnitude	Low – see Table 5-1 Moderate – see Table 5-1 High – see Table 5-1
Spatial Extent	Project – direct effect is only measurable within the confines of the proposed Project Local – direct effect is measurable within 1 km of the proposed Project Regional – direct effect is measurable within 25 km of the proposed Project

The identified environmental components that were assessed include:

- Hydrology and Water Quality
- Vegetation
- Wildlife
- Aesthetics
- Noise

- Odour
- Public and Contractor Safety

Potential effects to each component because of the proposed activities were estimated and discussed. Mitigation measures designed to reduce and/or lessen the effect were then proposed. The overall effect on the environmental component was then evaluated in accordance with the definitions presented in Tables 3-1 and 5-1.

4.0 DESKTOP REVIEW AND FIELD RESULTS

The following sections discuss the results of the desktop review and field assessment for the Study Area.

The desktop review examined existing information for the Study Area to provide a context and background for analysis of impacts and mitigation measures. This analysis was completed using existing information regarding the biophysical resources and a search of third party databases.

4.1 HISTORICAL AERIAL PHOTOGRAPH REVIEW

A historical aerial photograph review was conducted to collect historical information relevant to the history of the Study Area and the surrounding plant site. A summary of the review is provided below. The aerial photographs are contained in Appendix B.

In 1950, the Study Area consisted primarily of agricultural land, which appeared to have been cultivated, surrounded by piecewise vegetation. The first signs of residential development to the southwest of the Study Area and the first stages of what appears to be a water treatment plant (including storage lagoons) to the north of the Study Area appear in the 1962 photograph. The 1967 photograph contains the first presence of vegetation within the Study Area, in the form of what appears to be planted trees along the perimeter of the water treatment plant site.

In 1973, there appears to be some form of earthworks within and adjacent to the Study Area, including the appearance of the existing sludge pump house. In 1979, the vegetation within the Study Area continues to mature and the features of the park (southeast of the Study Area) have appeared. The 1979 photograph also contains the first appearance of the multipurpose walking trail that parallels the perimeter of the existing water treatment plant. The lagoons to the north of the Study Area appear to have been overgrown with vegetation in the 1979 photograph and remain that way until the area is cleared for what appears to be a laydown/storage area in 1996. The Study Area remains relatively constant between 1990 and 2014, with the exception of planted trees maturing. Throughout the water treatment plant site, infrastructure gradually appeared beginning in 1962 up until 2014.

4.2 GEOLOGY, SOILS, AND LANDFORM

Stantec conducted a geotechnical investigation on August 18, 2015 to support the design phase of the Project. Three boreholes were drilled to depths ranging from 4.3 m to 14.6 m. In general, the soils encountered consisted of a clay fill, over thin layer of silt to silty clay underlain by sand followed by clay shale (Stantec 2015). The low plastic clay fill was encountered at the surface (for BH1 and BH2) or directly below a 380 mm thick gravel fill layer (for BH3) (Stantec 2015). A layer of light brown silt to silty clay was encountered below the clay fill in BH1 and BH2 (Stantec 2015). Brown, compact, poorly graded sand, with occasional oxide staining, was encountered below

the silt to silty clay in BH1 and BH2 and directly below the clay fill in BH3 (Stantec 2015). Highly weathered bedrock, consisting of a clay shale that behaves similar to a hard, over consolidated clay that readily softens upon exposure, was encountered below the sand in BH1 and BH2 (Stantec 2015). A 25 mm diameter standpipe was installed in BH1 and BH3. Approximately two weeks after drilling, groundwater was measured at 8.28 m below ground and BH3 was dry (Stantec 2015).

A copy of the geotechnical assessment report, complete with soil handling and construction recommendations can be found in Appendix C.

4.3 VEGETATION

The NSR Valley, in which the Project is located, is a provincially significant natural area and a major ecological corridor that traverses the Province of Alberta (City of Edmonton 2008). The GBWWTP is situated within the Central Parkland Natural Subregion (Central Parkland), which is located within the Parkland Natural Region (NRC 2006). This subregion is a large transition zone between the Boreal Forest Natural Region to the north and the Grassland Natural Region to the south. The Central Parkland is dominated by undulating till plains and hummocky uplands. Under natural conditions, native vegetation community remnants are a mosaic of aspen (*Populus tremuloides*) dominated forest stands on moist sites intermixed with prairie vegetation on drier sites. Stands of aspen dominated forest are found throughout the Central Parkland and have understories dominated by saskatoon (*Amelanchier alnifolia*), prickly rose (*Rosa acicularis*), and beaked hazelnut (*Corylus cornuta*). Stands dominated by balsam poplar (*Populus balsamifera*) occur on moist, nutrient rich sites, and often have aspen and white spruce (*Picea glauca*) intermixed within the stand (NRC 2006).

The Study Area is located within the existing GBWWTP site (Figure 1, Appendix A). Although the Study Area has naturalized, as historic aerial imagery and geotechnical study has shown, the area has been used for agriculture and otherwise disturbed in the past and reclaimed to a treed area. The Study Area was classified as Mixed Deciduous and Evergreen Woodland Alliance (Wheatly and Bentz 2002).

4.3.1 Alberta Conservation Information Management System

Historical occurrences of flat-topped white aster (*Doellingeria umbellata* var. *pubens*) have been found within 12-053-24 W4M (Figure 2, Appendix A). Flat-topped white aster has an S rank of S3 (AEP 2015a) and a status of *may be at risk* according to the Alberta Wild Species rank (Government of Alberta 2012). This species of forb is a perennial generally found in moist woodlands and swamp edges (Kershaw et al. 2001). Flat-topped white aster can be distinguished from the common variety by the presence of fine hairs.

4.3.2 Field Results

The Study Area was classified as a Mixed Deciduous and Evergreen Woodland Alliance (Wheatly and Bentz 2002). This upland woodland alliance has a mixed forest canopy of both deciduous and coniferous species. Tree species dominating the canopy were white spruce, balsam poplar, and aspen. This alliance is typically found on well to moderately well drained upland soils with subhygric moisture conditions. The shrub layer was dominated by red-osier dogwood (*Cornus sericea*), prickly rose (*Rosa acicularis*), and pin cherry (*Prunus pensylvanica*). The ground cover layer was dominated by smooth brome (*Bromus inermis*), bunchberry (*Cornus canadensis*), bluejoint (*Calamagrostis canadensis*), and Kentucky bluegrass (*Poa pratensis*). A comprehensive list of species observed during the spring and summer rare plant surveys is provided in Appendix D.

Six species designated as *noxious* in the *Weed Control Regulation* were also observed:

- common burdock (*Arctium minus*)
- creeping thistle (*Cirsium arvense*)
- leafy spurge (*Euphorbia esula*)
- perennial sow-thistle (*Sonchus arvensis*)
- common tansy (*Tanacetum vulgare*)

Most *noxious* species were found in low densities within the Study Area; however, creeping thistle was observed in large patches throughout the Study Area.

4.4 WILDLIFE

The interconnected network of streams, gullies, ravines, and valleys that comprise the NSR Valley and Ravine System are vital habitats, food sources, and movement corridors for wildlife species inhabiting the Edmonton area (EPEC 1981).

The Study Area occurs within a Key Wildlife and Biodiversity Zone (KWBZ) (Figure 3, Appendix A).

4.4.1 Restricted Activity Periods

There are restricted activity periods related to construction activities and wildlife in the Study Area, they are detailed below.

4.4.1.1 Breeding Bird Restricted Activity Period

Virtually all birds (including their nests and eggs) are protected by the *Migratory Bird Convention Act, (*S.C. 1994, c. 22.*)* and it's Regulations and/or the Alberta *Wildlife Act (*R.S.A. 2000, c. W-10.). To reduce the risk of incidental take, which includes direct and indirect mortality of nesting birds, nestlings, and eggs, is to avoid activities that could result in incidental take (e.g., vegetation clearing and grubbing) within the migratory bird breeding period. Environment Canada provides information on the "general nesting periods" for migratory birds for Canada. The nesting periods

vary depending on nesting zone and habitat type (i.e., forest, open, wetlands), and because the Project lies at an intersection of all three habitat types the primary nesting period extends from April 26 to August 15. It should also be noted that some bird species such as owls and hawks nest earlier in the year, and their nests are also protected. The restricted activity period for breeding birds extends from March 15 to August 15.

4.4.1.2 Key Wildlife and Biodiversity Zone Restricted Activity Period (KWBZ RAP)

Guidelines for industrial activity within KWBZs relate to winter ungulate habitat and areas with higher biodiversity potential and are outlined in the Recommended Land Use Guidelines for Key Wildlife and Biodiversity Zones (AEP 2015c). It is recommended that no activity occur from January 15 to April 30 within the KWBZ. There are circumstances where exceptions to the KWBZ RAP are possible, these are determined in consultation with provincial regulators.

Approval standards and best management guidelines for activities within KWBZs are provided in the *Enhanced Approval Process: Integrated Standards and Guidelines* document (Alberta Energy Regulator and Government of Alberta 2013). For the KWBZ, both documents recommend that no activity occur from January 15 to April 30. However, there are circumstances where exceptions to the KWBZ RAP are possible:

- Timing restrictions may be adjusted in exceptional and localized situations if other considerations are applied that still protect the wildlife resource (AEP 2015d)
- Exceptions under favorable (non-adverse) ground conditions – activities planned within 100 m of existing arterial all-weather roads can be initiated at any time provided ground conditions are favorable, and may continue until adverse conditions are encountered (Alberta Energy regulator and Government of Alberta 2013).

The proposed Project would likely warrant an exception to this RAP, which is discussed in Section 5.3 below.

4.4.2 Fisheries and Wildlife Management Information System

A query of the FWMIS database for wildlife occurrence records was performed for a 1 km radius (AEP 2015a) on September 3, 2015. No records were returned.

4.4.3 Field Results

4.4.3.1 Species of Management Concern

No species of management concern were detected during field studies or desktop review.

4.4.3.2 Mammals

Red squirrel (*Tamiasciurus hudsonicus*) was detected during breeding bird surveys. Other small mammals may occur within the Study Area, such as mice, voles, and shrews. Medium and large-sized mammals are not anticipated in the Study Area because the area is presently fenced.

4.4.3.3 Birds

A breeding bird survey was conducted in the Study Area on June 11 and June 25, 2015 between sunrise and 10:00 a.m. during the peak breeding period for migratory songbirds. Six species were detected. Table 4-2, below, outlines the species detected and the provincial and federal status ranks associated with each species. None of the species detected are species of management concern, rather most are commonly-occurring, urban-adapted species that do well in small habitat patches or in edge habitat. It is assumed that any of the species present could be using the Study Area for breeding.

Table 4-1 Birds Detected in the Study Area

Common Name	Scientific Name	AEP General Status Ranks[1]	Species at Risk Act (Schedule, Status)[2]
American robin	*Turdus migratorius*	Secure	No Schedule, No Status
Black-capped Chickadee	*Poecile atricapillus*	Secure	No Schedule, No Status
Chipping sparrow	*Spizella passerina*	Secure	No Schedule, No Status
Red-eyed vireo	*Vireo olivaceus*	Secure	No Schedule, No Status
Rock Pigeon	*Columba livia*	Exotic	No Schedule, No Status
Yellow warbler	*Dendroica petechia*	Secure	No Schedule, No Status
Notes: [1]AEP (2015c) [2]Government of Canada (2015)			

4.4.3.4 Amphibians

Amphibian surveys were conducted in the Study Area on May 21st and 26th, and June 4, 2015, at one location. Boreal chorus frog (*Pseudacris maculata*) was the only amphibian species detected at a breeding area approximately 300 m from the Study Area. Boreal chorus frogs are not a listed or ranked species, provincially or federally. Nonetheless, amphibian species in general are considered valued components because of scientific and regulator concerns related to observed localized population declines, and habitat changes including the loss of wetland habitat.

4.5 SOCIO-ECONOMIC ENVIRONMENT

The following sections discuss the socioeconomic environment of the Study Area and the surrounding lands.

4.5.1 Land Use

The GBWWTP is bordered by residential communities to the north (Beverly Heights and Highlands), residential communities to the south (Gold Bar, Capilano, and Fulton Place), a public park to the west (Capilano Park), and a public park to the southeast (Gold Bar Park). The Study Area is located within the fenced facility boundaries of the existing GBWWTP site (a brownfield site that has been disturbed throughout its history), directly north of Gold Bar Park Road.

4.5.2 Archaeology and Historic Resources

Historical resources in Alberta are protected under the *Historical Resources Act* and include archaeological, historic and palaeontological sites, artifacts and fossils. Under the *Act,* no historical resources site can be disturbed without approval of the Minister of Alberta Culture and Tourism (ACT). ACT determines and issues the requirements for historical resources impact assessment (HRIA) studies and for mitigation measures for each archaeological and palaeontological resource site. ACT also issues *Historical Resources Act* clearance for projects to proceed.

The Project is situated on lands with designated high potential for both archaeological and palaeontological sites. A Statement of Justification (SoJ) has been prepared detailing the historical resource potential and recommending field investigation of the Study Area. A deep testing program has been recommended to investigate for deeply buried archaeological sites along the alluvial terrace. Palaeontological monitoring has also been recommended, as excavation activities will disturb alluvial sediments that have high palaeontological potential. ACT will review the SoJ and these recommendations. They will either issue *Historical Resources Act* clearance for the project to proceed, or may require HRIA studies or monitoring.

5.0 ASSESSMENT OF POTENTIAL ENVIRONMENTAL EFFECTS AND RECOMMENDED MITIGATION MEASURES

Stantec identified seven environmental components that will be considered in the identification and assessment of potential effects as a result of the Project, and proposed mitigation measures. As described in Section 3.3, specific definitions for magnitude have been created for each environmental element. Definitions are provided in Table 5-1.

Table 5-1 Magnitude Definitions

Environmental Element	Definition
Hydrology and Water Quality*	Low – minor loss or alteration to measurable surface water flow patterns or change of water volume and/or minimal decrease in water quality during/post-construction Moderate – partial loss or alteration to measureable surface water flow patterns or change of water volume and/or partial decrease in water quality during/post-construction High – total loss or alteration of measurable surface water flow patterns or change of water volume and/or substantial decrease in water quality during/post construction
Vegetation	Low – the distribution and abundance of native plant communities, rare plants, or rare ecological communities are not reduced in the Study Area beyond natural variation Moderate – the distribution and abundance of native plant communities, rare plants, or rare ecological communities are reduced, but not lost in the Study Area High – the distribution and abundance of native plant communities, rare plants, or rare ecological communities are completely removed from the Study Area
Wildlife	Low – no wildlife species will be eliminated from the Study Area Moderate – some species may be eliminated from the Study Area High – project will eliminate some species of management concern from the Study Area
Aesthetics	Low – minor loss or alteration to key elements/features/characteristics of view, and/or may not be uncharacteristic of the broader area Moderate – partial loss or alteration to key elements/features/characteristics of view, and/or may be somewhat uncharacteristic of the broader area High – total loss or alteration to key elements/features/characteristics of view, and/or totally uncharacteristic of the broader area
Noise	Low – minor change to perceived noise levels Moderate – moderate change to perceived noise levels High – large change to perceived noise levels and/or exceeds municipal sound level guidelines
Odour	Low – minor change to perceived odour levels Moderate – moderate change to perceived odour levels High – large change to perceived odour levels

Environmental Element	Definition
Public and Contractor Safety	Low – minor threat to public/contractor safety during construction, with risk of injury being low Moderate – partial threat to public/contractor safety during construction, with risk of injury being moderate High – substantial threat to public/contractor safety during construction, with risk of injury being high

The following sections present the results of the effects assessment on the seven environmental components that have been identified for this Project.

5.1 HYDROLOGY AND WATER QUALITY

Potential Environmental Effects

Clearing vegetation will increase soil exposure resulting in the possibility of erosion occurring during or following a storm event. The construction site is located on relatively level ground and is approximately 230 m from the NSR; however, storm sewer catch basins are located within the Study Area that could channel sediment laden water directly to the river. This could result in a potentially negative effect on river water quality if not mitigated.

The proposed Project will require some re-grading within the Study Area, which will affect the hydrology within the immediate footprint of the proposed facility. Roof drains will collect the roof drainage with rainwater leaders discharging to grade. The remainder of the disturbed site will be regraded to drain by overland flow to follow the existing drainage patterns and utilize existing underground storm sewer infrastructure.

No refueling is expected onsite, however, in the event that refueling becomes necessary there is a possibility of spills occurring. Fuel spills may have an impact on water quality as the soils on plant site are primarily gravel and sand, with high permeability. Washing of machinery or equipment, especially cement trucks, could also affect water quality due to the very basic nature of cement.

During operation, spills of the grit slurry material could negatively impact the NSR and both the vegetation and the aesthetics of Gold Bar Park, if not mitigated properly.

Proposed Mitigation Measures

Construction will be carried out in accordance with the requirements of the City of Edmonton's Erosion and Sedimentation Control Guidelines (City of Edmonton 2005a), and Erosion and Sedimentation Control Field Manual (City of Edmonton 2005b). The contractor will be required to monitor erosion, and may be required to implement measures such as placement of protection measures around existing catch basins.

During construction the contractor will be required to develop an ECO plan that will address items such as spill response. It is recommended that spill response material be kept on site at all times, and that refueling or equipment maintenance not be conducted onsite or near storm sewer catch basins. Cement truck washout should be conducted at an offsite, non-environmentally sensitive location.

The facility has been designed such that the outdoor permanent footprint areas of the facility will drain to the existing storm sewer system. Handling of the grit slurry will all occur within the facility, and any spill would be contained. If a spill does occur, it should be quickly managed to minimize injury to personnel or damage to the surrounding environment. Should a spill occur, occupation health and safety regulations and EPCOR procedures will be strictly adhered to.

Residual Effects

With the application of the above mitigation measures the proposed Project is anticipated to have a low likelihood of causing a short term effect to hydrology and water quality of moderate magnitude at a local extent.

5.2 VEGETATION

Potential Environmental Effects

The potential impacts of the project on vegetation include:

- Change in plant community composition
- Introduction and/or spread of weed species

Development of the Project will result in removal of some of the existing vegetation community in the area and has the potential to alter the remaining plant community composition resulting from edge effects such as increased light availability, decreased humidity, and introduced plant species. Approximately1312 m^2 of vegetation will be cleared (Figure 2, Appendix A). Clearing vegetation could create conditions amenable to the establishment of invasive species if not mitigated. Trees could also be damaged during construction through direct limb and trunk damage by contact with vehicles, equipment and personnel, or through compaction and crush damage to root systems.

Proposed Mitigation Measures

It is recommended that disturbed areas be reclaimed immediately with an approved seed mix to reduce weed establishment and erosion. For areas such as the temporary construction access that have been subjected to vehicle traffic, it is recommended that the area be decompacted prior to seeding. All revegetated areas should be monitored for weeds, and an appropriate weed control plan should be developed in accordance to the number and species of weeds observed. Construction fencing should be set up to protect existing trees from root and

trunk damage and should be set out from the trees at the drip line (edge of canopy above) or farther.

Residual Effects

The Project will result in the permanent loss of approximately 1312 m^2 of vegetation. With the application of the above mitigation measures the proposed Project is anticipated to have a high likelihood of causing a long-term effect to vegetation of moderate magnitude at a project extent.

5.3 WILDLIFE

Potential Environmental Effects

The following potential effects of the Project on wildlife were identified:

- Change in mortality risk – can occur through interactions with equipment or project components, vehicular traffic, and attraction to human activities.
- Change in habitat - can occur directly through habitat loss caused by site preparation activities or indirectly through change in habitat suitability through sensory disturbance (e.g., noise, visual cues, human presence).

Changes to wildlife movement was considered as potential effect, but ultimately scoped out because the Study Area occurs entirely within a previously fenced area, and changes to wildlife movement are not anticipated as a result of the Project. Table 5-2 below summarizes the potential effects of the Project on wildlife in the Study Area.

Table 5-2 Potential Effect Pathways and Affected Wildlife Resource Features

Potential Effect	Project Phase	Effect Pathway	Wildlife Resource Features Potentially Affected
Change in Habitat	Construction	Vegetation clearing and brushing required for site preparation, and temporary workspaces might temporarily or permanently change habitat through indirect or direct disturbance to vegetation.	• Birds • Small mammals • Medium and large mammals • Herptiles

Potential Effect	Project Phase	Effect Pathway	Wildlife Resource Features Potentially Affected
		Sensory disturbance (i.e., noise) from construction activities might displace some wildlife species from habitats around construction sites and access roads and trails, reducing habitat effectiveness during construction.	• Birds • Small mammals • Medium and large mammals • Herptiles
Change in Mortality Risk	Construction	Site preparation (vegetation clearing and brushing) might cause direct wildlife mortality because occupied small mammal dens or nests might be destroyed though none were directly observed. Individual animals that cannot move quickly from the affected area are more likely to be affected, such as small mammals and herptiles.	• Birds • Small mammals • Herptiles
		Construction traffic on 50 Street might cause direct wildlife mortality through vehicle–wildlife collisions	• Birds • Small mammals • Herptiles

Proposed Mitigation Measures

Snow fencing or other suitable barriers will be installed at the clearing boundary of the Study Area, to demarcate the Project boundary. The clearing of timber, stumps, brush, or any other vegetation outside footprint boundaries will be prohibited, thus preserving the remaining habitat.

Construction activities associated with the Project should be restricted to specific hours as per the City of Edmonton's Community Standards Bylaw 14600.

Given that the GBWWTP is completely enclosed by a perimeter fence and that it is already very active, it is highly unlikely that the ungulates for which the KWBZ was created are using the Study Area. Therefore, the RAP for conducting construction work within the KWBZ (January 15 to April 30) should be able to be avoided. AEP should be contacted and consulted with prior to initiation within the RAP to confirm this.

Where feasible, clearing activities will be avoided during the restricted activity period (RAP) for migratory birds (March 15 to August 15). If this cannot be done a survey for nesting birds should

be conducted by a qualified biologist prior to tree clearing. If warranted, additional RAPs will be described by a Professional Biologist.

Residual Effects

The residual adverse impacts on wildlife due to the Project are low magnitude impacts. There are small measurable changes to habitat, and mortality risk primarily related to the Project construction activities.

Low magnitude impacts to habitat in the Study Area are anticipated as a result of project construction activities, and to a lesser extent project operations. Habitat impacts, including approximately 1312 m^2 of vegetation clearing as well as sensory disturbance, are anticipated to be limited to the Project area, permanent in duration and of high-likelihood.

Project activities are anticipated to increase the risk of wildlife mortality during the construction period. Mortality risk will be reduced by implementing mitigations such as restricted activity periods for migratory birds. A pre-clearing nest survey may be indicated depending on project construction timing.

Overall the residual impacts of the Project on wildlife mortality risk are anticipated to have a low likelihood of causing a short term effect of low magnitude, limited to the project extent.

5.4 AESTHETICS

Potential Effects

During construction, some may view the aesthetics of the GBWWTP will be negatively affected by the loss of native vegetation, presence of excavations, machinery, construction materials, and temporary construction fencing, which will be visible from adjacent trails, park and from the north side of the river. However, the existing nature of the GBWWTP and the day to day activity that occurs there doesn't lend to a high aesthetic value in the pre-project condition. Once construction is complete, some may consider the aesthetics negatively impacted by the permanent loss of trees and the increase in truck traffic associated with operation of the facility.

Proposed Mitigation Measures

The majority of the construction footprint and access will be delineated by fencing and limited to the GBWWTP boundaries, which will control the amount of disturbed area. Upon completion of construction, temporary fencing and walkway protection will be removed and new internal fencing will be installed to protect the remaining forested area. The Project has also been designed with the aesthetics of the GBWWTP and its structures in mind.

Residual Effects

A low volume of extra truck traffic (approximately 2 trucks/day) will increase the traffic into the GBWWTP, but is anticipated not to be noticeable given the volume of existing traffic the facility receives. The construction of the proposed Project is anticipated to have a low likelihood of causing a short term effect to aesthetics of moderate magnitude at a project extent. The operation of the proposed Project is anticipated to have a low likelihood of causing a long term effect of low magnitude to aesthetics at a Project extent.

5.5 NOISE

Potential Effects

Noise from construction and construction traffic may negatively affect some park users, trail users or residents. The main sources of potential noise during operation will be associated with the HVAC supply air unit, the odour control unit, or the backing up of trucks in preparation for offloading. This is not anticipated to be significantly louder than the baseline noise already generated at the GBWWTP.

Noise effects related to wildlife has been addressed in Section 5.3.

Proposed Mitigation Measures

Depending on the equipment selected, screen walls to buffer noise will be considered and noise modeling of these systems will be evaluated and incorporated into the detailed design for the SGRTF. The Community Standards Bylaw (City of Edmonton 2014) should be followed in regard to the hours and levels of acceptable noise. Noise should be limited during the early morning and late evening hours, when wildlife movement is most likely in the native forest areas adjacent to the Park and the residents in the neighborhood nearby are trying to sleep. In addition, The natural setback created by Gold Bad Park between the residents of the Gold Bar neighborhood and the existing facility as well as the substantial elevation change between the two elements, will limit the disruption to residents in regards to onsite activities.

Residual Effects

With the application of the above mitigation measures, the construction of the proposed Project is anticipated to have a high likelihood of causing a short term effect in regards to noise of low magnitude at a local extent. With the application of above mitigation measures, the operation of the proposed Project is anticipated to have a low likelihood of causing a long term effect in regards to noise within the Study Area of low magnitude at a local extent.

5.6 ODOUR

Potential Effects

The sanitary grit to be accepted at the SGRTF is a mixture of inorganic and organic/fecal material that is often highly odourous. Odour concerns may negatively affect the park users, trail users or residents during the transport, offloading process, and the treatment process if not mitigated.

Proposed Mitigation Measures

To control odours released from truck discharges and grit processing operations, the building will be constructed to enclose the truck receiving area and processing equipment. The building is sized such that a hydrovac truck can park in the facility and discharge its contents with the door closed to contain odours. In addition, truck hold tanks will be washed out while within the facility and the facility will be equipped with a dedicated HVAC and odour control system. Air space volumes, exchange rates and ventilation rates will be designed to create an acceptable work environment for operations staff and a carbon absorber system will be installed to treat the exhaust air from the facility.

Residual Effects

With the application of the above mitigation measures, the proposed Project is anticipated to have a low likelihood of causing a long term effect in regards to odour of low magnitude at a local extent.

5.7 PUBLIC AND CONTRACTOR SAFETY

Potential Effects

The GBWWTP is not a highly visited facility with respect to public; however, the adjacent trails and park are used actively. The GBWWTP perimeter fence will not be affected by the proposed construction activities and will remain in place, effectively isolating the site from the public. The deep excavation and subsequent construction activities could however pose safety hazards to contractors and staff working within the GBWWTP site. Buried utilities could also pose a safety concern to contractors conducting ground disturbance activities. The change in traffic volume

both during construction and operation could impact the public; however, there is not anticipated to be a noticeable change in traffic given the existing volume of traffic already frequenting the site and access roadways.

Proposed Mitigation Measures

To mitigate the safety hazards to the public and contractors, temporary fencing will be installed around the working area. The section of trail directly adjacent to the project site will be covered to provide safe and uninterrupted use during construction. Upon completion of construction, the impacted section of the trail will be fully restored to conditions prior to construction.

All vehicular access into the GBWWTP will be through the west gate, which will continue to be monitored by security personnel between the hours of 7 am and 5 pm. The east gate, which is also manned, will be used for contractor personnel that do not require a vehicle on plant site. This will provide separation of contractors and the public, protecting the public from the hazards of the site, and allowing the contractors to focus on the tasks and hazards within the site. The contractor will be required to follow site specific safety requirements and may also have to develop additional safety documentation.

Residual Effects

With the application of the above mitigation measures, the proposed Project is anticipated to have a low likelihood of causing a short term effect in regards to public and contractor safety within the Study Area of high magnitude at a project extent.

6.0 PUBLIC CONSULTATION

The Gold Bar community was first notified of The Project in early 2015 during one of the quarterly community advisory panel (CAP) meetings, and the Project was well received. Area residents, park users, community leagues, government and the media have been identified as potentially affected stakeholders for the SGRTF. Outlined below are the proposed communication strategies/activities associated with the potentially relevant stakeholders.

Area Residents	▪ Open House (tentatively scheduled for November 4, 2015) ▪ Community Newsletter
Park Users	▪ Open House (to be communicated through local community newsletters and the Edmonton Journal) ▪ Signage (outlining work) ▪ Webpage on EPCOR's site
Community Leagues	▪ Solicit feedback from community league coordinators regarding additional communication strategies(Highlands, Beverly Heights, Fulton Place, Capilano, and Gold Bar)
Government	▪ Managed by EPCOR's Government Affairs group
Media	▪ Managed by EPCOR's media team ▪ Monitor social media sites for posts relating to the project

Schedule

The newspaper advertisements were scheduled to be run approximately four weeks prior to the open house. Open house invitations were to be mailed approximately two weeks prior to the open house. The target date for the open house is November 4, 2015. Community newsletters will be mailed at the end of 2015 or early 2016, pending final design details.

7.0 RECOMMENDATIONS

It is recommended that all mitigation measures detailed within Section 5.0 of this report be implemented. In addition, the following best management practices should be considered throughout the life of the Project:

- Wherever possible, minimize vegetation removal throughout the construction footprint.
- Install temporary construction fencing to isolate the construction area and protect existing trees from root and trunk damage. Remove temporary fencing upon completion of construction and install permanent fencing as required.
- Avoid clearing tree clearing activities during the migratory bird restricted activity period (March 15 to August 15) and consult with AEP if work needs to be completed during the KWBZ restricted activity period (January 15 to April 30).
- Fuel and maintenance materials stored within the working area for non-mobile equipment should be protected with appropriate containment measures to prevent spills and release of these fluids/substances to the environment. Ensure that an emergency spill kit will be kept on site in the event of fluid leaks or spills.
- Restrict construction activities to conform with the City of Edmonton's Community Standards Bylaw 14600.
- Ensure that all provincial, federal and municipal legislative requirements have been met, that contractors have read all approvals, and that copies of all approvals are present on site during construction.
- Construct a trail protection structure adjacent to the project site to provide safe and uninterrupted use of the trail during construction.
- Erect signage and barriers to educate the public and prevent public access to the construction site.
- An application has been made to Alberta Culture and Tourism for *Historical Resources Act* clearance for the project to proceed. EPCOR will abide by any conditions issued by Alberta Culture and Tourism.
- Reclaim disturbed areas as quickly as possible. Areas subject to vehicle/construction traffic that will be reclaimed should be decompacted prior to seeding.
- A weed control plan should be developed in accordance to the number and species of weeds observed, as required.

8.0 LIMITATIONS AND QUALIFICATIONS

In conducting the investigation and rendering our conclusions, Stantec gives the benefit of its best judgment based on its experience and in accordance with generally accepted professional standards for this type of investigation. This report was submitted with the best information to date and on the information provided. The conclusions made within this report are a professional opinion, not a certification of the Study Area's environmental condition, and no other warranty, expressed or implied, is made. This report has been prepared for the exclusive use of EPCOR for the purposes of assessing the potential environmental effects on the Study Area of the proposed Project and recommending measures to mitigate identified effects. Any use which any third party makes of this report, or any reliance on or decisions to be made on it, are the responsibility of such third parties. Stantec accepts no responsibility for damages, if any, suffered by any other third party as a result of decisions made or actions based on this report. Our conclusions are limited by the following:

- The field assessments were completed during the dates specified and conditions may vary outside that time
- The information contained within this report is based on the design drawings available at the time of report preparation. Should the drawings be amended in the future, revisions to the report may be required
- The investigation was limited to those parameters specifically outlined in this report

9.0 REFERENCES

AECOM. 2015. *Gold Bar Wastewater Treatment Plant Updated Phase I Environmental Site Assessment 10977 – 50 Street, Edmonton, Alberta – Final*. Edmonton.

Alberta Environment. 2003. *Weeds on industrial development sites – regulations and guidelines R&R / 03-4*. <http://www.environment.gov.ab.ca/info/library/5929.pdf> Accessed September 2015.

Alberta Environment and Parks (AEP). 2015a. *Alberta Conservation Information Management System* (ACIMS). Alberta Environment and Parks, Edmonton. http://www.albertaparks.ca/albertaparksca/management-land-use/alberta-conservation-information-management-system-(acims)/tracking-watch-lists.aspx. Accessed: August 2015.

AEP. 2015b. *Fisheries and Wildlife Management Information System* (FWMIS)- List of species of concern. http://esrd.alberta.ca/fish-wildlife/fwmis/default.aspx. Accessed: September 3, 2015.

AEP. 2015c. *Recommended land use guidelines – Key Wildlife Biodiversity Zones*. Available at: http://esrd.alberta.ca/fish-wildlife/wildlife-land-use-guidelines/default.aspx. Accessed on: September 15, 2015

AEP. 2015d. Wild Species Status Search. http://esrd.alberta.ca/fish-wildlife/species-at-risk/wild-species-status-search.aspx Accessed Sep 15, 2015.

Alberta Environmental Protection. 1991. *Alberta vegetation inventory standards manual*. Version 2.1. Alberta Environmental Protection, Resource Data Division, Data Acquisition Branch, Edmonton.

Environment and Sustainable Resource Development. 2013. *Sensitive Species Inventory Guidelines*. Alberta Fish and Wildlife Division, Edmonton. Available at: http://esrd.alberta.ca/fish-wildlife/wildlife-management/sensitive-species-inventory-guidelines.aspx. Accessed September 15, 2015.

Alberta Native Plant Council. 2006. *Plant collection guidelines for researchers, students and consultants*. <http://www.anpc.ab.ca/assets/researchers_students.pdf> Accessed August 2015.

Alberta Energy Regulator and Government of Alberta. 2013. *Integrated Standards and Guidelines: Enhanced Approval Process* (EAP). Available at: http://esrd.alberta.ca/forms-maps-services/enhanced-approval-process/eap-manuals-guides/default.aspx. Accessed: September 15, 2015.

Bibby, C.J., N.D. Burgess, D.A. Hill, and S. Mustoe. 2000. *Bird Census Techniques* (Second Edition). London: Academic Press.

City of Edmonton. 2000. *A Guide to Environmental Review Requirements in the North Saskatchewan River Valley and Ravine System*. City of Edmonton Planning and Development. Edmonton.

City of Edmonton. 2005a. *Erosion and Sedimentation Control Guidelines*. Edmonton.

City of Edmonton. 2005b. *Erosion and Sedimentation Control Field Manual*. Edmonton.

City of Edmonton. 2008. *Biodiversity Report*. Edmonton.

City of Edmonton. 2010. *North Saskatchewan River Valley Area Redevelopment plan, Bylaw No. 7188*. Planning and Development Department, Planning and Policy Services Branch. Edmonton.

City of Edmonton. 2013. *Community Standards Bylaw, Bylaw No. 14600*. City of Edmonton. Edmonton.

City of Edmonton. 2015. Sanitary Grit Residuals Treatment Facility Business Case. Drainage Services Edmonton, Alberta.

Doubt, J. and R. Belland. 2000. *Monitoring protocols for elements of nonvascular plant diversity in Alberta's forested zones*. Alberta Biodiversity Monitoring Program. Accessed August 2015. <http://www.abmi.ca/abmi/reports/reports.jsp>

EPEC Consulting Western Ltd. 1981. *North Saskatchewan River valley and ravine system biophysical study*. Edmonton.

Government of Canada. 2015. Species at Risk Public Registry – Species Search. Available at: http://www.sararegistry.gc.ca/search/SpeciesSearch_e.cfm. Accessed on: September 15, 2015

Historical Resources Act. R.S.A. 2000. c. H-9.

Integrated Taxonomic Information System (ITIS). 2015. *Integrated Taxonomic Information System.*. Available at: <www.itis.gov> Accessed: September 2015.

Migratory Bird Convention Act. S.C. 1994, c. 22.

Migratory Birds Regulations. C.R.C., c. 1035. (*Migratory Birds Convention Act,* 1994).

Natural Regions Committee. 2006. *Natural regions and subregions of Alberta*. Compiled by D.J. Downing and W.W. Pettapiece. Government of Alberta. Edmonton.

Noble, B.F. 2006. *Introductions to Environmental Impact Assessment: Guide to Principles and Practice*. Oxford University Press. Toronto: Oxford University Press.

Occupational Health and Safety Act. R.S.A. 2000, c. O-2.

Species at Risk Act. S.C. 2002, c. 29.

Stantec Consulting Ltd. 2015. *Geotechnical Investigation EPCOR Grit Handling Facility Gold Bar Wastewater Treatment Facility.* Edmonton.

Stewart, R.E. and H.A. Kantrud. 1971. *Classification of natural ponds and lakes in the glaciated prairie region.* Bureau of Sport Fisheries and Wildlife, U.S. Fish and Wildlife Service, Resource Publication 92. Washington.

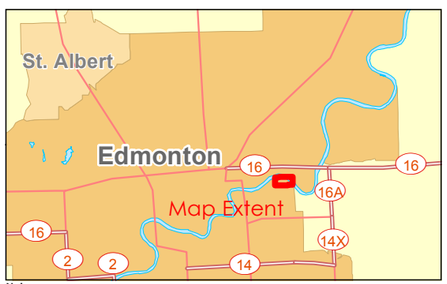
Weed Control Act. S.A. 2008, c. W-5.1.

Weed Control Regulation. Alta. Reg. 19/2010.

Wheatley, M. and Bentz, J. 2002. *A Preliminary Classification of Plant Communities in the Central Parkland Natural Sub-Region of Alberta*. Edmonton.

Wildlife Act. R.S.A. 2000, c. W-10.

APPENDIX A
FIGURES AND DRAWINGS



Study Area

ATS Quarter Section Grid

0 60 120 metres

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Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Orthoimagery: City of Edmonton, Transportation, 2014.

Stantec EPCOR

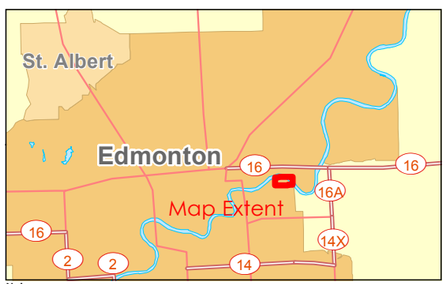
Project Location
Gold Bar Park Road, SW-12-053-24W4
NE Edmonton

110146363
Prepared by LF on 2015-09-15
Review by MK on 2015-09-16
Revised by LF on 2015-10-23

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
1.0

Title
Overall Site Plan



- Spring Rare Plant Survey
- Summer Rare Plant Survey
- Candidate Location Footprint
- Utility Right of Way
- Future Bioreactor Expansion
- Study Area
- Tree Clearing Extent
- ACIMS Occurence
- ATS Quarter Section Grid

0 60 120 metres

1:3,000 (At original document size of 11x17)

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Orthoimagery: City of Edmonton, Transportation, 2014.
4. ACIMS: Alberta Environment and Parks, 2015.
5. Site Details: Stantec, Water, Figure 5.0 Residual Solid Receiving Facility Location C, (.DWG).

Stantec EPCOR

Project Location
Gold Bar Park Road, SW-12-053-24W4
NE Edmonton

110146363
Prepared by LF on 2015-09-16
Review by MK on 2015-09-16
Revised by LF on 2015-10-23

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
2.0

Title
Rare Plant Survey Locations

J:\110Zactive\110146363\gis\EIA\EIA_Figure2_0_RarePlant.mxd Revised 2015-10-23 By: tfischuk

38400 38600 38800 39000 39200 39400

5936600

5936400

SE-11-053-24W4

SW-12-053-24W4

SE-12-053-24W4

North Saskatchewan River

50 Street North-west

Gold Bar Park Road

Storm Sewer ROW

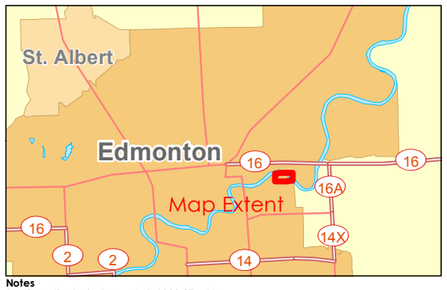
MBR Forcemain ROW

109A Avenue North-west

46 Street North-west

109 Avenue North-west

N



- Candidate Location Footprint
- Utility Right of Way
- Future Bioreactor Expansion
- Study Area
- Tree Clearing Extent
- Key Wildlife and Biodiversity Zone
- ATS Quarter Section Grid

NOTE: Entire Area Within Sensitive Raptor Range and Sharp Tailed Grouse Survey Area

0 60 120 metres

1:3,000 (At original document size of 11x17)

Stantec EPCOR

Project Location
Gold Bar Park Road, SW-12-053-24W4
NE Edmonton

110146363
Prepared by LF on 2015-09-16
Review by MK on 2015-09-16
Revised by LF on 2015-10-23

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
3.0

Title
Wildlife Sensitivity

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Orthoimagery: City of Edmonton, Transportation, 2014.
4. Key Wildlife Biodiversity Zone: Alberta Environment and Parks, 2015.
5. Site Details: Stantec, Water, Figure 5.0 Residual Solid Receiving Facility Location C. (.DWG).

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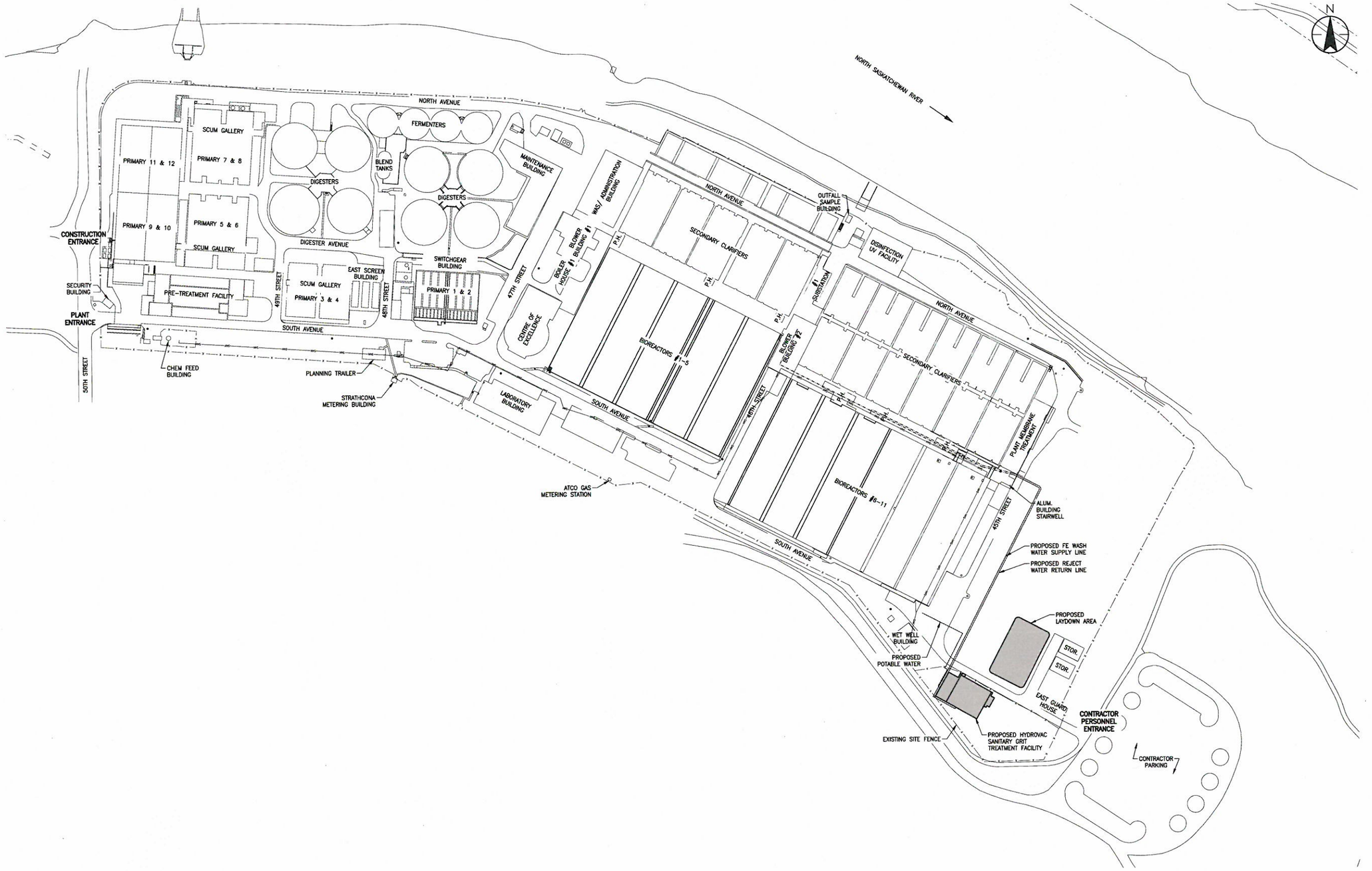

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A	2015.10.15	PRELIMINARY DESIGN	P.D.S.	W.L.	W.L.	Y.L.

ENGINEER

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EDMONTON, ALBERTA, CANADA

EPCOR

GOLD BAR WASTEWATER TREATMENT PLANT
HYDROVAC SANITARY GRIT TREATMENT FACILITY

GENERAL GOLD BAR WASTEWATER TREATMENT PLANT

DRAWING FILE NAME	PROJECT No.	
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OCTOBER 2015		
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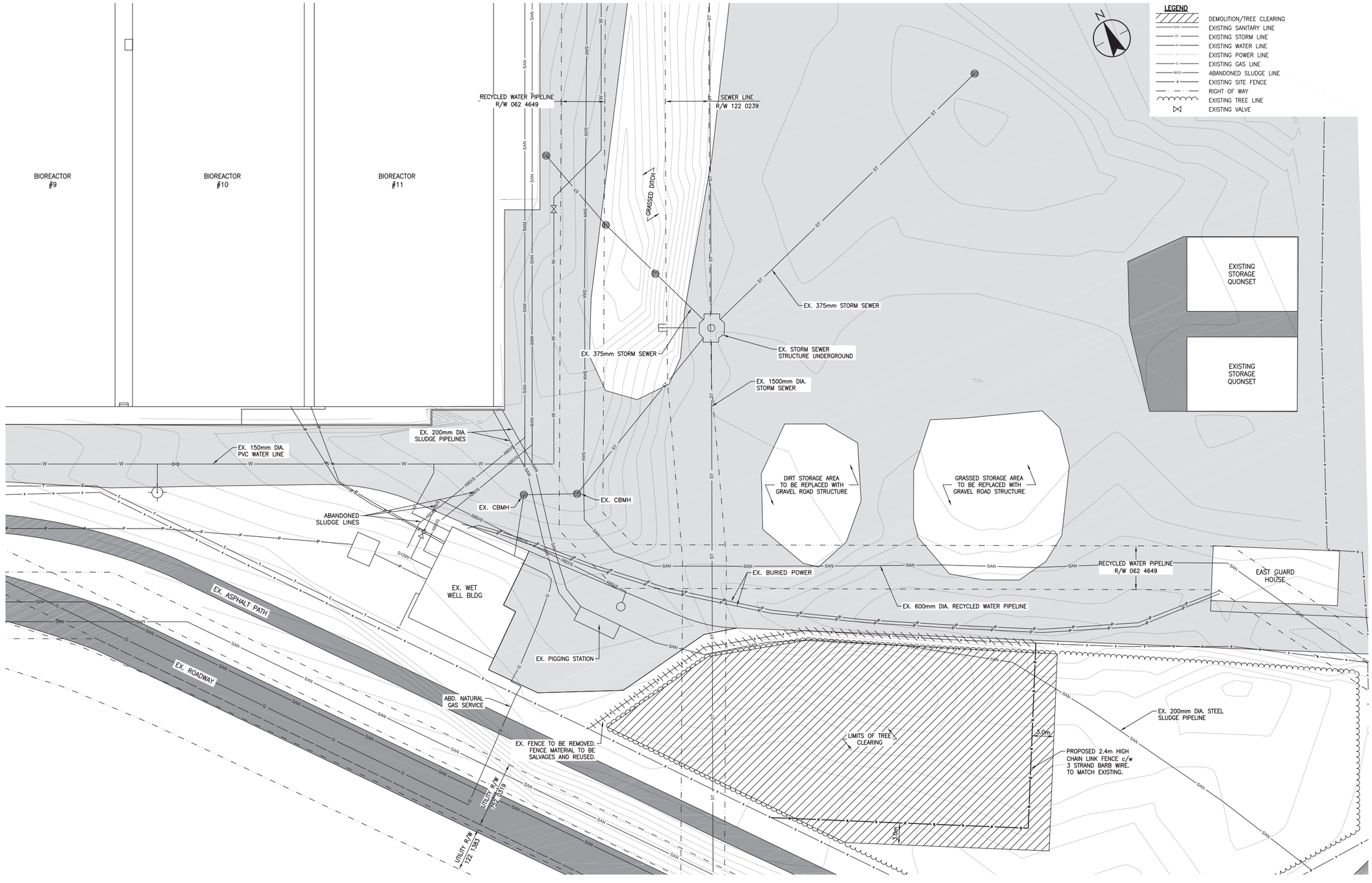

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ENGINEER

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EPCOR

GOLD BAR WASTEWATER TREATMENT PLANT
HYDROVAC SANITARY GRIT TREATMENT FACILITY

CIVIL
EXISTING TOPOLOGY AND UTILITIES, CLEARING, AND FENCING PLAN

DRAWING FILE NAME	PROJECT No.	
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DATE:		
AUGUST 2015		
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CODE	DRAWING	REV.
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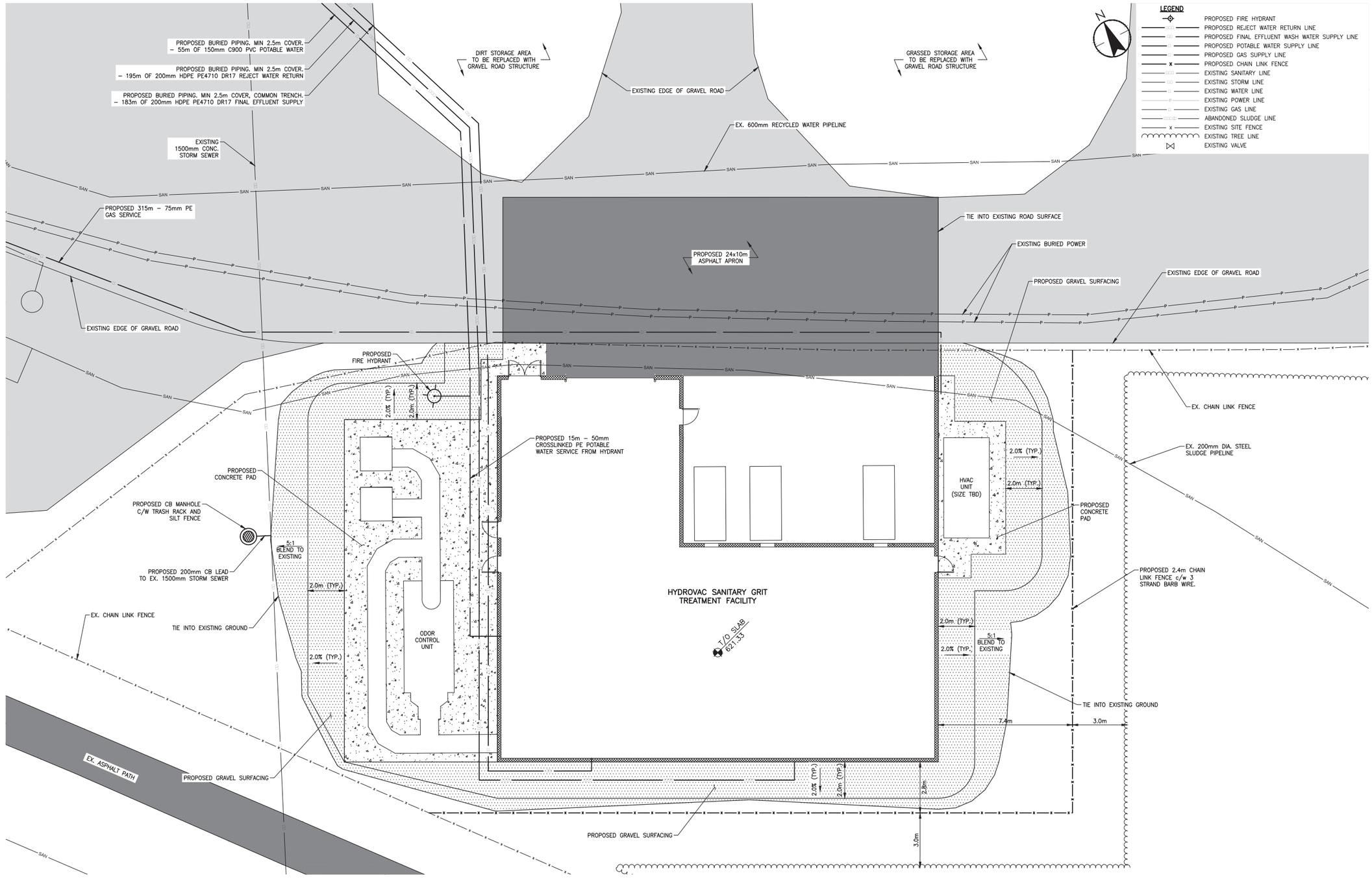

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GOLD BAR WASTEWATER TREATMENT PLANT
HYDROVAC SANITARY GRIT TREATMENT FACILITY

CIVIL
FACILITY GRADING PLAN

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APPENDIX B
HISTORIC AERIAL PHOTOGRAPHS

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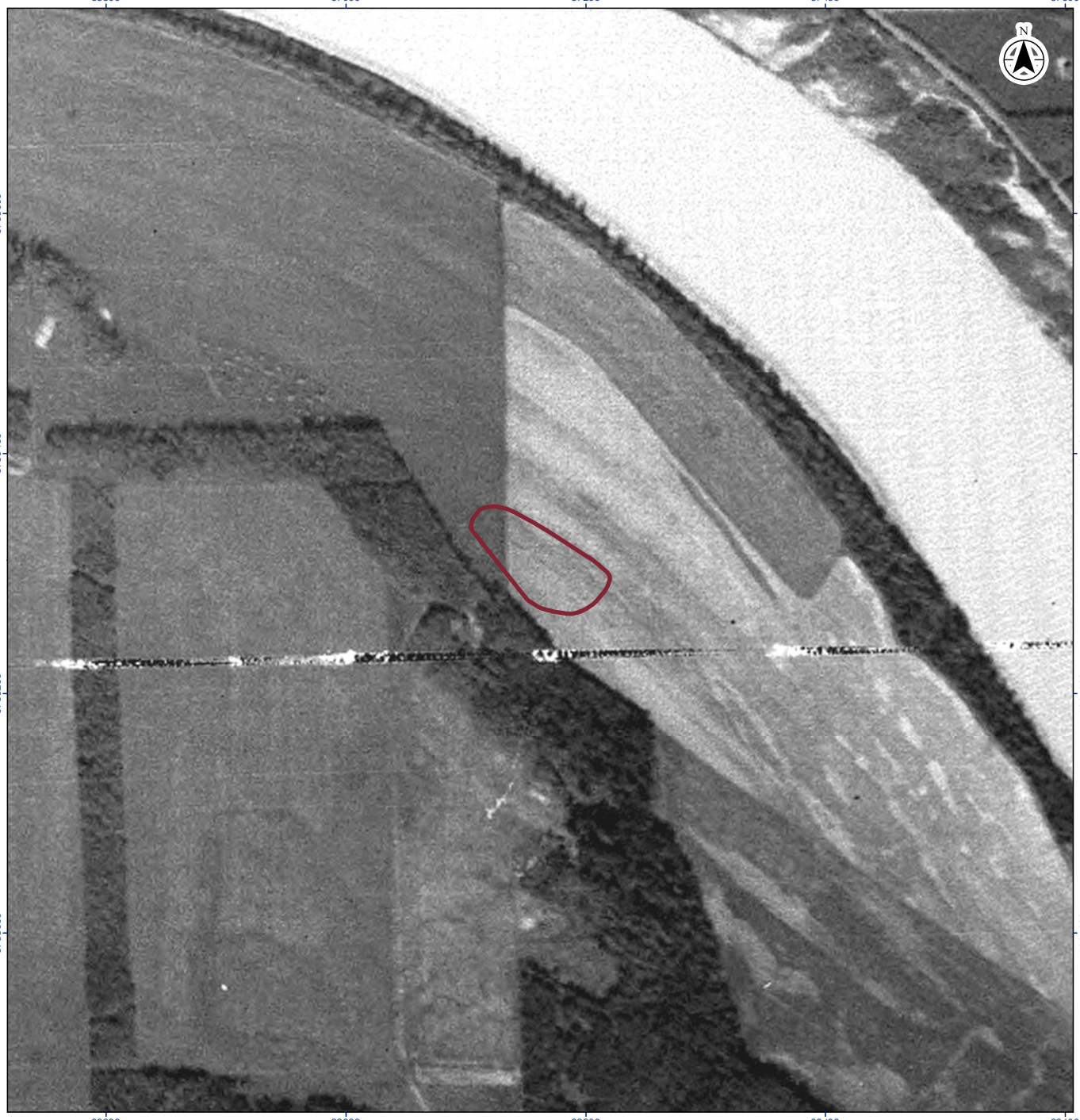

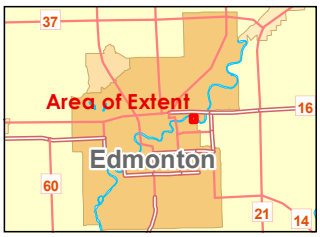

Geotechnical Assessment Area

0 50 100 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 12-053-24 W4M
Gold Bar Park Road,
NE Edmonton, Alberta

110146363
Prepared by LF on 2015-08-31
Review by MK on 2015-08-31

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
1950

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-134-108, 1950-08-20

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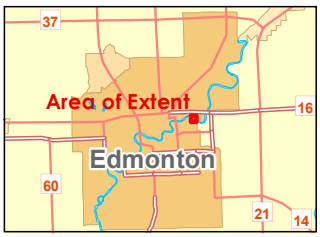

Geotechnical Assessment Area

0 50 100 metres

1:5,000 (at original document size of 8.5x11)

Stantec

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Environmental Impact Assessment

Figure No.
1962

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-818-151, 1962-05-08

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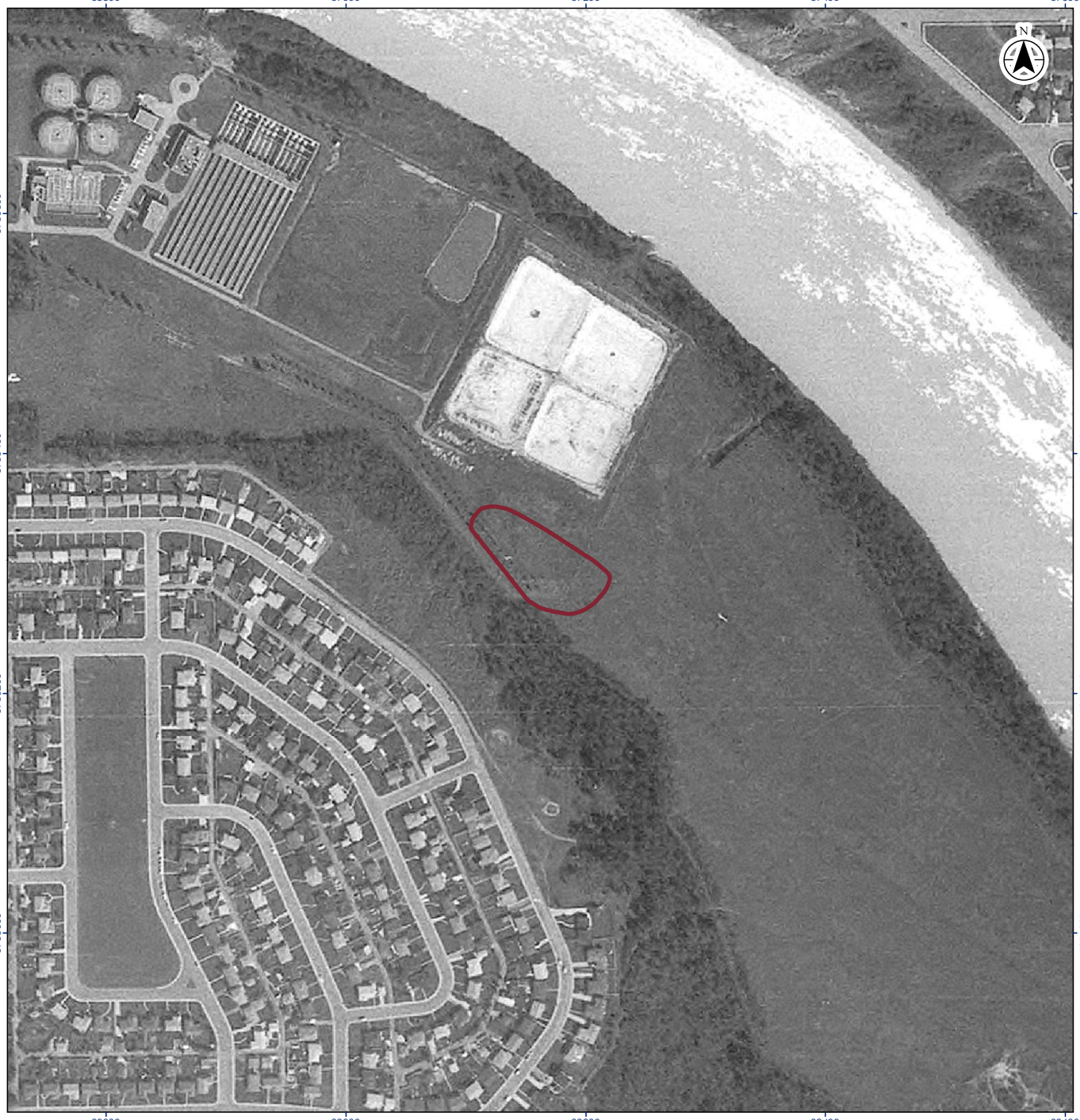

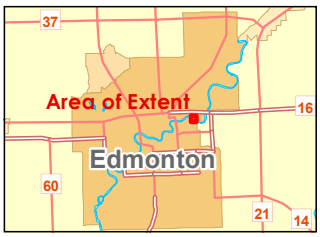

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Notes
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2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-979-260, 1967-08-15

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Environmental Impact Assessment

Figure No.
1967

Title
Historic Aerial Photograph Review

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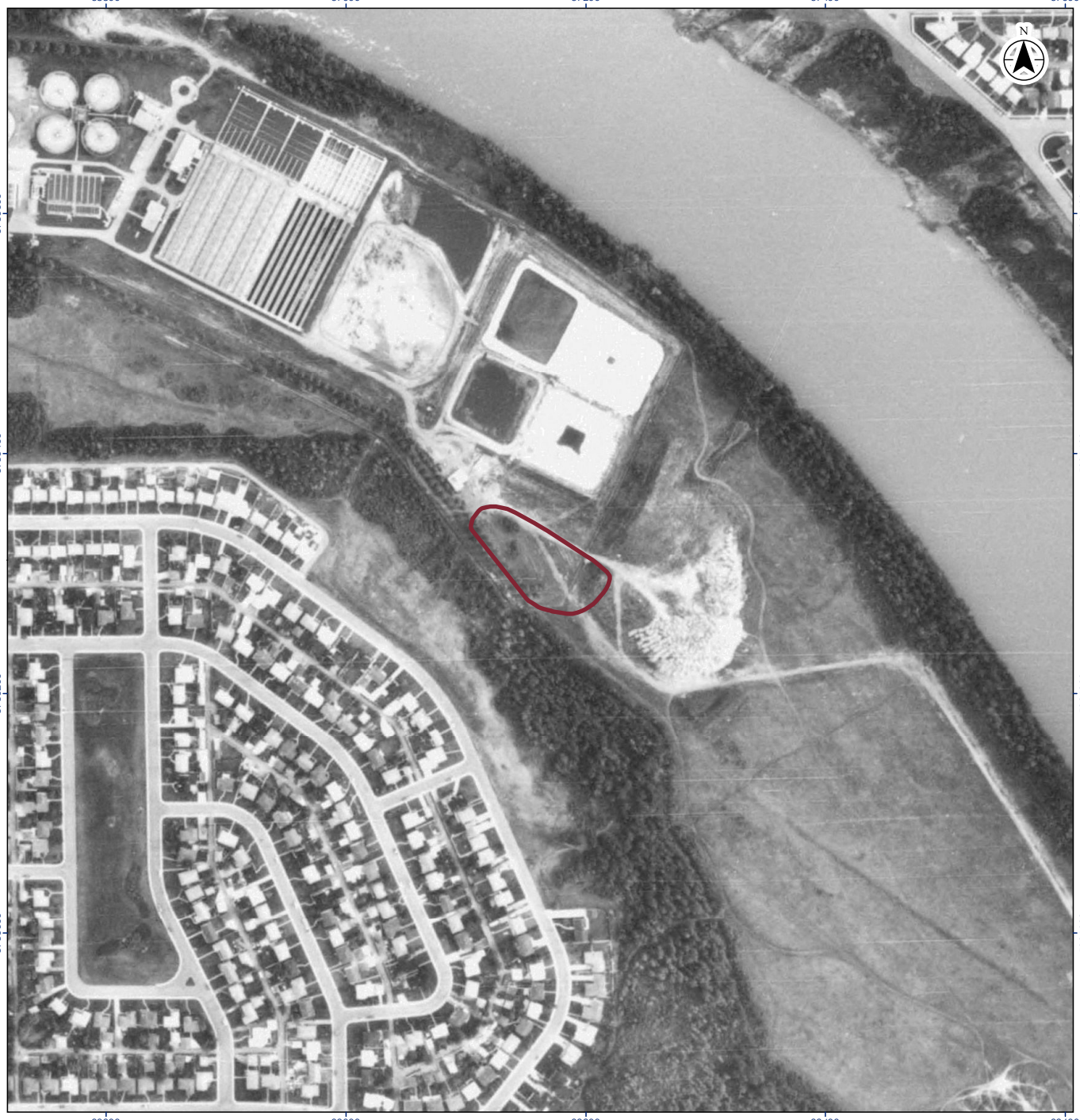

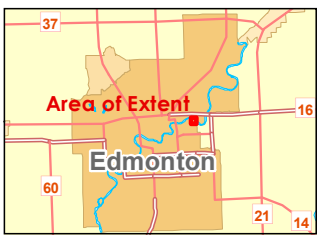

Geotechnical Assessment Area

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Client/Project
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Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
1973

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-1279-31, 1973-07-06

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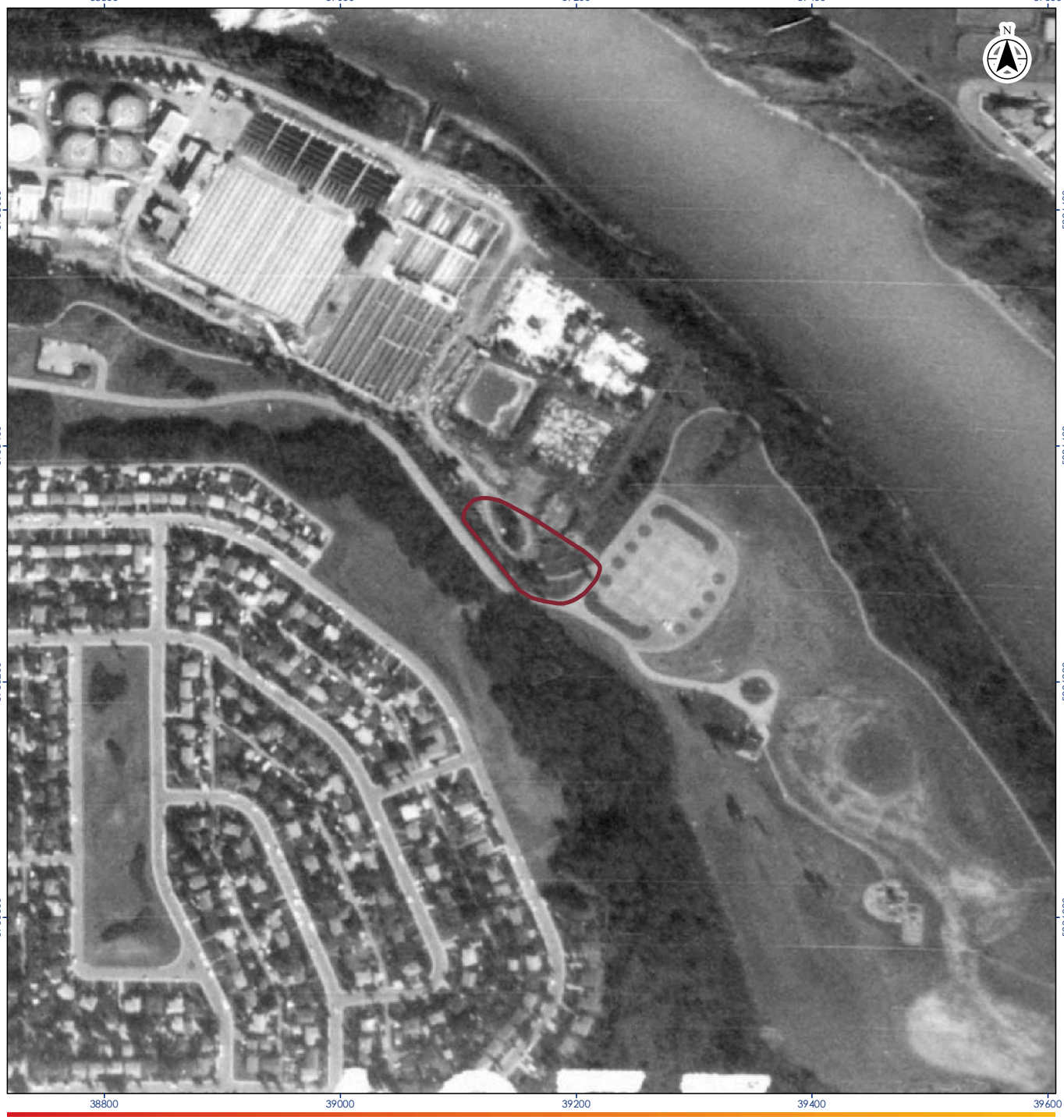

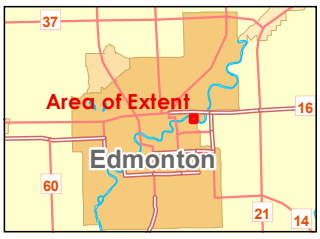

Geotechnical Assessment Area

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Stantec

Project Location
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NE Edmonton, Alberta

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Prepared by LF on 2015-08-31
Review by MK on 2015-08-31

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
1979

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-1955-30, 1979-09-01

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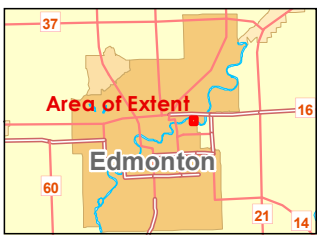

Geotechnical Assessment Area

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Stantec

Project Location
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Gold Bar Park Road,
NE Edmonton, Alberta

110146363
Prepared by LF on 2015-08-31
Review by MK on 2015-08-31

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
1985

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-3109-258, 1985-05-12

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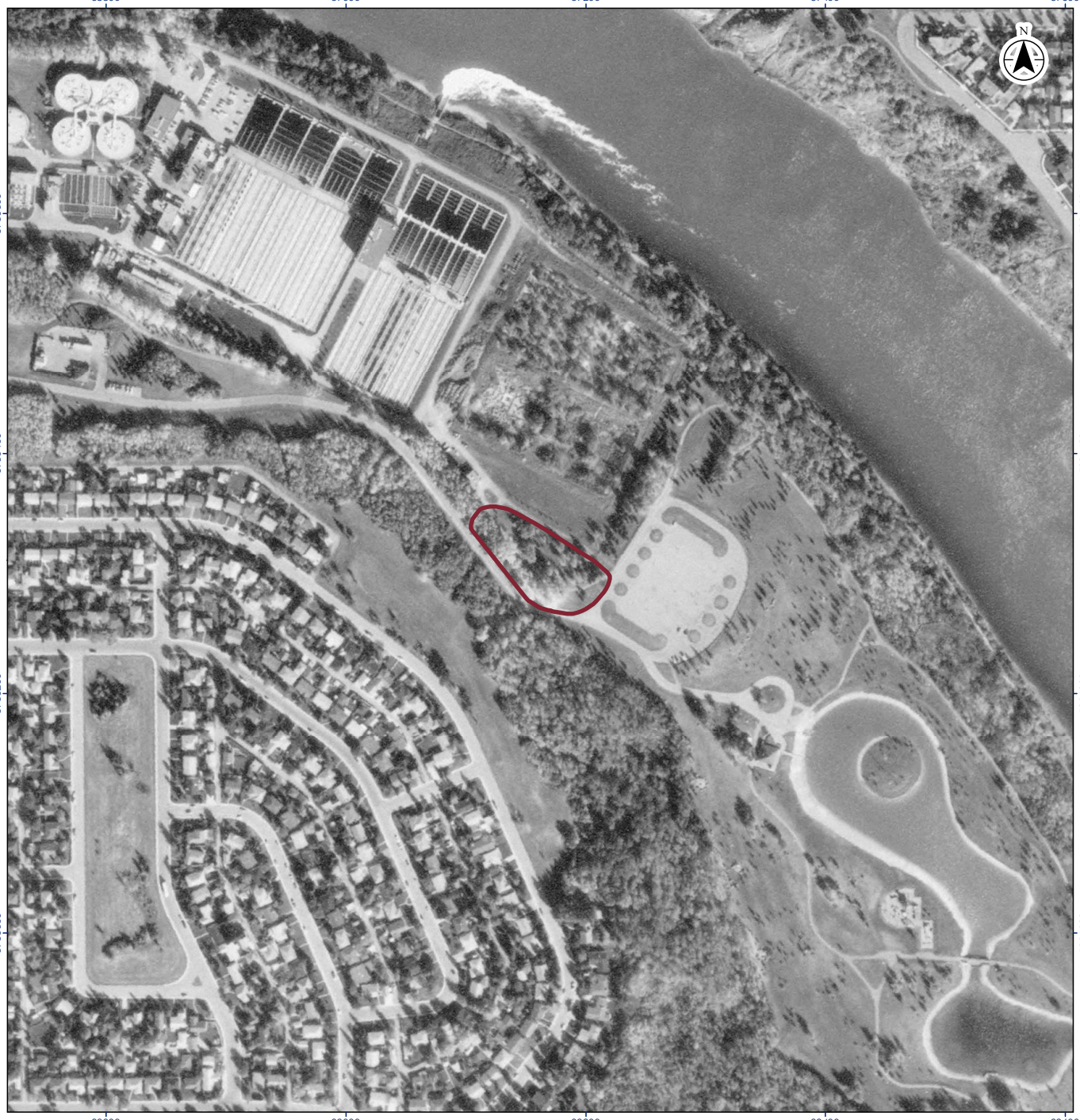

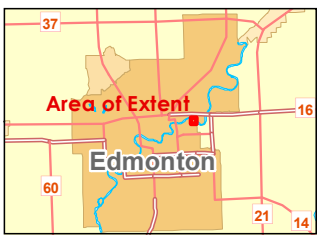

Geotechnical Assessment Area

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Project Location
SW¼ 12-053-24 W4M
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NE Edmonton, Alberta

110146363
Prepared by LF on 2015-08-31
Review by MK on 2015-08-31

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
1990

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-4068-89, 1990-09-28

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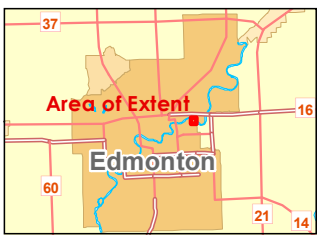

Geotechnical Assessment Area

0 50 100 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 12-053-24 W4M
Gold Bar Park Road,
NE Edmonton, Alberta

110146363
Prepared by LF on 2015-08-31
Review by MK on 2015-08-31

Client/Project
EPCOR
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Environmental Impact Assessment

Figure No.
1996

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, AS-4744-62, 1996-10-17

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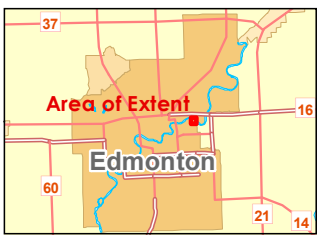

Geotechnical Assessment Area

0 50 100 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 12-053-24 W4M
Gold Bar Park Road,
NE Edmonton, Alberta

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Prepared by LF on 2015-08-31
Review by MK on 2015-08-31

Client/Project
EPCOR
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Environmental Impact Assessment

Figure No.
2001

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: Alberta Environment and Parks, ED2001-233, 2001-04-29

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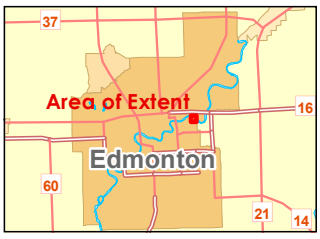

Geotechnical Assessment Area

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1:5,000 (at original document size of 8.5x11)

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Project Location
SW¼ 12-053-24 W4M
Gold Bar Park Road,
NE Edmonton, Alberta

110146363
Prepared by LF on 2015-08-31
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EPCOR
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Environmental Impact Assessment

Figure No.
2005

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, Transportation, 2005

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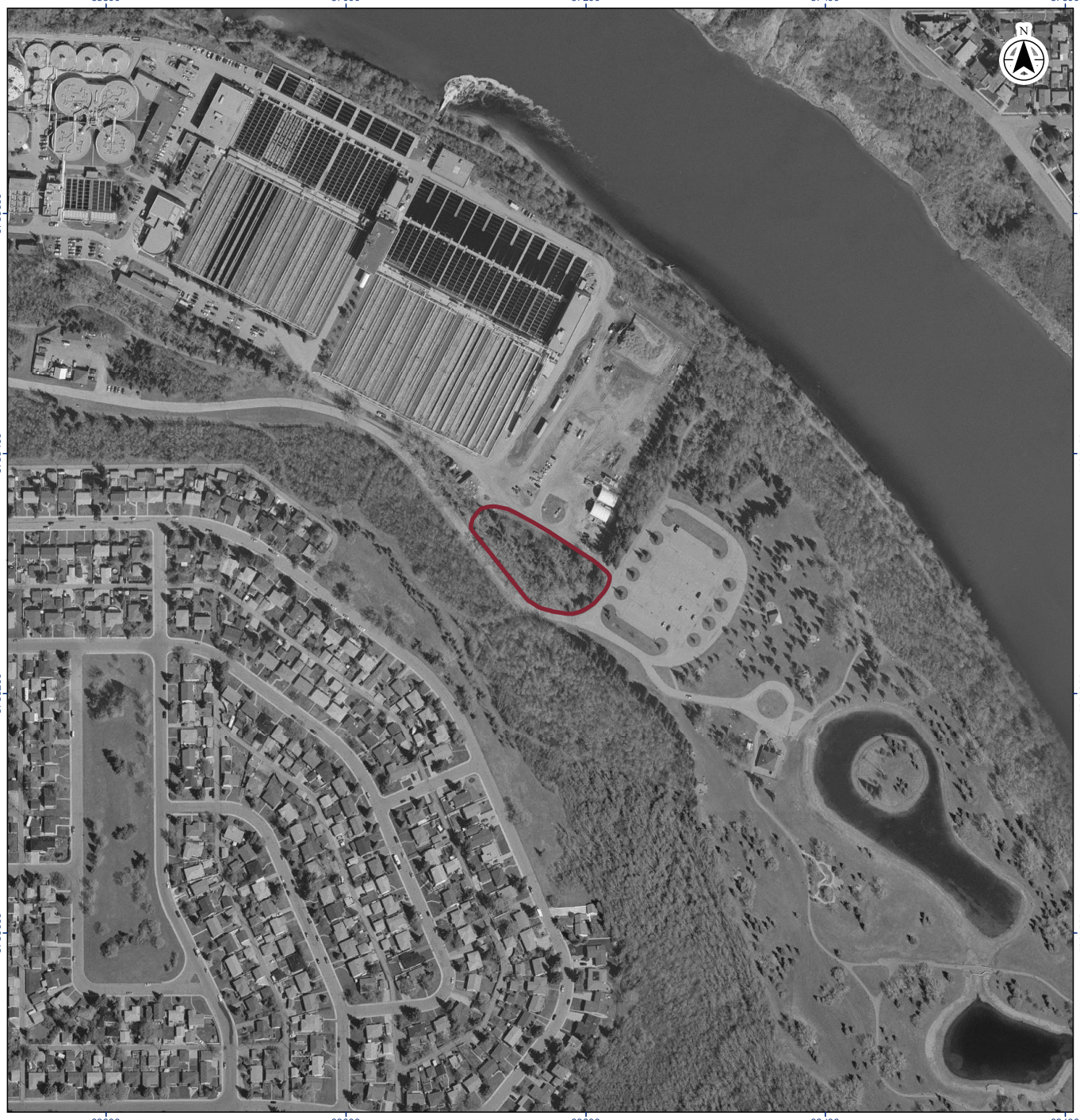

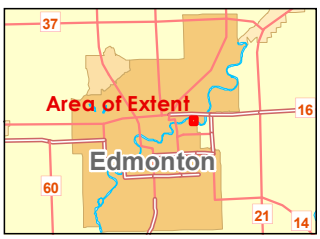

Geotechnical Assessment Area

0 50 100 metres

1:5,000 (at original document size of 8.5x11)

Stantec

Project Location
SW¼ 12-053-24 W4M
Gold Bar Park Road,
NE Edmonton, Alberta

110146363
Prepared by LF on 2015-08-31
Review by MK on 2015-08-31

Client/Project
EPCOR
Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
2010

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, Transportation, 2010

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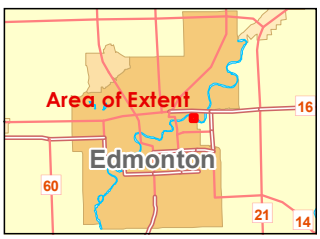

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Sanitary Grit Residuals Treatment Facility
Environmental Impact Assessment

Figure No.
2014

Title
Historic Aerial Photograph Review

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada, All rights reserved.
3. Imagery: City of Edmonton, Transportation, 2014

APPENDIX C
GEOTECHNICAL REPORT

Geotechnical Investigation EPCOR Grit Handling Facility Gold Bar Wastewater Treatment Facility, Edmonton, AB

EPCOR Grit Handling Facility

Prepared for:
EPCOR Utilities

Prepared by:
Stantec Consulting Ltd.

Project No. 110146363

October 2, 2015

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1.0 INTRODUCTION

As per our internal proposal (1233P901923) and on-going discussions with the Stantec Water Group (BC1101), the Stantec Geotechnical Group (BC1233) has completed a geotechnical investigation at the Gold Bar Wastewater Treatment Plant in Edmonton, Alberta. The investigation was undertaken to assist the Stantec project team in assessing the subsurface conditions at the location for a proposed grit handling facility.

The purpose of the geotechnical investigation was to assess the subsurface conditions at the borehole locations and based on the conditions encountered; provide preliminary geotechnical recommendations for design and construction of foundations, slabs and pavements for the proposed development. This report presents the results of our investigation, and provides geotechnical recommendations for the proposed development as described herein. Limitations associated with this report and its contents are outlined in the Statement of General Conditions provided in **Appendix A.**

It was beyond the scope of this geotechnical investigation to undertake environmental sampling or testing.

1.1 SITE AND PROJECT UNDERSTANDING

The Gold Bar wastewater treatment plant is located on the south bank of the North Saskatchewan River on inside of a river bend.

As show in **Figures 1 & 2**, of **Appendix B** the site is located in the "back 40" area at the Gold Bar Wastewater Treatment Plant in Edmonton, Alberta. The site is located on the south side of the North Saskatchewan River and is situated on a terrace within a flood plain. The area proposed for development is located in the south east corner of the Gold Bar plant site and backs on to the Gold Bar Park Road NW. At the time of the investigation the area proposed for development was primarily covered with mature trees and shrubs and grass. The site is located south of a plant access road and is generally low lying in comparison to the surrounding plant area.

It is in our understanding that the project is currently at the preliminary design stage. One to two additional boreholes will be completed within the building footprint in the area currently covered with trees during the detailed design stage of the project to confirm the subsurface conditions are consistent with the findings from this investigation. However, based on our review of the existing geotechnical data for the site, the subsurface conditions are not expected to vary much from those encountered in the present investigation.

It is understood that the proposed grit facility is approximately 400 m^2 in area and will have a basement. It is understood that the main floor will be at elevation 621.33 m. Based on the preliminary information it is understood that both slab-on-grade and structural slab on grade will be utilized for the building at the main floor elevation. It is further understood that the grit facility will have associated road access and parking. Grading design of the site is underway and for the purpose of this report it is assumed that final grades will be close existing grades. If the proposed final site grades deviate from this assumption, we should be contacted so that the recommendations in this report can be modified in the detailed design stage.

At the time of preparing this report, traffic information for the access road design was not available, therefore granular pavement structure for the proposed access road will be provided in an addendum memo to this report.

1.2 BACKGROUND

1.2.1 Geology

The surficial geology in the wastewater treatment plant area typically consists of alluvial terrace clay, silt, sand and gravel deposits overlying bedrock. The alluvial deposits typically grade from silty clay at surface to sands and gravel with depth.

The bedrock is of the Edmonton Group and consists of bentonitic claystone, sandstone and siltstone interbedded with coal seams.

1.2.2 Historical Reports

Review of previous geotechnical reports in the area was completed as part of this investigation. Thurber Engineering Ltd. (1994) conducted a geotechnical investigation at the Gold Bar Wastewater Treatment Plant for the expansion of the plant. During their investigation, Thurber drilled four test holes in close proximity to the proposed grit receiving facility and encountered clay fill underlain by silt or clay followed by sand underlain by clay shale. The subsurface conditions encountered at the time of Thurber investigation are similar to the conditions encountered during the current field investigation as described below in **Section 3.0**. The Thurber report also mentions that there were four former sludge lagoons located to the north of our study area. These lagoons were about 4.5 to 6 m deep with an asphalt liner and have not been in use since the 1960's. These lagoons are now overgrown with trees.

1.2.3 Aerial Photograph Review

A review of historical aerial photographs was conducted to collect information relevant to the development of the Study Area and the surrounding plant site. A summary of the review is provided below.

In 1950, the Study Area consisted primarily of cultivated agricultural land, surrounded by some vegetation. The first signs of residential development to the southwest of the Study Area and the first stages water treatment plant (including storage lagoons) to the north of the Study Area appear in the 1962 photograph. The 1967 photograph shows the planted trees along the perimeter of the water treatment plant site.

In 1973, there appears to be evidence of earthworks within and adjacent to the Study Area, and appearance of the existing sludge pump house. In the 1979 photograph, the vegetation within the Study Area appears to have matured and the features of the park (southeast of the Study Area) appear. The 1979 photograph also shows the multipurpose walking trail that parallels the perimeter of the existing water treatment plant. The lagoons to the north of the Study Area appear to have been overgrown with vegetation in the 1979 photograph and remain that way until the area is cleared for what appears to be a laydown/storage area in 1996. The Study Area remains relatively unchanged between 1990 and 2014, with the exception of maturing of planted trees. Throughout the water treatment plant site, infrastructure development gradually appears beginning in 1962 up until 2014.

2.0 METHOD OF INVESTIGATION

2.1 FIELD DRILLING PROGRAM

A field drilling program was carried out on August 18, 2015 in general accordance with our internal proposal sent on November 18, 2015. Stantec coordinated locating of underground utilities using Alberta One Call as well as a private locator. Following locating Stantec supervised Hydrovac daylighting of a sludge line and storm line in close proximity to the borehole locations. A total of three (3) boreholes were drilled at accessible locations on the site. Boreholes were advanced to depths ranging from 4.25 m to 14.6 m. The locations of the boreholes are shown in plan view on the attached **Figure 2** in **Appendix A**.

Disturbed grab samples were collected from the augers at 0.75 m depth intervals in all boreholes. Standard Penetration Tests (SPTs) were carried out every 1.5 m depth interval by utilizing a 50 mm diameter split-spoon sampler. Pocket penetrometer tests were also carried out on samples of cohesive soils to assist with the determination of undrained shear strength. Further details of the sampling and testing carried out are provided on the borehole records presented in **Appendix C**.

Following drilling, the approximate borehole locations were surveyed with a handheld GPS unit.

2.2 LABORATORY TESTING

Soil samples collected during the drilling program were returned to our Edmonton laboratory for classification and index testing such as moisture content, Atterberg Limits, grain size analysis and unconfined compression strength.

Select samples were also sent to Maxxam Analytics to analyze sulphates. Detailed results of the field drilling observations and laboratory testing can be found in the attached borehole records in **Appendix C** and laboratory testing reports in **Appendix D**.

3.0 SOILS

In general, the soils encountered in the borehole consisted of clay fill followed by a layer of silt/silty clay underlain by sand followed by clay shale. A detailed description of the soils encountered in each borehole can be found in the Borehole Records included in **Appendix C**.

3.1 GRAVEL FILL

Granular fill was found at the surface in Borehole BH 3 located on the gravel surfaced roadway, was 380 mm thick and underlain by a geotextile.

3.2 CLAY FILL (CL)

Clay fill was encountered at the surface of Boreholes BH 1 and BH 2 and below the granular fill in Borehole BH 3. The clay fill was brown in color and consisted of clay with some silt, some sand, trace gravel and contained occasional organics. The thickness of fill layer varied from 1 m to 2 m at the borehole locations.

Moisture contents of the clay ranged from 16.8% to 22.7%. An Atterberg limit test carried out on a sample of the clay fill indicated a Liquid Limit of 45 with a Plastic Limit 19. This result is indicative of low plastic clay (CL).

3.3 SILT TO SILTY CLAY (ML/CL)

A layer of silt to silty clay was encountered below the clay fill in Boreholes BH 1 and BH 2. The silt to silty clay was light brown in color and consisted of silt with some clay and trace sand.

Moisture contents of the silt to silty clay ranged from 11.2% to 24.4%. A hydrometer grain size analysis carried out on a sample of the silt in Borehole BH 1 indicated the material to consist of 59.3% silt, 22.0% clay and 18.7% sand. The thickness of the silt layer in borehole BH 1 was 0.3 m. In borehole BH 2, the thickness of the silty clay layer was 1.4 m.

3.4 SAND (SP)

Poorly graded sand (SP) was encountered below the silt and silty clay layer in Boreholes BH 1 and BH 2 and below the clay fill in BH 3. The sand was encountered between depths of 1.5 m and 2.45 m below ground. The sand was brown in color with occasional oxide staining.

Moisture contents of the sand ranged from 3.9% to 8.3%. Grain size analyses conducted on a sample of the sand indicated the following percentages: 3.9% gravel, 86.2% sand and 9.9% silt and clay size particles. Standard Penetration Tests (SPT's) carried out in the sand resulted N-Values ranging from 11 to 20. Based on SPT-N values, this layer of sand is characterized as compact.

3.5 CLAY SHALE BEDROCK

Highly weathered clay shale bedrock was encountered in Boreholes BH 1 and BH 2. This deposit is not cemented and essentially behaves similar to a hard, over consolidated clay that readily softens upon exposure to moisture. The clay shale is described as grey to brown, extremely weak to very weak and bentonitic. Plasticity indices are expected to be similar to high plasticity cohesive soil as would be expected with a bentonitic deposit. The moisture content of the clay shale ranged from 12.4% to 34.4%. Results from Standard Penetration Tests (SPTs) indicated SPT N-Values ranging from 49 to 50, in some instances an N-Value of 50 for 75 mm to 125 mm of penetration was recorded. These results are indicative of a hard soil.

3.6 GROUNDWATER

Minor seepage was encountered within Borehole BH 1 at the bottom of the sand layer and 1.2 m of water was present in the bottom of the hole on completion of drilling. A 25 mm diameter standpipe was installed in Boreholes BH 1 and BH 3. On August 27, 2015, approximately 14 days after drilling, groundwater levels were measured from the standpipes. Groundwater table in BH 1 was at 8.28 m below ground surface and the standpipe in BH 3 was found to be dry. Sloughing conditions were noted in boreholes BH 2 and BH 3.

3.7 CHEMICAL ANALYSIS

Water soluble sulphate testing was conducted on three (3) samples. The testing was carried out by Maxxam Analytics International of Edmonton, Alberta. The test results are provided in **Table 1** below.

Table 1 - Results of Chemical Analyses of Soil

Borehole # /Sample #	Approximate Depth Range (m)	Water Soluble Sulphate in Soil (%)
BH-01 / BS3	1.35 – 1.47	0.0042
BH-01 / BS7	4.55 – 4.67	0.0009
BH-01 / BS11	7.60 – 7.72	0.0130

4.0 GEOTECHNICAL CONSIDERATIONS

Based on the conditions encountered the proposed grit handling facility is feasible at this site. The following geotechnical considerations pertaining to the project scope have been identified:

- Proximity to existing underground utilities;
- Both shallow and deep foundations are considered feasible at this site;
- The soils encountered at site are considered to be frost susceptible. Thus, the subsurface materials have a potential for frost heave in the presence of water and freezing temperatures;
- The site is characterized by presence of relatively poor quality uncontrolled fills. The existing fills will need to be removed and replaced in areas of grade supported structures such as footings, and slabs. The fill soils on site are not recommended for re-use as engineered fill within the building footprint;
- Boulders or cobbles were not encountered during the drilling program; however, experience with the Edmonton area suggests that construction will likely encounter cobbles or boulders. The possible presence of boulders should be taken into account during the design and assessment of construction methodology;
- Bedrock was encountered at relatively shallow depths. If deep foundations are selected, contractors should be prepared to encounter bedrock;
- Relatively deep excavations (up to 5.6 m) will be required for basement construction;
- Braced excavations/ temporary shoring system such as sheet pile walls and soldier piles and timber lagging are feasible for the site;
- For the purpose of this report, we have assumed that any earthworks and concrete construction will be prepared in non-freezing conditions (non-winter months) unless proper hoarding and heating is provided; and

- The building will be located within a flood plain zone in close proximity to North Saskatchewan River.

4.1 SITE PREPARATION

In the proposed building development footprint, any topsoil, organic soil, fill material, loose, soft, wet and/or any other deleterious materials must be removed down to the firm to stiff undisturbed silt to silty clay layer or compact sand layer. This removal should extend out well beyond the limits of the building (i.e. minimum 1 m). The removed "un-desired" material should be replaced with engineered fill as discussed in **Section 4.3.3** below.

Following removal of unsuitable materials, exposed subgrade surfaces should be scarified to a depth of 300 mm. Before any subsequent fill placement, the exposed subgrade should be compacted to 100% of Standard Proctor Maximum Dry Density (SPMDD) in building footprints and 98% for driving lanes, parking areas and walkways. Where construction is carried out during winter conditions, the subgrade should be protected from freezing by hoarding and heating. In addition, the subgrade should be protected from wetting or drying, both before and after the placement of granular base material and concrete. Subgrade surfaces that are allowed to dry or become wet must be scarified, moisture conditioned, and re-compacted.

Following the above site preparation, exposed subgrade surfaces should be proof-rolled using heavy equipment such as a fully loaded tandem dump truck where possible. All soft areas must be sub-excavated to competent subgrade and replaced with approved engineered fill. To promote subgrade uniformity, soft area repair should be carried out using material of a similar nature and gradation to the native subgrade soils. In areas where the subgrade material is a silty clay or silt, repair of soft areas using granular materials may result in undesirable ponding and retention of water within the gravel in the repaired areas. Soft area repairs using gravel should therefore be carried out only with due consideration given to proper drainage of the repaired area.

It should be noted that the silt and silty clay subgrade is sensitive to construction traffic (i.e. rutting and sinking of equipment, etc.) especially when the subgrade is wet from precipitation events. Depending on the weather conditions at the time of construction (i.e. precipitation), the use of non-woven geotextile separators may be required between the subgrade and the gravel layer. This recommendation applies for both slab-on-grade and pavement areas. The construction contractor should be aware of the sensitive nature of the subgrade and use every means to not to soften or disturb the subgrade. The use of thick gravel platforms for roadways for heavy construction traffic might be required depending on subgrade conditions at the time of construction.

If a structural floor slab system is utilized at or slightly below exterior grade, it should be constructed over a void space and/or void form to allow for expansion and contraction of the

underlying materials. The subgrade should be graded to allow for drainage to a sump to allow for water removal from the building area. For a structural slab, the site grading and preparation must also take into account the need for a minimum 150 mm void form below the structural slab.

It is understood that the final site grades to be close to existing site grades and the proposed building main floor will be at elevation 621.33 m and will have a basement. Since the final grades around the building will be above the underside of the slab it is recommended for perimeter drains to be installed around the building envelope and connected to frost free outlets. Perimeter drains consisting of perforated PVC pipe, where used, should be protected from freezing, and protected from clogging by wrapping the surrounding granular free draining bedding materials with non-woven geotextile.

The final subgrade surface within floor slab and pavement areas should be carefully graded in order to prevent ponding and to direct water away from building areas and toward catch basins.

4.2 SITE MATERIAL REUSE

Based on the subsurface conditions encountered, the clay fill soils are acceptable for re-use as engineered fill for roadways, parking lots and landscape areas of the project or taken off site to an approved location. The existing clay fill soils shall not be used as engineered fill in building areas. However, it should be noted that clay fill and underlying silt to silty clay are susceptible to softening and loss of strength in the presence of excess moisture and moisture control during re-use is critical.

4.3 EXCAVATIONS AND BACKFILL

4.3.1 Excavations and Dewatering

The construction of basement will require excavations of the order of 3.6 m to 5.6 m below existing grade. Thus, excavation in the existing clay fill, silty clay and sand will be required. A braced excavation will be required to carry out the excavations to the design depths. The groundwater table is anticipated to be below the base of the excavation based on the limited monitoring. However, the contractor should have sump pumps on the assumption that groundwater control in excavation may be needed.

Excavations should be inspected regularly for signs of instability and flattened as required. All excavations should be in accordance with the applicable Alberta Occupational Health and Safety regulations.

The recommendations for the design of braced excavation are provided in the lateral earth pressure section.

4.3.2 Site Drainage

The prepared subgrade surface for the site should be shaped to prevent ponding of water and be directed away from the building**.** Excess water should not be allowed to pond and should be drained from the site as quickly as possible both during and after construction.

The subgrade below exterior slabs should have a minimum 2% grade downwards away from adjoining buildings or away from the center of the slab in order to help prevent the accumulation of water within the granular base material. If the building slab is proposed to be below grade, perimeter drains connected to frost free outlets should be installed as described in **Section 4.1**. Since a portion of the proposed building will likely be below grade, a sump pump connected to an appropriate positive outlet may be required.

The finished surface grades should provide drainage away from all structures. A minimum gradient of 2% should be used wherever possible. Roof and other drains should discharge well clear of any buildings or equipment.

4.3.3 Engineered Fill and Compaction Requirements

Engineered fill should consist of approved imported low plastic clay (liquid limit of 20 to 40 percent, plastic limit of 10 to 20 percent and plasticity index of 10 to 20 percent) or well graded granular fills materials free of organics and oversized material. As stated in **Section 4.2**, the clay fill from the site shall not be re-used as engineered fill in building areas for the proposed development. The clay fill may be reused in for roadways, parking lots and landscape areas of the project areas otherwise it should be taken to an approved location off site. Imported granular fill used as engineered fills should consist of an approved well graded sand and gravel such as 63 mm or 80 mm minus material meeting the City of Edmonton Specifications for Aggregate (Designation 3, Class 63 or 80).

All fill materials should be placed in lifts having a thickness such that the compaction equipment can achieve the required density, but shall not exceed 300 mm. Lift thicknesses adjacent to grade beams, pile caps and other structural elements should be reduced to 150 mm.

Compaction requirements for the various fill materials are provided in **Table 2**.

Table 2 - Compaction Requirements

Material	Location	Compaction Requirement (SPMDD)	Moisture Content Range
Engineered fill (low plastic clay) within building areas	Subgrade fill	100%	+2% of OMC
Engineered fill (low plastic clay) within parking and sidewalks	Subgrade fill	98%	+2% of OMC
Granular base under building slabs	Building areas	100%	±3% of OMC
Granular base and subbase for parking and sidewalks	Granular base and subbase	100%	±3% of OMC
General fill	Landscaped areas	92%	±3% of OMC
Note: 1) OMC – Optimum Moisture Content			

All imported fill materials should be tested and approved by the geotechnical engineer prior to delivery to the site.

4.4 FOUNDATIONS

Both shallow and deep foundation systems are considered feasible at this site provided that they are designed based on the recommendations provided herein.

4.4.1 Shallow Foundations – Footings

Shallow foundations such as strip or spread footings founded on the native sand are considered feasible for the support of the grit building provided it is lightly loaded and not sensitive to settlements.

Strip and spread footings supported on the undisturbed native sand can be designed using a factored geotechnical resistance at Ultimate Limits States (ULS) of 250 kPa for footings founded at a depth of 2.3 m and having a width of 0.9 m to 1.5 m. For SLS design of footings founded on undisturbed native sand a bearing pressure of 150 kPa should be used. Total and differential settlements under SLS condition are estimated to be less than 25 mm and 19 mm, respectively. A geotechnical resistance factor of 0.5 was applied to the ultimate geotechnical resistance to determine the above factored geotechnical resistance.

Stantec will be pleased to provide more detailed recommendations for ULS and SLS design for footings once more details such as footing size, depth of embedment, fill thickness, loading become available.

The subgrade surfaces beneath footing foundations must be free from frozen, lose or soft materials. The base of all footings must be inspected by Stantec geotechnical personnel prior to placing concrete in order to confirm adequate material at base elevation and to ensure there are no disturbances or deleterious materials. If the concrete for the foundations cannot be placed immediately after excavation and review (inspection), it is recommended to place a working mat of lean concrete to protect the integrity of the bearing surface.

4.4.2 Deep Foundations

Deep foundations (i.e. piles) based in the underlying clay shale bedrock are also considered feasible for support of the proposed building. There are several feasible pile types for the site such as cast-in-place piles, CFA piles or driven steel piles. For the purpose of this report, we have assumed that straight shaft cast-in-place concrete piles will be selected as they are expected to be the most economical for the loads expected from a single storey building in this area of Edmonton. CFA piles are also an option to consider for the building but this is a proprietary pile system and is often designed by the piling contractor.

4.4.2.1 Cast in Place Concrete Piles (Straight Shaft)

Cast-in-place concrete straight shaft piles founded in the clay shale and constructed as recommended below may be designed to resist static axial compressive reactions on the basis of the factored geotechnical shaft and toe resistance at Ultimate Limit State (ULS) values. It should be noted that the factored ULS values are based on the assumption that the piles are a minimum of 3 pile diameters apart. If the piles are spaced closer, group effects will reduce the resistance.

The design values for factored shaft friction and end bearing resistance at Ultimate Limit States (ULS) are provided below in **Table 3** below.

Table 3 - Cast-In-Place-Concrete Pile Design Parameters at ULS (Factored)

Soil Stratum	Depth (m)	Factored Shaft Resistance at ULS (kPa)	Factored Toe Resistance at ULS (kPa)
Frost Depth, Clay Fill and Silty Clay/Silt	0 to 2.5	0	0
Sand (SP)	2.5 to 7.5	14	0
Clay Shale Bedrock	7.5 to 14.5	50	700

Notes:
1) Depths indicated above should be confirmed on-site on a full time basis by qualified geotechnical personnel during construction.
2) A geotechnical resistance factor of 0.4 has been applied to the ultimate shaft and toe resistance to evaluate the factored shaft and toe resistances at ULS.
3) Based on assumed pile toe diameter ranging from 0.5 m to 1.0 m. If pile toe diameter is different than that assumed, Stantec should be contacted in order to revise toe resistances.
4) The toe resistance can only be used for the case of a clean pile base which requires full time inspection and confirmation by qualified geotechnical personnel.

Where beneficial heat transfer from supported facilities to the foundation soil is not likely to occur, such as the edge of the building, the minimum embedment length due to the uplift forces (frost jacking) may be calculated based on an assumed 65 kPa uplift acting on the upper 2.3 m of the pile shaft circumference. In this case, the recommended shaft resistance should only be applied along the shaft circumference of the pile below the frost penetration depth of 2.3 m. The sustained dead load applied on top of the pile could be included in this analysis. In order for concrete piles to resist uplift forces (including frost jacking), the steel reinforcement should be extended through the entire length of the pile.

The minimum embedment depth of cast-in-place concrete piles should be sufficient to resist the imposed loads and uplift forces due to frost heave. It is recommended that minimum embedment depths be determined once final pile details have been developed as the weight of the pile and the sustained dead load are forces which should be considered as forces resisting the adfreeze stresses. The minimum depth will also depend on the construction details of the pile and future fill placement. Cast-in-place concrete piles should have a minimum diameter of 500 mm and be reinforced to resist the imposed loads.

All piles should be constructed under the full time observation of experienced geotechnical personnel in order to confirm that the recommended shaft and toe resistance values are obtained and that the as-built pile installations are in accordance with the pile design approved by the geotechnical and structural engineers.

The piles should be concreted immediately following inspection of the base or toe in order to reduce the potential for sloughing, seepage or relaxation of the surrounding soils. The base of the pile excavation must be free of water and any loose or disturbed material prior to placing

concrete. Collected groundwater in the pile shaft drill hole must be removed by pumping water out of the pile shaft casing prior to concrete placement. The concrete should be placed in one continuous operation without any halts or delays.

For cast-in-place concrete pile installations, the designers and contractor should be aware that sloughing or caving soils (i.e. sands and silts) and seepage may be encountered at depth especially below the groundwater table. Although not encountered during our drilling program cobbles and/or boulders are possible in the soils at the site and contingencies to deal with this possibility should be made. Full length casing (down to the pile base or bottom) may be required and should be available should the need arise.

4.5 CONCRETE SLAB ON GRADE

It has also been assumed that site preparation will occur as described in **Section 4.1**. To promote subgrade uniformity under slab on grade system, at least 1 m of "un-desired" material as discussed in **Section 4.1** should be removed and replaced with engineered fill following recommendations discussed in **Section 4.3.3**. Following site preparations outlined in **Section 4.1** a granular base material should be used to underlay the concrete slab-on-grade. The granular base material should consist of an approved 25 mm clean, free draining material. The granular base material should have a minimum thickness of 200 mm and be compacted to a minimum of 100% SPMDD at moisture content within 3% of optimum.

It is important that the subgrade surface be protected from moisture changes both during and after construction in order to minimize the potential of swelling and/or heave/thaw actions on the subgrade soils.

Floor slabs constructed on granular base materials underlain by a subgrade compacted to a minimum of 100% of SPMDD and prepared as recommended herein may use a soil modulus of subgrade reaction, kv1, of 18 MPa/m for a 300 mm x 300 mm square plate.

Slabs-on-grade should float independently of all load-bearing walls and columns to minimize the potential for damage from small differential settlement between these elements. Due to the proposed final grades being below existing grade, perimeter drains connected to frost free outlets, should be installed where final grades around buildings are higher than the underside of the slab. Perimeter drains, where used, should be protected from freezing, and protected from clogging by wrapping the surrounding granular bedding materials with non-woven geotextile.

4.6 BRACED EXCAVATIONS

A temporary braced excavation system consisting of a driven sheet pile wall or soldier piles and timber lagging or other available braced wall systems can be considered for this site. Steel sheet pile walls are normally driven into the ground in pairs using a pile-driving hammer or vibratory

hammer similar to those used to drive foundation piles. Most sheet pile walls include additional lateral support, using internal bracing or tieback anchors. The additional support reduces the flexural stresses and lateral movements in the wall and promotes less settlement in the backfill.

It is assumed that the sheet piles will be required only for the excavations and will be removed after construction. The design of the braced excavation system is typically carried out by the contractor. The lateral earth pressure parameters for preliminary design are provided **Table 4** below.

It is recommended that the sheet piles be designed to be installed deeper than the anticipated depth of excavation. All construction equipment (excavators, stockpiled fill, or any other piece of equipment or load) should stay well away from the top of sheet pile walls during the excavation. It should be noted that, although boulders or cobbles were not encountered during the borehole drilling program, the presence of boulders and cobbles is not uncommon. Lateral Earth Pressure

For basement walls, the at-rest earth pressure (K_o) should be used for design along with other parameters listed in Table 4. Lateral earth pressures for the design of braced excavation may be calculated using the following parameters:

Table 4 - Lateral Earth Pressure Parameters

Parameters	Designation 3, Class 25[2]	Native Silty Clay to Silt	Native Sand
Unit Weight , kN/m³	21	18	20
Angle of Internal Friction, ϕ	32°	22°	30°
Active Earth Pressure Coefficient[1], K_A	0.31	0.45	0.34
Passive Earth Pressure Coefficient[1], K_P	3.3	2.2	3.0
At Rest Earth Pressure Coefficient, K_O	0.47	0.63	0.42
Notes: 1) These parameters are for a horizontal backfill above the retaining wall			

4.7 CONCRETE IN CONTACT WITH SOILS

The results of the sulphate testing presented in **Section 3.7** were compared to Table 3, CSA Concrete Materials and Methods of Concrete Construction (CSA A23.1). The water-soluble sulphate content test results indicate that the soluble sulphate contents were negligible in the soils, and as such concrete in contact with the site soils may be of type GU.

4.8 FROST PROTECTION

The soils encountered at the site are considered to be frost susceptible. There is a risk of heave due to frost action if frost is permitted to penetrate into the soils underlying or adjacent to structures. The depth of frost penetration at this site has been estimated at 2.3 m. Foundation elements located within a 1 m distance from the exterior walls of heated buildings will require a minimum frost protection equivalent to a soil cover of 2.0 m for protection against frost action. Foundation elements in unheated or isolated exterior areas should have a minimum frost protection equivalent to a soil cover of at least 2.3 m for frost protection.

Consideration may be given to protecting exterior unheated concrete pads from frost damage by using 160 mm of rigid insulation below the exterior slab. The subgrade below exterior slabs adjacent to the buildings should have a minimum 2% grade downwards away from the building in order to prevent moisture migration from the base gravels towards the buildings. Also, any cracking observed in the exterior slabs-on-grade should be promptly repaired to avoid increased moisture infiltration to the subgrade.

4.9 SEISMIC CONSIDERATIONS

Seismic design for "normal structures", such as warehouses, low-rise commercial buildings and high rise office towers is based on the 2010 National Building Code of Canada (NBCC). The primary objective of the NBCC earthquake resistant design requirements for "major occupancy structures" is to protect the life and safety of the building occupants as the building responds to strong ground shaking. Structures designed in conformance with the NBCC provisions may undergo extensive structural damage during strong ground shaking but should not collapse. Collapse is defined to be a state where occupants can no longer exit the building because of structural failure. This implies that supporting foundations necessary to ensure the building's post-earthquake stability must be protected against excessive movement under strong ground shaking.

Based on the results of the field investigation, it is appropriate to classify the ground conditions at the subject site as a **Site Class D**, in accordance with the 2010 NBCC (Table 4.1.8.4.A).

The 2010 NBCC seismic design procedures are based on ground motion parameters (e.g., peak ground acceleration (PGA) and spectral acceleration, Sa values) having a 2% probability of exceedance in 50 years; i.e., the 2,475 year return period earthquake event.

4.10 EXISTING UNDERGROUND UTILITIES

During the utility locating stage of the field program a sludge line was identified using physical locating methods in the area proposed for development of the grit handling facility. Daylighting of the sludge line in two locations marked by the physical locates was completed and the line

was measured to be 2.55 m below existing ground surface in both locations. Additionally, the City of Edmonton marked an unknown line using survey points that followed the same alignment as the sludge line but varied from 1 m to 2 m offset from the physical and daylighted locations. Hydrovac was completed to a depth of 3.3 m below ground at a location of one of the City markings but a line was not encountered. It is unknown if a line exists at the locations marked by the City of Edmonton and a thorough underground utility investigation should be conducted to resolve this discrepancy before any construction takes place. Furthermore, a stress analysis should be completed for the known sludge line as development of the area overlying the sludge line will induce new stresses on the pipe as well as possible settlement, which could cause failure of the pipe if not properly accounted for.

5.0 CLOSURE

This Geotechnical Report has been prepared for the sole use of EPCOR and their agents. This Geotechnical Report should not be relied upon by other parties without the express written consent of EPCOR and Stantec.

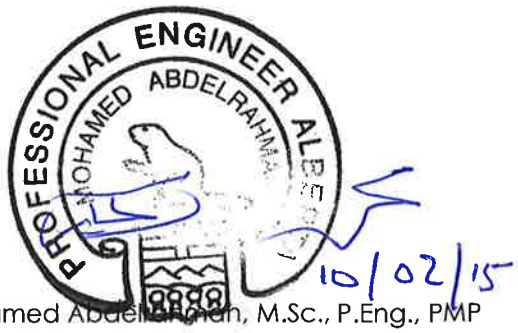
Should any assumptions listed in the report be incorrect, Stantec should be informed immediately, so that we can re-evaluate our recommendations presented in this report. Use of this report is subject to the Statement of General Conditions provided in **Appendix A**. It is the responsibility of EPCOR who is identified as "the Client" within the Statement of General Conditions, and its agents to review the conditions and to notify Stantec should any of these not be satisfied. The Statement of General Conditions addresses the following:

- Use of the report
- Basis of the report
- Standard of care
- Interpretation of site conditions
- Varying or unexpected site conditions
- Planning, design or construction

We trust the information in this report meets with your requirements. Should you have any questions or require further information, please contact the undersigned at your convenience. This report was prepared by Lowell Makarenko, E.I.T. and Mohamed Abdelrahman, M.Sc., P.Eng., PMP and reviewed by Arun Valsangkar Ph.D., P.Eng. (NB).

Yours very truly,

STANTEC CONSULTING LTD.



10/02/15

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APEGA Permit No.: 258

Appendix A
STATEMENT OF GENERAL CONDITIONS

October 2, 2015

STATEMENT OF GENERAL CONDITIONS

USE OF THIS REPORT: This report has been prepared for the sole benefit of the Client or its agent and may not be used by any third party without the express written consent of Stantec Consulting Ltd. and the Client. Any use which a third party makes of this report is the responsibility of such third party.

BASIS OF THE REPORT: The information, opinions, and/or recommendations made in this report are in accordance with Stantec Consulting Ltd.'s present understanding of the site specific project as described by the Client. The applicability of these is restricted to the site conditions encountered at the time of the investigation or study. If the proposed site specific project differs or is modified from what is described in this report or if the site conditions are altered, this report is no longer valid unless Stantec Consulting Ltd. is requested by the Client to review and revise the report to reflect the differing or modified project specifics and/or the altered site conditions.

STANDARD OF CARE: Preparation of this report, and all associated work, was carried out in accordance with the normally accepted standard of care in the state or province of execution for the specific professional service provided to the Client. No other warranty is made.

INTERPRETATION OF SITE CONDITIONS: Soil, rock, or other material descriptions, and statements regarding their condition, made in this report are based on site conditions encountered by Stantec Consulting Ltd. at the time of the work and at the specific testing and/or sampling locations. Classifications and statements of condition have been made in accordance with normally accepted practices which are judgmental in nature; no specific description should be considered exact, but rather reflective of the anticipated material behavior. Extrapolation of in situ conditions can only be made to some limited extent beyond the sampling or test points. The extent depends on variability of the soil, rock and groundwater conditions as influenced by geological processes, construction activity, and site use.

VARYING OR UNEXPECTED CONDITIONS: Should any site or subsurface conditions be encountered that are different from those described in this report or encountered at the test locations, Stantec Consulting Ltd. must be notified immediately to assess if the varying or unexpected conditions are substantial and if reassessments of the report conclusions or recommendations are required. Stantec Consulting Ltd. will not be responsible to any party for damages incurred as a result of failing to notify Stantec Consulting Ltd. that differing site or sub- surface conditions are present upon becoming aware of such conditions.

PLANNING, DESIGN, OR CONSTRUCTION: Development or design plans and specifications should be reviewed by Stantec Consulting Ltd., sufficiently ahead of initiating the next project stage (property acquisition, tender, construction, etc), to confirm that this report completely addresses the elaborated project specifics and that the contents of this report have been properly interpreted. Specialty quality assurance services (field observations and testing) during construction are a necessary part of the evaluation of sub-subsurface conditions and site preparation works. Site work relating to the recommendations included in this report should only be carried out in the presence of a qualified geotechnical engineer; Stantec Consulting Ltd. cannot be responsible for site work carried out without being present.

SEPTEMBER 2013

Appendix B
FIGURES

Q:\Clients\EPCOR\110146363_GoldBar_RSRF\Figures\Figure1_SiteLocationPlan.mxd Revised: 2015-09-18 By: rhamis

Site Location

0 70 140 metres

1:7,500 (at original document size of 8.5x11)

Stantec EPCOR

Project Location
152 Street and 121 Avenue
Edmonton, Alberta

110146363
Prepared by RH on 2015-09-18
Review by LM on 2015-09-18

Client/Project
EPCOR
Gold Bar
Waste Water Treatment Plant

Figure No.
1

DRAFT

Title
Residual Solid Receiving Facility
Site Location Plan

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada. All rights reserved.
3. Imagery: City of Edmonton, Transportation, 2014

Q:\Clients\EPCOR\110146363_GoldBar_RSRF\Figures\Figure2_BoreholeLocationPlan.mxd Revised: 2015-09-21 By: rharris

Notes
1. Coordinate System: NAD 1983 3TM 114
2. Base features: Geogratis, ©Department of Natural Resources Canada. All rights reserved.
3. Imagery: City of Edmonton, Transportation, 2014

0 7 14
metres
1:750 (at original document size of 8.5x11)

Stantec EPCOR

Project Location
152 Street and 121 Avenue
Edmonton, Alberta

110146363
Prepared by RH on 2015-09-18
Review by LM on 2015-09-18

Client/Project
EPCOR
Gold Bar
Waste Water Treatment Plant

Figure No.
2

DRAFT

Title
Residual Solid Receiving Facility
Borehole Location Plan

Appendix C
BOREHOLE RECORDS

SYMBOLS AND TERMS USED ON BOREHOLE AND TEST PIT RECORDS

SOIL DESCRIPTION

Terminology describing common soil genesis:

Rootmat	- vegetation, roots and moss with organic matter and topsoil typically forming a mattress at the ground surface
Topsoil	- mixture of soil and humus capable of supporting vegetative growth
Peat	- mixture of visible and invisible fragments of decayed organic matter
Till	- unstratified glacial deposit which may range from clay to boulders
Fill	- material below the surface identified as placed by humans (excluding buried services)

Terminology describing soil structure:

Desiccated	- having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured	- having cracks, and hence a blocky structure
Varved	- composed of regular alternating layers of silt and clay
Stratified	- composed of alternating successions of different soil types, e.g. silt and sand
Layer	- > 75 mm in thickness
Seam	- 2 mm to 75 mm in thickness
Parting	- < 2 mm in thickness

Terminology describing soil types:
The classification of soil types are made on the basis of grain size and plasticity in accordance with the Unified Soil Classification System (USCS) (ASTM D 2487 or D 2488) which excludes particles larger than 75 mm. For particles larger than 75 mm, and for defining percent clay fraction in hydrometer results, definitions proposed by Canadian Foundation Engineering Manual, 4th Edition are used. The USCS provides a group symbol (e.g. SM) and group name (e.g. silty sand) for identification.

Terminology describing cobbles, boulders, and non-matrix materials (organic matter or debris):
Terminology describing materials outside the USCS, (e.g. particles larger than 75 mm, visible organic matter, and construction debris) is based upon the proportion of these materials present:

Trace, or occasional	Less than 10%
Some	10-20%
Frequent	> 20%

Terminology describing compactness of cohesionless soils:
The standard terminology to describe cohesionless soils includes compactness (formerly "relative density"), as determined by the Standard Penetration Test (SPT) N-Value - also known as N-Index. The SPT N-Value is described further on page 3. A relationship between compactness condition and N-Value is shown in the following table.

Compactness Condition	SPT N-Value
Very Loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

Terminology describing consistency of cohesive soils:
The standard terminology to describe cohesive soils includes the consistency, which is based on undrained shear strength as measured by *in situ* vane tests, penetrometer tests, or unconfined compression tests. Consistency may be crudely estimated from SPT N-Value based on the correlation shown in the following table (Terzaghi and Peck, 1967). The correlation to SPT N-Value is used with caution as it is only very approximate.

Consistency	Undrained Shear Strength		Approximate SPT N-Value
	kips/sq.ft.	kPa	
Very Soft	<0.25	<12.5	<2
Soft	0.25 - 0.5	12.5 - 25	2-4
Firm	0.5 - 1.0	25 - 50	4-8
Stiff	1.0 - 2.0	50 – 100	8-15
Very Stiff	2.0 - 4.0	100 - 200	15-30
Hard	>4.0	>200	>30

ROCK DESCRIPTION

Except where specified below, terminology for describing rock is as defined by the International Society for Rock Mechanics (ISRM) 2007 publication "The Complete ISRM Suggested Methods for Rock Characterization, Testing and Monitoring: 1974-2006"

Terminology describing rock quality:

RQD	Rock Mass Quality
0-25	*Very Poor Quality*
25-50	*Poor Quality*
50-75	*Fair Quality*
75-90	*Good Quality*
90-100	*Excellent Quality*

Alternate (Colloquial) Rock Mass Quality	
Very Severely Fractured	*Crushed*
Severely Fractured	*Shattered or Very Blocky*
Fractured	*Blocky*
Moderately Jointed	*Sound*
Intact	*Very Sound*

RQD (Rock Quality Designation) denotes the percentage of intact and sound rock retrieved from a borehole of any orientation. All pieces of intact and sound rock core equal to or greater than 100 mm (4 in.) long are summed and divided by the total length of the core run. RQD is determined in accordance with ASTM D6032.

SCR (Solid Core Recovery) denotes the percentage of solid core (cylindrical) retrieved from a borehole of any orientation. All pieces of solid (cylindrical) core are summed and divided by the total length of the core run (It excludes all portions of core pieces that are not fully cylindrical as well as crushed or rubble zones).

Fracture Index (FI) is defined as the number of naturally occurring fractures within a given length of core. The Fracture Index is reported as a simple count of natural occurring fractures.

Terminology describing rock with respect to discontinuity and bedding spacing:

Spacing (mm)	Discontinuities	Bedding
>6000	*Extremely Wide*	-
2000-6000	*Very Wide*	*Very Thick*
600-2000	*Wide*	*Thick*
200-600	*Moderate*	*Medium*
60-200	*Close*	*Thin*
20-60	*Very Close*	*Very Thin*
<20	*Extremely Close*	*Laminated*
<6	-	*Thinly Laminated*

Terminology describing rock strength:

Strength Classification	Grade	Unconfined Compressive Strength (MPa)
Extremely Weak	R0	<1
Very Weak	R1	1 – 5
Weak	R2	5 – 25
Medium Strong	R3	25 – 50
Strong	R4	50 – 100
Very Strong	R5	100 – 250
Extremely Strong	R6	>250

Terminology describing rock weathering:

Term	Symbol	Description
Fresh	W1	No visible signs of rock weathering. Slight discoloration along major discontinuities
Slightly	W2	Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately	W3	Less than half the rock is decomposed and/or disintegrated into soil.
Highly	W4	More than half the rock is decomposed and/or disintegrated into soil.
Completely	W5	All the rock material is decomposed and/or disintegrated into soil. The original mass structure is still largely intact.
Residual Soil	W6	All the rock converted to soil. Structure and fabric destroyed.

STRATA PLOT

Strata plots symbolize the soil or bedrock description. They are combinations of the following basic symbols. The dimensions within the strata symbols are not indicative of the particle size, layer thickness, etc.

Boulders Cobbles Gravel | Sand | Silt | Clay | Organics | Asphalt | Concrete | Fill | Igneous Bedrock | Meta-morphic Bedrock | Sedi-mentary Bedrock

SAMPLE TYPE

SS	Split spoon sample (obtained by performing the Standard Penetration Test)
ST	Shelby tube or thin wall tube
DP	Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS	Piston sample
BS	Bulk sample
HQ, NQ, BQ, etc.	Rock core samples obtained with the use of standard size diamond coring bits.

WATER LEVEL MEASUREMENT

measured in standpipe, piezometer, or well

inferred

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered. For rock core, recovery is defined as the total cumulative length of all core recovered in the core barrel divided by the length drilled and is recorded as a percentage on a per run basis.

N-VALUE

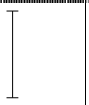
Numbers in this column are the field results of the Standard Penetration Test: the number of blows of a 140 pound (63.5 kg) hammer falling 30 inches (760 mm), required to drive a 2 inch (50.8 mm) O.D. split spoon sampler one foot (300 mm) into the soil. In accordance with ASTM D1586, the N-Value equals the sum of the number of blows (N) required to drive the sampler over the interval of 6 to 18 in. (150 to 450 mm). However, when a 24 in. (610 mm) sampler is used, the number of blows (N) required to drive the sampler over the interval of 12 to 24 in. (300 to 610 mm) may be reported if this value is lower. For split spoon samples where insufficient penetration was achieved and N-Values cannot be presented, the number of blows are reported over sampler penetration in millimetres (e.g. 50/75). Some design methods make use of N-values corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-values presented on the log.

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the Standard Penetration Test. The DCPT value is the number of blows of the hammer required to drive the cone one foot (300 mm) into the soil. The DCPT is used as a probe to assess soil variability.

OTHER TESTS

S	Sieve analysis
H	Hydrometer analysis
k	Laboratory permeability
γ	Unit weight
G_s	Specific gravity of soil particles
CD	Consolidated drained triaxial
CU	Consolidated undrained triaxial with pore pressure measurements
UU	Unconsolidated undrained triaxial
DS	Direct Shear
C	Consolidation
Q_u	Unconfined compression
I_p	Point Load Index (I_p on Borehole Record equals $I_p(50)$ in which the index is corrected to a reference diameter of 50 mm)

	Single packer permeability test; test interval from depth shown to bottom of borehole
	Double packer permeability test; test interval as indicated
	Falling head permeability test using casing
	Falling head permeability test using well point or piezometer

Stantec

Borehole Coordinates
5936344.376 N
39141.812 E
Datum: UTM NAD 83

BH 1

CLIENT **EPCOR**

PROJECT **EPCOR Grit Facility**

PROJECT No. **110146363**

LOCATION **Gold Bar Waste Management Facility**

BH SIZE **150 mm**

DATES (mm/dd/yyyy): BORING **8/13/2015** WATER LEVEL **8.28 m on Aug 27, 2015**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm or CORE %	SAMPLES N-VALUE or RQD %	WATER LEVEL	MONITOR WELL/ PIEZOMETER
0	620.41								
		Brown, lean, sandy clay FILL, some silt, trace gravel, occasional organics, damp to moist		BS	1				
1	619.21			SS	2	450	9		
	618.91	Light brown, clayey SILT (ML), some samd, damp to moist		BS	3				
		- Hydrometer on BS 3 at 1.35 m Gravel - 0% Sand - 18.7% Silt - 59.3% Clay - 22.0%							
2				SS	4	400	17		
		Brown, medium grained, compact, poorly graded SAND (SP), trace silt, trace gravel, occasional coal inclusions or coal streaking, occasional oxide stains, damp to moist		BS	5				
3									
		- Sieve on SS 6 at 3.8 m Gravel - 3.9% Sand - 86.2% Fines - 9.9%		SS	6	420	18		
4		- From 4.10 m to 4.85 m, increased percentage of gravel in the sand, sand is coarser grained		BS	7				
				SS	8	410	20		
5									
		- At 5.95 m, sand became moist		BS	9				
6	613.56								
		Grey, extreamely weak, weathered, CLAY SHALE, occasional coal inclusions, damp to moist - At 6.85 m, 240 mm of coal		SS	10	150	50		
7				bs	11				
8									

Undrained Shear Strength (Cu) : (kPa) ▲
Cu based on Pocket Penetrometer : (kPa)★
50 100 150 200
Cu Scale (kPa)

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N), BLOWS/0.3m
10 20 30 40 50 60 70 80 90
%MC or Blow Count Scale (% or N)

**Groundwater level measured on date indicated. ▼

Stantec

Borehole Coordinates
5936344.376 N
39141.812 E
Datum: UTM NAD 83

BH 1

CLIENT **EPCOR**

PROJECT **EPCOR Grit Facility**

PROJECT No. **110146363**

LOCATION **Gold Bar Waste Management Facility**

BH SIZE **150 mm**

DATES (mm/dd/yyyy): BORING **8/13/2015** WATER LEVEL **8.28 m on Aug 27, 2015**

Undrained Shear Strength (Cu) : (kPa) ▲
Cu based on Pocket Penetrometer : (kPa) ★
50 100 150 200
Cu Scale (kPa)

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N), BLOWS/0.3m
10 20 30 40 50 60 70 80 90
%MC or Blow Count Scale (% or N)

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY mm or CORE %	N-VALUE or RQD %	WATER LEVEL	MONITOR WELL/ PIEZOMETER
8		Grey, extreamely weak, weathered, CLAY SHALE, occasional coal inclusions, damp to moist						▼	
				SS	12	450	13/27/50		
9				BS	13				
10				SS	14	450	10/25/50		
				BS	15				
11									
				SS	16	300	50 for 125 mm		
12		- At 12.2 m, driller remarked that drilling became more difficult, shale contained small gravel chips		BS	17				
13		- At 12.95 m, 50 mm of coal		SS	18	100	50 for 100 mm		
				BS	19				
14									
	605.81			SS	20	100	50 for 75 mm		
		End of Borehole at 14.6 m Bulk taken from 0.1 m to 1.2 m On Completion: No Slough Water at 13.4 m BGS							
15									
16									

**Groundwater level measured on date indicated. ▼

Stantec

Borehole Coordinates
5936333.471 N
39158.685 E
Datum: UTM NAD 83

BH 2

CLIENT **EPCOR**

PROJECT **EPCOR Grit Facility**

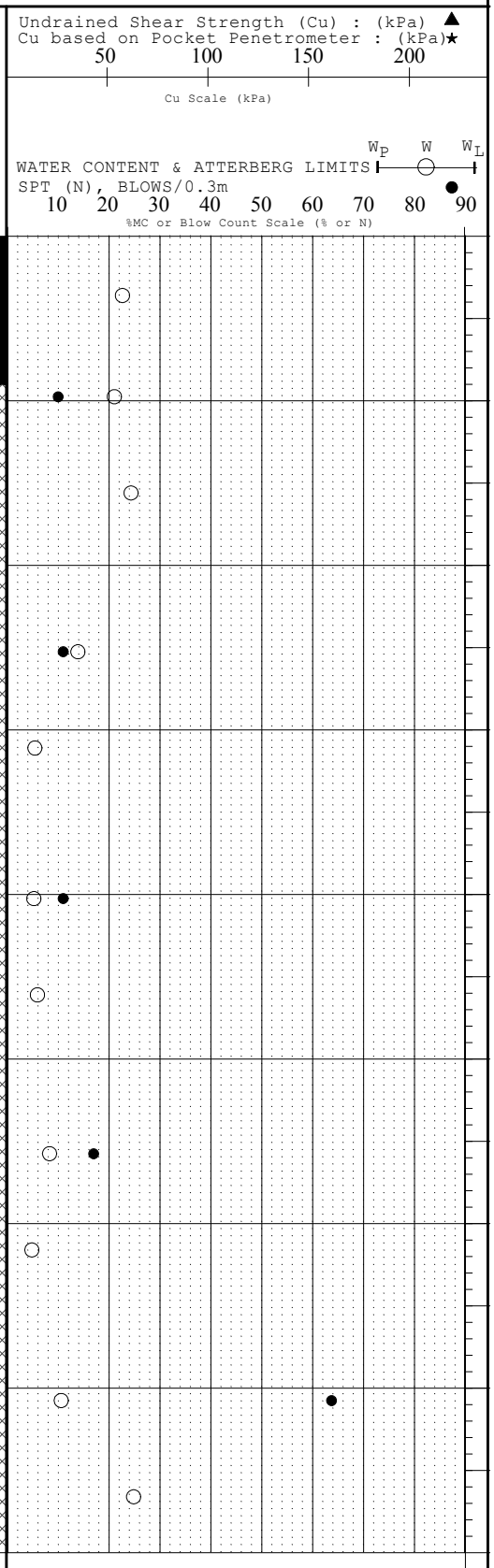
PROJECT No. **110146363**

LOCATION **Gold Bar Waste Management Facility**

BH SIZE **150 mm**

DATES (mm/dd/yyyy): BORING **8/13/2015** WATER LEVEL **No Well Installed**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm or CORE %	SAMPLES N-VALUE or RQD %	WATER LEVEL	MONITOR WELL/ PIEZOMETER
0	620.79								
		Brown, lean, sandy clay FILL, some silt, trace gravel, occasional organics, damp to moist		BS	1				
1	619.74			SS	2	230	10		
		Light brown, lean, silty CLAY (CL), damp to moist		BS	3				
2	618.34								
		Brown, medium grained, compact, poorly graded SAND (SP), trace silt, trace gravel, occasional coal inclusions or coal streaking, occasional oxide stains, damp to moist		SS	4	380	11		
3		- From 2.6 m to 3.05 m, increased percentage of gravel in the sand, sand is coarser grained		BS	5				
4				SS	6	220	11		
				BS	7				
5				SS	8	360	17		
6				BS	9				
7	613.59			SS	10	360	64		
		Grey, extreamely weak, weathered, CLAY SHALE, occasional coal inclusions, damp to moist							
		- At 7.2 m, 480 mm of coal		BS	11				
8									



Stantec

Borehole Coordinates
5936333.471 N
39158.685 E
Datum: UTM NAD 83

BH 2

CLIENT **EPCOR**

PROJECT **EPCOR Grit Facility**

PROJECT No. **110146363**

LOCATION **Gold Bar Waste Management Facility**

BH SIZE **150 mm**

DATES (mm/dd/yyyy): BORING **8/13/2015** WATER LEVEL **No Well Installed**

Undrained Shear Strength (Cu) : (kPa) ▲
Cu based on Pocket Penetrometer : (kPa)★
50 100 150 200
Cu Scale (kPa)

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N), BLOWS/0.3m
10 20 30 40 50 60 70 80 90
%MC or Blow Count Scale (% or N)

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	NUMBER	RECOVERY mm or CORE %	N-VALUE or RQD %	WATER LEVEL	MONITOR WELL/ PIEZOMETER
8		Grey, extreamely weak, weathered, CLAY SHALE, occasional coal inclusions, damp to moist		SS	12	400	49		
9				BS	13				
10				SS	14	300	50		
11				BS	15				
	609.04			SS	16	300	50		
12		End of Borehole at 11.75 m Bulk taken from 0.1 m to 1.05 m On Completion: Slough to 11.55 m No Water							
13									
14									
15									
16									

Stantec

Borehole Coordinates
5936346.653 N
39153.838 E
Datum: UTM NAD 83

BH 3

CLIENT **EPCOR**

PROJECT **EPCOR Grit Facility**

PROJECT No. **110146363**

LOCATION **Gold Bar Waste Management Facility**

BH SIZE **150 mm**

DATES (mm/dd/yyyy): BORING **8/13/2015** WATER LEVEL **Dry on Aug 27, 2015**

DEPTH(m)	ELEVATION(m)	SOIL DESCRIPTION	STRATA PLOT	SAMPLES TYPE	SAMPLES NUMBER	SAMPLES RECOVERY mm or CORE %	SAMPLES N-VALUE or RQD %	WATER LEVEL	MONITOR WELL/ PIEZOMETER
0	621.39								
	621.01	Gravel FILL - 380 mm, geotextile below gravel		BS	1				
1		Brown, lean, clay FILL, some sand, some silt, trace gravel, occasional organics, damp to moist		SS	2	450	35 on gravel		
				BS	3				
2	619.04								
		Brown, medium grained, compact, poorly graded SAND (SP), trace silt, trace gravel, occasional coal inclusions or coal streaking, occasional oxide stains, damp to moist		SS	4	450	12		
3				BS	5				
4	617.14			SS	6	450	25		
		End of Borehole at 4.25 m Bulk taken from 0.4 m to 1.85 m On Completion: Slough to 3.65 m No Water							
5									
6									
7									
8									

Undrained Shear Strength (Cu) : (kPa) ▲
Cu based on Pocket Penetrometer : (kPa) ★
50 100 150 200
Cu Scale (kPa)

WATER CONTENT & ATTERBERG LIMITS W_P W W_L
SPT (N), BLOWS/0.3m
10 20 30 40 50 60 70 80 90
%MC or Blow Count Scale (% or N)

Appendix D
LABORATORY TEST RESULTS

Stantec

Moisture Content of Soil or Aggregate
CSA A23.2-11A
ASTM D2216

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5
Tel: (780) 917-7463

Project:	EPCOR Gold Bar Grit Receiving	Date Tested:	17-Aug-15
Project No.:	110146363.404	Tested By:	JA

Moisture Content Worksheet

Borehole / Test Pit No.	1	1	1	1	1	1	1
Sample	**BS1**	**SS2**	**BS3**	**SS4**	**BS5**	**SS6**	**BS7**
Tare No.	17	EE	Q11	DJ	EW	A10	34A
Mass Tare Container	8.7	8.7	8.7	9	8.7	232.6	9.1
Mass Sample (Wet+Tare) (g)	172.9	232.3	303.2	143	200.3	892.3	180.6
Mass Sample (Dry+Tare) (g)	149.3	199.6	273.6	135.2	191.8	858.1	172.8
Mass of Water (g)	23.60	32.70	29.60	7.80	8.50	34.20	7.80
Mass Dry Sample (g)	140.60	190.90	264.90	126.20	183.10	625.50	163.70
Moisture Content (%)	16.8%	17.1%	11.2%	6.2%	4.6%	5.5%	4.8%
Comments							
Borehole / Test Pit No.	1	1	1	1	1	1	1
Sample	**SS8**	**BS9**	**SS10**	**BS11**	**SS12**	**BS13**	**SS14**
Tare No.	6	CT	12A	EI	ZC	IGGY	DY
Mass Tare Container	8.3	8.6	9.2	8.7	9.6	8.5	8.7
Mass Sample (Wet+Tare) (g)	140.2	131	45.9	156.4	154.3	142.9	179.7
Mass Sample (Dry+Tare) (g)	135.2	123.8	36.5	128.9	131	119	151.9
Mass of Water (g)	5.00	7.20	9.40	27.50	23.30	23.90	27.80
Mass Dry Sample (g)	126.90	115.20	27.30	120.20	121.40	110.50	143.20
Moisture Content (%)	3.9%	6.3%	34.4%	22.9%	19.2%	21.6%	19.4%
Comments			COAL				
Borehole / Test Pit No.	1	1	1	1	1	1	
Sample	**BS15**	**SS16**	**BS17**	**SS18**	**BS19**	**SS20**	
Tare No.	17A	EB	D3	21A	14A	D12	
Mass Tare Container	9.6	8.6	8.6	9.2	9.3	8.8	
Mass Sample (Wet+Tare) (g)	141.2	136.9	190.1	77.6	146.5	105	
Mass Sample (Dry+Tare) (g)	121.6	119.8	170.1	63.9	121	85.6	
Mass of Water (g)	19.60	17.10	20.00	13.70	25.50	19.40	
Mass Dry Sample (g)	112.00	111.20	161.50	54.70	111.70	76.80	
Moisture Content (%)	17.5%	15.4%	12.4%	25.0%	22.8%	25.3%	
Comments							
Borehole / Test Pit No.							
Sample							
Tare No.							
Mass Tare Container							
Mass Sample (Wet+Tare) (g)							
Mass Sample (Dry+Tare) (g)							
Mass of Water (g)							
Mass Dry Sample (g)							
Moisture Content (%)							
Comments							

Reviewed By: _____

Stantec

Moisture Content of Soil or Aggregate
CSA A23.2-11A
ASTM D2216

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10575 106 ST
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Canada T5H 2X5
Tel: (780) 917-7463

Project:	EPCOR Gold Bar Grit Receiving	Date Tested:	17-Aug-15
Project No.:	110146363.404	Tested By:	JA

Moisture Content Worksheet

Borehole / Test Pit No.	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Sample	**BS1**	**SS2**	**BS3**	**SS4**	**BS5**	**SS6**	**BS7**
Tare No.	9	DA	EK	CF	D24	J2	D5
Mass Tare Container	8.5	8.7	8.5	9.3	8.6	9.1	8.7
Mass Sample (Wet+Tare) (g)	144.1	123.9	163.1	223.8	211.2	123.3	212.9
Mass Sample (Dry+Tare) (g)	119	103.8	132.8	197.7	200.8	117.7	201.5
Mass of Water (g)	25.10	20.10	30.30	26.10	10.40	5.60	11.40
Mass Dry Sample (g)	110.50	95.10	124.30	188.40	192.20	108.60	192.80
Moisture Content (%)	22.7%	21.1%	24.4%	13.9%	5.4%	5.2%	5.9%
Comments							
Borehole / Test Pit No.	**2**	**2**	**2**	**2**	**2**	**2**	**2**
Sample	**SS8**	**BS9**	**SS10**	**BS11**	**SS12**	**BS13**	**SS14**
Tare No.	DE	19A	ER	3	D13	CY	MM
Mass Tare Container	8.8	9.3	8.6	8.7	8.9	8.8	9.6
Mass Sample (Wet+Tare) (g)	143.9	170.5	128.5	171.2	170.1	143	189.7
Mass Sample (Dry+Tare) (g)	133.6	163.1	117	138.8	140.6	122.6	164.9
Mass of Water (g)	10.30	7.40	11.50	32.40	29.50	20.40	24.80
Mass Dry Sample (g)	124.80	153.80	108.40	130.10	131.70	113.80	155.30
Moisture Content (%)	8.3%	4.8%	10.6%	24.9%	22.4%	17.9%	16.0%
Comments							
Borehole / Test Pit No.	**2**	**2**					
Sample	**BS15**	**SS16**					
Tare No.	7A	D16					
Mass Tare Container	9.3	8.7					
Mass Sample (Wet+Tare) (g)	160	137.7					
Mass Sample (Dry+Tare) (g)	134.4	118.6					
Mass of Water (g)	25.60	19.10					
Mass Dry Sample (g)	125.10	109.90					
Moisture Content (%)	20.5%	17.4%					
Comments							
Borehole / Test Pit No.	**3**	**3**	**3**	**3**	**3**	**3**	
Sample	**BS1**	**SS2**	**BS3**	**SS4**	**BS5**	**SS6**	
Tare No.	FA	222	DC	D20	29	D1	
Mass Tare Container	8.8	9.2	8.9	8.8	9.3	8.7	
Mass Sample (Wet+Tare) (g)	216.3	179.6	164.5	157.2	186.4	162.2	
Mass Sample (Dry+Tare) (g)	211.3	167.6	139.2	144	181.4	156.9	
Mass of Water (g)	5.00	12.00	25.30	13.20	5.00	5.30	
Mass Dry Sample (g)	202.50	158.40	130.30	135.20	172.10	148.20	
Moisture Content (%)	2.5%	7.6%	19.4%	9.8%	2.9%	3.6%	
Comments							

Reviewed By: _____

Stantec

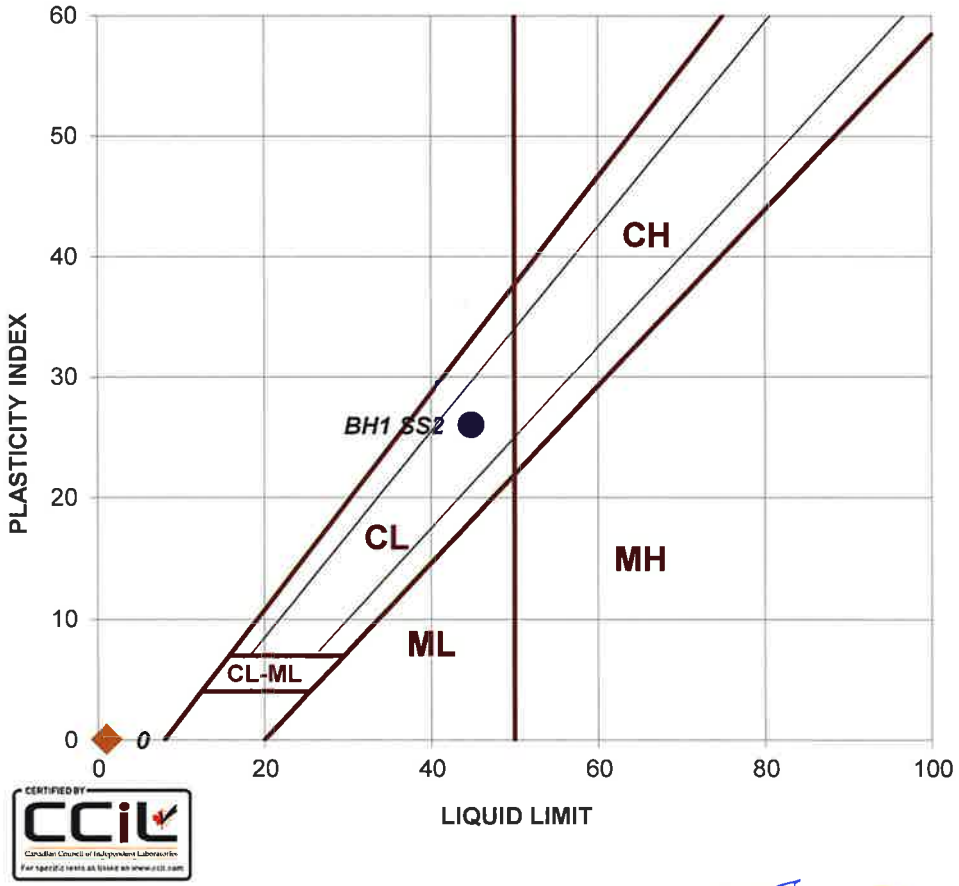
Atterberg Limits
ASTM D4318
Method B- One Point

Client:	EPCOR Water Services Inc.
Project Name:	EPCOR Gold Bar Grit Receiving
Project No:	110146363.404
Date Received:	August 13, 2015
Date Tested:	August 19, 2015
Tested By:	JA

OFFICE
10160 - 112 ST
Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
Canada T5H 2X5
Tel: (780) 917-7463

Sample:			Sample:	
BH1 SS2				
LIQUID			LIQUID	
1	2	Trial No.	1	2
20	20	Number of Blows		
11B	4B	Container Number		
37.89	36.53	Wt. Sample (wet+tare)(g)		
30.79	29.95	Wt. Sample (dry+tare)(g)		
15.40	15.61	Wt. Tare (g)		
15.4	14.3	Wt. Dry Soil (g)		
7.1	6.6	Wt. Water (g)		
46.1%	45.9%	Water Content (%)		
44.9%	44.7%	Corrected Water Content (%)		
PLASTIC			PLASTIC	
1	2	Trial No.	1	2
BK	AV	Container Number		
20.61	20.83	Wt. Sample (wet+tare)(g)		
19.57	19.76	Wt. Sample (dry+tare)(g)		
14.09	14.14	Wt. Tare (g)		
5.5	5.6	Wt. Dry Soil (g)		
1.0	1.1	Wt. Water (g)		
19.0%	19.0%	Water Content (%)		
AVERAGE VALUES			AVERAGE VALUES	
1	2		1	2
LL	45		LL	
PL	19		PL	
PI	26		PI	
CLASSIFICATION			CLASSIFICATION	
CL			NON-PLASTIC	



CERTIFIED BY CCIL Canadian Council of Independent Laboratories

Reporting of these test results constitutes a testing service only. Engineering interpretation or evaluation of the test results is provided only on written request. The data presented above is for the sole use of the client stipulated above. STANTEC is not responsible, nor can be held liable, for the use of this report by any other party, with or without the knowledge of STANTEC.

Reviewed By: _____

Stantec

Grain Size Analysis

Hydrometer Report

ASTM D422

Client: EPCOR Water Services Inc.

Project Name: EPCOR Gold Bar Grit Receivin

Project No: 110146363.404

OFFICE
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Edmonton, Alberta
Canada T5K 2L6
Tel: (780) 917-7000

LABORATORY
10575 106 ST
Edmonton, Alberta
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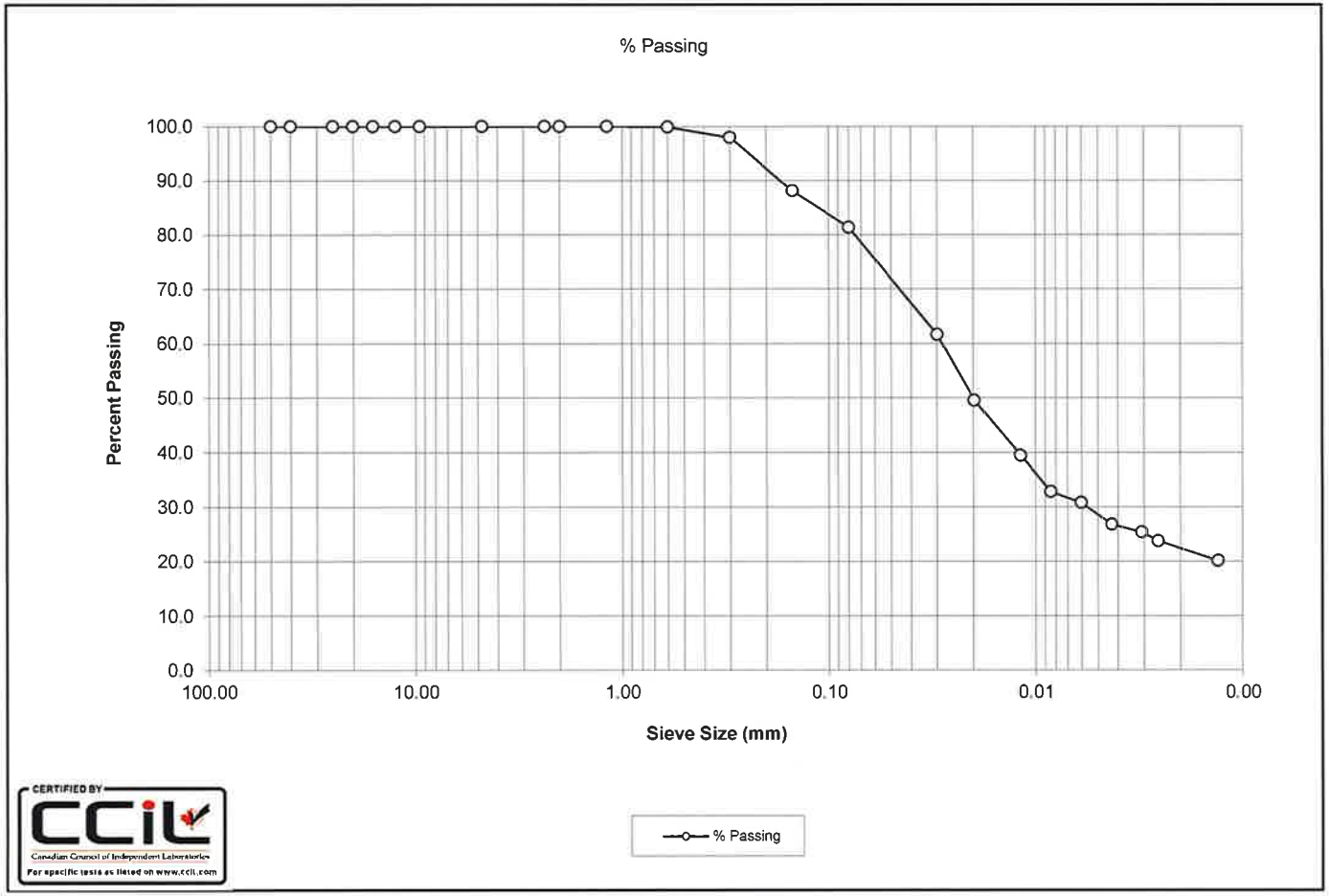
Tel: (780) 917-7463

SAMPLE #: BS3
SOURCE: BH1
TESTED BY: JA

DATE TESTED: August 20, 2015
DATE RECEIVED: August 13, 2015
SAMPLE DESCRIPTION: Silt and/or clay with sand



Sieve (mm)	Sample % Passing	Sieve (mm)	Sample % Passing
50.0	100.0	0.0060	30.8
40.0	100.0	0.0043	26.8
25.0	100.0	0.0031	25.4
20.0	100.0	0.0026	23.7
16.0	100.0	0.0013	20.1
12.5	100.0		
9.5	100.0		
4.75	100.0		
2.36	100.0		
2.00	100.0		
1.18	100.0		
0.600	99.9		
0.300	97.9		
0.150	88.0		
0.080	81.3		
0.0299	61.6		
0.0198	49.5		
0.0118	39.4		
0.0084	32.8		

CERTIFIED BY CCIL Canadian Council of Independent Laboratories For specific tests as listed on www.ccil.com

Comments:

Reviewed by:

Stantec Consulting Ltd.

10575 106 Street
Edmonton, Alberta
T5H 2X5

Stantec

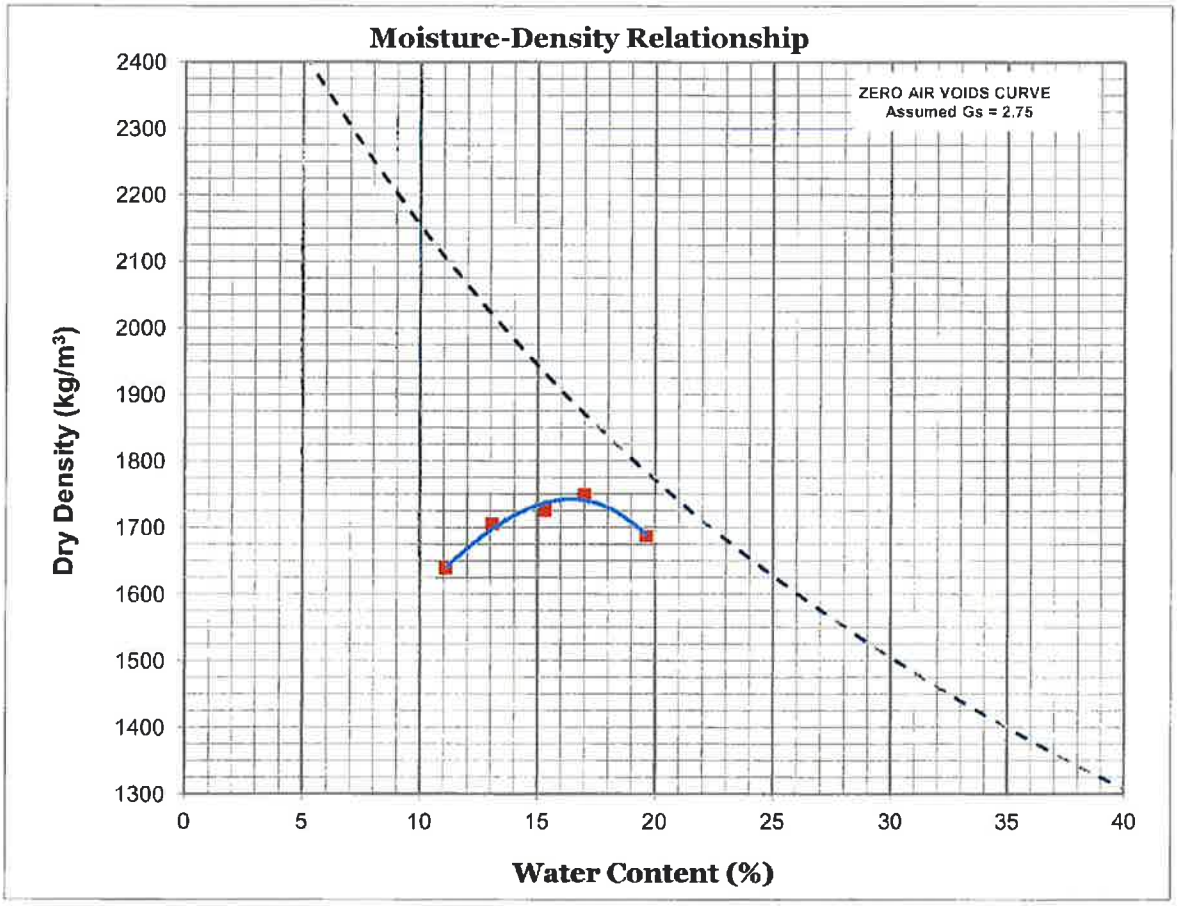
Moisture Density Relationship

☑ ASTM Designation: D698 ☐ ASTM Designation: D1557

PROJECT:	**EPCOR Gold Bar Grit Receiving**	**DATE SAMPLED:**	August 26, 2015
CLIENT:	**EPCOR Water Services Inc.**	**DATE RECEIVED:**	August 26, 2015
PROJECT No.:	**110146363**	**SAMPLE No.:**	BH3

TRIAL No.	**1**	**2**	**3**	**4**	**5**
DRY DENSITY (kg/m³)	1640	1706	1726	1749	1688
MOISTURE CONTENT (%)	11.1	13.1	15.4	17.0	19.7

Source of Sample: 1.3FT - 6.1FT
Soil Description: SILT AND CLAY, TR SAND, TR GRAVEL
Date Tested: August 31, 2015
Maximum Dry Density: 1745kg/m³
Optimum M.C. 16.2%
Natural M.C. NA
Oversize Correction 0.0%



Reviewed By:

Steffen Karl, P.Eng

Stantec Consulting Ltd.

California Bearing Ratio Test Report

Date Sept 9/15

Checked By

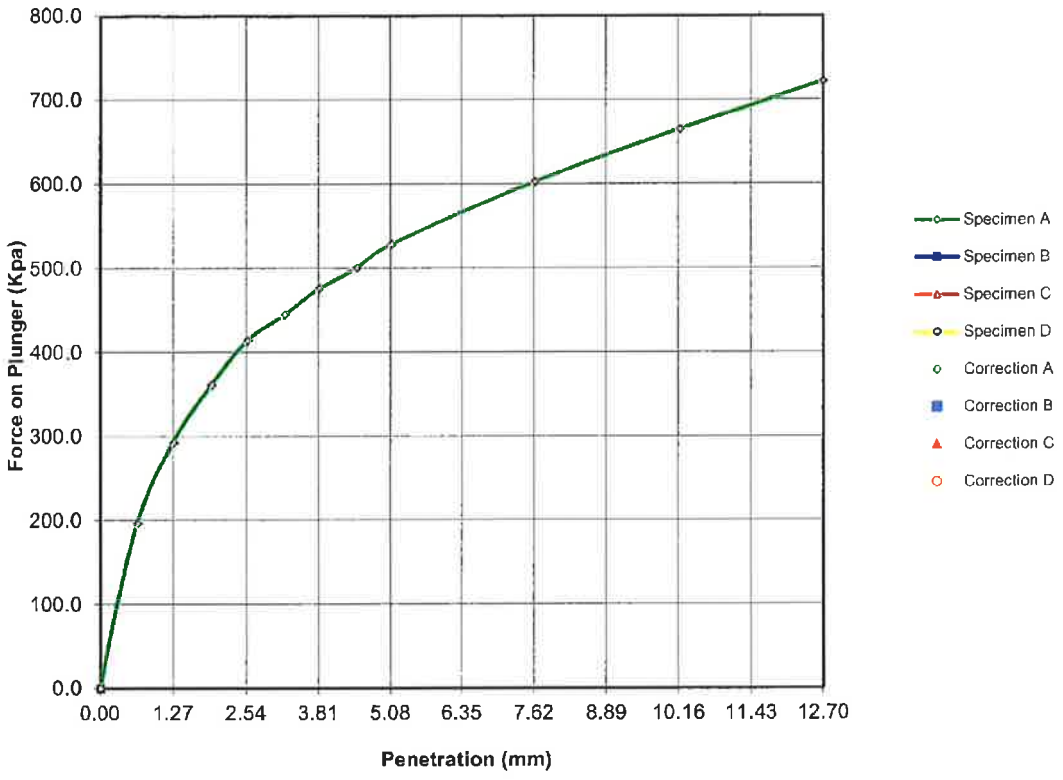
Date 9/8/2015

Computed By J.A

Date 9/4/2015

Tested By J.A

Load Penetration Curve



CBR Results					
Results	A	B	C	D	Average
2.54 mm Pen.	6.0				6.0
5.08 mm Pen.	5.1				5.1
Moisture (%)	14.95				14.95
Density (g/cm3)	1.71				1.71
Final Moisture (%)	19.8				19.80
Final Density (g/cm3)	2.68				2.68

Project Information			
Project Num	110146363.404	Sample Location	
Project	EPCOR Gold Bar Grit Receiving	Specimen A	Edmonton
Date	Sept 4, 2015	Specimen B	
Client	EPCOR Water Services INC.	Specimen C	
		Specimen D	
		Test Variables	
Job Ref.		Liquid Limit:	
Sample Num.	BH1	Plastic Limit:	
Remarks			

Success Through Science®

Your P.O. #: 110146363.404
Your Project #: EPCOR GRIT FACILITY
Your C.O.C. #: A124163

Attention:Lowell Makarenko

STANTEC CONSULTING LTD
10160-112 STREET
EDMONTON, AB
CANADA T5K 2L6

Report Date: 2015/08/25
Report #: R2029745
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B571949
Received: 2015/08/18, 15:08

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Ca,Mg,Na,K,SO4 (Soluble)	3	2015/08/24	2015/08/25	AB SOP-00033 / AB SOP-00042	EPA 200.7 CFR 2012 m
Soluble Paste	3	2015/08/24	2015/08/24	AB SOP-00033	Carter 2nd ed 15.2 m

Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Jeremy Wakaruk, B.Sc., Senior Project Manager
Email: JWakaruk@maxxam.ca
Phone# (780)577-7105 Ext:7105

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B571949
Report Date: 2015/08/25

STANTEC CONSULTING LTD
Client Project #: EPCOR GRIT FACILITY
Your P.O. #: 110146363.404
Sampler Initials: LM

RESULTS OF CHEMICAL ANALYSES OF SOIL

Maxxam ID		MY0285	MY0286	MY0287		
Sampling Date		2015/08/13	2015/08/13	2015/08/13		
COC Number		A124163	A124163	A124163		
	UNITS	**BH1 BS3**	**BH1 BS7**	**BH1 BS11**	**RDL**	**QC Batch**
Soluble Parameters						
Saturation %	%	40	29	98	N/A	8010575
Soluble Sulphate (SO4)	mg/L	42	9.3	130	5.0	8013478

RDL = Reportable Detection Limit
N/A = Not Applicable

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Maxxam Job #: B571949
Report Date: 2015/08/25

STANTEC CONSULTING LTD
Client Project #: EPCOR GRIT FACILITY
Your P.O. #: 110146363.404
Sampler Initials: LM

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	27.0°C

Results relate only to the items tested.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam Job #: B571949
Report Date: 2015/08/25

STANTEC CONSULTING LTD
Client Project #: EPCOR GRIT FACILITY
Your P.O. #: 110146363.404
Sampler Initials: LM

QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	UNITS	QC Limits
8010575	LZ0	QC Standard	Saturation %	2015/08/24		95	%	75 - 125
8010575	LZ0	RPD	Saturation %	2015/08/24	2.5		%	12
8013478	SRT	QC Standard	Soluble Sulphate (SO4)	2015/08/25		93	%	75 - 125
8013478	SRT	Method Blank	Soluble Sulphate (SO4)	2015/08/25	<5.0		mg/L	
8013478	SRT	RPD	Soluble Sulphate (SO4)	2015/08/25	3.0		%	35

Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Maxxam Analytics International Corporation o/a Maxxam Analytics Calgary: 2021 - 41st Avenue N.E. T2E 6P2 Telephone (403) 291-3077 Fax (403) 291-9468

Maxxam

Calgary: 4000 19st St. NE, T2E 6P8. Ph: (403) 291-3077, Fax: (403) 735-2240, Toll free: (800) 386-7247
Edmonton: 9331 - 48 Street, T6B 2R4. Ph: (780) 577-7100, Fax: (780) 450-4187, Toll free: (877) 465-8889
www.maxxamanalytics.com

08/731 (1) Chain of Custody A124163

INRC 722

Page: 1 of 1

	Invoice To: C/O Report Address ☑	Report To: Same as Invoice ☐	Report Distribution (E-Mail):
Company:	STANTEC		LOWELL.MAKARENKO@STANTEC.COM
Contact:	LOWELL MAKARENKO		GBC MATERIALS DISPATCH@STANTEC.COM
Address:	10160 112 ST NW		
	Prov: AB PC:	Prov: PC:	
Contact #s:	Ph: (780) 917-7303 Cell: (780) 700-1679	Ph: Cell:	

REGULATORY GUIDELINES:
- ☐ AT1
- ☐ CCME
- ☐ Regulated Drinking Water
- ☐ Other:

All samples are held for 60 calendar days after sample receipt, unless specified otherwise.

PO #: 1101463G3 - 404
Project # / Name: EPCOR GRIT FACILITY
Site Location:
Quote #:
Sampled By: LOWELL MAKARENKO

SERVICE REQUESTED:
- ☐ RUSH (Contact lab to reserve) Date Required:
- ☑ REGULAR (5 to 7 Days)

See reverse for package specifics

	Sample ID	Depth (unit)	Matrix GW / SW Soil	Date/Time Sampled YY/MM/DD 24:00	SOIL: BTEX F1-F4	Sieve (75 micron)	Regulated Metals (CCME / AT1)	Salinity 4	Assessment ICP Metals	Basic Class II Landfill	SULPHATES	WATER: ☐VOCs ☐BTEX F1	☐BTEX F1-F2	☐BTEX F1-F4	☐Routine Water ☐Turb ☐F	☐TOC ☐DOC	Regulated Metals (CCME / AT1) Total	Regulated Metals (CCME / AT1) Dissolved	Mercury ☐Total ☐Dissolved	Other Analysis	HOLD - Do not Analyze	# of Containers Submitted
1	BH1 BS3			15/08/13							✓											
2	BH1 BS7			15/08/13							✓											
3	BH1 BS11			15/08/13							✓											
4																						
5																						
6																						
7																						
8																						
9																						
10																						
11																						
12																						

18-Aug-15 15:08
Jeremy Wakaruk
B571949

Please indicate Filtered, Preserved or Both (F, P, F/P) → F/P

Relinquished By (Signature/Print):	JAMES AROMIN	Date (YY/MM/DD): 15/08/18	Time (24:00): 15:05
Relinquished By (Signature/Print):	Jaime Shmilak 20150820	Date (YY/MM/DD):	Time (24:00): 1146
Special Instructions:			# of Jars Used & Not Submitted

LAB USE ONLY

Received By:	Date:	Time:	Maxxam Job #:			
Degna. DETIWU	2015/08/18	15:08		Custody Seal	Temperature	Ice
Lab Comments: Harry Joiz 20151820 16:58			21121122	absent	27.27.27 (bag)	absent

AB FCD-00331 Rev3 2010/05

Maxxam Analytics International Corporation o/a Maxxam Analytics

APPENDIX D
COMPREHENSIVE SPECIES LIST

Comprehensive Species List

Scientific Name	Provincial Common Name	Plant Form
Achillea millefolium	common yarrow	Forb
Arctium minus	common burdock	Forb
Artemisia spp.	sagebrush species	Forb
Artemisia absinthium	absinthe wormwood	Forb
Cirsium arvense	creeping thistle	Forb
Cornus canadensis	bunchberry	Forb
Euphorbia esula	leafy spurge	Forb
Galium boreale	northern bedstraw	Forb
Lathyrus spp.	peavine species	Forb
Maianthemum canadense	wild lily-of-the-valley	Forb
Maianthemum stellatum	star-flowered Solomon's-seal	Forb
Prosartes trachycarpa	fairybells	Forb
Solidago canadensis	Canada goldenrod	Forb
Sonchus arvensis	perennial sow-thistle	Forb
Symphyotrichum ciliolatum	Lindley's aster	Forb
Tanacetum vulgare	common tansy	Forb
Taraxacum officinale	common dandelion	Forb
Vicia americana	wild vetch	Forb
Bromus inermis	smooth brome	Graminoid
Calamagrostis canadensis	bluejoint	Graminoid
Elymus trachycaulus	slender wheatgrass	Graminoid
Poa palustris	fowl bluegrass	Graminoid
Poa pratensis	Kentucky bluegrass	Graminoid
Amelanchier alnifolia	saskatoon	Shrub
Cornus sericea ssp. sericea	red-osier dogwood	Shrub
Corylus cornuta	beaked hazelnut	Shrub
Cotoneaster lucidus	Peking cotoneaster	Shrub
Prunus pensylvanica	pin cherry	Shrub
Rhamnus alnifolia	alder-leaved buckthorn	Shrub
Rosa acicularis	prickly rose	Shrub
Rosa woodsii	common wild rose	Shrub
Rubus idaeus	wild red raspberry	Shrub
Shepherdia canadensis	Canada buffaloberry	Shrub
Symphoricarpos albus	snowberry	Shrub
Symphoricarpos occidentalis	buckbrush	Shrub
Viburnum edule	low-bush cranberry	Shrub
Acer negundo	Manitoba maple	Tree
Fraxinus pennsylvanica	green ash	Tree

Scientific Name	Provincial Common Name	Plant Form
Picea glauca	white spruce	Tree
Pinus banksiana	jack pine	Tree
Populus balsamifera	balsam poplar	Tree
Populus tremuloides	aspen	Tree
Sorbus americana	American mountain-ash	Tree