ATTACHMENT 4

Biosolids Truck Loading and Odour Control Facility for Highland Creek Treatment Plant

PREPARED FOR:	City of Toronto
PREPARED BY:	AECOM Inc.
DATE:	April 4, 2011

1.0 Introduction

1.1 Purpose

The purpose of this Technical Memorandum (TM) is to identify and make provision for the future possibility of the shutdown of the biosolids multiple hearth incinerators in favour of a biosolids beneficial use program and/or offsite haulage to landfill. Biosolids treatment upgrade design considerations are identified in this TM to accommodate a future Biosolids Truck Loading Facility and a tentative site location has been made to best coincide with the present operations and site logistics.

2.0 Truck Loading and Odour Control Overview

2.1 Design Basis

Design of a new future biosolids loading facility would be based on an average dewatered biosolids production of 140 m^3/d, with peak daily production of approximately 200 m^3/d. Total solids concentration of the dewatered biosolids is expected to be between 25% and 32% (28%). The overall facility should have 5-6 days of dewatered biosolids storage at peak rates and a 20 minute truck loading timeframe. Facility design and constructability would be co-ordinated with current operations to minimize interruption to biosolids production and operation processing.

Key design data for the dewatered biosolids storage, conveyance and loading system are as tabulated below from a Dewatering Design Basis TM, dated October 29, 2007 and would form the basis of design for a future Biosolids Truck Loading Facility.

Biosolids Loading Facility Design Parameters	**Value**
Average daily dewatered biosolids production	140 m^3/d
Peak daily dewatered biosolids production	200 m^3/d
Total solids concentration of dewatered biosolids	25% - 32% (28%)
Range of total biosolids storage volume (i.e., 5 days to allow for long weekends or interruptions to process operations, 5.5x200)	1100 m^3
Total bulk storage in silos (150x2)	300 m^3

Biosolids Loading Facility Design Parameters	Value
Total storage in truck loading hoppers (200x4)	800 m^3
Number of additional biosolids pumps (1@14 m^3/hr & 2@7 m^3/hr)	3
Number of pipelines from bulk storage to truck loading facility	2
Average biosolids pumping between bulk storage silos and truck loading facility (using one (1) pipeline) (140 m^3/d)	14 m^3/h (10 hrs)
Peak biosolids pumping between bulk storage and truck loading facility (using one (1) pipeline) (200 m^3/d)	14 m^3/hr (14.3 hrs)
Rating for distribution screw conveyors in truck loading	30 m^3/hr
Truck loading facility peak daily loading capacity with one (1) truck bay operational	200 m^3/d
Number of truck bays in loading facility	2

2.2 Biosolids Silo Storage

Under the current Biosolids Treatment Upgrades design, one new 14 m^3/hr biosolids pump and 250 mm diameter pipeline would pump biosolids to a new 150 m^3 biosolids storage silo in the Biosolids Treatment Building. With a future addition of a truck loading facility, this pumping capacity and storage arrangement would be duplicated primarily for maintenance redundancy purposes to provide for a total installed storage capacity of 300 m3. To provide direct pumping to the truck loading facility, as the primary mode of operation, some piping and valves would require upsizing to accommodate this change. Demolition of disused Biosolids Treatment equipment has already been included in the current Biosolids Treatment Upgrades Contract and the Biosolids Treatment area can easily accommodate the additional silo and associated equipment.

The Pre-design Report for the Biosolids Treatment Upgrades Contract describes and presents the current singular silo and pump arrangement which would be replicated for the additional silo.

2.3 Dewatered Biosolids Conveyance from Silo Storage to Truck Loading Facility

Biosolids would be pumped, as a secondary mode of operation, from the storage silos in the Biosolids Treatment Building to four (4) new rectangular biosolids hoppers located in the truck loading facility through a new annexed building overhead heated pipe gallery. The truck loading facility, selected to be located south and slightly east of the Biosolids Treatment Building, is envisioned to occupy about a quarter of the south ash lagoon area. This ash lagoon location facilitates a minimal impact to the current Biosolids Treatment Upgrades design, a minimal disruption to existing production and lagoon switchover and a high utilization of the existing refurbished infrastructure. The site addition of a Truck Loading Facility would require an additional three (3) new biosolids pumps - two (2) pumps for the new silo and one (1) transfer pump sized to pump directly to the truck loading facility. Pumps would require the following design characteristics:

Type	Hydraulically-driven, dual cylinder reciprocating piston type positive displacement
Make	Two (2) Schwing KSP25 (Silo)
Minimum effective volumetric feedrate at 28% total solids	7 m^3/hr
Capacity range	2 to 7 m^3/hr
Drive	75 kW (100 hp)
Discharge Pressure	8400 kPa
Discharge Pipe Size	200 mm dia.

Type	Hydraulically-driven, dual cylinder reciprocating piston type positive displacement
Make	One (1) Schwing KSP45 (Transfer)
Minimum effective volumetric feedrate at 28% total solids	14 m^3/hr
Capacity range	3 to 14 m^3/hr
Drive	90 kW (125 hp)
Discharge Pressure	8400 kPa
Discharge Pipe Size	300 mm dia.

The rated discharge pressure is twice the estimated system pressure that occurs when two pumps, each operating at their design capacity, discharge simultaneously through a single pipeline, without pipeline lubrication. The biosolids pumps and discharge piping would be designed for high and variable friction head losses.

Provisions will be made to inject controlled amount of plant potable/non-potable water or a dilute polymer solution in the biosolids pipeline. The pipeline lubrication system consists of a series of lubrication pumps, a package polymer addition system, and lubrication injection rings, complete with a dedicated control panel.

Four (4) screw conveyors, one atop of each of the four (4) truck loading hoppers in the truck loading facility, collect and distribute the dewatered biosolids evenly from the biosolids pump system into the hoppers. The screw conveyors are shaftless with the following key characteristics:

Type	Dual inline, electrically driven, reversible, shaftless screws
Maximum capacity (per two inline screws)	75 m^3/hr
Maximum screw feed	20 rpm
Maximum allowable filling factor at maximum capacity	50%
Maximum linear movement of material along length of screw	9.75 m/min

2.4 Biosolids Truck Loading Facility Considerations

Dewatered biosolids delivered to the truck loading facility would be stored in four (4) live-bottom hoppers, configured with two hoppers, in series, in each loading bay. It is proposed to incorporate rectangular all stainless steel hoppers with wedge bottoms similar to the ABTP Truck Loading Facility. Each hopper would incorporate twin load out augers in the bottom section to ensure continuous feed of dewatered biosolids to trucks. The hoppers have a total active volume of 800 m^3 (4 x 200 m^3). The interior wetted surface of the hoppers will be polished 316L stainless steel and the exterior structural framing will be carbon steel.

The truck loading facility would consist of two drive-through loading bays, each equipped with a digital model weighing scale, capable of operating simultaneously. Loading bays would be designed to accommodate various truck sizes and configurations, including those trucks used by the City have approved biosolids haulers. The truck loading facility would be designed to achieve the following key criteria:

- To load a minimum of fourteen 40-cubic meter trucks within six hours, with a single bay operating.
- To load the peak daily production of 200 m^3 of dewatered biosolids into trucks during a single 8-hour shift.
- To allow a “truck cycle time” of less than 15 minutes - where "truck cycle time" represent the time elapsed from entrance to the loading bay through loading to exiting.
- To complete all loading operations with truck bay doors closed.
- To minimize accidental spillage of biosolids on floor.

2.5 Odour Control Facility

2.5.1 Mechanical Ventilation System

To minimize the probability of odour emissions from the proposed new biosolids storage and truck loading facility, odourous compounds emitted from the process should be collected at the source and treated effectively prior to discharge to the atmosphere. Thus, as part of our proposed installation of the odour control facility, the odorous gases from the dewatering building, biosolids storage silos and biosolids truck loading facility will be collected and treated. Odour treatment could either consist of a scrubbing process

using a packed tower (wet scrubber) system or a biofilter. Building ventilation systems will be designed to ensure that odourous gas emanating from the operation of the proposed biosolids storage and truck loading facility will be contained and sent to the inlet fans of the odour control system for treatment.

The ventilation system will include the following:

- Design for Truck bay doors closed
- Truck enclosure/exhaust hood
- Connection to Biosolids hoppers
- Connection to Biosolids silos
- Odour laden air collection duct work
- Exhaust fans
- Scrubber fans and associated ductwork
- Make-up air systems
- Controls

2.5.2 Odour Treatment

The treatment of odour will be by either packed tower or biofiltration, to be determined during the Predesign Phase of the Truck Loading Facility. Regardless of the technology chosen, the treatment units will have the capacity to handle up to 20 m^3/s of odourous gases in any mode of operation.

The packed towers have been shown in this TM for the purpose of illustration and are housed in a building directly adjacent to the truck loading facility as shown in figure 3. The facility will also house the packed tower inlet fans and all auxiliary equipment for the odour control facilities.

The principal objective of the odour treatment system is to ensure that the public are not disrupted by odours emanating from the new biosolids storage and truck loading facility.

Design criteria for the odour control system would be established during the Truck Loading Facility Predesign.

3.0 Digester

HCTP currently has four digesters and three flares. Under average throughput the digesters have a retention time of 16 days, however at peak flow the facility only have 12 days.

The ensure that the HCTP meet the MOE 15 day minimum retention time for land application we are recommending that the facility install an extra digester and flares.

4.0 Preliminary Capital Cost Estimate for Truck Loading and Odour Control

We have reviewed the components of the proposed truck loading and odour control facilities as shown on Figure 3. The preliminary capital cost estimate, in 2010 dollars, is in the order of $97.2 million (excluding HST).

4.1 Basis of Cost Estimate

General Contractor Mark-ups

A mark-up of fifteen percent (15%) for contractor's overhead, profit, mobilization, demobilization, and bonding/insurance etc is included. This 15% mark-up is based on the following:

- Contractor's overhead and profit: 12% (opinion based on current construction market conditions, market availability, and experience on recent tenders received)
- Mobilization and demobilization: 1%
- Bonding and Insurance: 2%

Escalation

For the purpose of this TM, the construction estimate provided above has been shown in 2010 dollars. Escalation is not included in the estimate.

Contingency Allowance

An allowance of twenty five percent (25%) for contingency has been included. This contingency allowance is based on a conceptual design and the total contingency allowance will decrease as the design develops and more information is available. The contingency includes 5% for change orders. However, this contingency does not include for additions to the scope of work.

Cost Estimating Basis/Assumptions

The total cost estimate was prepared using the following basis, assumptions, and exclusions:

Assumptions:

- Based on normal construction (that is, five days per week at eight hours/day, 40-hour working week)
- Estimated construction cost is in 2010 dollars
- Unit prices are based on quotations, cost books, and historical data
- Equipment estimates are based on vendor quotations or historical data from recently tendered WPCP projects (with allowances for installation based on ratios of the equipment cost)
- General Contractor Mark-up: 15%
- Conceptual Contingency Allowance: 25%
- Process Mechanical Allowance to cover piping and ancillary systems (including installation costs)
- Retrofit Allowance for building renovations and facilities that require significant tie-ins to existing facilities
- Engineering, 12% of Capital Cost
    - Design, 5% of Capital Cost
    - Site Services During Construction, 6% of Capital Cost
    - Post Construction, 1% of Capital Cost

Exclusions:

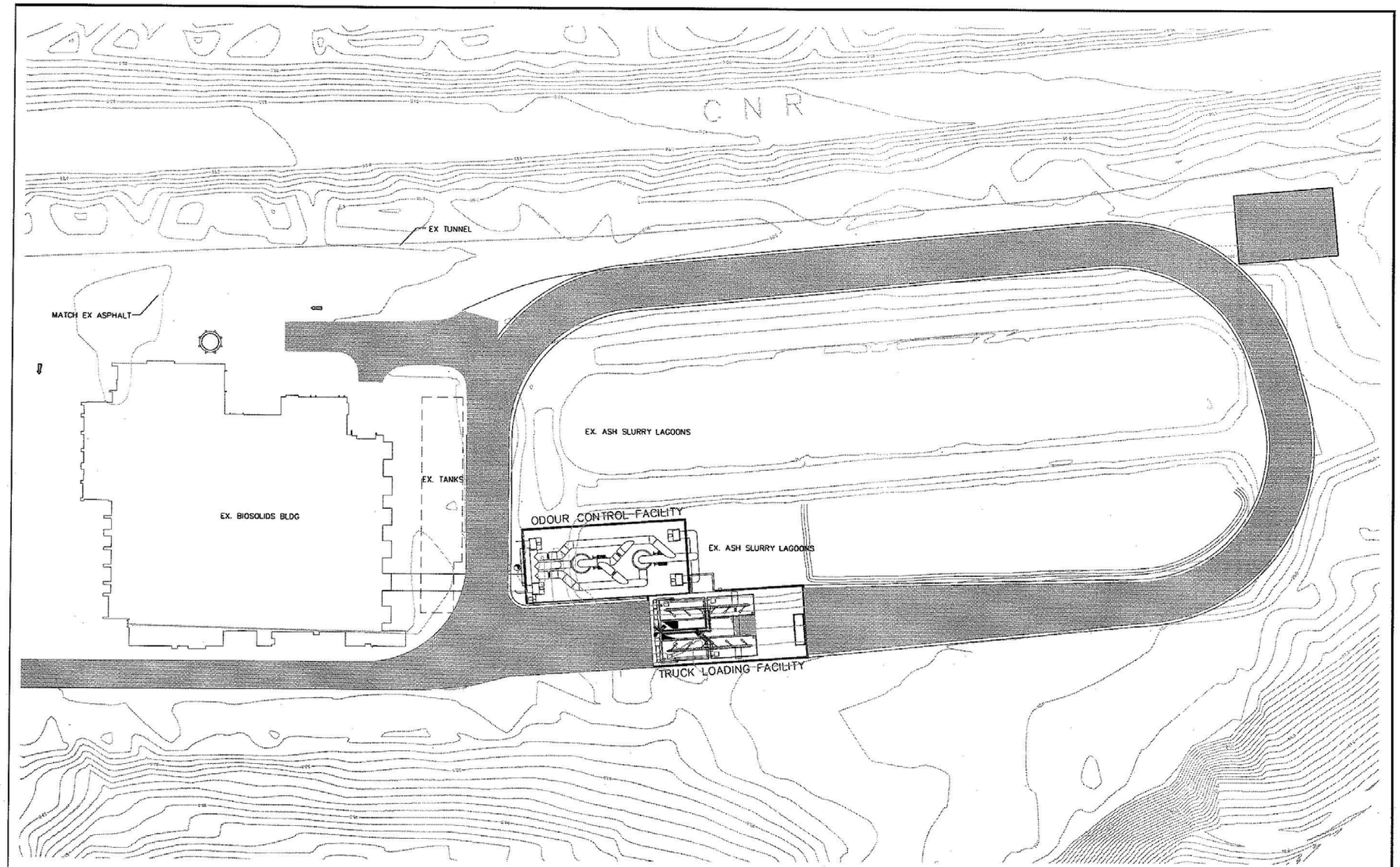
- Engineering and City costs
- Geotechnical Work
- Impacts due to inflation and escalation
- Removal of hazardous waste (investigations will be done to determine if any are present)
- Rock excavation
- Non-competitive market conditions (that is, shortage of materials, shortage of skilled labour, among others)
- Additional costs for various approaches for accelerating construction

The following Table outlines our preliminary capital cost estimation for the construction of a new biosolids truck loading facility, an extra digester and all auxiliary equipment. The total project preliminary cost estimate (including capital, engineering and HST costs) is **$97,244,000.00**

Highland Creek Treatment Plant

Preliminary Capital Cost Estimate

Component Description	Quantity	Unit	Unit Cost	Installation % of Matl	Total Cost ($)
Utilities	1	lump sum	$440,000	incl	440,000
Major Equipment	1	lump sum	22,000,000	incl	22,000,000
Civil (Structural, Civil, Architectural)	1	lump sum	10,600,000	incl	10,600,000
Mechanical (Pipefitting, Millwrighting)	1	lump sum	6,400,000	incl	6,400,000
Sheet Metal (Ductwork, Fans)	1	lump sum	3,400,000	incl	3,400,000
Electrical, Instrumentation & Controls	1	lump sum	4,300,000	incl	4,300,000
Boilermaker (Silos, Hoppers0	1	lump sum	1,600,000	incl	1,600,000
Commissioning	1	lump sum	1,000,000	incl	1,000,000
Permits	1	lump sum	160,000	incl	160,000
Digester Capacity Increase	1	lump sum	10,500,000	incl	10,500,000
Sub-Total Basic Facility Costs					**$60,400,000**
General Contractor's Overhead & Profit, Mob.,Bonds		% of A	15.0%		$9,060,000
Sub-Total Basic Facility Costs					**$69,460,000**
Conceptual Design Contingency		% of B	20.0%		$13,892,000
Construction Contingency (Change Orders)		% of B	5.0%		$3,473,000
Total Estimated Construction Costs					**$86,825,000**
Engineering		% of C	12.0%		**$10,419,000**
Total Estimated Capital Costs, Excluding HST					**$97,244,000**



TORONTO WATER

AECOM

Markham, Ontario 905.886.7022

No.	DATE	REVISIONS	INITIAL	SIGNED

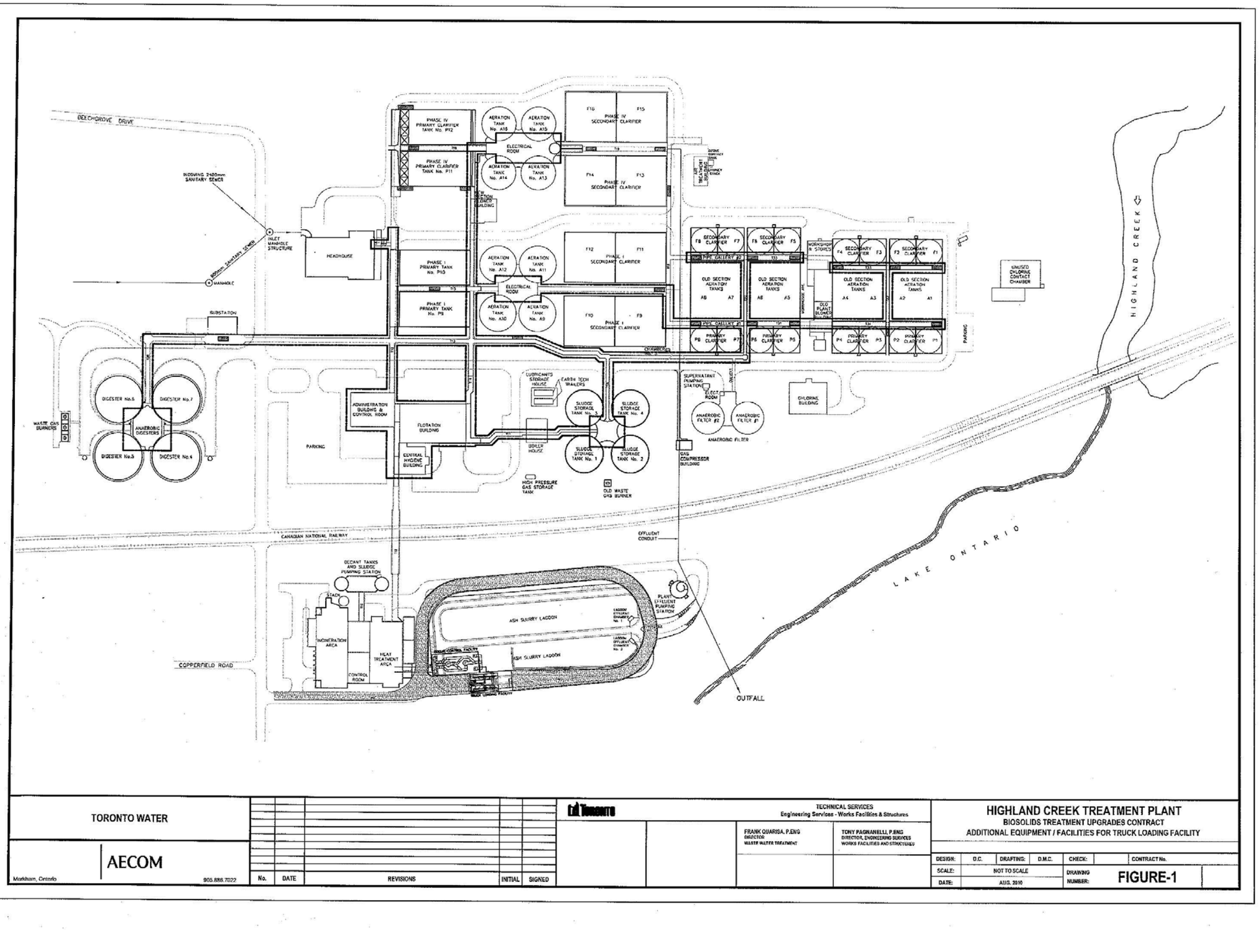
TECHNICAL SERVICES
Engineering Services - Works Facilities & Structures

FRANK QUARISA, P.ENG
DIRECTOR
WASTE WATER TREATMENT

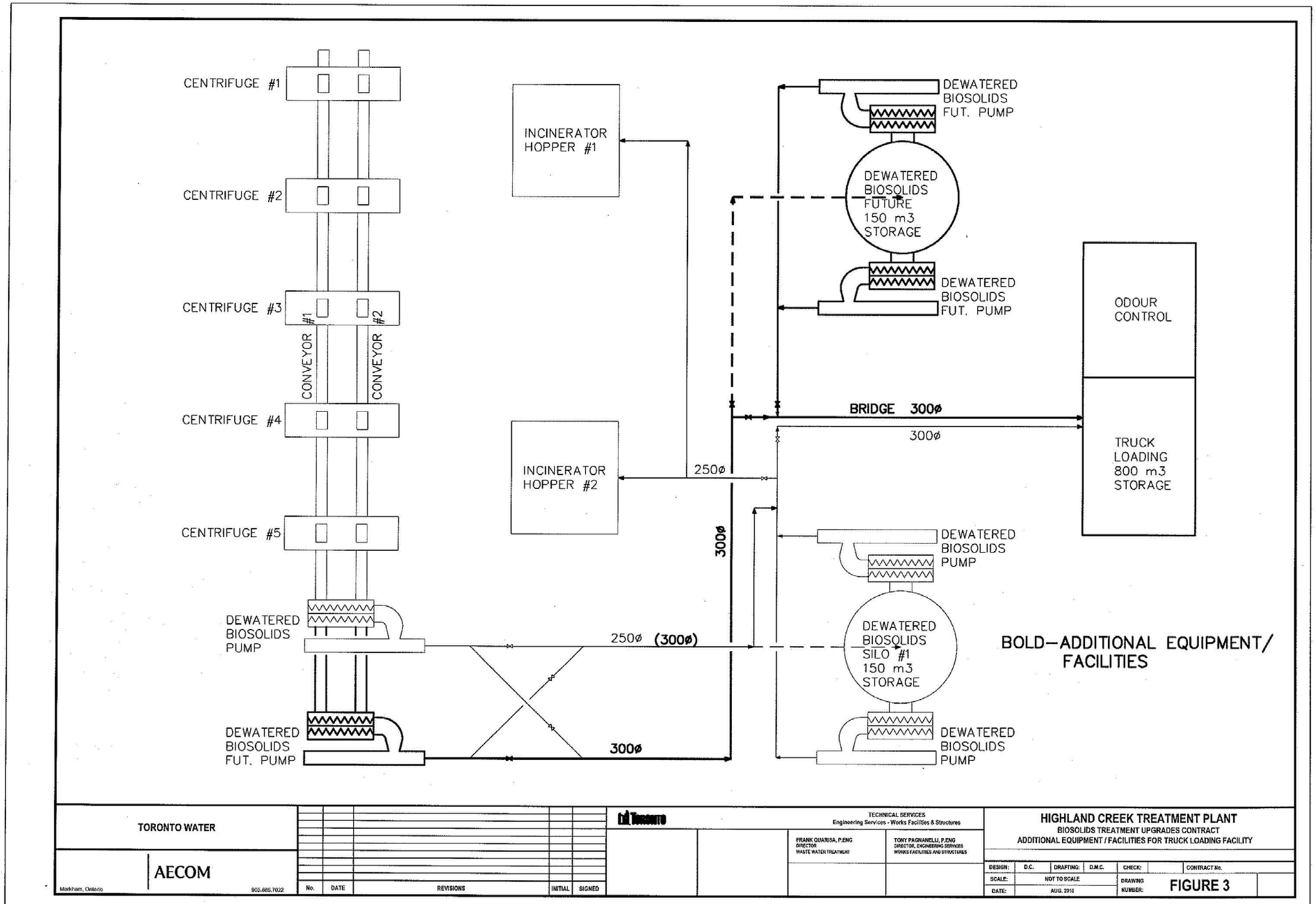
TONY PAGNANELLI, P.ENG
DIRECTOR, ENGINEERING SERVICES
WORKS FACILITIES AND STRUCTURES

HIGHLAND CREEK TREATMENT PLANT
BIOSOLIDS TREATMENT UPGRADES CONTRACT
ADDITIONAL EQUIPMENT / FACILITIES FOR TRUCK LOADING FACILITY

DESIGN:	D.C.	DRAFTING:	D.M.C.	CHECK:		CONTRACT No.	PDR
SCALE:	1:500			DRAWING NUMBER:	**FIGURE-2**		
DATE:	AUG. 2010						



TORONTO WATER			TECHNICAL SERVICES Engineering Services - Works Facilities & Structures		HIGHLAND CREEK TREATMENT PLANT BIOSOLIDS TREATMENT UPGRADES CONTRACT ADDITIONAL EQUIPMENT / FACILITIES FOR TRUCK LOADING FACILITY
AECOM Markham, Ontario 905.886.7022	No. DATE REVISIONS INITIAL SIGNED		FRANK QUARISA, P.ENG DIRECTOR WASTE WATER TREATMENT	TONY PAGNANELLI, P.ENG DIRECTOR, ENGINEERING SERVICES WORKS FACILITIES AND STRUCTURES	DESIGN: D.C. DRAFTING: D.M.C. CHECK: CONTRACT No. SCALE: NOT TO SCALE DRAWING NUMBER: FIGURE-1 DATE: AUG. 2010



TORONTO WATER

AECOM
Markham, Ontario 905.686.7022

No.	DATE	REVISIONS	INITIAL	SIGNED

TECHNICAL SERVICES
Engineering Services - Works Facilities & Structures

FRANK QUARISA, P.ENG
DIRECTOR
WASTE WATER TREATMENT

TONY PAGNANELLI, P.ENG
DIRECTOR, ENGINEERING SERVICES
WORKS FACILITIES AND STRUCTURES

HIGHLAND CREEK TREATMENT PLANT
BIOSOLIDS TREATMENT UPGRADES CONTRACT
ADDITIONAL EQUIPMENT / FACILITIES FOR TRUCK LOADING FACILITY

DESIGN:	D.C.	DRAFTING:	D.M.C.	CHECK:		CONTRACT No.
SCALE:	NOT TO SCALE			DRAWING NUMBER:	FIGURE 3	
DATE:	AUG. 2010					