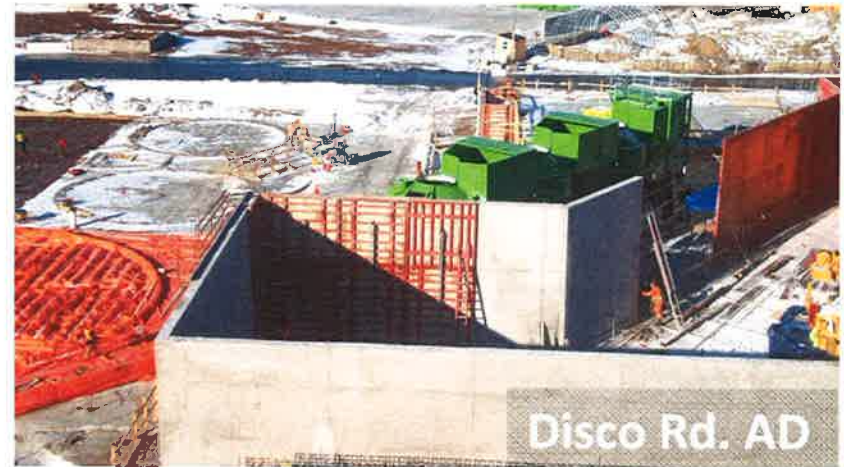




Dufferin AD



Disco Rd. AD

Anaerobic Digestion of Municipal SSO in the City of Toronto

Seminar on Anaerobic Digestion for Organic Wastes
SWANA NY Chapter
June 20, 2012

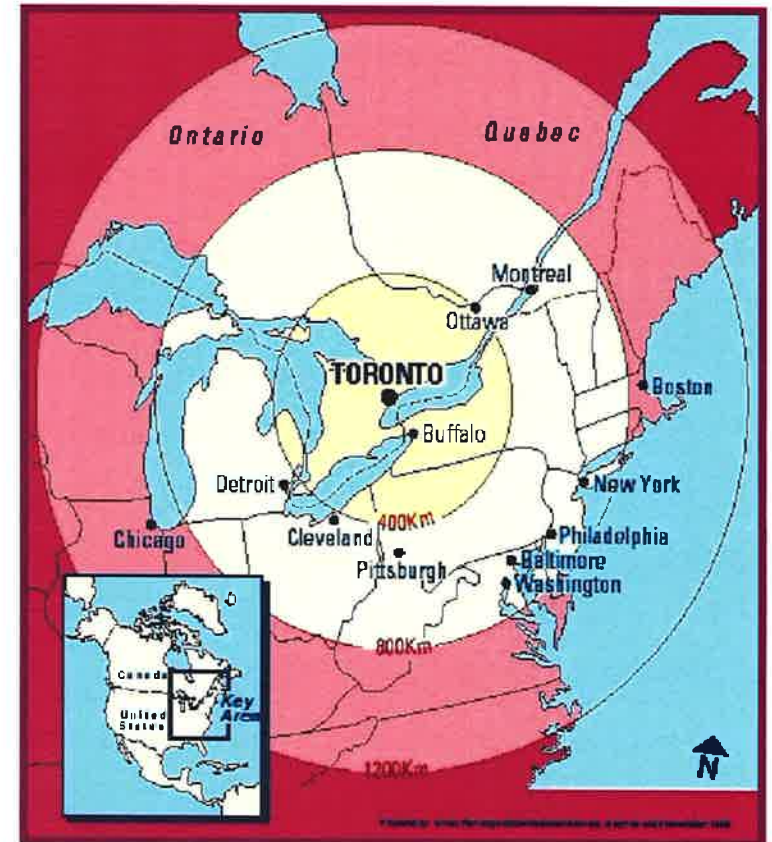
Overview

- Overview of Toronto SWM Programs
- Background - Green Bin Organics Program
- Background - Dufferin AD Facility
- Current expansion – Disco AD Facility
- Biogas utilization



About Toronto - Statistics

- Capital of Ontario
- Population 2.5 million
- 510,000 single-family homes
- 500,000 apts., condos etc. (and growing)
- Part of Greater Toronto Area, Population ~ 8 million



City of Toronto Waste Statistics

In 2009, Toronto SWM Services managed (tonnes):

- Total - 933,052 MT/yr
- Diverted Waste:
 - Single-stream recyclables = 204,023
 - Organics (SSO)= 111,116 (11.9%)
 - L&YM = 95,777 (10.3%)
 - Plus White Goods, Bulky Items, HHW etc.
- Residual Waste = 522,136

* Metric tons per year

Toronto's Green Bin Program – Facts & Figures

➤ Quantity

- Single family 250 kg/hh-yr (~550 lb/hh-yr)
- Multi-family 75 kg/unit - yr (~165 lb/unit-yr)

➤ Current Tonnage

(Single-Family + commercial)

=> **110,000 MT/yr (~121,000 tons/yr)**

➤ Ultimate Tonnage

(include Multi-Family + schools etc.)

=> **170-180,000 MT/yr (~198,000 tons/yr)**

Curbside Residential Program - Three Stream Collection

Three “Core” Streams

- Single-stream Recycling (bi-weekly)
- Green Bin (weekly)
- Residual (bi-weekly)

“Specialty” Streams

- Yard + Garden Waste (seasonal; bi-weekly)
- Household Durable Goods (bi-weekly)
- White Goods – by Appointment
- Household Hazardous Waste





Green Bin Program Typical Curbside Set Out

**Popular with residents.
Participation: ~ 90% of households have 1 or
more set out per month. Consistent; 2002 – 2010.**



28 9:28 AM

Multi-Family Organics Collection: Deep Collection System Pilot



Toronto's Green Bin Program – Facts & Figures

- Part of City's "Target 70" goal (70% waste diversion from LF)
- **Objective:** maximize recovery of source separated organics (SSO) through:
 - User convenience (kitchen & green bins provided)
 - Allow use of regular plastic bagging (difficult for composting)
 - Green Bin Collection (weekly)
 - Bi-weekly residual waste collection to encourage diversion
- **NO** yard waste accepted (collected separately)

Accepted Material:

- fruits
- meat, shellfish, fish products
- pasta, bread, cereal
- dairy products, egg shells
- coffee grounds, filters, tea bags
- soiled paper towels, tissues
- soiled paper food packaging: fast food paper packaging, ice cream boxes, muffin paper, flour and sugar bags
- paper coffee cups, paper plates
- household plants, including soil
- diapers, sanitary products
- animal waste, bedding (e.g. from bird/hamster cages), kitty litter
- pet food



Toronto's Green Bin Program - Collection



Sources: City of Toronto; CCI; AECOM

Organic Solid Waste & Anaerobic Digestion

Challenge

Organic solid waste (source separated organics or the organic fraction of MSW) is inhomogeneous and contains impurities

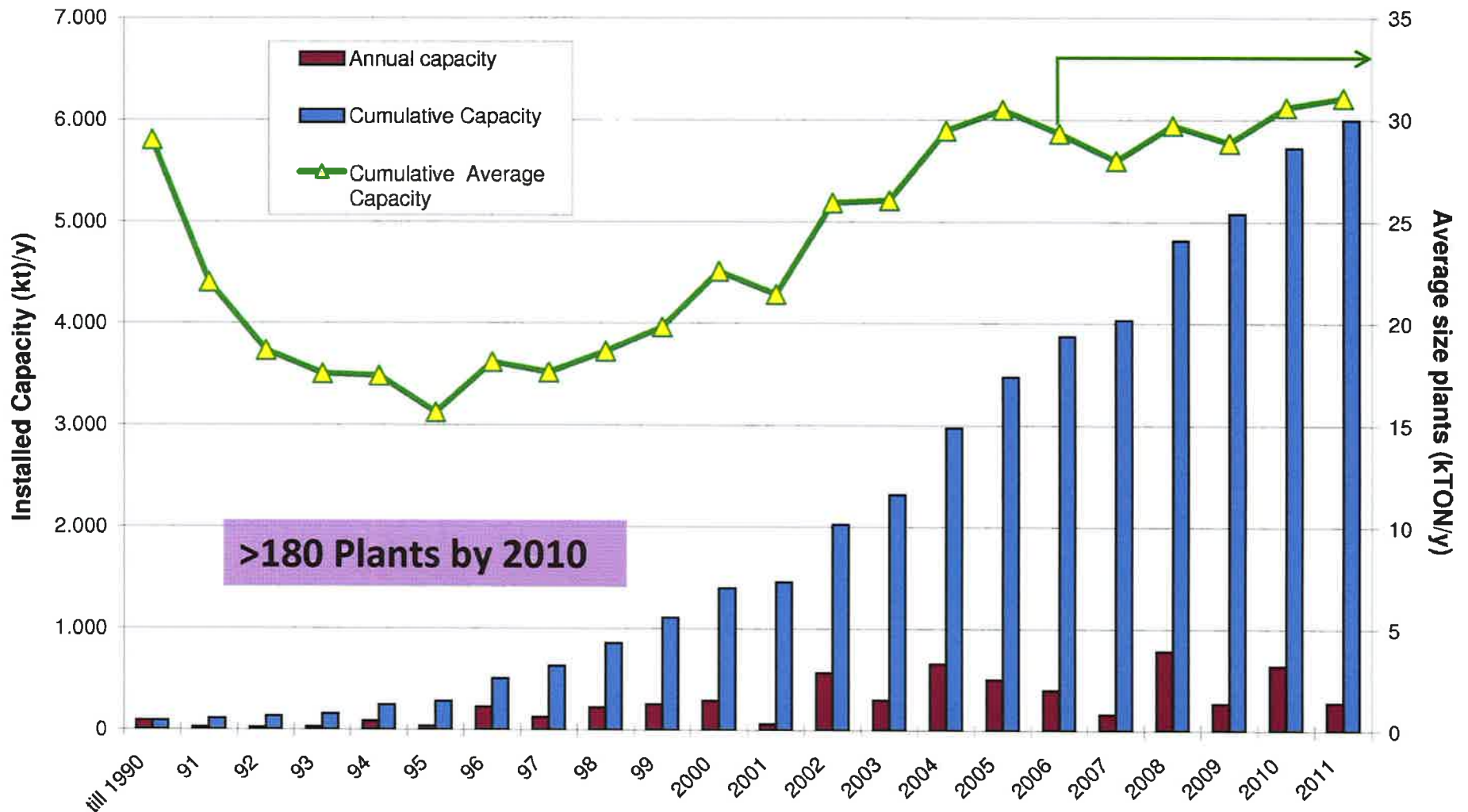
(e.g. plastic bags, textiles, cardboard, stones, grit, bones, shells, glass, metals, batteries) requiring pre-treatment prior to digestion.



Solution

Application of a "Pre- and/or Post-Treatment Process" for effective removal of contaminants & homogenization.

AD Plant Capacity of SSO and OFMSW in Europe



Source: De Beare, L.; Mattheeuws, B. (2010); adapted

City of Toronto's Green Bin Program

Dufferin AD Demonstration Plant w/ 'wet' BTA Process



Start-up: 2002

Capacity: 25,000 MT/yr SSO (design);
40,000+ MT/yr (2011)

Setup: City owned; contractor operated

AD Process: "Wet" BTA

- Complete mixed (w/digester gas)
- Single stage, Mesophilic



* Metric tons per year

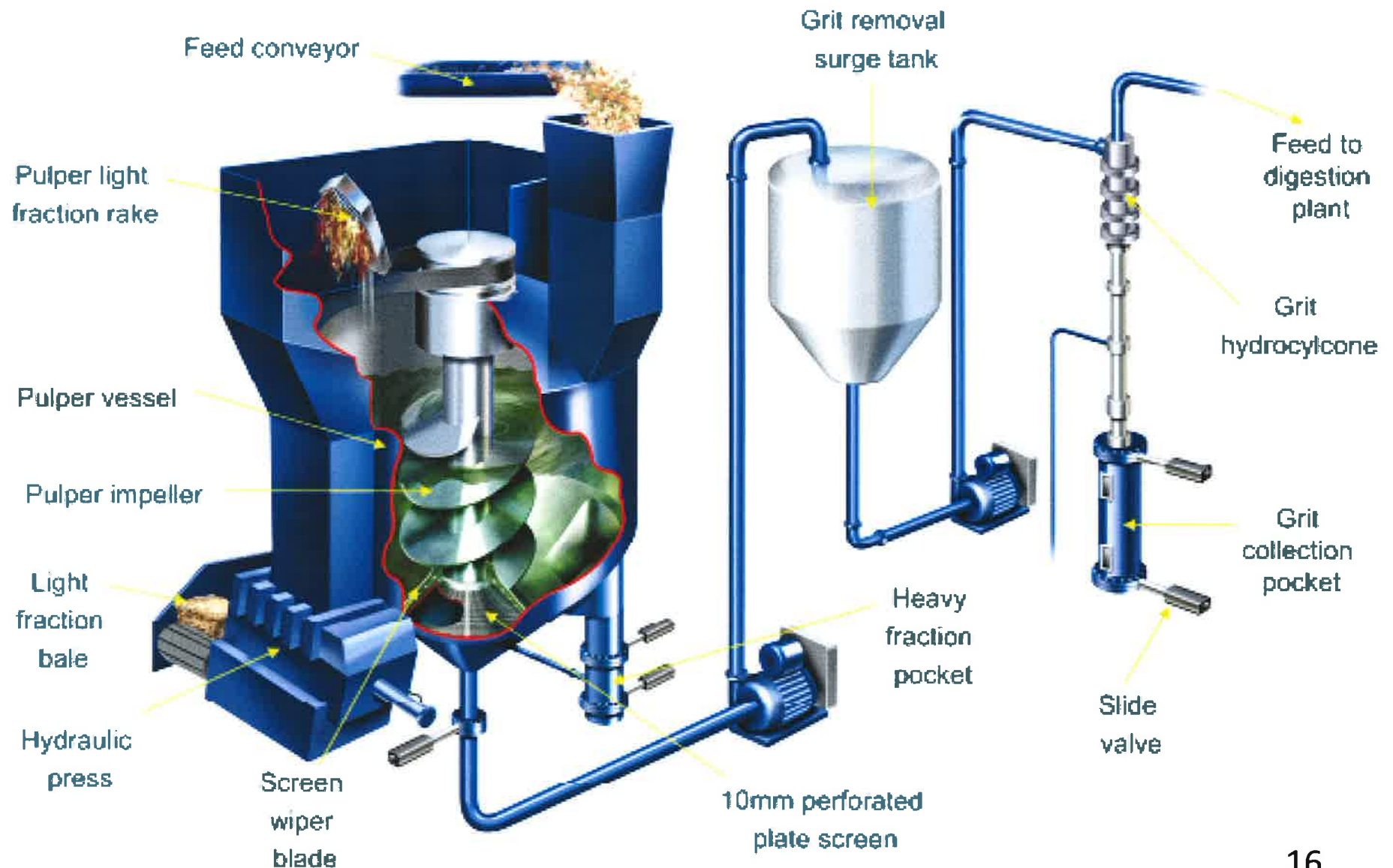
Sources: City of Toronto; CCI; BTA
International

The Dufferin Model

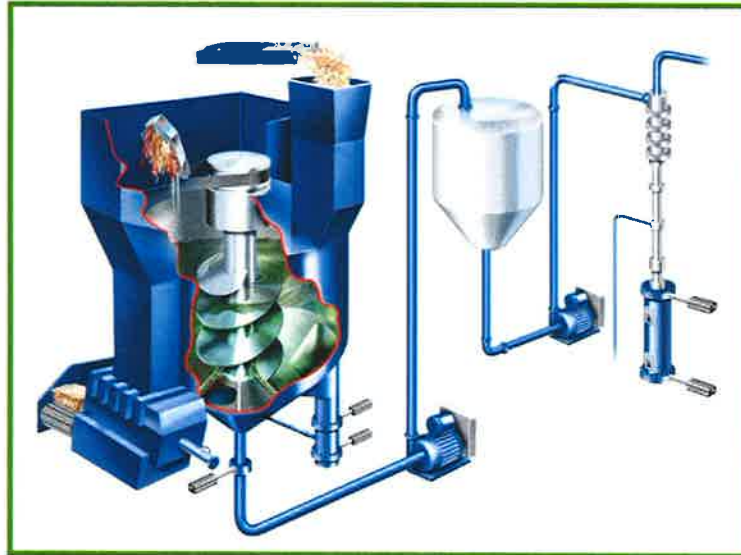
- The Dufferin model was chosen over other options because:
 - Compact size allows facilities to be located within the City
 - Wet pre-processing removes fine contaminants and plastics; allowing a Grade AA Compost to be produced
 - Challenge of Odours is minimized
 - AD achieves significant mass reduction = reduced transportation costs and carbon footprint
 - Wet digestion maximizes biogas production together combined with location close to potential points of use

Source: City of Toronto

The BTA Process – Hydropulper & Grit Removal System



The BTA Process at the Dufferin AD Plant



The BTA Process at the Dufferin AD Plant

Pre-treatment – Removed Contaminants

Hydropulper



Stones, glass, metal...



Plastics, textiles, wood...



Grit Removal System (w/Hydrocyclone)

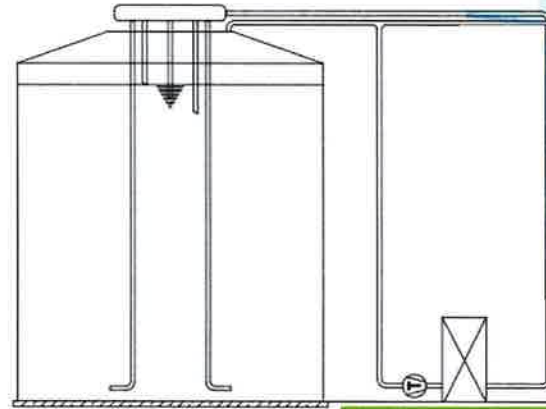


Tiny pieces of sand & grit

The BTA Process at the Dufferin AD Plant

Digestion – Heating and Mixing

- Complete mixed w/digester gas
- Single stage
- Mesophilic (35 – 38 degC)
- Intermittent feeding (weekday only)
- Feed: 8-10% TS
- Solids Recycling
 - 15 d HRT
 - 25 d SRT



Digester Design



Gas Lances



Tube Heat Exchangers



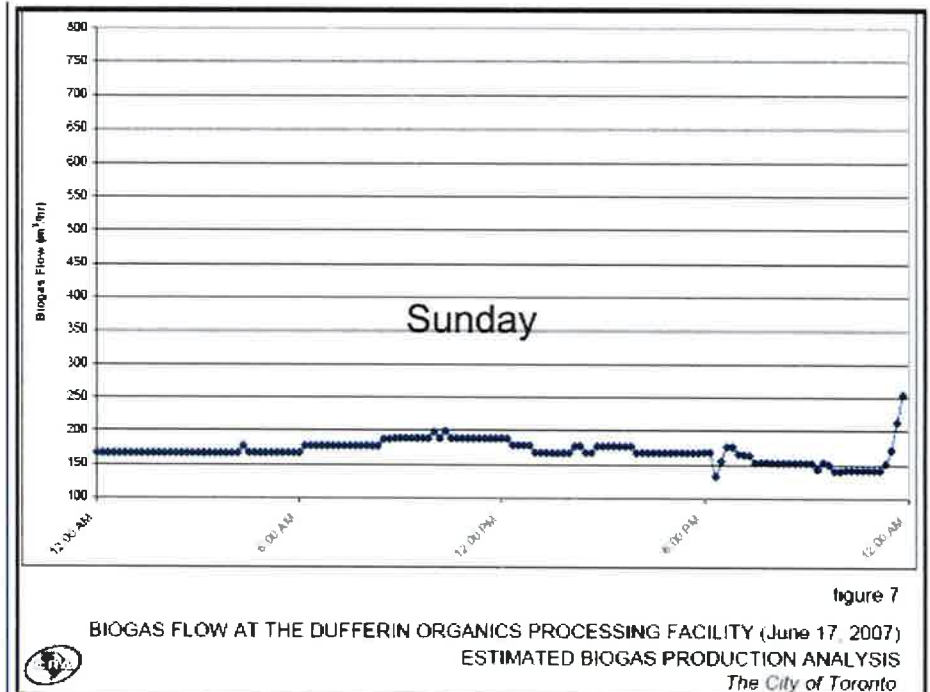
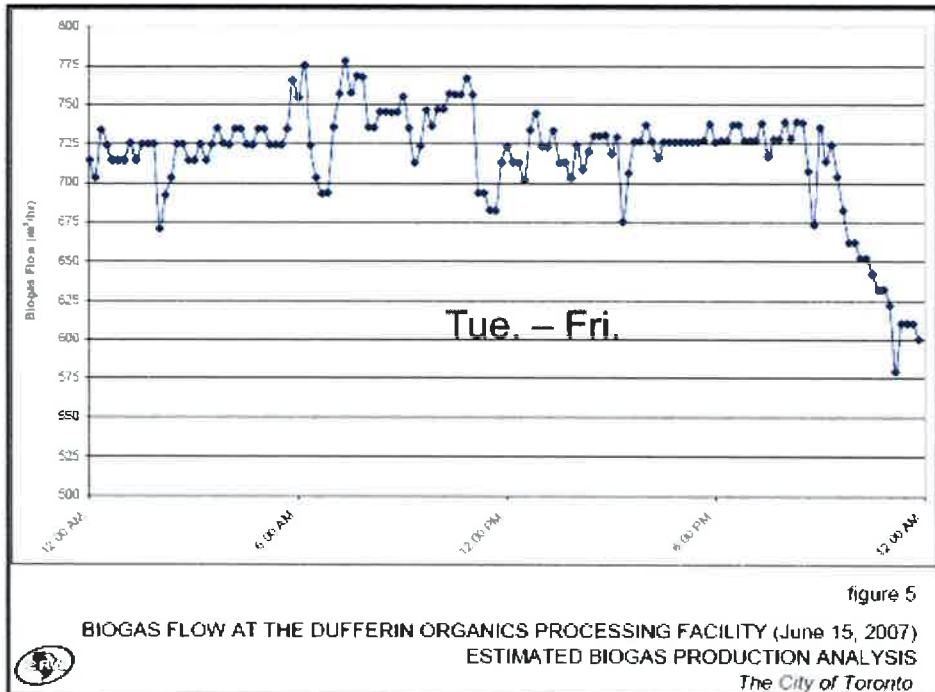
Gas Compressors

Dufferin AD Plant - Operational Experience

Dufferin AD Facility Performance Summary	2004		2007		2010	
	tonnes	%	tonnes	%	tonnes	%
SSO Processed	23,301	100	35,881	100	43,535	100
Biogas Produced	2,875	12.3	3,835	10.7	4,151	9.5
m ³ /tonne	123		107		95	

Increase in Annual Processing Capacity =>
Trade-off between Throughput and Biogas Production

Dufferin AD Plant - Operational Experience



**Intermittent AD feeding causes daily and weekly variation in biogas production
=> Solution: Addition of Buffer Tank(s)**

Green Bin Program - The Future

- 70% diversion goal requires SSO program expansion
- SSO tonnage to increase to ~180,000 MT/yr
- 110,000 MT/yr City base capacity + 70,000 MT/yr private

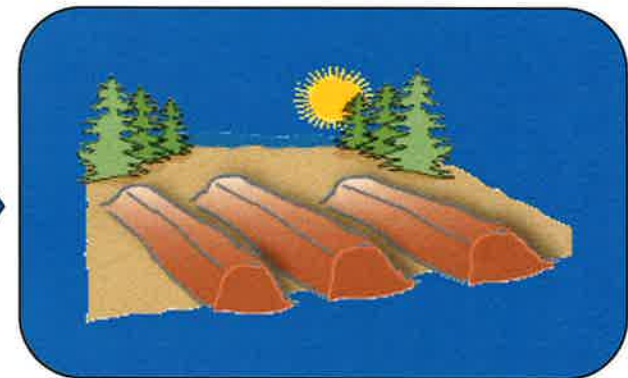
Primary Sites:

*Pre-processing + AD
In-City, City-owned*



Secondary Site:

*Composting External
(public or private)*



Digester Solids

- 2007 City Council approved construction of 2 AD facilities:
 - 55,000 MT/yr at Dufferin Waste Management Facility
 - 55,000 MT/yr (75,000 MT/yr max) at Disco Rd Transfer Station

Future Expansion of Dufferin AD Facility



**Phase 1:
New Digester & Biofilter**

**Phase 2:
Expansion of Tip Floor & Processing**

**Ultimate Capacity:
Up to 55,000 tonnes per year**

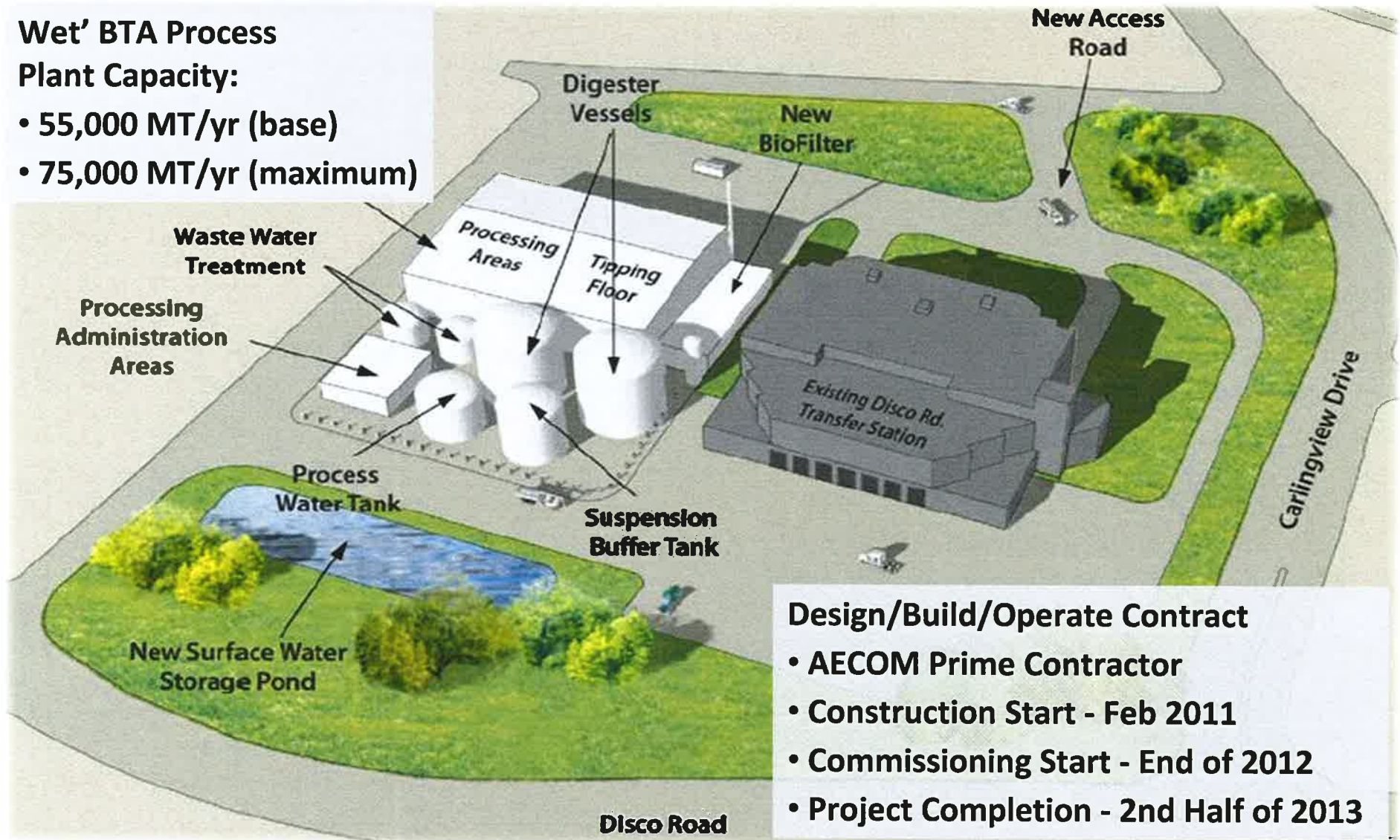


Disco Road Waste Transfer Station with New SSO Anaerobic Digestion Facility

Wet' BTA Process

Plant Capacity:

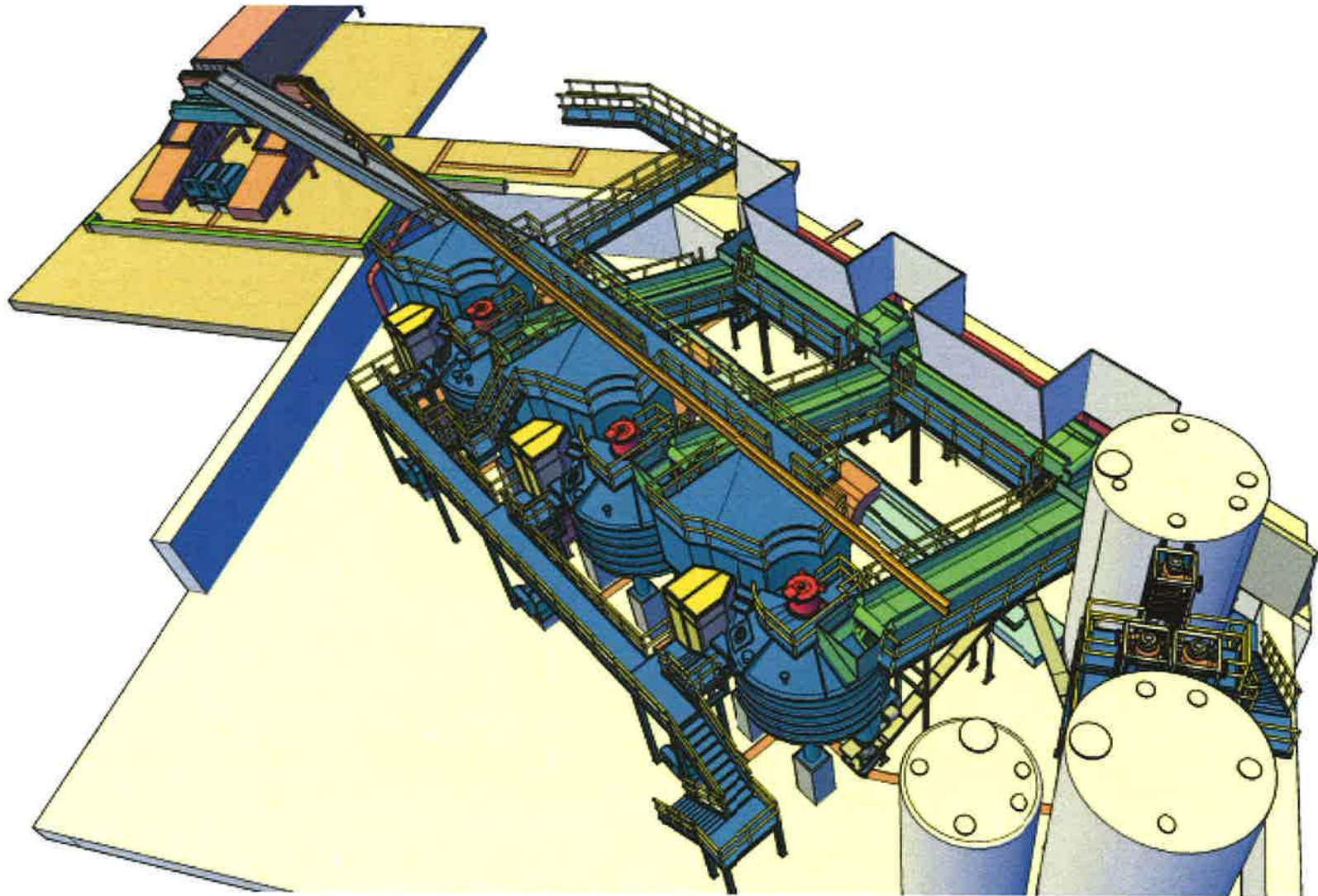
- 55,000 MT/yr (base)
- 75,000 MT/yr (maximum)



Design/Build/Operate Contract

- AECOM Prime Contractor
- Construction Start - Feb 2011
- Commissioning Start - End of 2012
- Project Completion - 2nd Half of 2013

Toronto Disco Road SSO AD Facility 3-D Model, BTA Pre-treatment Process



Source: BTA International

Disco Road Waste Transfer Station – *Before Site Preparation & Construction* (Sept. 2010)



Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *General View* (May 2012)



Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Tank Farm* (May 2012)



Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Hydropulpers & LF Presses*



Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Conveyor System* (May 2012)



Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Conveyor System* (May 2012)



Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Residue Presses* (May 2012)



Source: AECOM

New Toronto Disco SSO AD Facility under Construction – *Residue Presses* (April 2012)



Source: AECOM

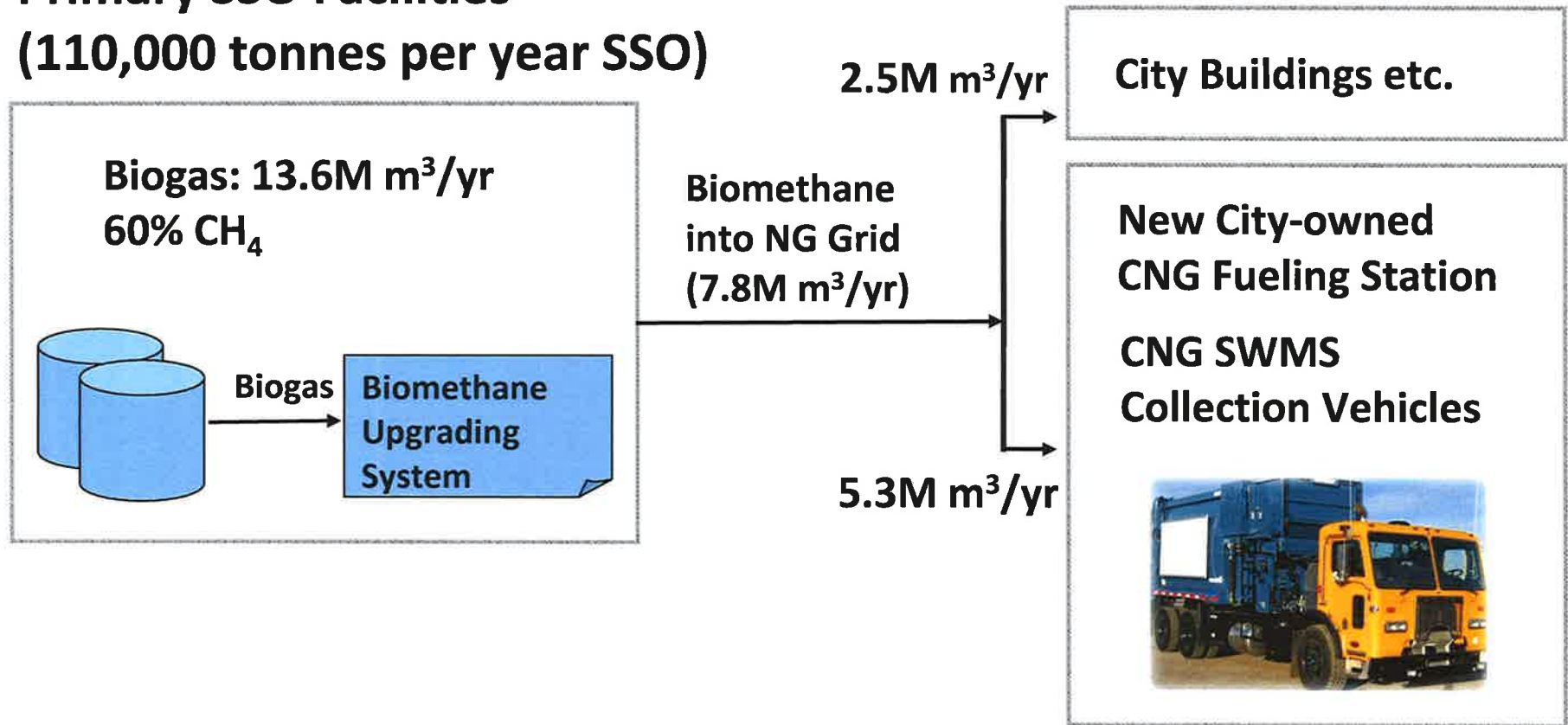
New Toronto Disco SSO AD Facility under Construction – *Grit Charge Tanks* (May 2012)



Source: AECOM

Biogas Utilization Plan: Biomethane + CNG Vehicles

Primary SSO Facilities (110,000 tonnes per year SSO)



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THANK YOU!

AECOM