

Birth of a New Regional Biosolids Handling Facility

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**CDM
Smith**

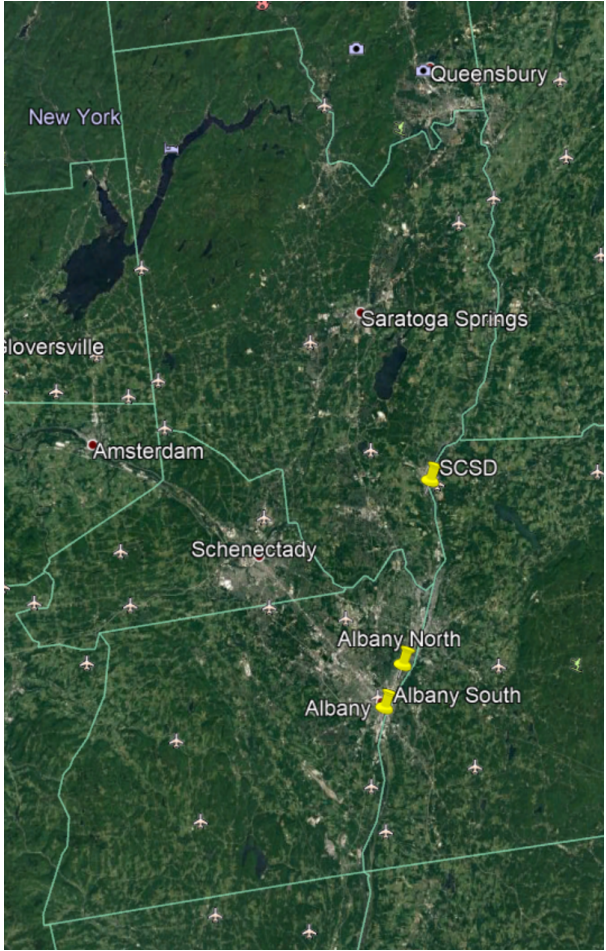
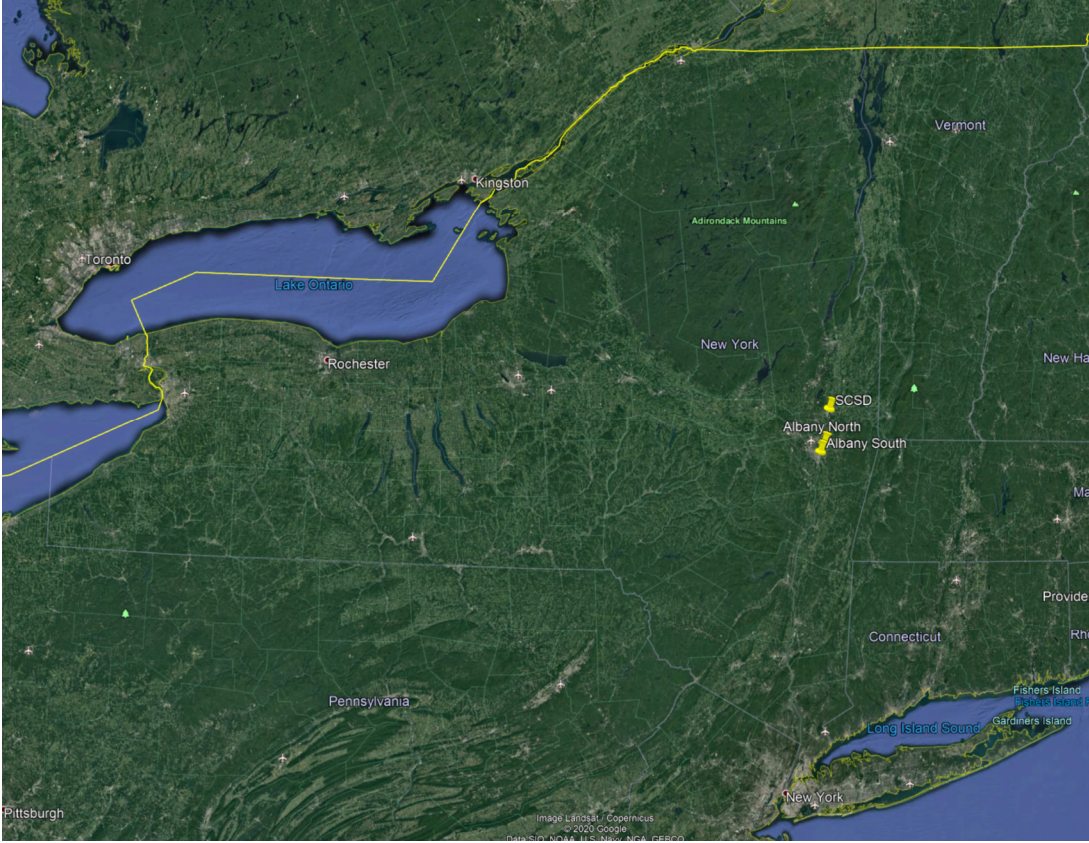
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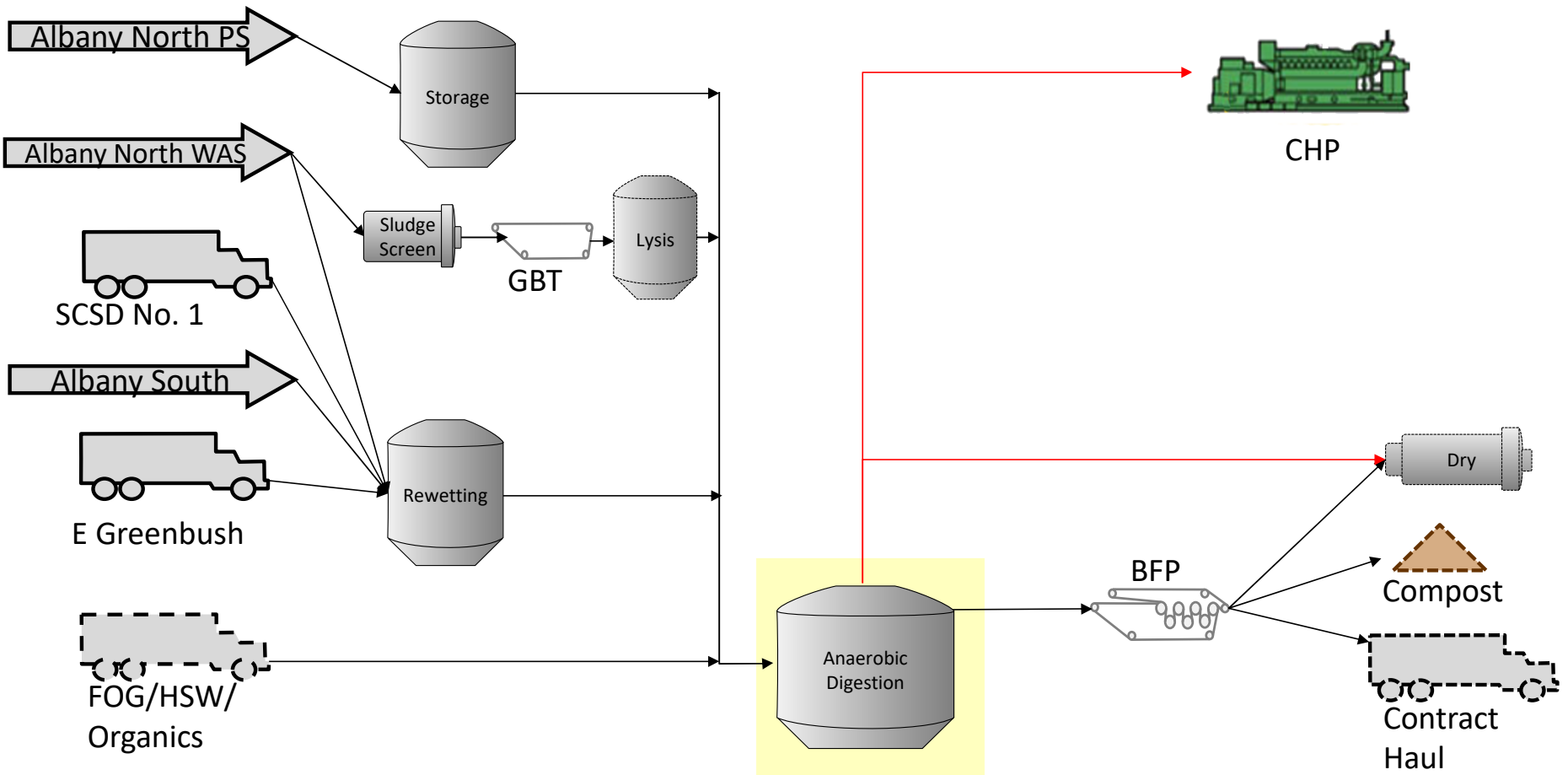
Background

- ~2016 Albany County completed a feasibility study to replace aging multiple hearth incinerators with new anaerobic digesters
- Concurrently, Saratoga County Sewer District had shut down an existing fluidized bed incinerator and was exploring alternative methods of sludge minimization
- In ~2018 Albany and Saratoga County entered an intermunicipal agreement to build, own, and operate a Regional Biosolids Facility located at ACWPD's North Plant.
- Anaerobic digestion will serve the heart of the new facility to promote resource recovery

Geography



New Process



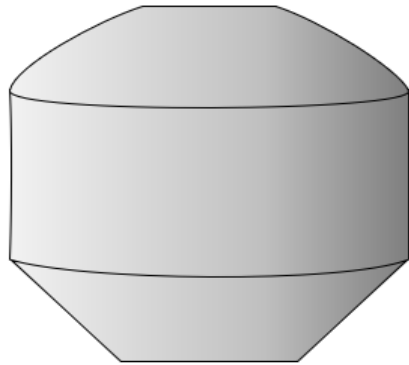


Alternatives Development

Digester Volume and Configuration

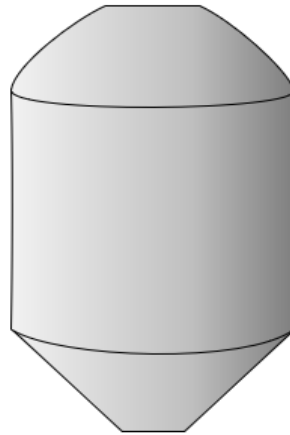
- 3.5 million gallons of digester volume
 - 15-day SRT at maximum month
 - 22-day SRT at average loading
- Two configurations were evaluated
 - Two tank configuration (1.75 MG each)
 - Three tank configuration (1.15 MG each)

Digester Geometry



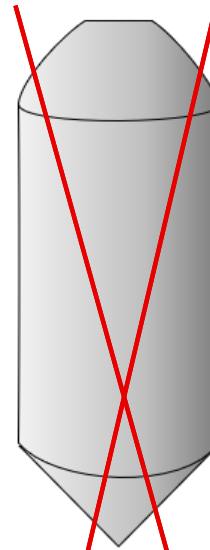
Pancake

$W:H > 2:1$



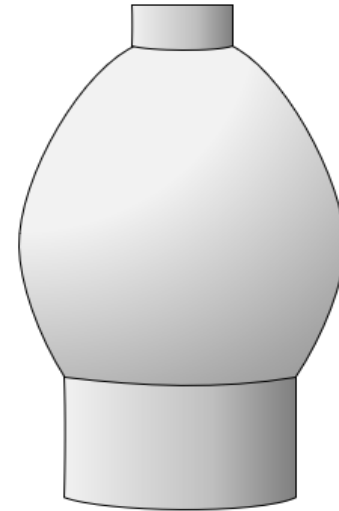
Conventional

$2:1 < W:H < 1:2$



~~Silo~~

~~**$W:H < 1:2$**~~



Egg

N/A

**Width:
Height**

Alternatives

- Alternative 1
3 Conventional Digesters
- Alternative 2
3 Pancake Digesters
- Alternative 3
2 Conventional Digesters
- Alternative 4
2 Pancake Digesters
- Alternative 5
2 Egg-shaped Digesters
- Alternative 6
3 Egg-shaped Digesters



Materials of Construction

Construction Materials and Methods

- Cast-in-place (CIP) concrete
- AWWA D110 wire-wrapped pre-stressed concrete
- AWWA D115 internal tendon pre-stressed concrete
- Bolted glass-fused-to-steel
- Bolted epoxy coated steel
- Double fold stainless steel
- Welded steel (egg only)

Traditional Cast-in-Place Concrete



Traditional Cast-in-Place Concrete

■ Pros

- Established technology
- General contractor can self-perform
- Easy to modify
- Flexibility to coordinate piping system

■ Cons

- Thick walls with high soil loading
- Expensive
- Prone to cracking
- Required interior coatings especially for gas zone
- Long construction time especially in cold weather

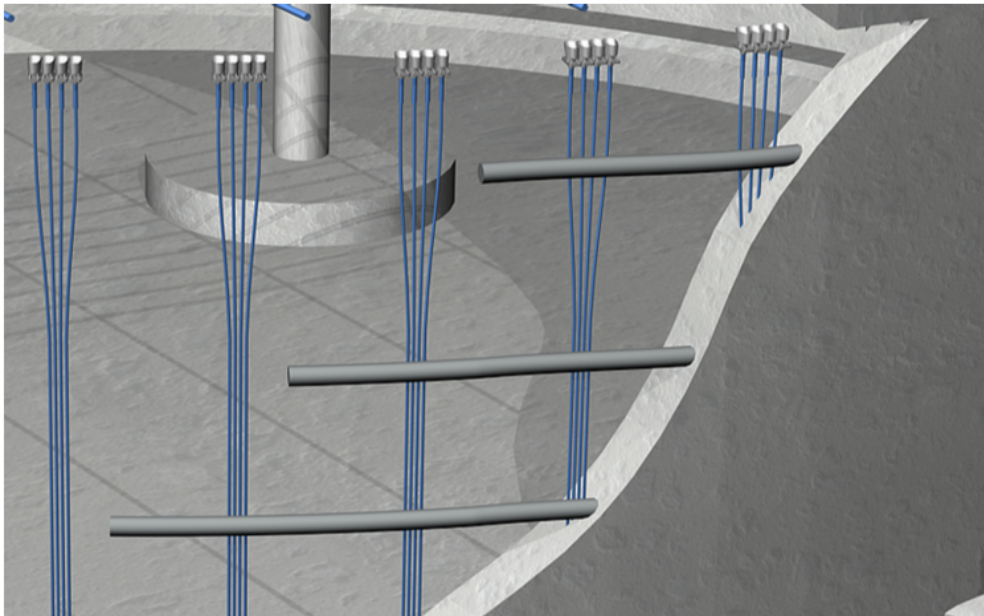
Wire-Wrapped Pre-Stressed Concrete (D110)



Wire-Wrapped Pre-Stressed Concrete (D110)

- Pros
 - Thinnest walls
 - Flexible floor/wall connection
 - Pre-cast onsite
 - Significant experience with large pancake style water tanks.
- Cons
 - Required interior coatings especially for gas zone
 - Cannot pre-stress roof or slab
 - Expensive side-wall penetrations, and limited ability to add penetrations after erection.
 - Vendors geographically limited
 - Two potential bidders - neither will cast-in-place
 - Limited experience with tall tanks
 - Race-track required around tank
 - Large lay-down area required

Internal Tendon Pre-Stressed Concrete (D115)



Internal Tendon Pre-Stressed Concrete (D115)

■ Pros

- Least lay-down area and site constraints
- Thinner walls than conventional cast-in-place
- Pre-stressed roof and floor slab
- Easier wall penetration
- Fast erection time
- Experience with large digesters

■ Cons

- Required interior coatings especially for gas zone
- Thicker walls than D110
- Potential for air-gaps in conduit (corrosion and tank weakening)
- Three known potential vendors
- Limited tank height

Bolted Glass-Fused-to-Steel



Bolted Glass-Fused-to-Steel

■ Pros

- Chemically inert glass coating
- Recoating not required
- Light weight

■ Note

- Common in agricultural market

■ Cons

- Potentially sole source (three known vendors, one AIS compliant)
- May require replacement of sacrificial anode
- Relatively little experience with municipal anaerobic digesters
- Must be entirely above grade

Bolted Epoxy Coated Steel



Bolted Epoxy Coated Steel

■ Pros

- Lowest Cost Option
- Light Weight

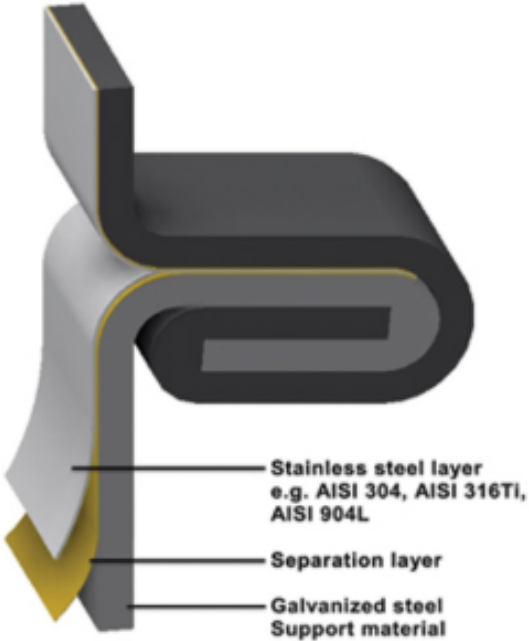
■ Note

- Common in agricultural market
- Common in vendor upgrade packages (Suez 2PAD, Evoqua BVF, etc)

■ Cons

- Requires periodic inspection and recoating
- Requires regular replacement of sacrificial anode
- Relatively little experience with municipal anaerobic digesters
- Must be entirely above grade

Double Fold Stainless Steel (LIPP Tanks)



Double Fold Stainless Steel

■ Pros

- Stainless steel lining material
- Light weight
- Little time required onsite (approximately 10 days)

■ Cons

- Sole source
- May not be AIS compliant
- Limited experience with anaerobic digestion in the US (Medina, OH)
- Only installed if ambient temperature is $>35^{\circ}\text{F}$
- Requires regular replacement of sacrificial anode
- No bid for “conventional” geometry
- Must be entirely above grade

Welded Steel Egg-Shaped



Welded Steel Egg

■ Pros

- Self-scouring design
- Can have high gas pressure design
- Smallest water surface (simple foam management)
- Several high-profile US project
- Performance guarantee

■ Cons

- Sole source
- No freeboard
- Very tall structures
- Steel must be entirely above grade
- Highest cost



Ancillary Systems

Ancillary Systems

- Covers
 - Floating Steel
 - Fixed Steel
 - Dual Membrane
- Biogas Storage
 - Dual membrane
 - Steel Sphere
- Mixing System
 - Pump and Nozzle
 - Linear Motion
 - Side entry
 - Draft tube



Economics

Tank Costs – in millions

	2 tanks “Conventional”	2 tanks “Pancake”	3 tanks “Conventional”	3 tanks “Pancake”
Cast-in-place	\$9.7	\$8.3	\$10	\$8.7
D110	\$5.4	\$5.1	\$6.3	\$5.7
Pre-cast D115	N/A	\$4.0	N/A	\$4.8
Cast-in-place D115	\$6.4	\$5.8	\$7.2	\$6.8
Bolted Glass-fused- to-steel	\$5.5	\$5.3	\$7.2	\$6.8
Bolted Epoxy Coated	\$3.3	\$3.4	\$3.8	\$3.8
Double fold SS	N/A	\$7.7	N/A	\$7.7
Steel Egg	\$18.3		\$20.4	

Tank Costs and Recommendation

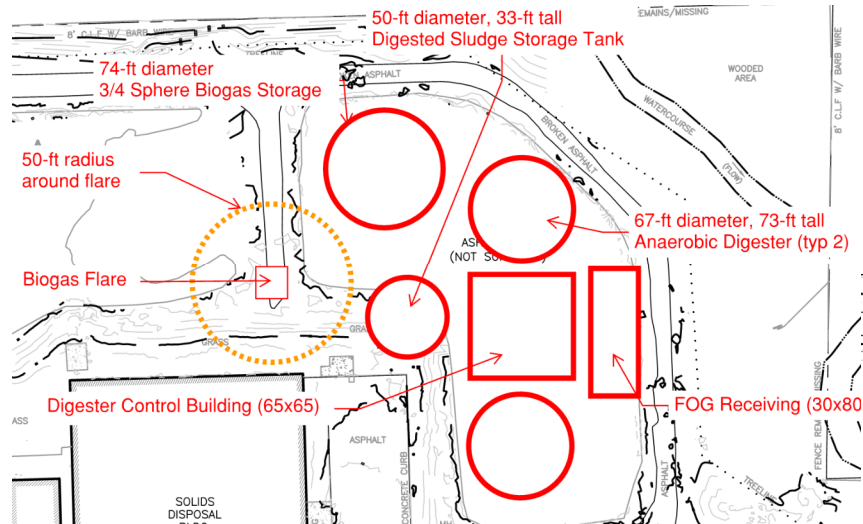
- Worked with owners to develop recommendations
- Two anaerobic digesters
 - “Conventional” geometry
 - Bolted epoxy coated steel
 - A vendor provided self-supported steel roof
- Mixing by chopper pump and nozzle
- Biogas storage in pad mounted $\frac{3}{4}$ sphere dual-membrane



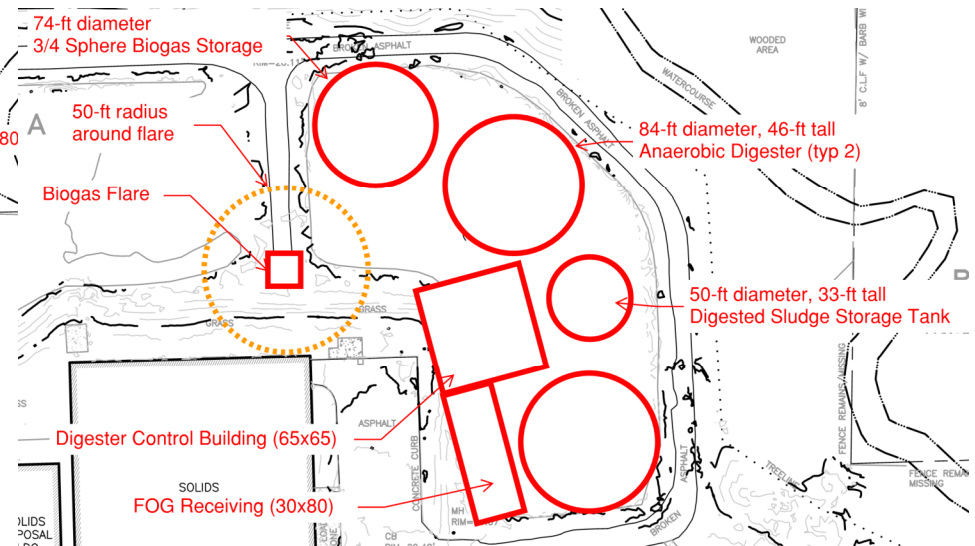
Non-Cost Factors

Non-cost Factor: Site Plan

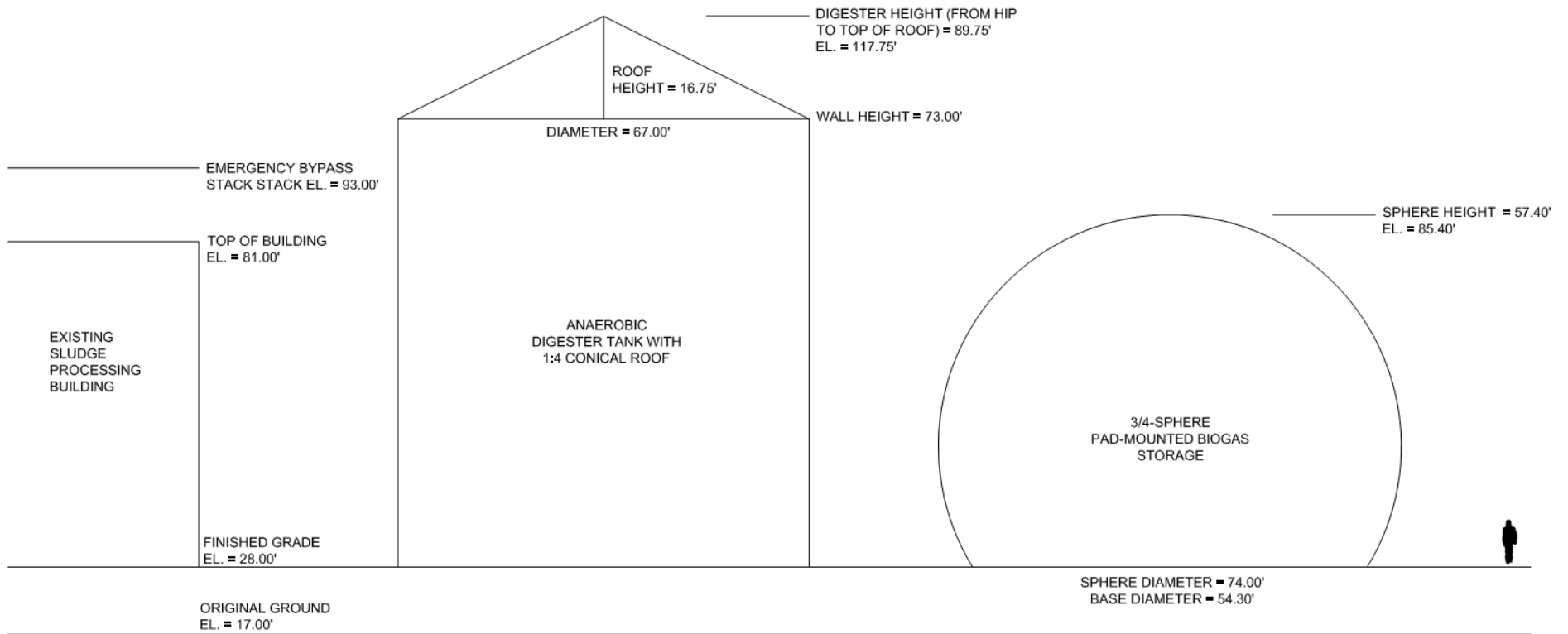
Conventional



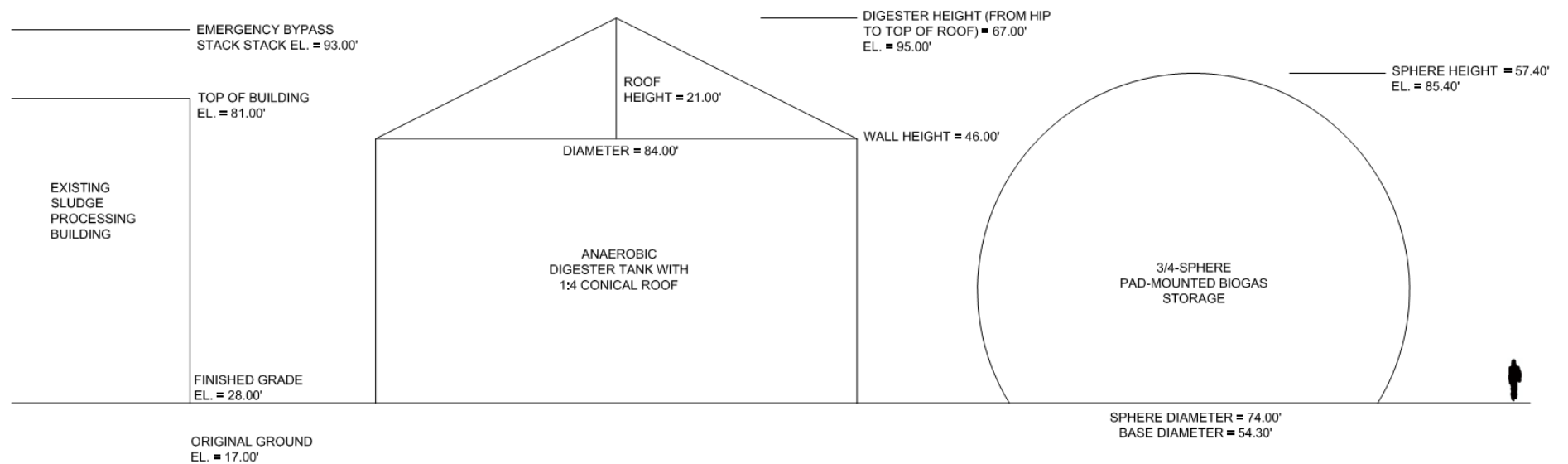
Pancake



Non-cost Factor: Tank Height – 2 tank conventional with 3/4 sphere gas storage



Non-cost Factor: Tank Height – 2 tank pancake with ¾ sphere gas storage



Thanks!

Colleagues and Coworkers

Albany County Water Purification District

Saratoga County Sewer District

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