NEWEA 2019 Annual Conference
MANCHESTER, NH WWTP
Primary Clarifier/Thickener Upgrade

Frederick J. McNeill, P.E. - EPD

Robert J. Robinson, P.E. - EPD

David J. Mercier, P.E. – Underwood Engineers, Inc.

January 29, 2019

CITY OF MANCHESTER
ENVIRONMENTAL PROTECTION DIVISION
DEPARTMENT OF PUBLIC WORKS

NEW ENGLAND WATER ENVIRONMENT ASSOCIATION
NEWEA
WORKING FOR WATER QUALITY

Agenda

- Manchester Background
- Study
- Design
- Construction
- Lessons Learned
- Questions

Background – City of Manchester

- Largest City North of Boston - 109,000 population
- Settled in 1725
- Evolved from Agricultural to Industrial: 1725 - 1815
- Amoskeag Mills: Largest single mill in the world 1915
- Post Industrial Depression: 1935 – 1980's
- Revitalization: 1990 to Present
- Revitalization = "ManchVegas"

Background – Collection System

- 385 Miles of sewer
  - 50% combined system
  - 11,000 SMHs
  - 15 CSO outfalls
- 100 Miles of pipe
  100 years old or older

Background – Stormwater

- 180 miles of drains
  -14,000 CBs
  -3,000 DMHs
- 6 Urban Ponds

Background – Pump Stations

- 12 pump stations
- Constructed from 1973 to 2014
- 140 gpm to 42,000 gpm

Background – WWTP

- Serves 4 communities
  - Bedford
  - Goffstown
  - Londonderry
  - Manchester
- Metro pop. 172,000
- WWTP Flows: 26 mgd annual average

Background – WWTP

1975 26 MGD

1994 34 MGD

2016 42 MGD

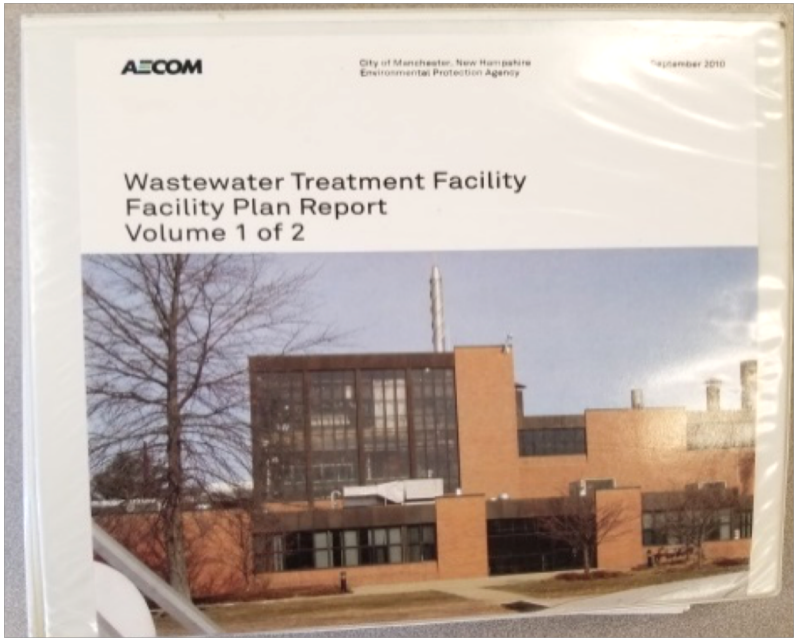
Other major upgrades over the past decade:

- 2006 Dewatering Upgrade
- 2010 Secondary Clarifier Upgrade
- 2011 Fluidized Bed Incinerator Upgrade
- 2013 Grit Upgrade
- 2016 Aeration Upgrade
- 2017 Boiler Upgrade

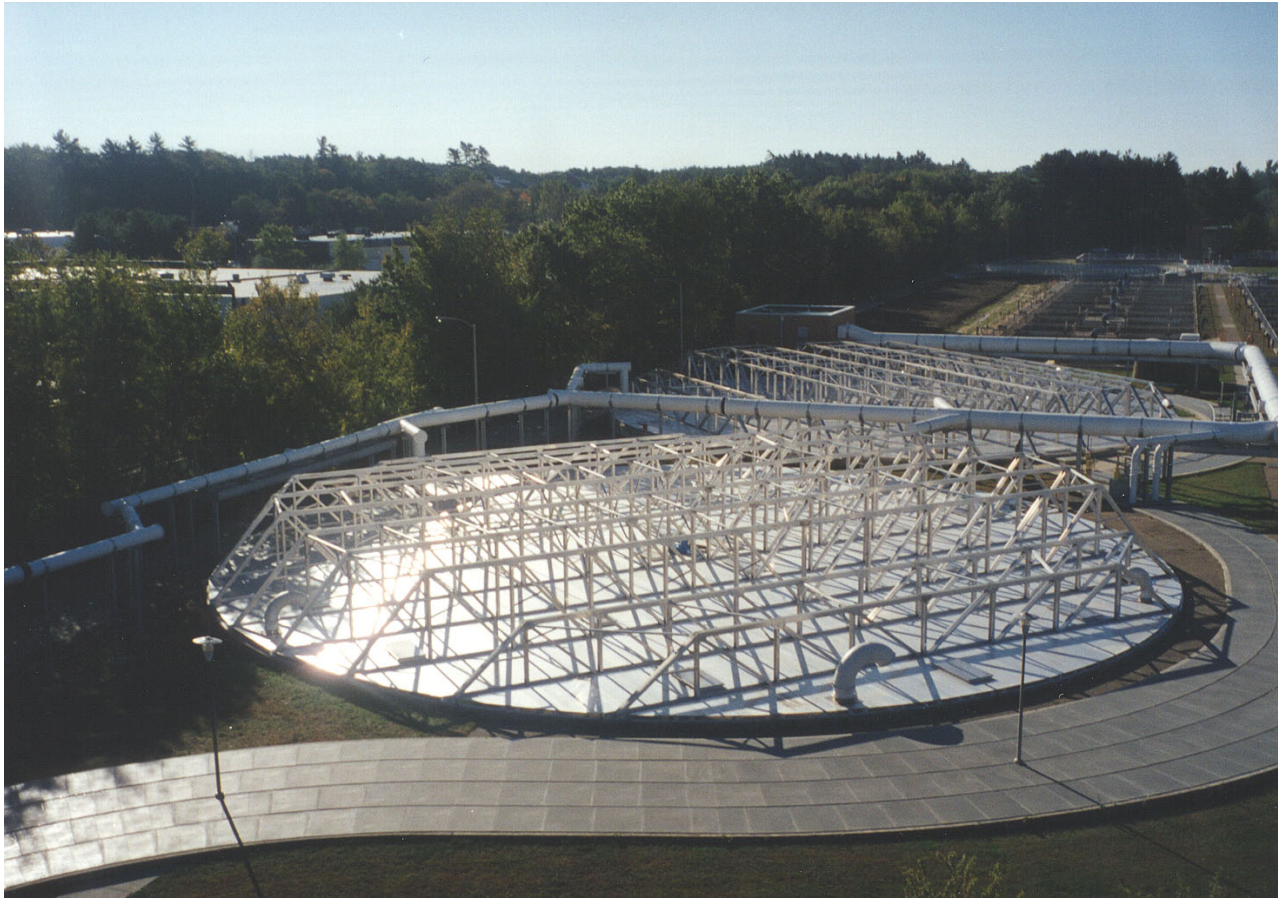
The City of Manchester is in the Middle of its $75 Million WWTP CIP Now!

2010 Facility Plan

- Phase I
  - Grit ☑
  - Aeration ☑
  - Primary Clarifiers
- Phase II
  - Solids Train
  - Generators
  - Buildings



Primary Clarifier/Thickener Upgrade



Primary Clarifiers

- Three 130-ft dia. concrete tanks w/ painted steel mechanisms
  - Two built in 1975
  - One built in 1993
- Center feed w/ double sided internal launder
- Conventional segmented plow blade sludge removal
- Covers added in 1998

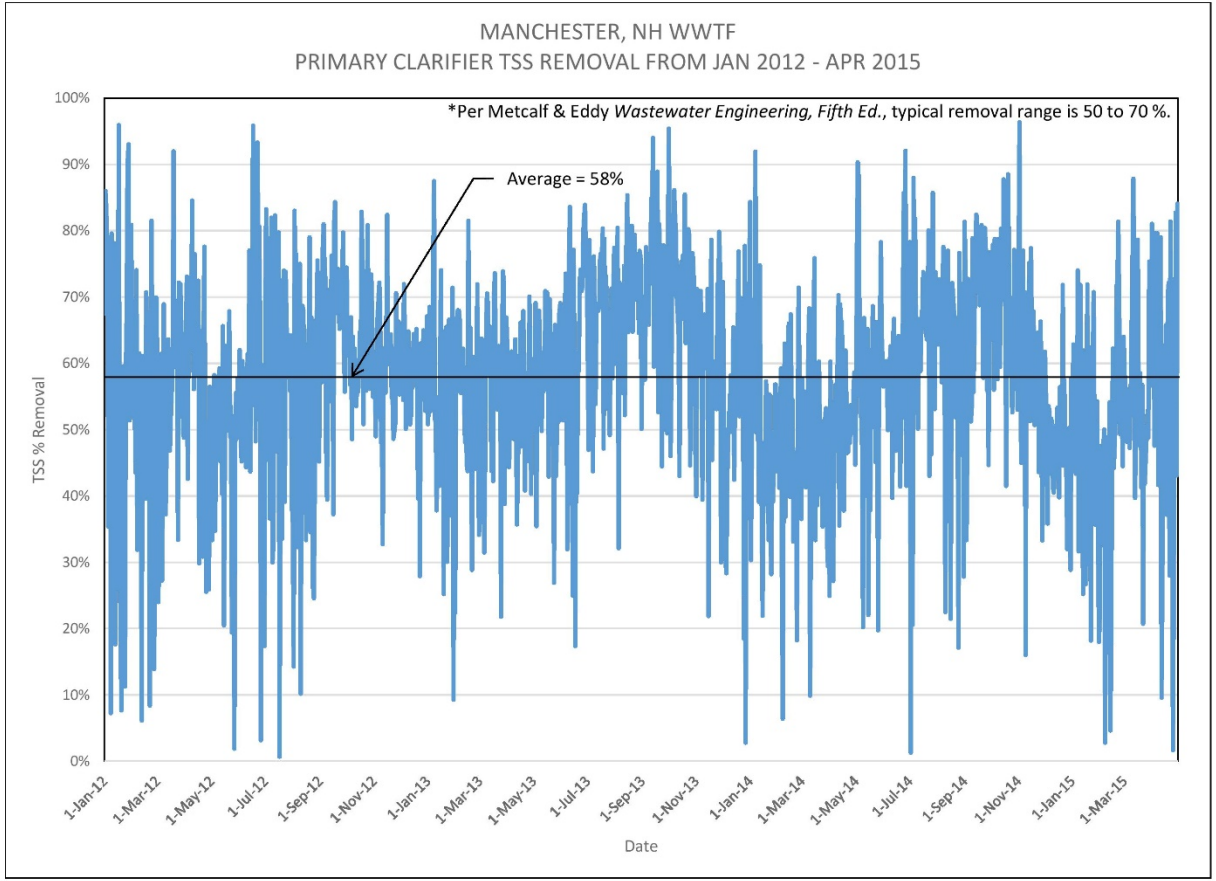
Gravity Thickeners

- Three 50-ft dia. painted steel tanks w/ painted steel mechanisms
  - Two built in 1975
  - One built in 1993
- Center feed w/ single sided perimeter launder
- Conventional segmented plow blade sludge removal
- Open top tanks located in Ops Building

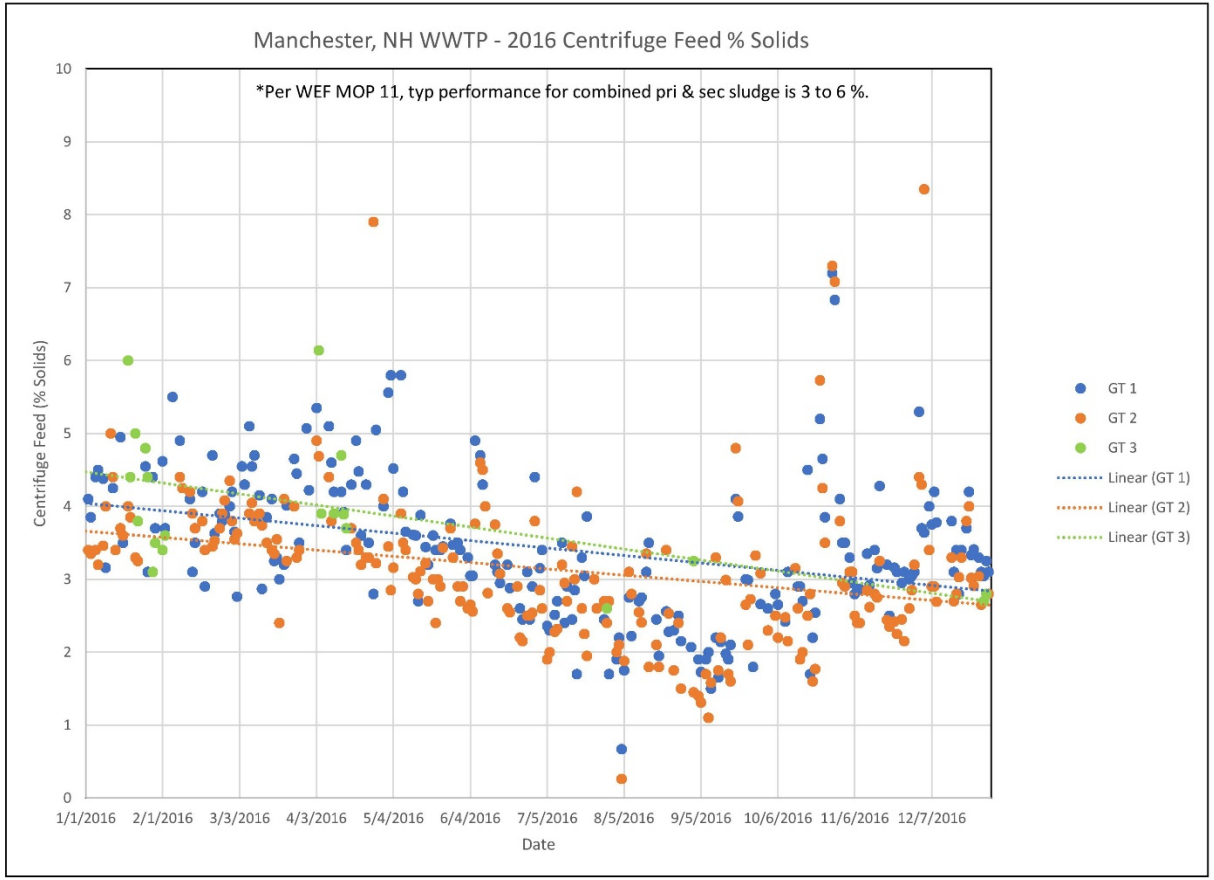
Study Phase

- Goals:
  - Perform a comprehensive upgrade
  - Achieve a 30+ year design life
  - Standardize equipment
  - Increase SCADA monitoring/automation
- Major Study Areas:
  - Performance
  - Hydraulics

Primary Clarifier Performance



Gravity Thickener Performance



Hydraulics

- Stress Testing:
  - Performed in conjunction with Clarifier Performance Evaluations, Inc. (CPE)
  - Tested Primary Clarifiers for
    - Hydraulic balance/performance/capacity
  - Tested units at average flows and storm flows
  - Collected visual, dye test and TSS data

Hydraulics

- Stress Testing Results:
  - Existing units/design still performed well after 40 years
  - Internal launder inboard vs outboard weir results similar
  - Short circuiting a concern at storm flows
- Stress Testing Recommendations:
  - A larger and deeper center well was recommended
  - Stick with internal double sided launder
  - No need to add EDI or DCB at this time

Design Phase

- Major Areas of Focus:
  - PC's
    - Effluent Launders
    - Scum Collection
  - GT's
    - Existing Steel Integrity and Repairs
    - Covers

PC Effluent Launders

- Internal double sided vs conventional perimeter

PC Effluent Launders

- Provide all new supports vs reuse existing anchor points

PC Scum Collection

- Multiple skimmer arms
- Full surface skimming vs perimeter skimming
- Water flushing at scum trough

GT Steel Integrity

- Thickness Testing (Corrosion Probe, Inc.)
- Repair Methods

Photo No. 4 Wall of Thickener No. 1, under Skimmer Scum box, thin wall plate detected.

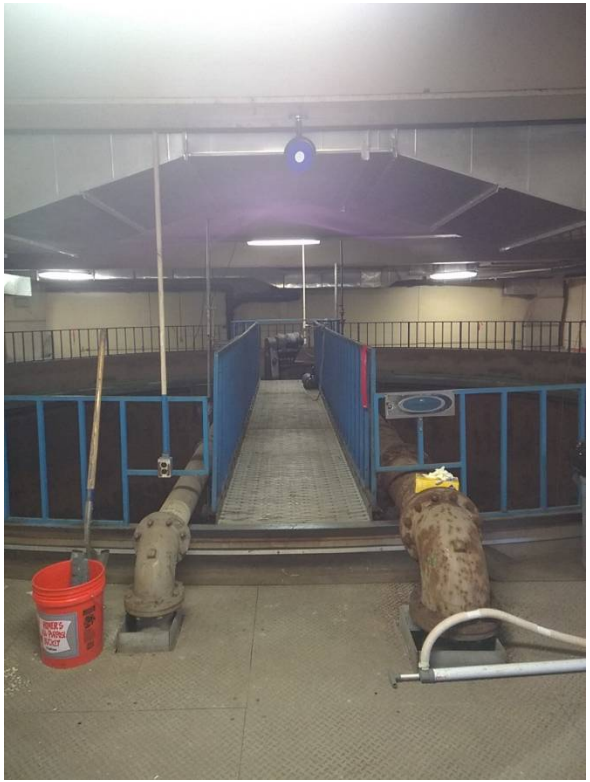
Photo No. 5 Center Column of Thickener No. 1, looking North at locations 10 thru 13.

Photo No. 6 Wall and floor of Thickener No. 1, looking Southwest at locations 10 thru 14.

Photo No. 7 Center Column of Thickener No. 1, looking South at locations 1 and 16 thru 20.

GT Covers

- Custom low profile design
- Odor control intake and discharge ports
- New blowers to existing scrubber

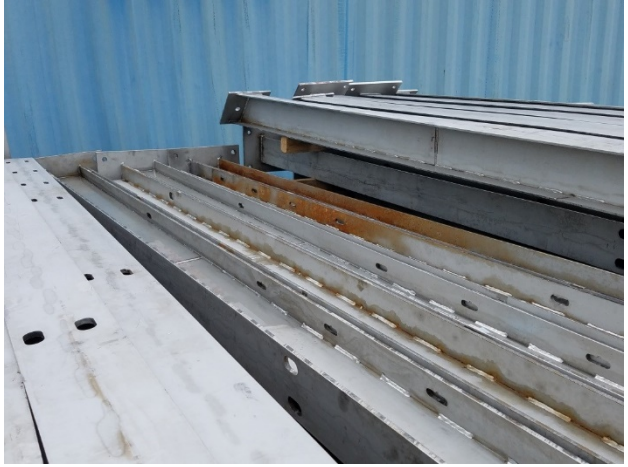


Construction Phase

- Key PC Construction Challenges
  - SS components (red residue/staining; twisted members)
  - Launder support attachment to wall
- Key GT Construction Challenges
  - Sand blasting showed new repair areas
  - Not all new welds water tight
  - Custom covers

PC SS components

- Red residue/staining
- Twisted members

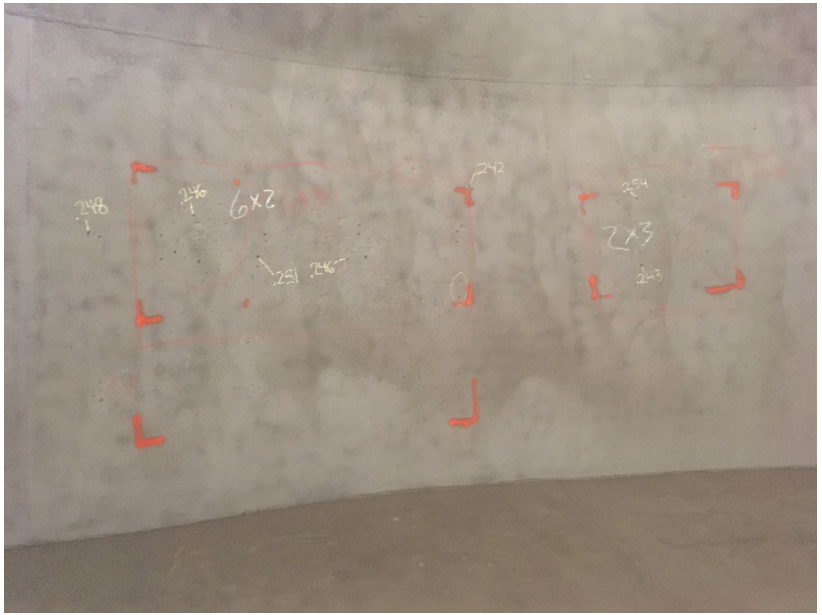


PC Launder Supports

- Bolted attachment
- Welded attachment

GT Sandblasting/Welding

- Sand blasting showed new repair areas
- Not all new welds water tight



GT Custom Covers

Construction Phase

- Expect the Unexpected
  - PC skimmer arm scraper blade tension spring lets go……

Construction Phase

- Expect the Unexpected
  - GT SBD loosens and contacts skimmer arm……

Construction Phase

- Expect the Unexpected
  - 6”x6”x2’ PT block vs PC skimmer arm……

Construction Phase

- Expect the Unexpected
  - 20’ deep PC influent sample line plug lets go……

Project Summary

- Four year project from 2015-2018
- Total project cost:
  - $1.4M Engineering
  - $7.6M Construction
- Came in over original schedule but within original budget
- Upgraded PC's and GT's are performing well
  - PCs avg eff TSS percent removal = 67.7 %
    - Avg eff TSS concentration = 59.4 mg/L
  - GTs avg underflow solids = 4.2 %

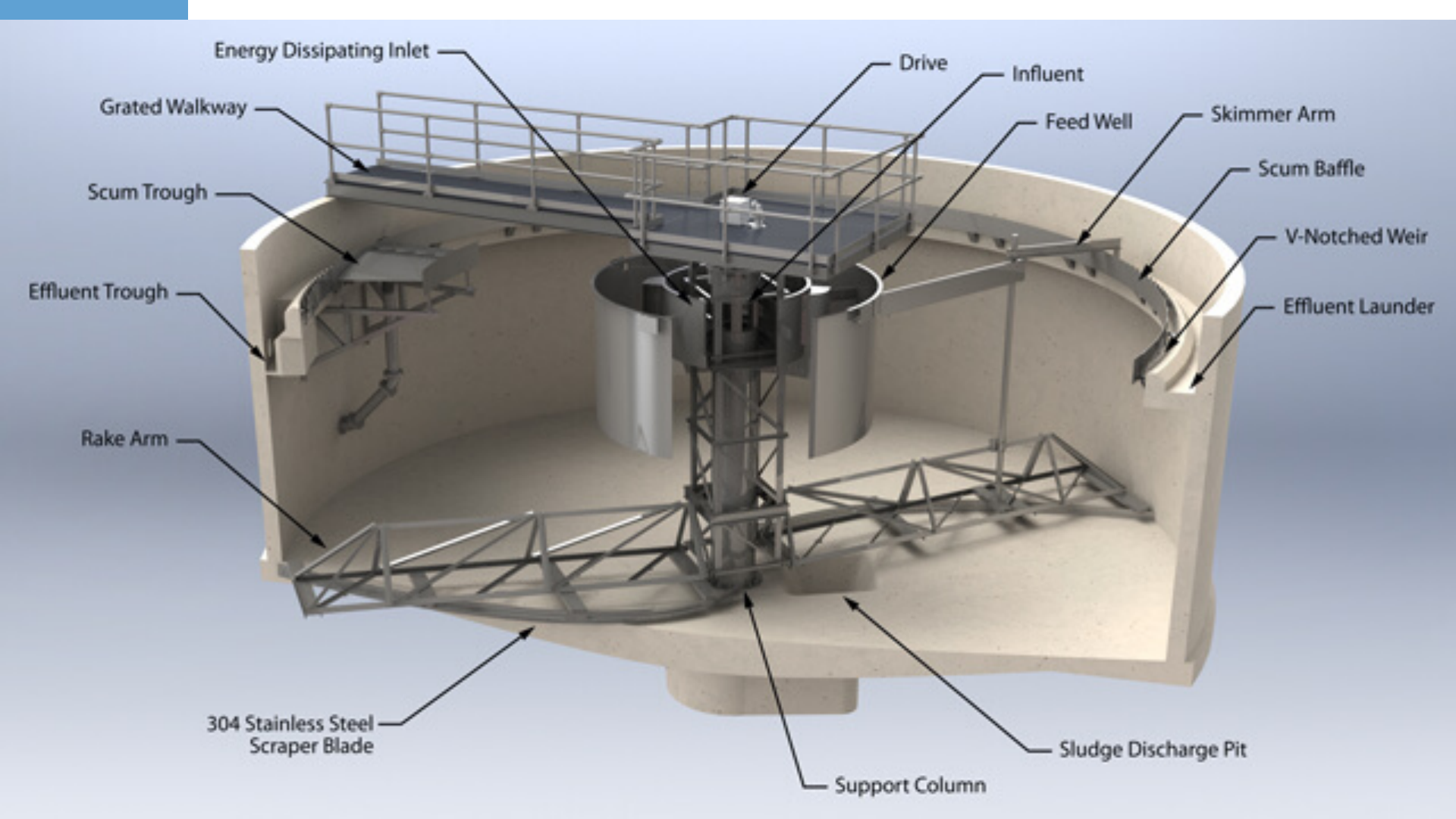
Lessons Learned/Take Aways

1. Not all stainless steel is created equal
2. Going all new may actually save time and $$
3. Don't assume similar tanks match or that new equipment matches old equipment
4. Plan for post-sand blast re-inspection of steel
5. Some welds will leak and have to be repaired
6. Expect the unexpected!
7. Collaborative approach with Engineer + Contractor + Owner = Success

Acknowledgements

- Manchester Environmental Protection Division Team
  - Frederick J. McNeill, P.E. – Chief Engineer
  - Robert J. Robinson, P.E. – Plant Superintendent
  - David St. Armand – Chief Operator
  - Kirk Ray – Maintenance Supervisor
  - Robert Morris – Assistant Maintenance Supervisor
- Methuen Construction Co., Inc.
  - Richard Czerw – Project Manager
  - Eric Delisle – Assistant Project Manager
  - Donald Reynolds - Superintendent

Thank You…


Energy Dissipating Inlet
Drive
Influent
Grated Walkway
Feed Well
Skimmer Arm
Scum Baffle
Scum Trough
V-Notched Weir
Effluent Trough
Effluent Launder
Rake Arm
304 Stainless Steel
Scraper Blade
Sludge Discharge Pit
Support Column