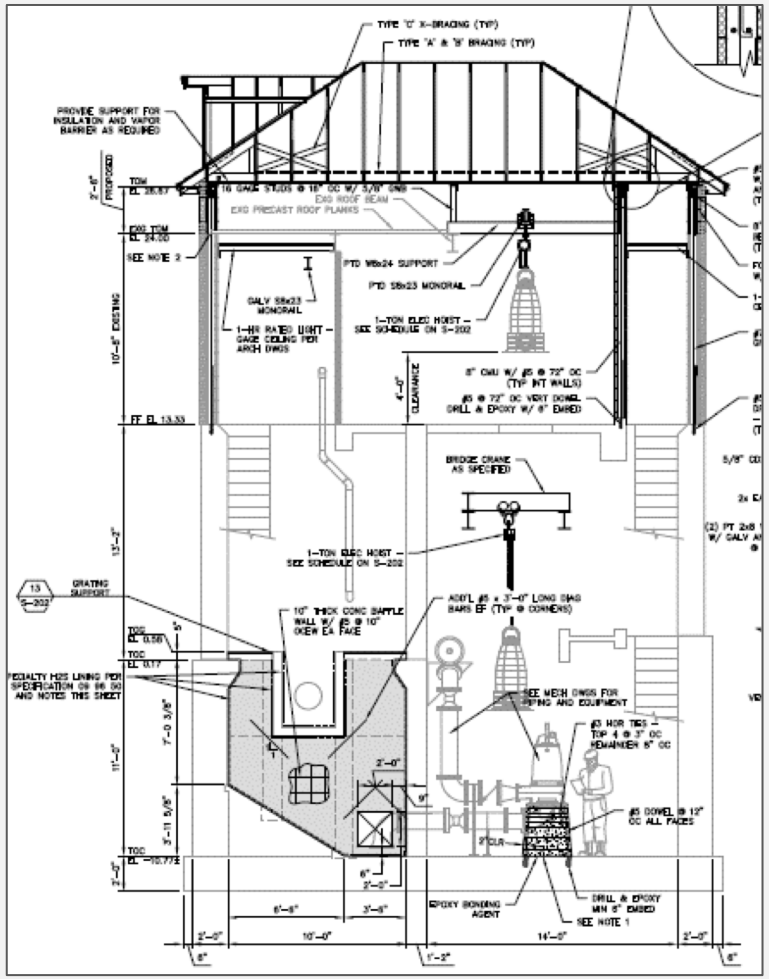
Pump Station Upgrade for Improved Performance, Operations and Aesthetics

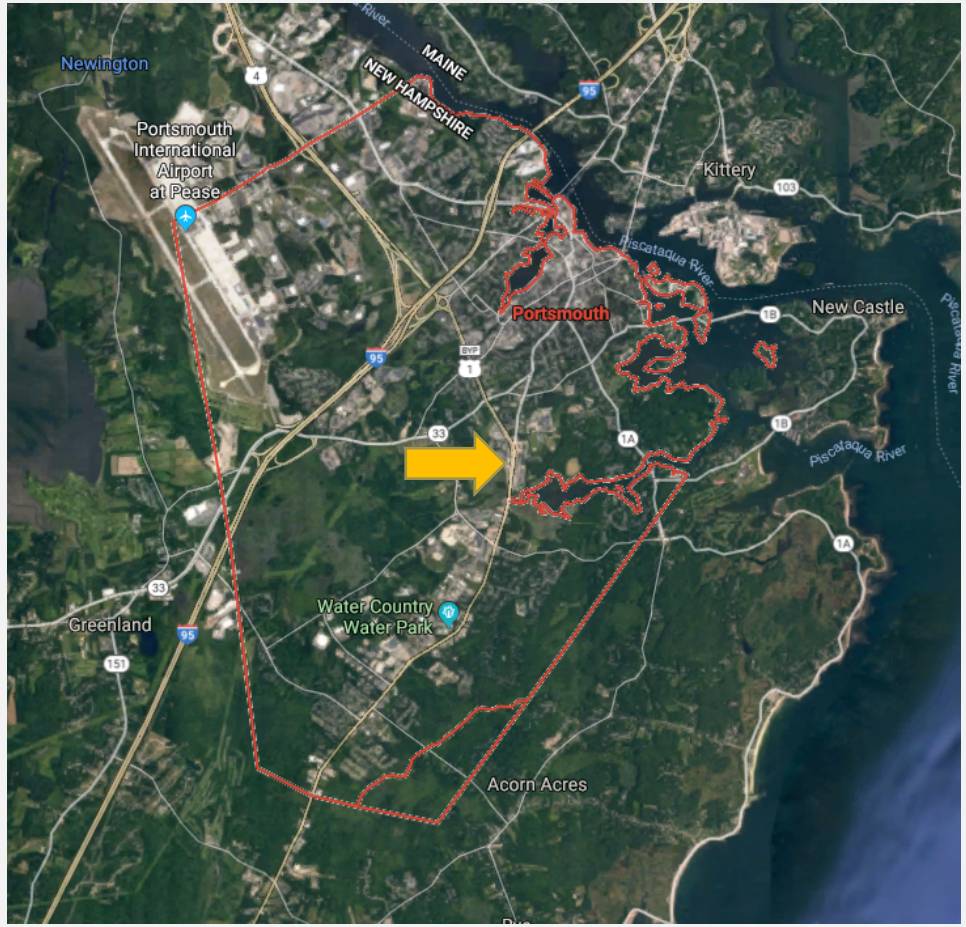
COMMITMENT & INTEGRITY DRIVE RESULTS

Outline



- Background
- City's Vision
- Design for Performance and O&M
- Structural and Architectural Design
- Lessons Learned
- Costs
- Questions

City of Portsmouth



- NH Seacoast city of 22,000
- 100 miles of sewer
- 6 major pump stations
- 14 smaller pump stations

Existing Conditions

- 4.4 mgd pump station
- Built c1962
- Upgraded 1981, 2001
- Aging equipment
- Poor wet well access
- Commercial area sensitive to aesthetic and odor impacts

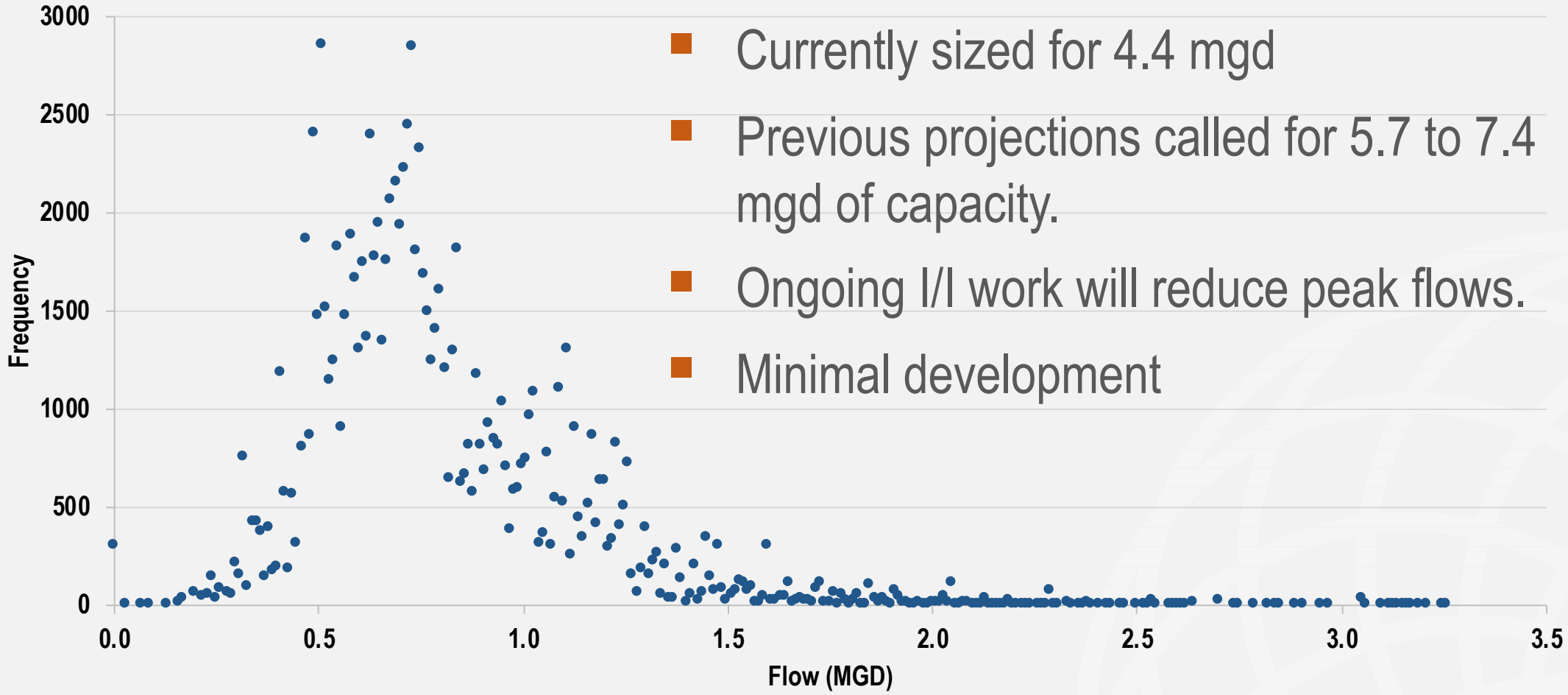
Existing Conditions

- Extended shaft pumps
- Defunct grinder
- Difficult wet well access
- Outdated electrical & controls
- Indoor generator

City's Vision

- **High-Performance**
  - Capacity to handle peak & typical flows
  - Minimize ragging issues
  - Resilient and reliable
- **Simple to Operate & Maintain**
  - Easier wet well cleaning
  - Pump removal
  - Permanent bypass
  - Full SCADA monitoring
  - Outdoor generator
  - Lighting & ventilation
- **Aesthetically Appealing**
  - Architectural upgrade
  - Odor treatment
  - Pad-mounted transformer

Capacity for Peak & Typical Flows



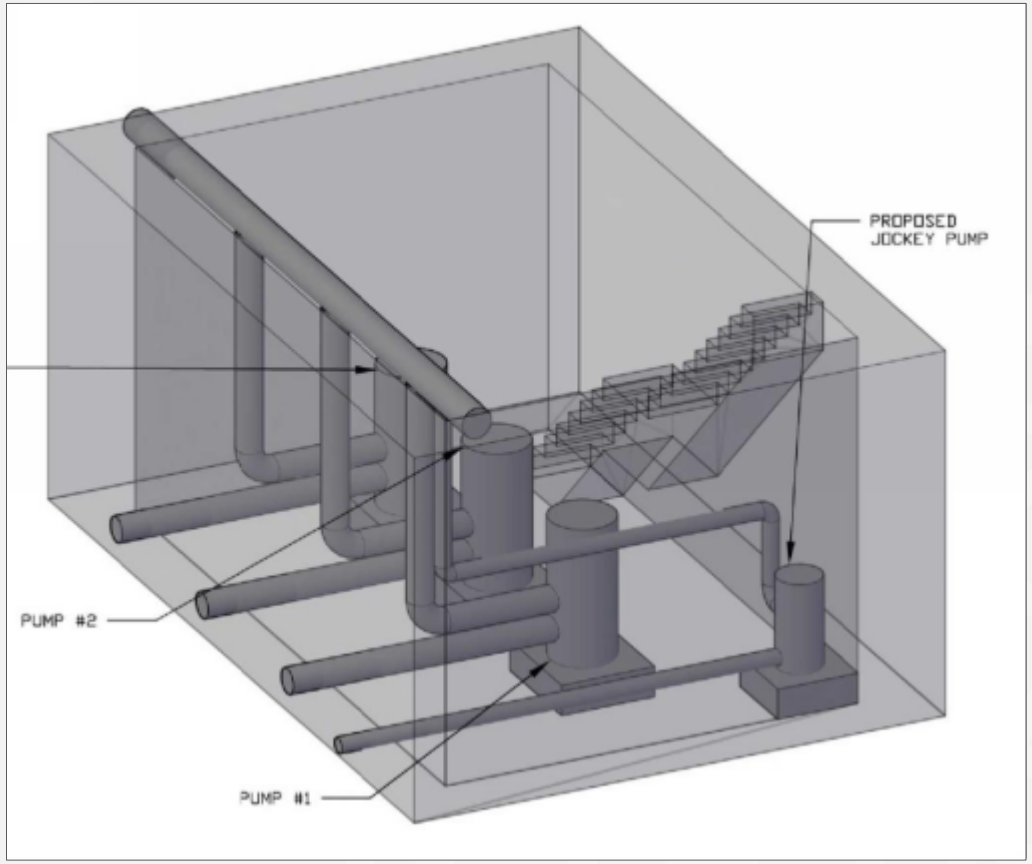
- Currently sized for 4.4 mgd
- Previous projections called for 5.7 to 7.4 mgd of capacity.
- Ongoing I/I work will reduce peak flows.
- Minimal development

Capacity for Peak & Typical Flows

- Consider a small “jockey” pump for typical flows.
- Reduced energy cost
- Less wear & tear on impeller and bearings
- Reduced chance of ragging
- You need to have the space!

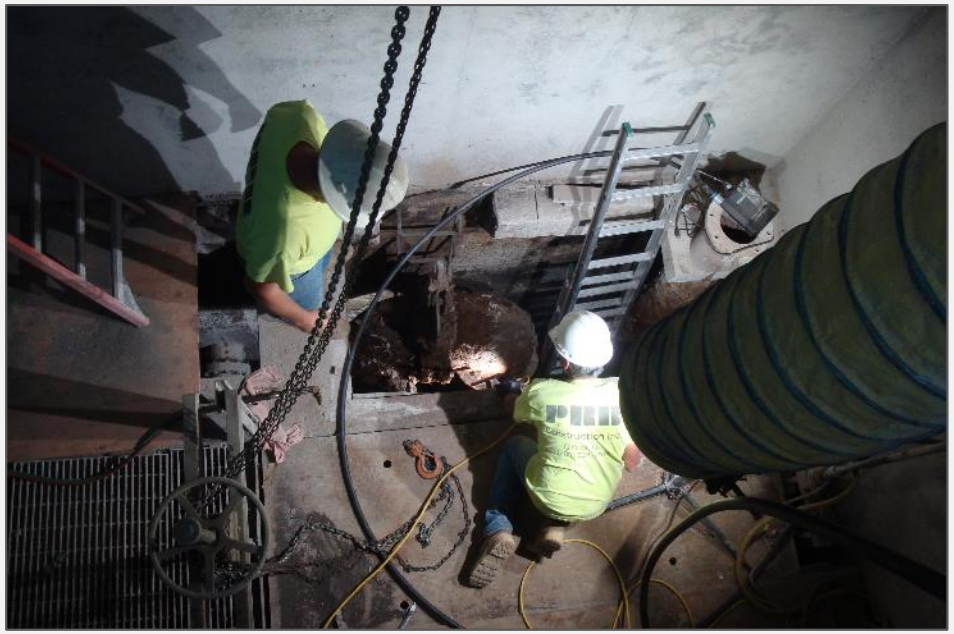
Capacity for Peak & Typical Flows

- Jockey Pump is more efficient at typical flows: 70% vs 56%
- Payback 8-13 years
- Access and removal was a concern
- Ultimately decided not to include



Easier wet well O&M

- Replaced section of floor with grating
- Added a dividing wall
- Added H_2S-resistant epoxy coating

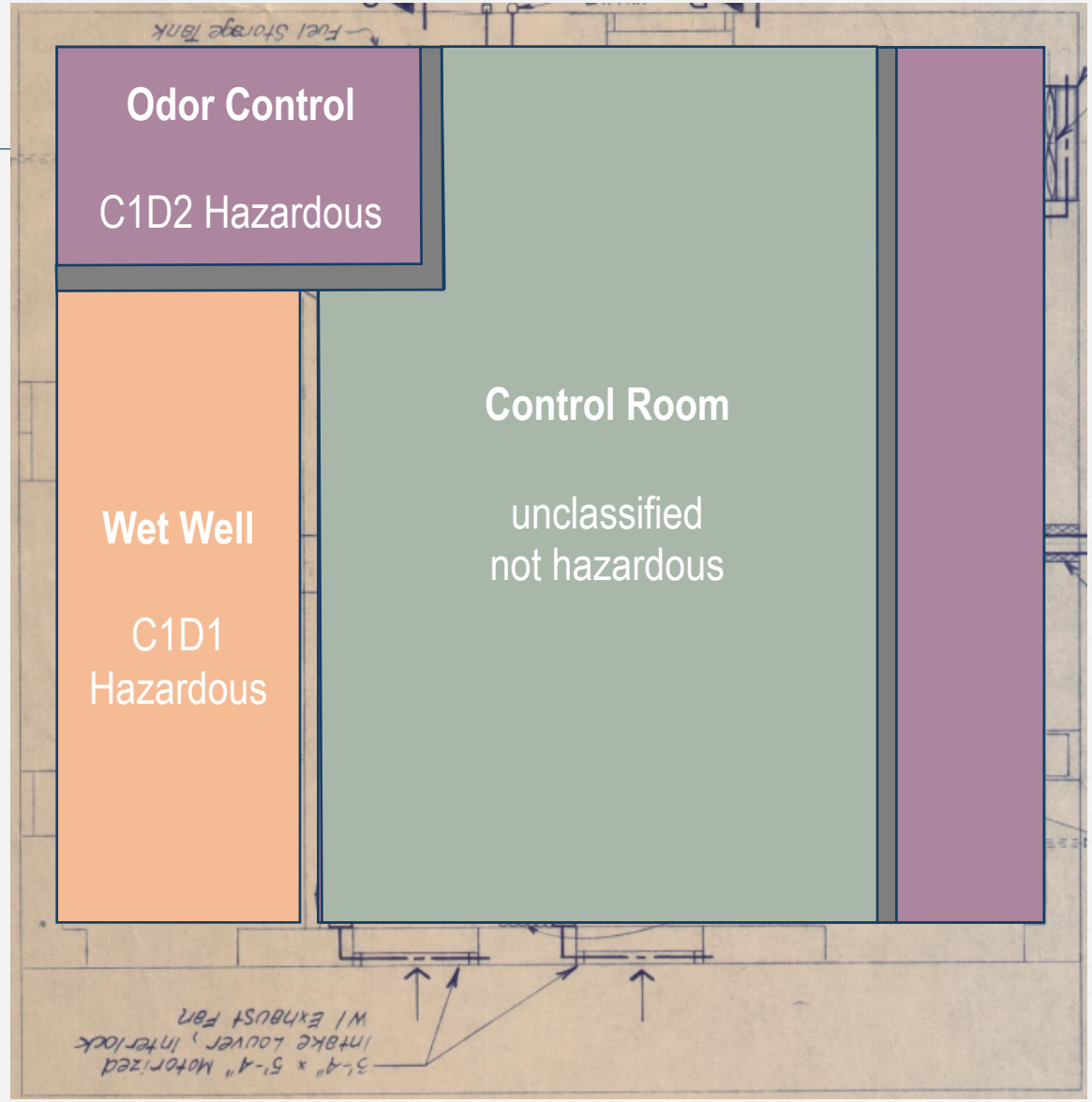


Space Configuration

- NFPA 820 adds a challenge to upgrading existing wastewater facilities.
- Ventilate at high rates

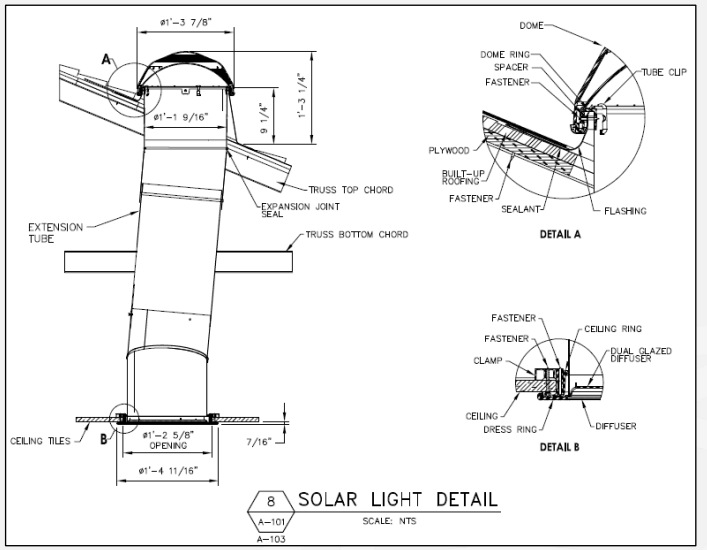
or

- Explosion-proof equipment
- Add walls to separate spaces



Architectural Goals

- Architectural Goals:
  - Improve building aesthetics and “curb appeal”
    - Match Deer Street Pump Station
    - Solar lighting
    - Interior Painting
    - Handrails that meet code
  - Improve energy efficiency
  - Provide maintenance access (pump removal)
  - NFPA 820 Gas-tight separation of spaces (intumescent collars on PVC pipes)



Before, During, After

Before and After

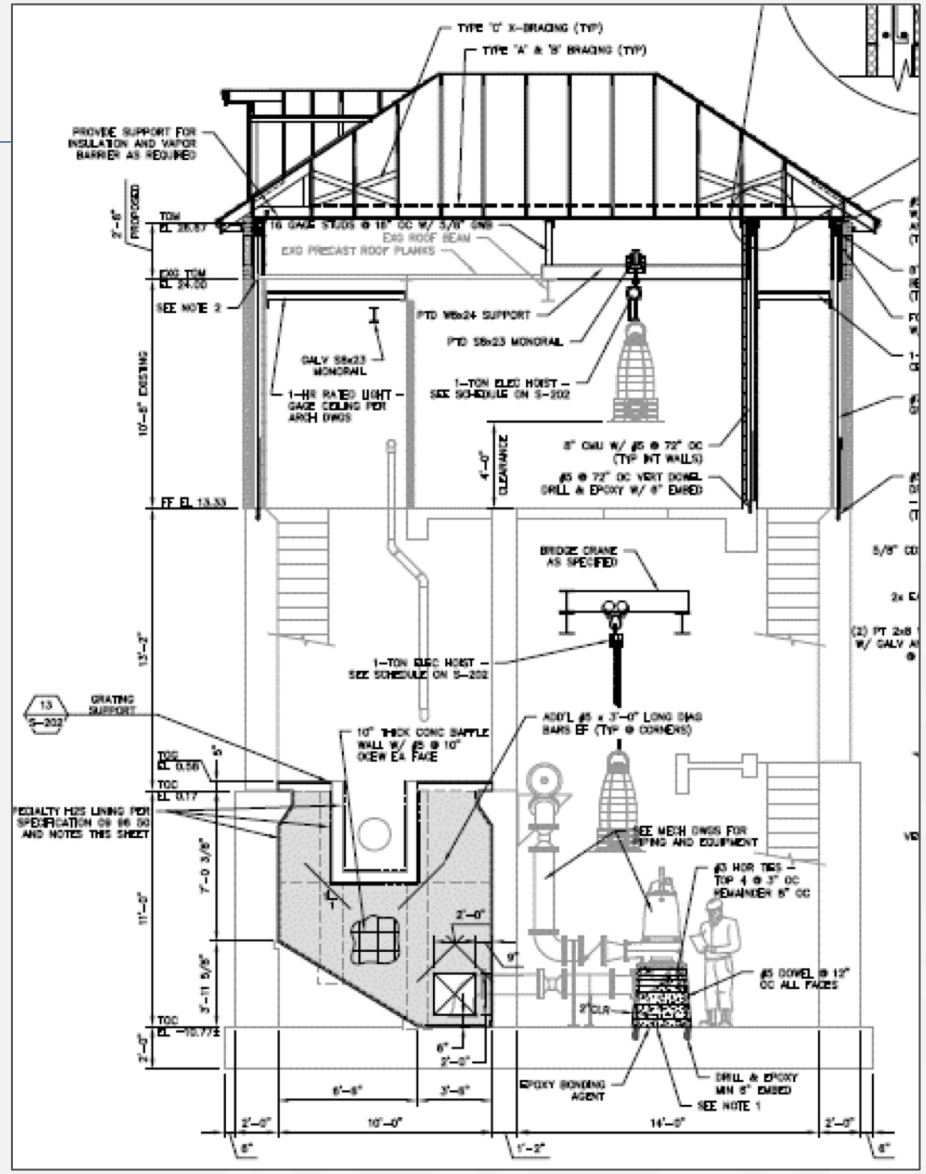
Before and After

Architectural Renderings

- Renderings
  - Aided in color selection
  - Helped with roof profile and dormer locations
  - Located several “faux” windows for symmetry

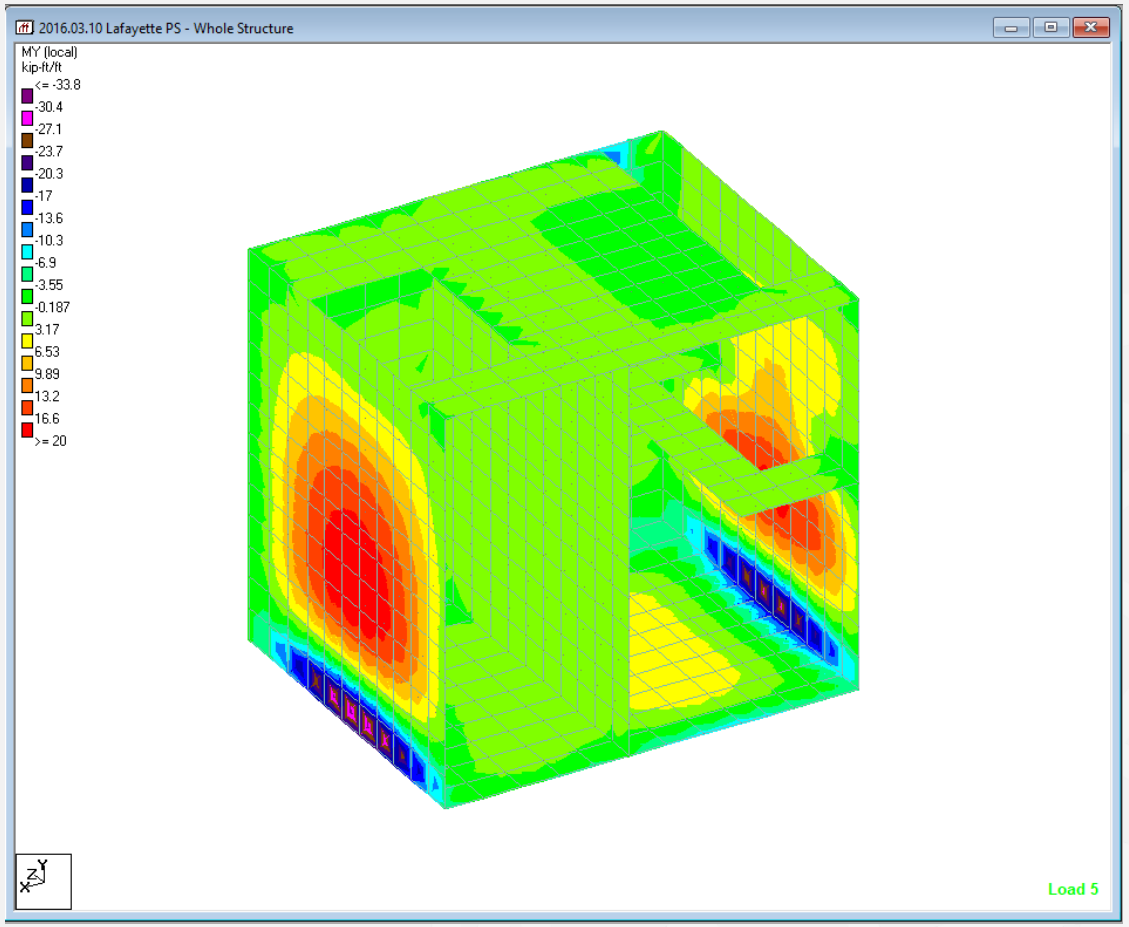
Pump Removal

- NFPA 820 Class 1 Division 2 electrical requirements
- Manual powered hoist and trolley have easily moved 2,000 lb pumps several times now
- Bridge crane allowed for increased maneuverability
- Upper level monorail, with access through door, tall enough to land pump on a 4’ tailgate
- Check head clearances with shop drawings



Analysis of Existing Structure

- Finite Element Analysis (FEA) of modified structure to meet current codes
  - wet well floor removal
  - Electrical equipment loads on upper slab



Reinforcement of Existing Structure

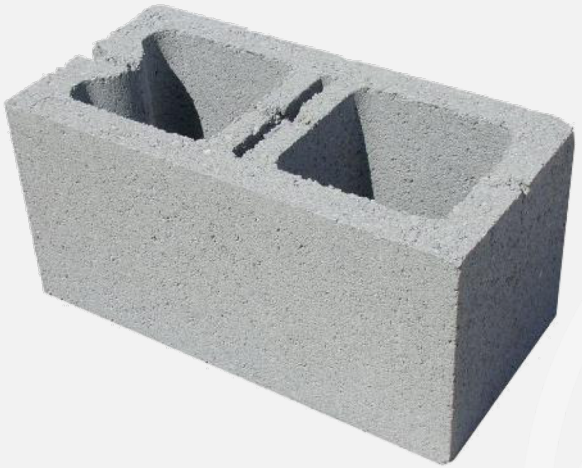
- International Existing Building Code (IEBC) requirements:
  - Level 1 Alteration (removal and replacement of existing items)
  - Level 2 Alteration (adding/removing openings)
  - Level 3 Alteration (> 50% of building area)
  - Requires complying with current IBC level wind and seismic provisions
- Original design vs current code loading requirements:
  - Original Design: ??
  - 2006 IBC w/ City of Portsmouth Amendments: 100 MPH 3-second wind gust, Seismic Design Category C (1% probability of collapse in 50 years)

Reinforcement of Existing Structure

- Building envelope changes
  - New roof profile
  - New openings
  - Taller walls

Reinforcement of Existing Structure

- Field investigation confirmed unreinforced masonry
- Check of existing masonry for out-of-plane bending/shear, and in-plane-shear with new roof diaphragm loads. Not enough capacity to meet modern codes.
- Three-cell CMU issues and solutions



Reinforcement of Existing Structure

- Designed reinforcing scheme to satisfy current codes.
  - Reinforced piers integral to wall, no loss of interior space
  - Needed close coordination with louvers and windows

Lessons Learned

- New construction vs. retrofit
- More solar tubes
- Resilient hinged check valves

Project Financials

Project Phase	Cost (Million Dollars)
Engineer's Estimate	2.95
Bids (March 2017)	2.57 2.71 2.78 4.22
Final Cost with CO	2.63 (2% CO)

Acknowledgements

- Mike Baker – Pump Station Manager
- Terry Desmarais, P.E. - City Engineer
- Norm Dugas – Resident Engineer
- PRB Construction – General Contractor

Questions and Answers

Capacity for Peak & Typical Flows