Penn State University Park WRF Upgrade: Innovative Approaches to Common Challenges
Penn State WWTP

- Plant site has been used for sewage treatment since 1913.
- PSU WWTP treats an average of 1.6 million gallons of waste water per day.
- Current permitted capacity is 4.0 MGD.
- Majority of processes constructed in 1950’s and 1960’s.
Existing Process Flow Diagram

Ex. Liquid Train

MLE Train

TF Train

ASP Train
Project Objectives

1. Renovate or replace aged infrastructure
2. Improve safety
3. Minimize operational risks from variable flows
4. Improve treatment and energy efficiency
5. Ensure compatibility with future reclaimed water goals
6. Maintain flexibility for future campus growth
7. Improve educational and research opportunities
Project Delivery Method Selection

Benefits:

1. One contract – single point of responsibility
2. Compressed schedule
3. Early collaboration with builder
   - Improved constructability, cost estimating, value engineering, budget certainty
Progressive Design Build

- Preconstruction
  - Evaluation Period
  - Design Development
  - GMP Development
  - Permitting

- Construction
  - Construction Administration
  - Final Commissioning

100 Days → 12 Months → 26 Months
Project Challenges

- Schedule Constraints
- Maintenance of Plant Operations (MOPO)
- Watershed Protection
- Stakeholder Involvement
Project Challenge: Schedule
## Schedule Review and Key Dates

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
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<tbody>
<tr>
<td>Project Award</td>
<td>August 2017</td>
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<tr>
<td>30% Design Submittal</td>
<td>March 2018</td>
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<tr>
<td>Submit 60% Design</td>
<td>June 12, 2018</td>
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<tr>
<td>Early Package Mobilization</td>
<td>September 2018</td>
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<tr>
<td>Submit 90% Design</td>
<td>October 2018</td>
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<tr>
<td>Bidding</td>
<td>November 2018</td>
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<tr>
<td>GMP to PSU</td>
<td>December/January 2019</td>
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<td>GMP Approval</td>
<td>February 22/23, 2019</td>
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<td>GMP Notice to Proceed</td>
<td>March 2019</td>
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<tr>
<td>Substantial Completion</td>
<td>December 2021</td>
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</tbody>
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First 100 Days

10 Haskell-Hazen Team Members

1 Week

Intensive On-Site Investigation

ZERO Learning Curve

On-site Sampling and Interviews

Structural Evaluation

Data Analyses

Process Modeling
Progressive Design Build

- Preconstruction
  - Evaluation Period
  - Design Development
  - GMP Development
  - Permitting
- Construction
- Construction Administration
- Final Commissioning

- 100 Days
- 12 Months
- 26 Months
Early Procurement Packages

- MBR design advancement
- Temporary thickening
- Utility relocation
- Demolition
Project Challenge: MOPO
BioWin Model Calibration

- Model calibrated to September 2017
  - Treatment
  - Mass balance
Conventional Activated Sludge Layout
MBR Layout
Temperature Sensitivity Analysis

**Conditions used in Analysis**
- Influent Flow 3 mgd annual avg (4 mgd max month)
- MLSS < 3500 mg/L
- Effluent NH3-N < 1 mg/L
- Effluent TN < 10 mg/L

**Note:** Volumes are presented for comparison only, and do not necessarily indicate volumes to be used in design.

**10 °C typical design minimum temperature for region**

**15 °C current minimum temperature at PSU WWTP**
Utility Locations: Potholing
Project Staging
Staged Construction

Diagram showing various stages of a facility.
Project Challenge: Watershed Protection
Protection of Thompson Spring

- Early meetings with PA DEP
- Building in previously disturbed areas
- Emphasis on reducing impervious areas
- Turbidity monitoring prior to construction
Existing Land Use
Proposed Land Use
Project Challenge: Stakeholder Involvement
Virtual Meetings

Not shown:
- San Diego, CA
- Tempe, AZ
- San Francisco, CA
- El Paso, TX
- Multiple offices and stakeholders within PSU

Solution:
Envision Sustainable Infrastructure Rating System

- Authored by APWA, ASCE, ACEC, and Harvard University in 2012

- What makes it different?
  - Applies to civil infrastructure
  - Addresses full spectrum of triple bottom line
  - Applicable in any project phase

- Credible and transparent platform for quantifying non-monetary attributes
BIM Visualization: PTF
BIM Visualization: BRBs and MBR
Sequencing and Coordination with Operations