A Sustainable Approach with a Noticeable Shift in Water Treatment Residuals Management

Ohio Section Annual Conference
September 12, 2019
Columbus Division of Water

Serves 1.2 million customers in Central Ohio

Three water plants, all lime softening – one future plant

- 125 and 80 mgd surface water plants (alum/lime)
- 50 mgd groundwater
- Future 4th water plant, ?? mgd surface water (likely lime softening)
These plants produce **A LOT** of Residuals!

**Total:** 228 tons dry solids/day
- Comprised of approx 34 tons alum, 194 tons lime
- Columbus WWTPs produce 60 tons ds/day biosolids – 100% beneficial use

**Surface Water:** Hap Cremean Water Plant (HCWP) and Dublin Road Water Plant (DRWP)
- 164 tons ds/day
- Approximately 20% alum, 80% lime

**Groundwater:** Parsons Avenue Water Plant (PAWP)
- 64 tons ds/day
- 100% lime
What They Do Now for Residuals

- McKinley Avenue Quarry (MAQ)
- DRWP
- HCWP
- PAWP
- Lagoons
MAQ – A Great Investment for Columbus!

• Started pumping residuals to MAQ in 1979

• Capacity of 11.3 million cubic yards
Two Main Project Questions

• How much time is remaining in the quarry? *Previous estimates assumed 20-40 years remaining.*

• What to do when the quarry is full?

*Plenty of time to consider the “universe of options”.*

Easy, right?!
First Step – Surveying and Sampling in MAQ

Bathymetric surveying to determine the elevation of residuals in the quarry – Remaining Volume

Sampling to determine the makeup of the residuals in the quarry – Mass balance of what went into quarry

Compare the two results
Surveying – Generated 3D Rendering

- Bathymetric survey below water
- Secchi disk to confirm top of residuals
- LiDAR data above water
Sampling - Locations
Sampling Results - % Solids

- Average % dry solids: 23.7%

- Graph showing increasing depth at respective sample locations.

- #9 & #10 - PAWP Residuals
How Much Volume is Remaining

- Compared survey results to mass balance results – within 7%.
- Both have potential for inaccuracy, but less concerns with the survey approach.
- Survey approach yielded the slightly higher remaining volume of 3.2 million cubic yards.
- So about 8 million cubic yards in the quarry.

So, how much time is left?
Depends on Thickening of Remaining Volume

Data from samples indicates that solids concentration in top 15’ of quarry is < 15%.

<table>
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How Much Time is Remaining in MAQ?

- Estimate at the beginning of the project - > 20 years
- Updated estimate based on sampling and analysis - < 10 years
- Original quarry estimates and all subsequent estimates based on 30% solids in the quarry
  - Limited sampling in the 90’s indicated 30% was reasonable.
- One potential cause – DBP control
  - DRWP increased alum dose in 1995 from 50 to 90+ mg/l
  - Impact on solids production was captured in previous estimates
  - Alum/lime ratio in quarry significantly increased. May have reduced thickening in quarry
Some Relief…

• During project, City purchased a new quarry for PAWP residuals

• Recently started a project to design/permit discharge to quarry

• Focus shifted to surface water plant residuals
Developing the Roadmap

- Need a roadmap that can be implemented quickly before we run out of space in MAQ.
- Looked at ALL options
- Used Multi-Criteria Decision Analysis (MCDA) to evaluate options
## Beneficial Use Options Considered

<table>
<thead>
<tr>
<th>Market</th>
<th>Lime-Only WTR</th>
<th>Alum-Only WTR</th>
<th>Alum/Lime Blend</th>
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<tbody>
<tr>
<td>Agriculture (Phosphorus-binding / Integration into DOSD Biosolids Program)</td>
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<td>Agriculture (Liming Value)</td>
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<td>Cement Manufacturing</td>
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<td>Disturbed Land Reclamation</td>
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<td>Flue Gas Desulfurization</td>
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<td>Industrial Waste Scrubbing</td>
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<td>Landfill Daily Cover</td>
<td>X</td>
<td>X</td>
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<td>Soil Blending</td>
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MCDA Approach

• Started with 7 Alternatives, added 5 hybrid Alternatives after discussion.

• Alternatives included:
  • Beneficial Use
  • Recalcination
  • New Quarry Disposal
  • Landfill Cover and/or Disposal
  • Combinations thereof

• Alternatives needed to consider further treatment of residuals (i.e., dewatering/thickening)
MCDA Approach

• Established criteria and scoring, considering:
  • Regulatory Implications
  • Environmental Footprint
  • Impact on Plant
  • Operational Complexity
  • Reliability
  • Capital Cost
  • Time to Implement

• Sustainability/environmental footprint criterion used life cycle assessment (LCA) evaluation
LCA Results – Summary

Recalcination

Conducted using the TRACI (USEPA, 2014) impact assessment method
MCDA Results

![MCDA Results Graph](image)

Legend:
- Env Footprint
- Regs
- Plant Ops
- Reliability
- Complexity
- Cost
- Time

Dewater/Quarries

Aggregate Score vs. Alternative

1 2 3 4 5 6 7 H1a H1b H2 H3 H4 H5 Max
MCDA - Conclusions

Evaluation resulted in City selecting the following options to advance:

- Dewatering, either separate or combined (lime/alum), trucking to beneficial use
- Additional quarries for disposal of residuals from surface water plants

For now, ruled out recalcination of lime residuals – least cost, highest environmental impact, complexity
Recommended a parallel track for…

- Cleanout lagoons at HCWP, haul to beneficial use – In progress
- Contract operations for dewatering, beneficial use. Quick implementation to test market and preserve MAQ – In progress
- Search for and permit a new quarry(ies) – In progress
- Design of City owned dewatering facilities (once suitable market is identified) – Pilot testing ongoing, design in future
Pilot Testing

- **Screw press** – Feb 2018 (HCWP), August 2019 (DRWP)
- **Belt press, centrifuge** – side-by-side, June 2019
- **Plate and frame** – planned for Oct 2019
# Pilot Results

<table>
<thead>
<tr>
<th>Dewatering Technology</th>
<th>% Dry Solids</th>
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<tbody>
<tr>
<td></td>
<td>Alum</td>
</tr>
<tr>
<td>Screw Press (DRWP)</td>
<td>25%</td>
</tr>
<tr>
<td>Belt Press (HCWP)</td>
<td>27-33%</td>
</tr>
<tr>
<td>Centrifuge (HCWP)</td>
<td>37-49%</td>
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</table>
Beneficial Use Challenges

- Markets not as fully developed compared to biosolids. (Alum)
- Phosphorous driver not yet there in many markets. (Alum)
- Dewatering technologies for coagulant difficult to achieve high solids concentrations. Trucking costs for hauling dewatered residuals drive costs. (Alum)
- Polymer use for dewatering can be problematic for beneficial end users (soil blenders). (Alum)
- Some markets have uncertain futures – flue gas desulfurization. (Lime)
- Algal toxin impacts to land application. (Alum/lime)
HCWP Lagoon - Sampling/Cleanout
HCWP Lagoon – Beneficial Use
Next Steps

• Finalize/issue RFP for contract dewatering/beneficial use for HCWP and DRWP

• Results will determine need for/schedule for City owned dewatering facilities

• Begin permitting steps with OEPA for new quarry for disposal of surface water plant WTRs – especially 4th water plant

• Continue helping City with the transition from disposal to beneficial use
Thank You!

Questions?

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