Addressing the City of Albany’s CSO and Flooding Challenges with CMAC Technology

NEWEA - Annual Conference
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Michael Miller, P.E. - CHA Consulting, Inc.
The Albany Water Board, established in 1987, owns the water and combined and sanitary sewer infrastructure of the City of Albany.

Focused on projects which mitigate flooding and sewer backups, especially in the Beaver Creek combined sewer district.
Challenges

- Mitigating surface flooding and combined sewage surface discharges during storms
- Reporting wet weather CSOs to comply with Sewage Pollution Right To Know
- Complying with requirements for new development in combined sewer areas
- Tracking dry weather flows and available dry weather capacity
- Planning sewer separation projects
- Planning flood mitigation projects
- Developing flood mitigation measures for a higher level of service
- Finding the funds to do the projects
Addressing the Challenges

- Green infrastructure practices for flood mitigation and combined sewage discharges
- Adaptive controls to optimize system storage and minimize flooding and CSOs
- Continuous level monitoring at CSO regulators
- Continuous flow monitoring at trunks sewers, interceptor and WWTP
- Stringent requirements in City Code for storm water management
- New York State low interest loans and grants
Beaver Creek Flood Mitigation Work

Created separate sewers along 1700 ft. of Quail Street

Involved construction of storm sewer on Elberon Place discharging into Washington Park Lake

Created a wetland to mitigate flooding
Building a Smart City around Stormwater Management
Building partnerships for smart stormwater management

Ignition - SCADA

SmartCover Systems
  Monitoring

RTUs reporting directly to Ignition

Opti CMAC
Welcome to the City of Albany Sewer System SCADA
CSO Monitoring
Rainfall Data 2017

Albany NY

[RAIN] Rain Data

SmartCover® Unit Location

Application: Rain

Charts

Management Status Alarm Settings Info Maintenance

Rain Data

Total Rain: 38.5 in

Time Period: Last Year
From: 2017-01-01 12:33
To: 2018-01-01 12:33

Adjust Scale
Max Y: 0.9
Min Y: 0

Download Data
Long Filter Gaps
CSO Overflow and WWTP Flow June 19-20
Building Operational Intelligence within the Beaver Creek Sewershed
Building Operational Intelligence

- Incorporation of operational controls to optimize the performance of the wastewater system
  - Insights into maintenance activities
  - Early detection and warnings of impending flooding
    - Notification for properties within known flood hazard areas
    - Other emergency actions (e.g., evacuations, barricade of streets)
  - Continuous Monitoring and Adaptive Control (CMAC)
    - Optimize the use of available system storage to reduce surcharging and flooding within the collection system
    - Maximize conveyance of flows to the wastewater treatment plant
    - Reduce combined sewer overflows to the Hudson River
Continuous Monitoring and Adaptive Control (CMAC)

Enables Dynamic and Adaptive Water Storage Management
Projected partially funded by the New York State Environmental Facilities Corporation (EFC) with a $450,000 grant from the Green Innovation Grant Program (GIGP) and a $600,000 Integrated Construction Solutions (ISC) grant.
Ryckman Alley Constructed Wetlands
Ryckman Alley Constructed Wetlands
Project recently awarded an Integrated Solutions Construction (ISC) Grant for stormwater re-use applications:

- Irrigation of the ballfield
- Street sweeping operations
- Supplemental water supply for City-wide green infrastructure installations
Hansen Alley Regional Underground Cistern System
Does the available storage exceed the forecasted runoff?

- Yes: No discharge during wet-weather event

- No: Controlled release through actuated valve with passive high level overflow

Extended 24-Hour Programmed Discharge
Web-Based CMAC Dashboard

Hansen Stormtech

Water Level Elevation
- 12hr | 24hr | 4hr | 1wk
- 12/28/2017 06:36: 182.2 ft MSL
- 2.79 in
- Cumulative Precipitation: 27.95 in
- Outlet Valve Invert: Unknown
- Flood Alert: 188 ft MSL
- Passive Overflow: 186.45 ft MSL

Outflow Valve
- 12hr | 24hr | 4hr | 1wk
- Target Discharge: cfs
- Target Valve Percent Open: %
- Measured Valve Percent Open: %

Precipitation Forecast
- 12hr | 24hr | 4hr | 1wk
- 12/29/2017 10:54: 0.0 in
- 24-hour Forecast Runoff
- Volume (ft³): 0.0

Storage
- 12/29/2017 10:54: 0.0

System Control:
- 12 in Butterfly Valve

Operation Mode:
- Automatic Control
- Manual Control

Manual Valve Setpoint:
- 0.0% Open
- Not available for control
Web-Based CMAC Dashboard

Ryckman Wetland

Precipitation Forecast
Future 48 Hours

- 12/30/2017 19:00
- Quantity: 0.01 in
- Probability: 33%

Water Volume in Storage

- 12hr | 24hr | 48hr | 1wk

- Measured Volume
- Target Volume
- Max Target Wet Weather Volume

Weather Radar

NOAA

Storage Available (ft³)

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Performance Analysis - Hansen Alley

Water Volume in Storage

Precipitation Forecast
Forecast: 1.75in
Actual: 1.59in
Summary Metrics

- Event Precipitation: 1.59 in
- Opti Wet Weather Flow: 0 ft$^3$ and 0 cfs max discharge
- Passive Wet Weather Flow: 11,800 ft$^3$ (90,000 gallons) and 0.89 cfs max discharge
**Summary Results for Hansen Underground Cistern System**  
*(4/1/2017 to 9/1/2017)*

<table>
<thead>
<tr>
<th></th>
<th>Opti - CMAC</th>
<th>Passive</th>
<th>Pre-construction</th>
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<tbody>
<tr>
<td>Total Precipitation: 22.6 in (NOAA)</td>
<td></td>
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<tr>
<td>Opti Rain Gauge: 21.84 in</td>
<td></td>
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<tr>
<td>Total Inflow: 120,000 ft³*</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Wet Weather Flow</td>
<td>0 ft³</td>
<td>87,000 ft³ with 4” orifice **</td>
<td>120,000 ft³</td>
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<tr>
<td></td>
<td></td>
<td>111,000 ft³ with 12” orifice</td>
<td></td>
</tr>
<tr>
<td>Percent Wet Weather Flow</td>
<td>100%</td>
<td>27% with 4” orifice</td>
<td>0%</td>
</tr>
<tr>
<td>Reduction</td>
<td></td>
<td>7% with 12” orifice **</td>
<td></td>
</tr>
<tr>
<td>Maximum Discharge Rate</td>
<td>0 cfs in wet weather</td>
<td>0.43 cfs with 4” orifice</td>
<td>4.46 cfs</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.46 cfs with 12” orifice</td>
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* Total inflow based on mass balance and to does not include estimated exfiltration occurring above the liner
** 12” orifice is installed with Opti CMAC for the Hansen site
Washington Park Lake CSO Abatement and Flood Mitigation

Phase 1 - Quail Street Green Infrastructure Project

Phase 2 - Elberon CSO and Flood Mitigation Project

Project partially funded by $1MM Water Quality Improvement Project (WQIP) grant from the NYS Department of Environmental Conservation (DEC) and $1.8MM grant through the NYS Environmental Facilities Corporation (EFC) Green Innovation Grant Program (GIGP)
Washington Park Lake Inlet Configuration
Washington Park Lake CMAC Outlet Configuration

Re-establishes 7 million gallons of Beaver Creek floodplain storage
Washington Park Lake Logic Control

Pre-Event Planning based on NWS forecast

Does the available storage exceed the forecasted runoff?

Yes

No discharge during wet-weather event

No

Controlled release through actuated valve with passive high level overflow

Post-Event

Extended 24-Hour Programmed Discharge

Pre-Event 50% Volume Drawdown
Early trends confirm reduced flow levels in the CSS
Next Steps

- Begin CMAC control of Washington Park Lake
- Integration of Opti controls with CSO monitoring equipment to inform discharge logic during dry-weather periods
- Incorporation of additional metering equipment for calibration of measures; and CSO recording and reporting purposes
- Retrofitting the Hansen regional cistern system to allow for stormwater re-use applications
- Evaluation of existing “traditional” passive storage systems
- Expansion of additional green infrastructure and/or CMAC elements to further enhance the performance of the system
Lessons Learned

● Building greater “performance and operation intelligence” can assist with prioritizing future capital investments, as well as providing improved LOS and means to measure results.

● May wish to consider further calibration of the system control logic based on actual observed system response.

● Use of CMACs further optimizes the operational performance of green infrastructure and storage elements.

● CMACs can present cost-effective measures to enhance the performance of both existing facilities and new projects.
Thanks to our Project Sponsors

The Beaver Creek CSO Abatement and Flood Mitigation Projects received the following grants:

- $2,250,000 in grants from the NYS Environmental Facilities Corporation (EFC) Green Innovation Grant Program (GIGP)
- $600,000 grant from the NYS EFC Integrated Solutions Construction (ISC) Program
- $1,000,000 grant from the NYS Depart. of Environmental Conservation (DEC) Water Quality Improvement Project (WQIP)
- $50,000 grant from the NYS DEC Sewerage Pollution Right to Know (SPRTK) Program
Questions & Contact

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1. Introduction (Bill)
   a. Overview of Albany’s watersheds and sewer districts
   b. Stormwater management challenges in Albany - water quality and flooding
2. Intelligence network - smart cities - optimize storage assets?
   a. Monitoring Data (i.e. Scada, Smart Cover, Meters)
   b. Adaptive Control (i.e. Opti)
3. Utilizing forecast-based controls (Mike)
   a. CMAC overview
   b. Beaver Creek CSO Abatement and Flood Mitigation Projects
      i. Storage elements and operational control logic
      ii. Performance analysis and dashboard screenshots
      iii. Calibrations
      iv. Value Proposition (cost, time)
4. Next steps
   a. Long-term vision in Albany (upcoming projects)
   b. Lessons for other municipalities
Summary Metrics
Event Precipitation: 1.59 in
Opti Wet Weather Flow: 0 ft$^3$ and 0 cfs max discharge
Passive Wet Weather Flow: 7,800 ft$^3$ and 0.31 cfs max discharge
Building Performance Intelligence

- Utilizing smart-infrastructure principals to better understand system performance and wet-weather response
  - Consolidation and management of traditional SCADA system data
  - Deployment of in-system monitors (i.e., Smartcovers, pressure sensors, soil moisture probes) within critical reaches or elements of the system
  - Installation of metering equipment to record flows and for reporting requirements for CSO discharges under the Sewage Pollution Right to Know (SPRTK) Act
  - Utilize “performance intelligence” to identify problems or operational issues, evaluate the effectiveness of constructed practices and for the design of future mitigation projects
Web-Based CMAC Dashboard
Next Steps

- Begin CMAC control of Washington Park Lake
- Integrate Opti controls with information from CSO monitoring equipment to release based upon the water level at the combined sewer overflow dams
- Install additional SmartCovers at CSO regulators and Opti controls at key locations, such as the Big C CSO regulator
- Implement additional flood control projects in the City, the next areas of priority being Hackett Blvd and Sheridan Avenue
- Retrofit existing storage system(s) with Opti Controls, such as Beaver Creek I (165,000 CF)