

Project Status, December 2018: CS-175; Dynamic Collection System Control

Summary

The two areas of focus for the project CS-175; Dynamic Collection System Control are: analysis of dynamic control for the GDRSS system, and an operator decision support dashboard. Here we provide a review of progress made for each of these tasks and discuss future work.

Project Status

Decision Support Dashboard

The Decision-Support Dashboard can be accessed here: <http://data.open-storm.org:3000/?orgId=1>. A screenshot of the dashboard can be found below. The scripts underlying the Dashboard calculate new recommendations currently every 10 minutes, on the sevens. (i.e. 1:07, 1:17, 1:27, ... 1:57.) When viewing the dashboard in Grafana we recommend refreshing your browser a few moments after these times. An updated version of the dashboard will not require browser refreshing.

Currently, the dashboard provides actionable recommendations for the following assets:

- Conner Creek Pump Station, Sanitary Pumps
- Conner Creek Pump Station, Storm Pumps
- Conner Creek Forebay, VR-02
- Fairview Pump Station, Sanitary Pumps
- Freud Pump Station, Storm Pumps

In addition to recommendations, the Dashboard displays the most recent measures of pump, gate, and valve states and level and flow data from across the system. These measures provide context to the recommendations.

In the case of assets that have binary states (i.e. on/off, or opened/closed,) when an action is recommended an icon will turn green – indicating the pump should be turned on or gate opened – and a number beneath it will provide a suggested amount of time (in minutes) to leave the asset on or opened before closing. As part of the formulations in the recommendation engine all recommendations to turn pumps on for less than 3 minutes have been neglected. It is our understanding that this lower cutoff is well below the current frequency for toggling pumps and valves. This threshold can be changed in the software and can be reviewed during the upcoming trial phase.



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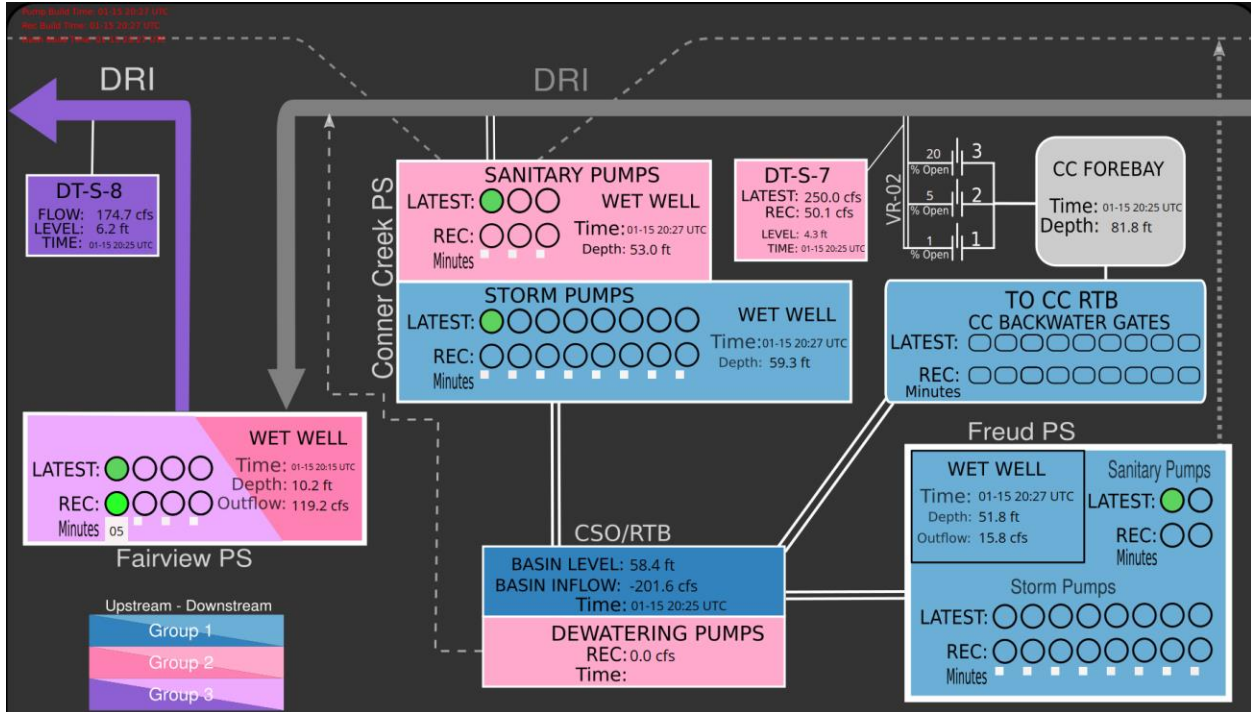


Figure 1 Current version of GLWA Eastside Decision-Support Dashboard

Missing Recommendations

There are three recommendation locations on the Dashboard that do not currently provide actionable recommendations to operators. They are:

- Conner Creek CSO Retention Basin, Dewatering Pumps
- Conner Creek Forebay, Backwater Gates
- Freud Pump Station, Sanitary Pumps

Below is a brief summary for why these respective assets do not have recommendations.

Conner Creek CSO Retention Basin, Dewatering Pumps

Recommendations for the Dewatering Pumps depend on accessing measurements that are not currently available on PI. It is our understanding that there are four pumps that dewater the CSO basin to the DRI. The current operation of these pumps is based on the levels at:

- The two Retention Basin Cross Collector Sump Levels
- The level sensor in the Dewatering Sewer Manhole in Freud Avenue, and
- The Conner Sanitary Pump Station Suction (Wet Well)

On August 20, 2018 Christopher Nastally provided pumping capacities for the four pumps at their limits of their operating range (7600 GPM @ 12.3 ft TDH and 4475 GPM @ 45.5 TDH). Pump output, and likewise a recommendation, rely on calculating the Total Dynamic Head. This is calculated using the datapoints listed above. To our knowledge, only the Conner Sanitary Pump Station Suction (Wet Well) measurement is available in PI and has been shared with the team. We made a request with Betty Thomas and Joe Burchi to look for the other assets, but they could not find these measurements. Anthony Troy has also been incorporated into the search for these data points in PI.



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Though not an impediment to the implementation of a recommendation, it is also our understanding that SCC operators do not have remote access to the states of the Conner Creek CSO Basin Dewatering Pumps. Instead, they must phone the operators at Conner Creek CSO to understand which pumps are running. This also means that the dashboard cannot reflect the dewatering pump states, similar to how other pumps are represented in the graphic. We recommend that the dewatering pump statuses be quarriable in PI.

Conner Creek Forebay, Backwater Gates

The complex hydraulics and a lack of downstream measurement make providing an informed recommendation for the Conner Creek Forebay Backwater Gates a difficult task. The nine gates regulate flow from the Conner Creek Forebay into the Conner Creek CSO Retention Basin. Upstream of the gates and inside the forebay is a dam structure that obstructs flow through the gates for water levels lower than 82.5 feet. Once the water passes ovetop of this structure it then interacts with open or closed gates. Flow through these structures is a complex hydraulic process and depends upon water levels upstream and downstream, gate states, and constants that account for energy losses which are usually determined through experimentation and physical models. This level of detail for a single structure is well beyond the scope of the GDRSS SWMM provided to the team – whose purpose is to serve as a model for the entire stormwater network. It is also not found in other material shared with the team. However, there could exist a design report or hydraulic study that would provide insight to how to approximate flows through the structure.

An associated problem is that the nearest lever sensor downstream of the gates is within the CSO RTB, which is well downstream of the gates and cannot be used to estimate flows through the structure.

Freud Pump Station, Sanitary Pumps

Freud Pump Station has two sanitary pumps with capacities of 20 cfs and 35 cfs respectively. In the development of our recommendation engine theses pumps were ignored on the basis that the flow capacity through them are orders of magnitude lower than all others. For consistency, and with the potential to incorporate recommendations at a later date, the current states and a recommendation options for the pumps were included in the graphic.

Outreach, Support, and Communications

We are currently writing documentation for this project which includes the findings from our analyses, project workflows, and tutorials on how to use the software modules that were developed to support this work. The most recent version of this documentation can be found here: <https://realtimerecs-gregjewi.readthedocs.io/en/latest/>.

Future Work

What We Need

Conner Creek, Dewatering Pumps

To move forward with a recommendation for the operation of the pumps, we need to understand if the sump level and the level sensor at the manhole in Freud Avenue can be made available for use.

Conner Creek, Backwater Gates

Any resources that would help us understand the hydraulic characteristics of the backwater gates.



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