Project Status, March 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.

Updates
Decision Support Dashboard
A meeting time for April 6th has been established to discuss the priorities and next steps for this tool. Updates will be forthcoming in April's project update.

Dynamic Control for the GDRSS
In last month's update, we reported that we had reformulated the representation of the In-storage dams (ISDs) in the GDRSS model to apply dynamic control algorithms to these structures. Since, we have worked to apply our Market-Based Control (MBC) framework to the GDRSS SWMM. Figure 1 provides an example of the input parameters associated with MBC, and the resultant hydrograph compared to uncontrolled flow at the same location. In this simulation, local peak flows at the downstream of ISD002 were reduced by approximately 65%. MBC parameters include user defined set points for downstream storage and in-line assets. The simulations illustrate how ISDs can be used to capacity, without overflowing, which reduces peak flows downstream. At each time-step, price and demand for upstream and downstream assets are computed from model results and their relation to set-points. With price and demand computed for the time-step, control decisions are made at each ISD, i.e. inflate or deflate the dam.

Integration of our MBC algorithms into GDRSS prompted a discussion about defining what a successful control intervention looks like, and therefore what should be the predefined set-points and weighting criteria for our algorithms. We have identified multiple objectives that may be incorporated into our definitions of set-points and price and demand curves. The following are considered positive outcomes due to a control intervention for the GDRSS: increased treated outflow (i.e. increased flows through outfall-nodes 100 and 200,) decreased inflow to the treatment facility from the DRI, and increased volume stored behind the ISD control structures during a storm event. We are investigating how changes in set-points and weighting factors in the price and demand equations effect the interaction and achievement of these objectives.

Future Work
We continue to incorporate the other control points of the system into the MBC schema. Also, as mentioned above, we must now investigate how changes in set-points and weighting factors in the price and demand equations effect the interaction and achievement of the larger control objectives. Future work on the Decision Support Dashboard will be determined after our meeting on April 6th.

What we need: We anticipate having a list of requested items for the Decision Support Dashboard after our meeting on April 6th. However, at this time, we do not have any requests.

Reporting
We look forward to providing an update of our progress on April 30, 2018.

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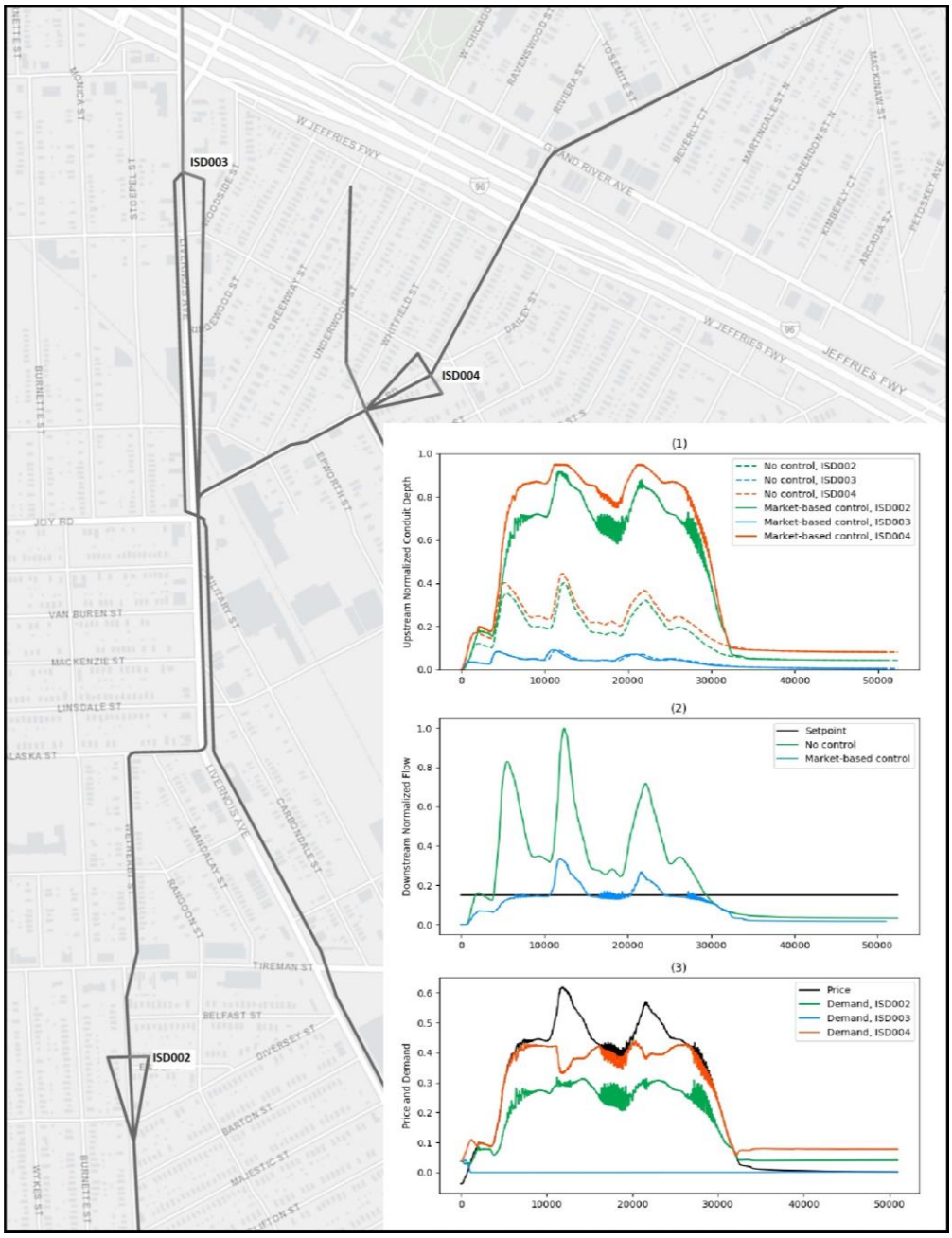

Figure 1 Simulation results and Market-Based Control parameters downstream of ISD002 for the May 2017 storm. Market-Based Control parameters include user defined set points for downstream storage and in-line assets, as shown in the downstream setpoint within subplot 2. Price and demand for assets are computed using model results and their relation to these set-points, at each simulation time-step (subplot 3). Once price and demand are computed for the time step, control decisions are made for each ISD, i.e. inflate or deflate the dam. These control actions effect the hydrograph downstream of the controlled asset by reducing peak flows due to the inflated dams (in this case by as much as 65%,) and in the system trying to maintain the set point level on the recession of the hydrograph peaks. Oscillation around the set point due to controller intervention can be seen before the time steps 20,000 and 30,000 in subplot 2. The background map shows the approximate location of the ISDs visualized in this study.

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