

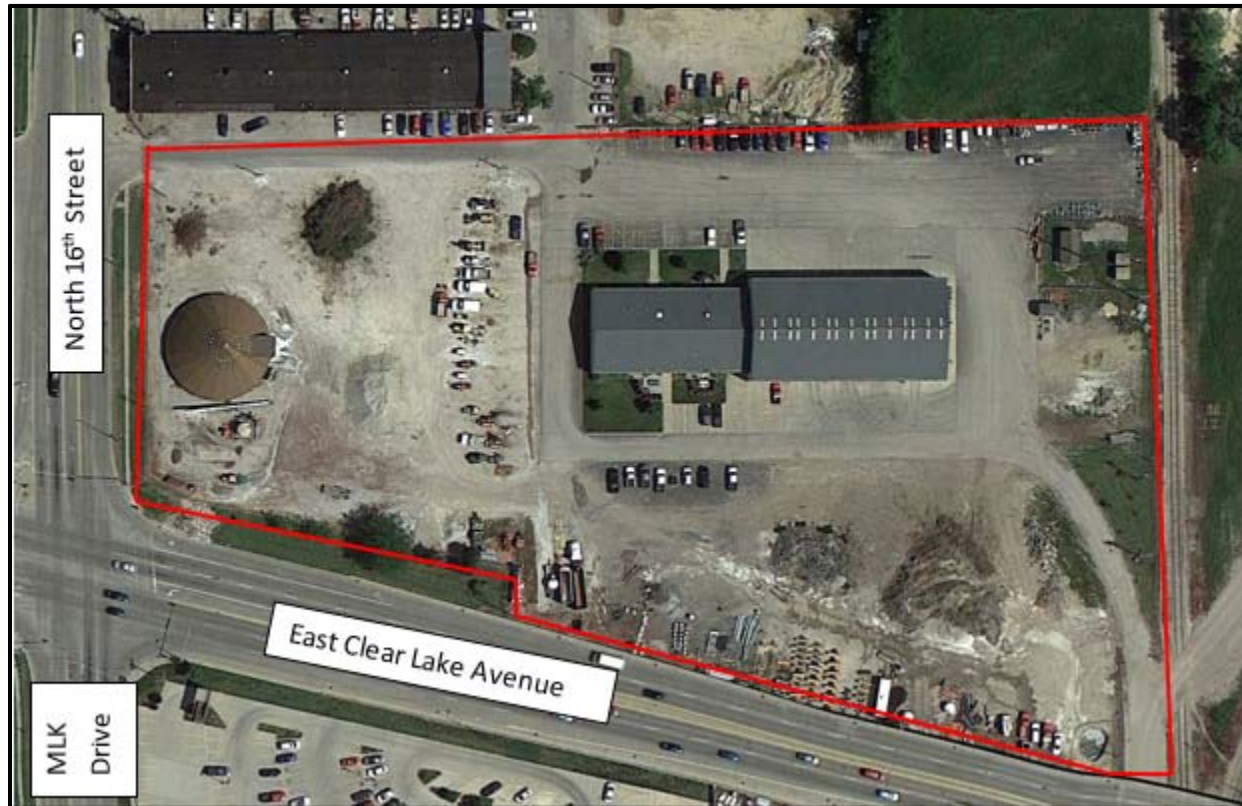
Green Infrastructure Bio-Swale, Stormwater Capture and Reuse Project City of Springfield, Illinois



Presented by:
Lee Bloome, P.E. – Hanson Professional Services Inc.

Project Need:

- The City of Springfield's Sewer Garage facility is an active site that contains the City's salt dome, equipment storage and temporary storage of construction debris and yard waste.



Project Need:

- Existing site issues included salt laden runoff leaving the site to the southwest and the potential for high suspended solids entering the combined sewers that serve the site.



Construction material storage.
No vegetated buffers.

Brine Runoff and Eroded Soil



Project Need:

- Existing site drainage is collected by storm sewers on the east side of the site and one inlet on the west side of the site which are tributary to a combined sewer running from north to south.





Project Need:

- Hanson approached the City of Springfield after learning of the Illinois Green Initiative Grant (IGIG) program to see if there was an opportunity for a project.
- We saw it as an opportunity to reduce the amount of stormwater and associated pollutants entering the City's combined sewer at several locations throughout the City.
- Hanson initially approached the City about a rainwater harvesting concept in the Central Business District that would help alleviate some existing water issues.



Project Need:

- The Central Business District combined sewer system is currently 150 years old and at the time served the downtown well.
- As is common, the City has grown, grassed lots paved and the volume of storm runoff increased with little or no concern about detention.
- Combined sewers that used to handle a 10 year storm now surcharge at a 2 month event.
- The public's expectations of what the sewer should be able to handle differs greatly from what the sewer can handle.



Project Need:

- The first concept proposed to the City was a rainwater harvesting system located west of the core of downtown.
- The concept would be to capture roof runoff in a silo style storage tank to be installed behind the downtown buildings in alleyways or parking lots.
- Hanson and the City approached a building owner who was having drainage issues during large rain events.
- The owner's roof drainage discharged at the base of his building and flowed along the foundation leaching into the basement of the building.

Project Need:

- Unfortunately there wasn't a good location for an above grade tank.
- Hanson and the City approached the owner about storing roof drainage in the basement of the building in a bladder style storage tank.
- Initially the owner was open to the idea but in the end a deal couldn't be made.
- The collected rainwater would have been used for watering downtown planters.





Illinois Green Initiative Grant:

- The Illinois Green Initiative Grant (IGIG) program was administered through the Illinois Environmental Protection Agency (IEPA).
- The program provided matching grants to projects located within Municipal Separate Storm Sewer System (MS4) or Combined Sewer Overflow (CSO) areas.
- There were three categories of grants issued; CSO rehabilitation, retention/infiltration, and small project.
- Since the sewer garage facility is tributary to a CSO, we selected the CSO rehabilitation category which consisted of an 85% grant, 15% match program.



Project Need:

- Hanson conducted site visits, obtained drawings with existing utilities and proposed the following to the City:
 - Grade the west half of the site to drain to a bioswale that would provide both detention and filtration to the site runoff as well as improve the site aesthetics.
 - Intercept stormwater on the east site, filter it, store it, and use it for the City's sewer jetting trucks, street sweepers and for watering the downtown planters.
 - The City agreed to the improvements and the grant application was written.
 - And we waited.... The grant award announcements came almost 9 months after they were scheduled to be announced.

Project Need West Site:



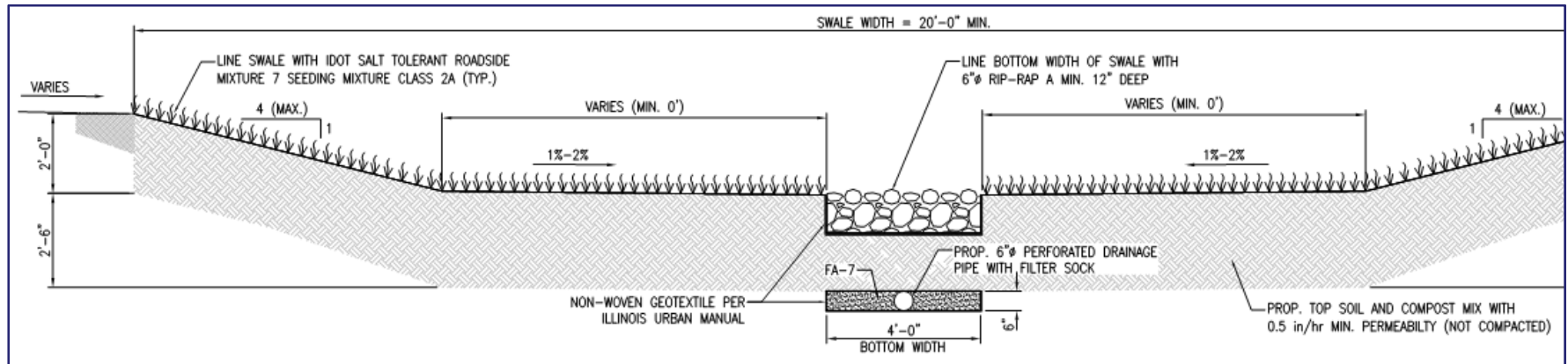
- Intercept site runoff.
- Redirect drainage to the south.
- Maintain site usefulness.
- Do not impact future material storage building.



West Design:

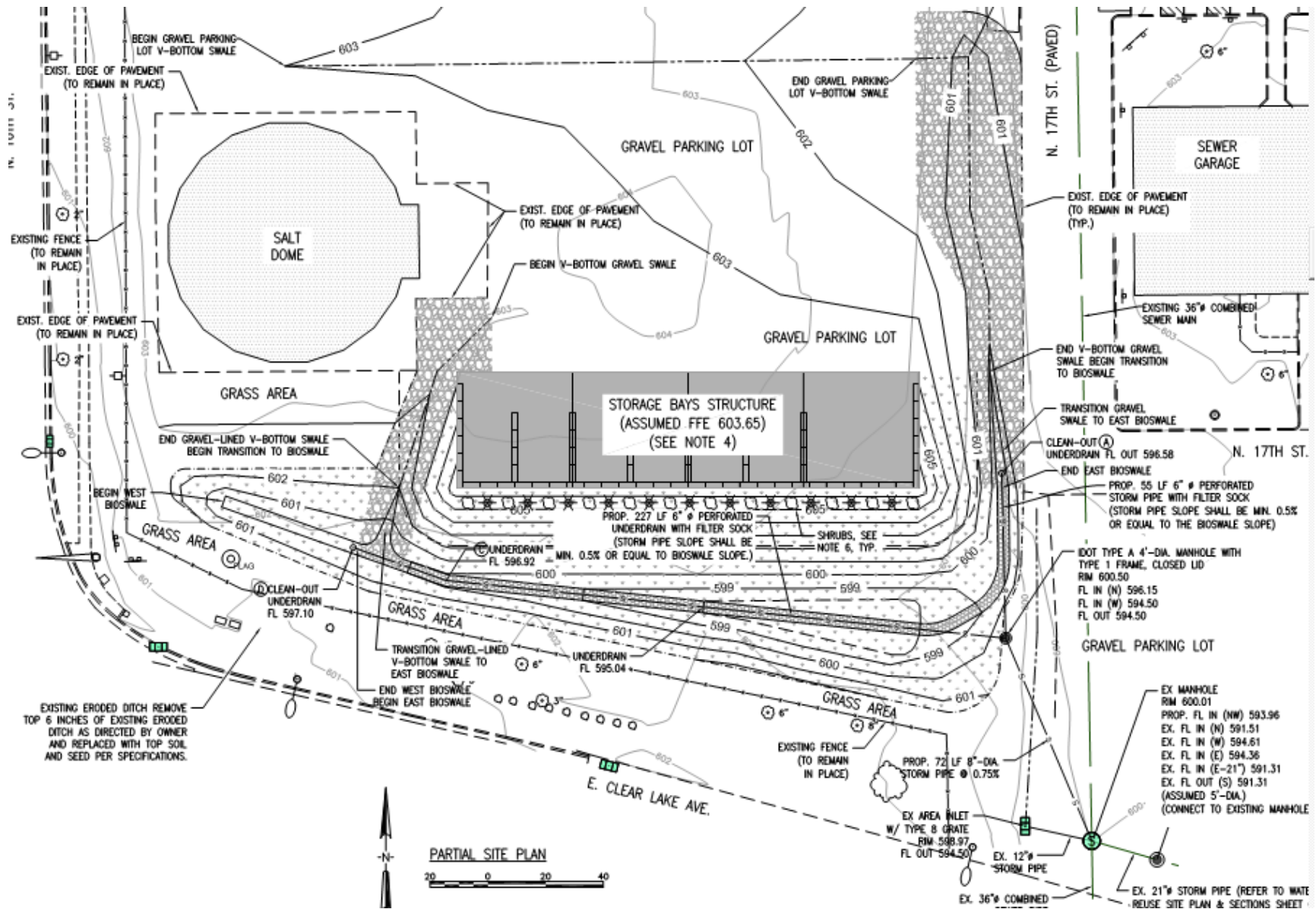
- The Iowa Stormwater Management Manual was used when designing the bioswale.
 - 4:1 max side slopes will allow for maintenance and mowing.
 - The underdrain pipe and drainage medium will be encapsulated in geotextile to prevent clogging.
 - The engineered soil ratios were field tested by the contractor and confirmed by the engineer before the final matrix was mixed and installed.
 - The resulting basin tapers from west to east and has a volume of 5,575 cubic feet and can capture up to 0.91" of a rain event.
 - Greater rain events are bypassed to the combined sewer inlet east of the basin.

West Construction:



Bioswale Typical Cross Section

- **Bioswale Layers:**
- **Salt Tolerant Grass, IDOT Mix 7**
- **Rip-Rap Pilot Channel**
- **Engineered Soil**
- **Sand Underdrain with 6" Perforated Underdrain Pipe**



West Site Preconstruction:



West site looking west prior to construction.

West site looking east prior to construction.



West Construction:



Looking west at the start of grading.

No surprises were found while excavating. Since the area used to be residential there was the potential for house foundations.



West Construction:



Looking west at the finished bioswale prior to seed germination.

Looking east. The drop down pilot channel from the west side of the site is visible to the left.



Finished Bioswale:



Photo taken
after a 0.81
inch rain
event

Nov. 17,
2015.

Project Need East Site:



- Intercept storm runoff.
- Provide storage.
- Maintain site usefulness.
- Keep the footprint as small as possible.
- Convenient truck filling location.



Project Need East Site:

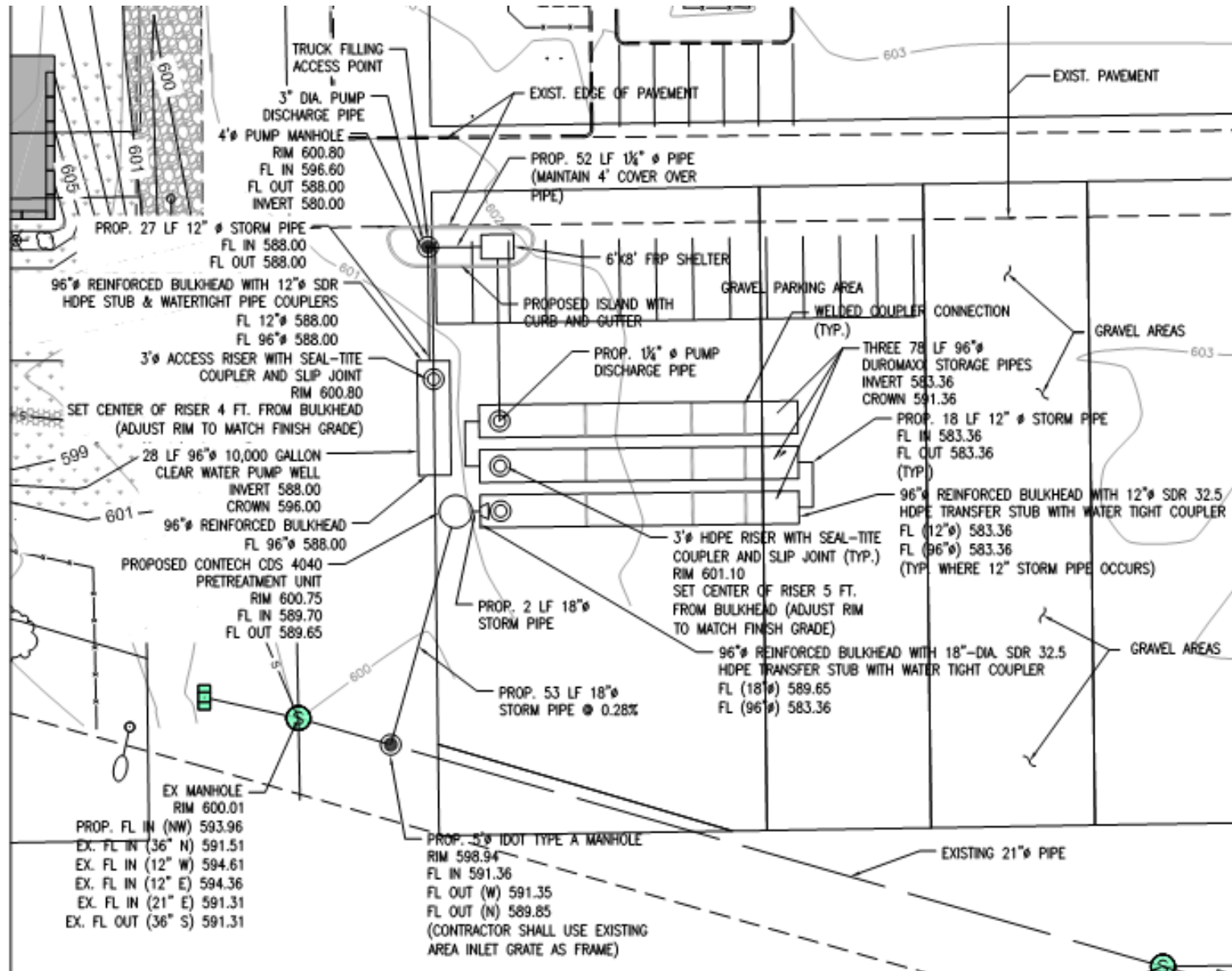
- As Hanson reviewed the site, the following base design criteria was used for the east project:
 - The east project would harvest rainwater for reuse.
 - Water use by the City's sewer jetting and planter watering totals 1.4 million gallons per year at the sewer garage facility or roughly 117,000 gallons per month.
 - The water reuse would need to filter to 10 microns to protect the pumps in the sewer jetting trucks.
 - Disinfection would be required per Department of Public Health requirements for plant watering.



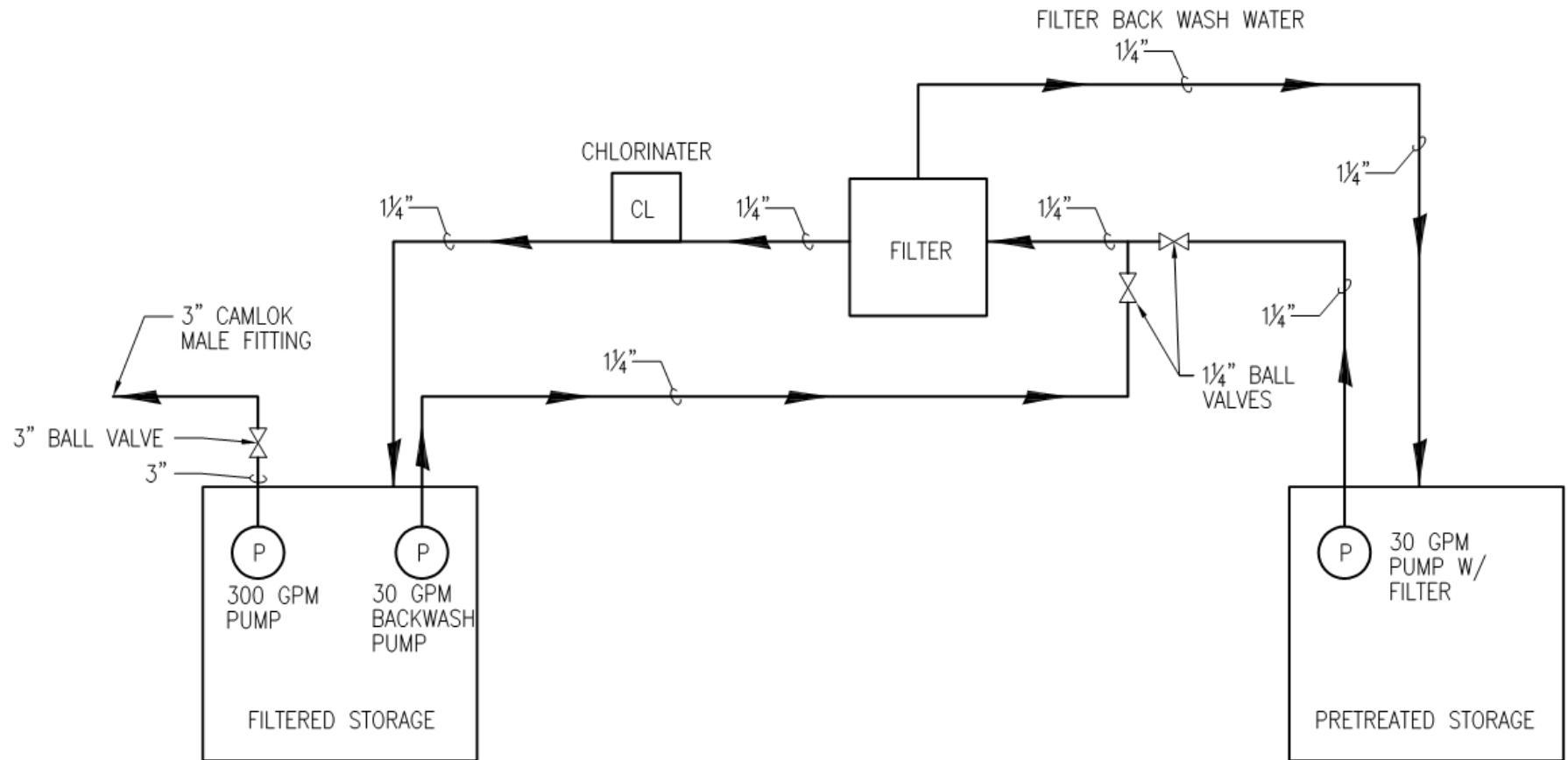
Project Need East Site:

- A rainwater harvesting runoff calculator from Contech was utilized to optimize rainwater storage vs site stormwater runoff.
- The following parameters were entered into the calculator:
 - Drainage areas with runoff coefficients.
 - Project location.
 - Daily water demand.
- The calculator simulates runoff using 20 years of historical rainfall data for your specific location.
- The calculator confirmed we had enough site runoff to provide the 117,000 gallons per month and the optimized storage volume was calculated at 124,000 gallons.

East Construction:



East Construction:



1
C505

FILTER AND WATER SUPPLY FLOW CHART

NOT TO SCALE

East Site Preconstruction:



East Site Looking East.
Earth Stockpiled in the
Background.

East Site Looking Northeast.
Multiple stored materials.



East Site Construction:



Underground detention excavation.
Excavation dimensions 18'D, 66'W, 106'L

Installing the base course.
The hydrodynamic separator
is located to the right.



East Site Construction:

Installation of the 96" diameter Duramax pipe.
Three parallel storage pipes 78 feet in length.



The three pipe runs were plumbed in a serpentine fashion to allow for added stormwater clarification

East Site Construction:

Sand filter and chlorinator being installed within the insulated and heated control building.



Controls to operate the pumps are simple toggle switches. Float switches provide pump protection.

The control building and truck filling connection were incorporated into a concrete island.



East Site Construction:

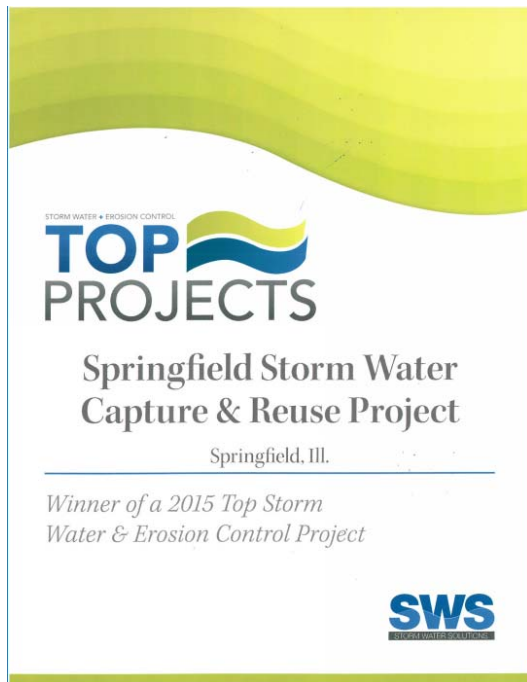
Since the east site is used for raw material storage, the finished project looks like it did before construction with the exception of the island, fill pipe and access hatches.

Sewer jetting trucks pull up parallel to the fill station, hook up their cam-lock hoses and flip the fill switch.



Project Award:

Stormwater Solutions Magazine recognized the City of Springfield's Storm Water Capture and Reuse Project as a 2015 Top Project.



Design and Construction Challenges:

- The project had several design challenges that needed to be addressed during and after construction.
- The bioswale took an exceptionally long time to fill in with grass. The filter medium was placed loose and seeded so as not to over-compact it. There was plenty of moisture, but the seed did not spread quickly.
- Spring rains submerged the basin on multiple occasions with the water draining within a day of the initial filling. With the grass not established, there was some initial erosion along the edges of the pilot channel that needed to be filled this spring.



Design and Construction Challenges:

- During construction, it was observed that there was a potential for the combined sewer to surcharge far enough during large rain events that it could backflow into the rainwater collection system.
- Solutions were researched and it was decided that a check valve upstream of the tie in to the combined sewer would prevent any backups.
- A checkmate check valve from Tideflex was selected for its simplicity and that it didn't need a new structure for installation.



Location of the check valve

Design and Construction Challenges:

- The storm sewer wasn't done with surprises though.
- As the Contractor was tapping into the line to install the bypass manhole, it was discovered that concrete trucks has been washing out their trucks into the east end of the storm sewer and the resulting storm sewer, while still functioning, was over half full of concrete washout.
- The City utilized their vacator trucks and has cleaned a large portion of the washout from the line.





Design and Construction Challenges:

- We experienced another “lessons learned” when using the reuse water.
- The City’s vector trucks have aluminum water tanks for their jetting water. The tanks have a small filter plate to protect the pumps from debris and grit.
- Upon using the reuse water for the first time, the City personnel complained that there was a white “oatmeal” type floc that was plugging the filters and starving the pumps.
- We examined the day tanks and sampled the water. It was clear and free of debris. Initially we thought there may have been a biofilm that had sloughed off when the tank was chlorinated. This was determined to be incorrect.

Design and Construction Challenges:

- Remembering the concrete washout, we obtained a sample bottle of the filtered water and added a piece of aluminum to it. It reacted immediately causing oxidation and pitting in the bar.
- Subsequent water tests showed the water had a pH of 11.4.
- The pH of the water is raised as it flows through the old concrete washout the City hasn't been able to get out of the storm sewer. The pH has slowly been lowering with subsequent flushing to a point where it will not be reactive to the aluminum tanks.



QUESTIONS

For more information, please contact

Lee Bloome, P.E.,
at Hanson Professional Services Inc.
(217) 788-2450
or at lbloome@hanson-inc.com

