

## 6<sup>th</sup> Street Detention Project Description

This project is located in the City of Wood River, Madison County, Illinois approximately 15 miles northeast of downtown St. Louis. 6<sup>th</sup> Street detention pond is an existing detention pond located between N 6<sup>th</sup> Street and N 9<sup>th</sup> Street and south of W Woodland Drive that has a current capacity of 528,700 cubic yards of storage. The proposed 9<sup>th</sup> Street detention pond will be located east of North 9<sup>th</sup> Street and south of W Woodland Drive (See Project Location Exhibit). The project area is located on Flood Insurance Rate Map (FIRM) Community Panel Numbers 170451 005 B and 170440 0005 B. On the FIRMs the project is located in a Special Flood Hazard Area (SFHA) in Zone AH. Zone AH is an area of 100-year shallow flooding where depths are between one and three feet (See exhibit 01- Effective FIRMs for Flood maps). In order to remove homes from this flood designation, the City has submitted the required information under a process known as MT-2 Revisions and a Certified Letter of Map Revision (CLOMR). The storm water from the project area currently drains to the facility known as the 6th Street Detention Pond. The pond is then pumped using a pump station and effluent force main, which were constructed in phases from the late 1970's through mid-1980's. This existing force main discharges into the East Fork Wood River located approximately 2 miles north of the pond.

Currently, the 6<sup>th</sup> Street Detention Pond is inadequately sized to remove these homes from the floodplain and reduce the potential for damage due to flooding. The detention pond is an extended wet detention pond with a pump that has a capacity of 26 cfs that removes the water from the detention pond and conveys it via force main to the East Fork Wood River when it rises above the wet bottom elevation during storm events. The East Fork Wood River meets the West Fork Wood River and turns into the Wood River that dumps into the Mississippi River. The 26 cfs pump was constructed in 1980 with the 6th street detention pond and is nearing the end of its design service life.

Properties in the Eastwood Subdivision and Lincoln Addition neighborhoods in Wood River, Illinois are currently within the regulatory floodplain and are required to purchase flood insurance. When the available storage is exceeded, water surface elevations rise above the top of the pond and flood the surrounding low-lying areas. Additional flood protection measures including upgrading the existing 6th Street Pond pump station, expansion of the 6th Street Pond storage volume, and construction of a new detention pond east of 9th Street that is connected to the existing pond, will provide adequate protection to lower Base Flood Elevations (BFE) to remove the properties from the floodplain.

Due to the City's desire to reduce flooding, these map revisions and the requirements by FEMA the City has engaged Gonzalez Companies, LLC to provide professional services in order

to complete the required tasks to obtain the CLOMR, as-built LOMR, preparation of construction plans and bidding documents for the desired improvements, as well as permitting and loan application assistance.

The details of the proposed improvement were largely dependent on the hydraulic analysis and required detention volume determined by said analysis. The proposed details of the improvement include dredging of all sediment from the existing 6th Street Detention Pond to its original designed elevations, expanding this detention area to its available limits of the property in the southwest, and upgrading the current pump from 26 cfs to 55 cfs. In addition to the expanded 6th Street Detention Pond construction of a new detention area (9th Street Detention Pond), connecting culvert, and all other miscellaneous improvements will complete the improvements. See design alternatives considered in the application sections to follow.

The expanded 6<sup>th</sup> Street Detention Pond will have an approximate storage volume of 365 Acre-Ft. (599,950 Cubic Yards) and the 9th Street Detention Ponds volume is anticipated to be 240 Acre-Ft (418,700 Cubic Yards). The ponds are anticipated to be constructed using 1V:3H earthen side slopes and will be protected from unauthorized entry by using various safety methods deemed appropriate during design. The connecting culvert will be a 42" diameter concrete pipe with sufficient capacity to function similarly to the new 55 cfs pump, this will allow the two detention ponds to act as one pond.

Gonzalez used hydrologic and hydraulic methodologies to size the detention ponds. The hydrologic methods used were from Illinois State Water Survey (ISWS) Bulletins 70 and 75 to perform storm analysis for the 1% annual chance flood, referred to as the 100-year return interval. These methods supersede the Soil Conservation Service (SCS) Type III hydrograph and ISWS Technical Letter 13 approach that were originally used in the Flood Insurance Study (FIS) (See exhibit 13 – 1978 Effective FIS for the Flood Insurance Study). ISWS methods use Illinois-specific unit hydrographs based on drainage area size and rainfall depths based on geographic location in the state. Drainage area runoff Curve Numbers (CN) and times of concentration were calculated using United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS) methods from TR-55 (See exhibits 04 and 05 for WinTR-20 calculations). Antecedent Moisture Condition (AMC) III was used to be consistent with the AMC used in the FIS. The sectional rainfall data from Bulletin 75 was not adjusted for "The St. Louis Anomaly" discussed in Bulletin 70 because Bulletin 75 used more detailed data collection that eliminated the need to account for this anomaly in Madison County. Hydrologic calculations were performed using the NRCS WinTR-20 computer software. The design evaluated BFE using a critical storm duration analysis to determine which storm duration results in the highest water surface elevations. Storm durations used varied between five minutes to 10 days per Bulletins 70 and 75.

Two types of hydraulic calculations were performed. The existing and proposed detention ponds were modeled using WinTR-20 to route the storm hydrographs through the

ponds' stage-storage-discharge rating curves to determine the maximum stage in the pond for each storm duration. The USACE River Analysis System (HEC-RAS) computer software was used to perform one-dimensional (1D) backwater analysis of the manmade channel west of the pond and Tributaries 1, E, F, and G east of the pond. Win TR-20 was also used to calculate the peak flows for each tributary that drains to the detention pond. The peak flow for the 100-year 2-hour storm was found to be 1610.4 cfs. The results from the WinTR-20 shows that the peak water surface elevation will be reduced from 438.99 to 434.98 feet.

Channel and overbank roughness coefficients for Tributaries 1, E, F, and G in HEC-RAS were set to match the maximum values used in the FIS. The channel roughness coefficient was set to be 0.04 and the overbank roughness coefficients were set to be 0.08 (See exhibits 06-10 for HEC-RAS calculations).

Time of concentration was also calculated for each tributary draining to the detention ponds. The Technical Release 55 (TR-55) method was used to calculate sheet flow, shallow concentrated flow, and channel flow. The total time of concentration is the combination of these three calculations. Time of concentration for the tributaries ranges from 0.84 hours in Upper Tributary F to 2.32 hours in Tributary 1 and the 6th Street Detention Pond Tributary.

The maximum pond stage elevation used to design the detention pond sizes was 436 feet for a 100-year storm. With these restraints a few options were explored to find the total storage volume required. The chosen option for this project is for a new 55 cfs capacity pump to be installed at the 6th street pond to obtain an approximate storage volume of 976,000 cubic yards. The existing detention pond has a wet bottom from elevations 407 to 414 which can be pumped at higher elevations. The first place to expand storage is to maximize the size of the existing detention pond on the City's property. The maximum storage volume for the 6th street pond is approximately 599,950 cubic yards. The city also purchased a property to the east of 9th street to create a secondary detention pond with a culvert connecting them so they would act as a singular detention pond. This detention pond, the "9th Street Pond" is designed to hold 418,700 cubic yards with elevations up to 436 feet. With the new 55 cfs pump, the detention ponds will be able return to the 414 wet bottom elevation after 187 hours.

Once the project goes to construction it will be broken down into 3 phases. The three phases will be expansion of the 6th Street Detention Pond, construction of the 9th Street Detention Pond, and upgrades to the existing pump station.

For phase one of the project the existing 6th Street detention pond will be excavated to its original design volume as constructed in 1980 with a retention area to store water below the pump elevation. The 6th Street Detention pond will also be expanded in the southwest quadrant to maximize storage volume on the existing property. The detention pond will maintain its 1V:3H side slopes around the entire pond.

For the second phase of the project the existing field on the east side of 9th Street will be excavated to create a second detention pond. This detention pond will not have any retention areas and will slope towards the northwest corner. In the northeast corner a culvert will be constructed under 9th Street to connect the two ponds. The culvert will cause the detention ponds to function as one feature with the culvert having a similar capacity of 55 cfs to the pump station that will be upgraded in phase 3. The 9th Street Detention Pond will also have 1V:3H side slopes. Once construction of both ponds is completed, all disturbed areas will be seeded.

The third and final phase of this project is to construct a new pump station with a capacity of 55 cfs. This new pump station will be constructed in replacement of the existing pump station that has a capacity of 26 cfs in the northwest corner of the existing 9th Street detention pond.