



Highland Park Dam Mitigation Project

FINAL REPORT

CITY OF TOLEDO in LUCAS COUNTY, OHIO

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Prepared For:

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Patekka Bannister	City of Toledo (Environmental Services)
Cherie Blair	Ohio EPA
Regina Collins	City of Toledo (Environmental Services)
Steve Day	City of Toledo (Engineering Services)
David Derrick	US Army Corps of Engineers
Dennis Garvin	City of Toledo (Forestry)
Jeff Grabarkiewicz	Lucas Soil and Water Conservation District
Matt Horvat*	Toledo Metropolitan Area Council of Governments
Patrick Lawrence	The University of Toledo
Kristina Patterson	Partners for Clean Streams
Scott Sibley	City of Toledo (Engineering Services)

**Team Leader*

Thank you to the Toledo ZooTeens for assisting in the harvesting of vegetation necessary to stabilize the streambanks and keys of this project. To The Nature Conservancy and the Toledo Area Metroparks for allowing us to harvest materials from their property.

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Thank you to those who provided photos and illustrations for this report, including Cherie Blair, Dave Derrick, Scott Dierks, Jeff Grabarkiewicz, Matt Horvat, Katie McKibben, Patrick Lawrence, Kristina Patterson, and Scott High School.

Special thanks to those who helped during construction to cooperatively and quickly address on-site issues including: Chuck Campbell, Irene Neal, and Frank Mortali.

Highland Park Dam Mitigation Project
Final Report

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1.0 EXECUTIVE SUMMARY

The Highland Park Dam Mitigation Project was commissioned to mitigate the low-head dam on Swan Creek near the South Avenue Bridge, at Highland Park in Toledo, Ohio. The project was funded through a Joyce Foundation Grant to the Partners for Clean Streams (PCS). The project was bid as a design-build contract in August 2007. Construction was completed a year later in August 2008. Although the final design evolved throughout the design and construction process, the overarching goal to improve fish passage over the dam without removing the dam was accomplished.

Highland Park Dam looking upstream before construction.

The objectives of the project, as stated in the Request for Proposals, are outlined below:

A) Restore floodplain function
B) Mitigate the negative effects of a low head dam for aquatic species and public safety
C) Provide an example of how a low head dam can be mitigated onsite without removal
D) Provide a learning experience for officials, dam owners, consultants, academia, etc.
E) Provide safe public access to the creek
F) Improve the aquatic health and water quality

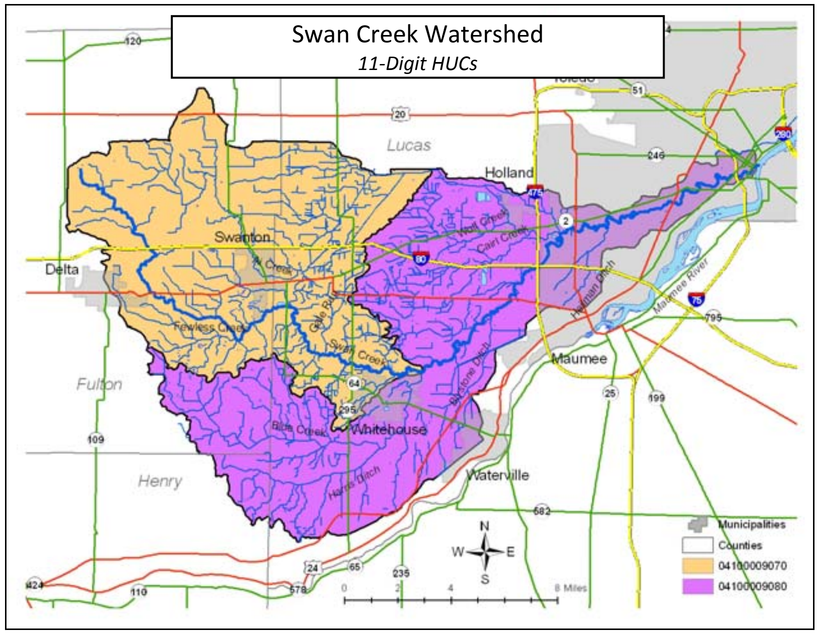
Except for restoring floodplain function, these objectives were met. Due to cost prohibitive and complicated factors, floodplain function was not restored however, two small native plant demonstration areas were established on the west bank of the creek. In-stream construction of the Highland Park Dam Mitigation Project began on August 19, 2008 and was completed on August 28, 2008. Two engineered rock riffles (ERR) were built just downstream of the low-head dam to create "steps" and allow fish passage over the dam during low flow. Approximately 1,900 tons of large stone (18"-30" average diameter) and 600 tons of smaller choke stone (3"-4" average diameter) were used to construct the ERR.

Local plant materials were harvested with the assistance of the Toledo ZooTeens. On August 12-13, 2008, locally native species of willow and dogwood were harvested and then soaked to facilitate growth. The materials were installed throughout the course of construction along the streambank and along the keys for the engineered rock riffles.

An educational workshop was incorporated into this project so that it could serve as a learning tool/model for other areas in similar circumstances. The workshop was held August 25-27, 2008. The workshop included several presentations by team members (PCS, JFNew, US Army Corps of Engineers) as well as hands-on activities including live stake harvesting and planting, and native plant demonstration garden preparation and planting.

2.0 BACKGROUND

2.1 The Watershed



The Swan Creek Watershed is comprised of United States Geological Survey (USGS) Hydrologic Units 04100009 070 and 04100009 080. The drainage area of Swan Creek is 203.9 square miles. Its headwaters rise in Henry, Fulton, and western Lucas counties. Over 200 miles of creeks and ditches drain this watershed. Swan Creek itself is only about 40 miles long. Swan Creek's shallow gradient is similar to the Maumee River with a drop of 2.1 feet per mile (0.04% gradient). The majority of the Swan Creek watershed is located within the Maumee Area of Concern (AOC). The major streams that feed Swan Creek are Ai Creek, Blue Creek, Wolf Creek, and Blystone Ditch.

The Swan Creek watershed can be divided into three major reaches, or parts, based on the dominant stream characteristics within each reach. In the upstream reach from river mile 19 in Monclova Township to the headwaters, or source, the channel is stable, banks are low (15 to 25 feet) with indistinct valleys and floodplains, and the primary land use is agriculture. The middle reach is the area that lies between river miles 19 and 6. Here the creek is actively eroding its channel. The banks are high (35 to 45 feet or more) and unstable and are intermixed with detached floodplains. The major problems in the middle reach are from urbanization, with floodplain filling and destruction of wetland areas.

The Highland Park project site is located in the lower reach of Swan Creek. The lower reach, from river mile 6 (CSX Railroad Bridge) to the mouth in downtown Toledo, is actively silting in its channel. The banks are as high as 35 to 45 feet and are intermixed with floodplain areas. This lower reach is under the seiche effect from the Maumee River and Lake Erie. The level of Lake Erie prevents the lower reach from naturally deepening itself.

The major problem in the lower reach of Swan Creek is extremely poor water quality, due to storm runoff, hydromodification and urban development. This lower reach is neither swimmable nor fishable according to public health standards. Contributing to the pollution are the combined sewer overflows, industrial discharges, storm sewer contamination, and urban storm water runoff which carries fertilizers from lawns and street debris. All of this can and does reach the creek, degrading water quality.

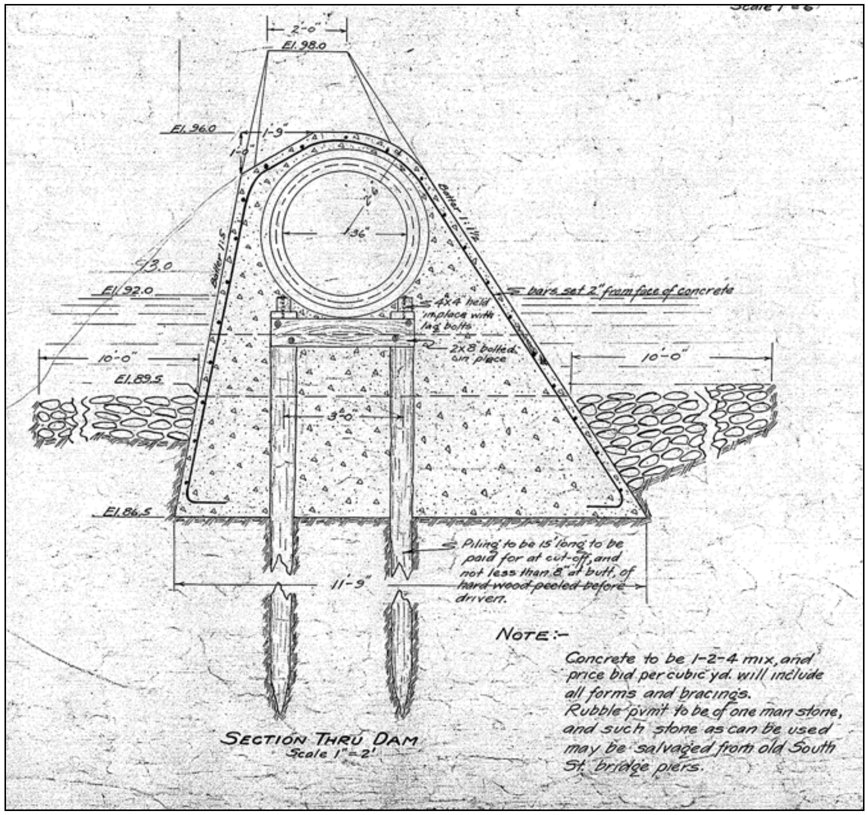
In 2006, Ohio EPA conducted a Total Maximum Daily Load (TMDL) study of the Swan Creek watershed. Samples were collected upstream and downstream of the Highland Park Dam. Data included water chemistry, sediment quality, fish communities and macroinvertebrate communities, as well as riparian habitat quality. The results of this study provide a baseline indication of the health of the stream and the restrictions to fisheries.

Highland Park in Toledo, Ohio and low head dam location

2.2 The Dam

The Highland Park Dam is located on Swan Creek at river mile 4.4, just north (downstream) of the South Avenue Bridge. The low-head dam encases a 36” sewer main. The dam was constructed in circa 1926 specifically for the sewer crossing. Mitigating the impacts of the dam had to be done without removing the dam. A cross-section of the dam and pipe are shown Error! Reference source not found. below. The dam is also believed to be protecting the 3-lane roadway bridge immediately upstream.

Water flowing over the dam created a scour hole immediately downstream of the dam. The combination of the dam height and the scour hole created a barrier to fish passage with a 3 to 4 feet drop in water surface during low stream flow conditions.



Cross-section of original construction plans for Highland Park Dam. (Courtesy of the City of Toledo)

The Highland Park Dam is the furthest downstream dam on the main stem of Swan Creek. It is located within a highly utilized City of Toledo park surrounded by a high density residential area. The successful implementation of the Highland Park Dam Mitigation Project was to restore flow integrity to approximately the lower 11 miles of the main channel.

The Project

The Highland Park Dam Mitigation Project is located in the City of Toledo's Highland Park between the South Avenue bridge and Champion Street bridge, Toledo, Lucas County, Ohio (*Drawing 1 in Attachment A*). The project site is the Highland Park Dam on Swan Creek, a perennial tributary to the Maumee River. Specifically, it is located in Sections 9 and 10 of Township 3 and Range 7 East, of the second principal meridian, on the Toledo (OH, MI) USGS quadrangle.

This project was to effectively eliminate the dam barrier to fish passage and minimizing the safety hazard to fisherman and curious park guests, while improving aquatic and riparian habitat and restoring natural stream function without removing the dam structure. It was also to serve as a demonstration/learning project for others that want to remove low-head dams, but have infrastructure concerns.

The mitigation of the dam involved constructing two large in-stream riffle structures, termed Engineered Rocked Riffles, (ERR), using local quarried stone materials, to ease the elevation change downstream of the dam. The ERR were keyed into the banks using vegetated stone keyways so the structures would not be flanked during high energy events. The ERR were constructed with integrated meandering fish bypass low flow channels. The project also incorporated public access areas so that residents can fish or simply enjoy the stream in a more natural setting; hopefully fostering more concern and care for the natural environment.


Highland Park Dam before construction.

The project evolved during the entire design and construction process. The request for proposals and conceptual design had originally included floodplain re-connection/restoration. The adjacent floodplain was about 2 acres and is already occasionally flooded (several times a year).

A good rule of thumb for any detention facility to have any real hope of mitigating flood impacts or improve water quality is it has to be sized so that it is at least a couple percent of the total contributing area (Wu, et.al., 1996). With approximately 125,000 acres of contributing watershed, there is no cost-effective way that 2 acres (or 0.001% of the watershed area) will have a real impact on either water quantity or quality for Swan Creek. Any significant floodplain enhancements for water quantity or quality control were left out due to budget and time constraints.

2.3 The Team

The Chicago-based Joyce Foundation awarded $5 million in grants to four national and local organizations in a quest to aid the recovery of the 8,316 square mile Maumee watershed, the largest river system in the Great Lakes region. Partners for Clean Streams was proud to be one of the organizations funded through The Joyce Foundation's *Great River – Great Lakes Initiative*.

The Partners for Clean Streams (PCS) was created to assist the Maumee RAP by providing broader funding and project implementation opportunities. Although a new entity was created, the partners, RAP process, and goals for restoration of the Maumee AOC did not change. Together, PCS and the new Maumee RAP Advisory Committee stand as an independent organization to deliver a wide range of programs, projects, and community outreach efforts associated with water quality improvements that have been of long-standing interest to the Maumee RAP community.

Partners for Clean Streams, Inc. is a 501(c)3 non-profit community organization with an interest in supporting local and regional water quality improvements in the metro-Toledo area. They are striving for abundant open space and a high quality natural environment; adequate floodwater storage capacities and flourishing wildlife; stakeholders who take local ownership in their resources; and rivers, streams, and lakes that are clean, clear and safe.

The Highland Park Dam Mitigation Project is one of three projects that are being conducted by PCS through a grant received from The Joyce Foundation. To carry out this project a team of partners, or Project Management Team (PMT), was assembled consisting of representatives from the U.S. Army Corps of Engineers, Ohio EPA, Ohio DNR, City of Toledo, Lucas County, Lucas SWCD, University of Toledo, Toledo Metropolitan Area Council of Governments (TMACOG), and Maumee RAP Advisory Committee. The individual team members are recognized in the Acknowledgements of this report.

The request for proposals for the design-build contract of Highland Park Dam Mitigation Project was released in the end of July 2007. JFNew won the design-build contract for a total amount of $200,000. The JFNew team included engineers and ecologists from JFNew (Ann Arbor, MI), floodplain modeling specialists from TetraTech (Ann Arbor, MI), and landscape architects from Pollock Design Associates (Ann Arbor, MI). JFNew subcontracted with Ecological Restoration (Apollo, PA) for the construction portion of the project.

3.0 DESIGN

3.1 Data Collection and Site Surveys

The JFNew team collected available data from several sources for the Highland Park Dam Mitigation project. The data included site infrastructure details (bridge and dam drawings), topographic maps, soils data, stream and watershed data including the Swan Creek FEMA HEC-2 model and Lucas County flood insurance study (FIS), climatologic data, and digital GIS layers. We also downloaded the historic flow record from the Maumee River USGS gage (station 04193500) at Waterville to compare with flow estimates of Swan Creek.

JFNew conducting an on-site survey during the fall of 2007.

JFNew performed an in-stream cross-section and longitudinal profile survey of about 2,400 feet of Swan Creek in November 2007. The surveyed reach was between the South Avenue Bridge and the Champion Street Bridge. The first cross-section was taken on the upstream side of the South Avenue Bridge (about 50 feet upstream of the dam), and the last cross-section was taken just upstream of the Champion Street Bridge. Cross-sections were spaced approximately 100 to 200 feet apart, with closer spacing between cross-sections at the dam. Cross-sections were taken just upstream and downstream of each of the bridges (including the Highland Park footbridge).

We compiled dimensions of the bridges from field measurements and drawings obtained from the City of Toledo. Although in-stream work was not planned in the downstream portion of the surveyed reach, we included these cross-sections because the Lucas County Flood Insurance Study (FIS) indicates that the Champion Street Bridge plays a role in controlling flood elevations upstream. The survey cross-section locations are shown below.

Surveyed cross-section locations on Swan Creek at Highland Park.

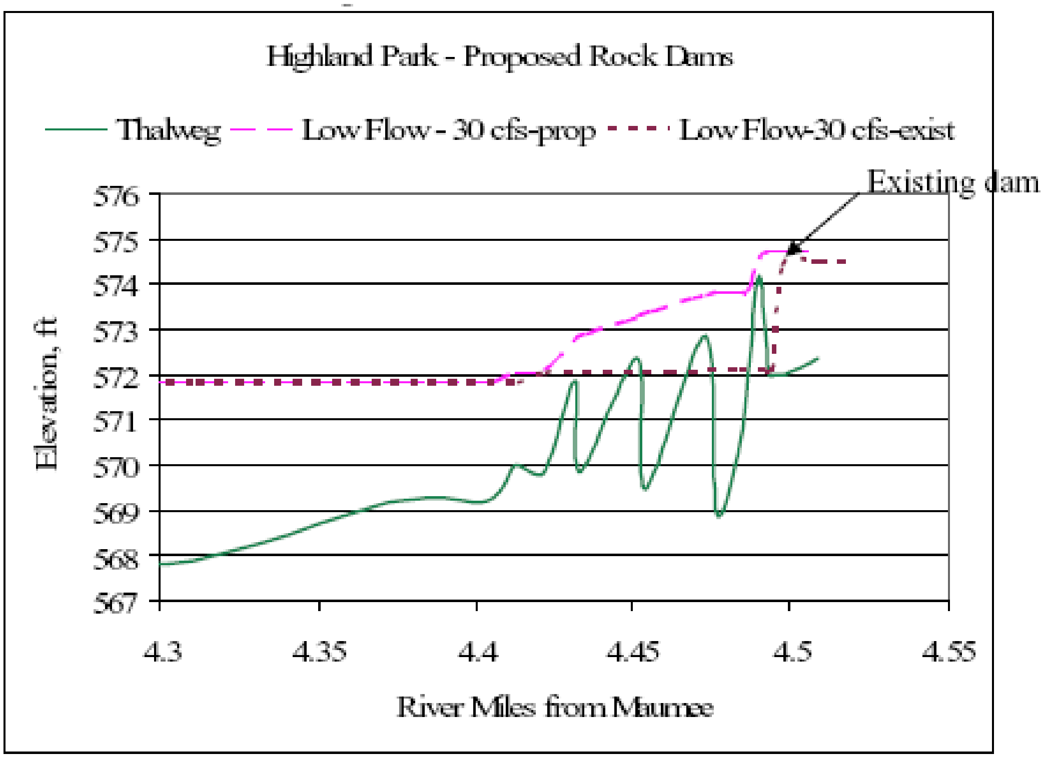
While on-site for the stream survey, JFNew used a velocity meter to measure velocities and flows. We also surveyed site infrastructure including concrete retaining walls and incoming pipes. We looked for high water indicators, such as debris lines, upper limits of bank erosion, changes in bank vegetation, algae lines, water marks on structures, etc. These high water indicators typically identify the ordinary high water (OHW) mark and can be indicative of bankfull flow event. We collected this data as confirmatory evidence of the flow estimation as part of the hydrologic analysis. Lastly, the stream bed material size was also characterized.

A wetland delineation was performed by JFNew on April 4, 2008. One wetland area (approximately 0.2 acres) was found on the west streambank, just upstream of the Highland Park footbridge. This area was partially inundated during the delineation and met all three wetland criteria: vegetation, hydrology and hydric soils. The wetland is dominated by sedge

(*Carex spp*., most FAC, FAC+ or wetter), sycamore (*Platanus occidentalis*, FACW-), and moneywort (*Lysimachia nummularia*, OBL). Positive wetland hydrology was indicated by drainage patterns and soil pit hydrology at 14 inches below the soil surface. The soils displayed a matrix color of 10 YR 4/1 to 14 inches and 10 YR 4/1 with 10 YR 4/4 redoximorphic concentrations to 18 inches with sandy clay and sandy loam textures, respectively. The wetland is likely to be considered jurisdictional by the Corps due to its connection with Swan Creek. See *Wetland Delineation Report in Appendix B* for more details**.**

3.2 Hydraulic and Hydrologic Modeling

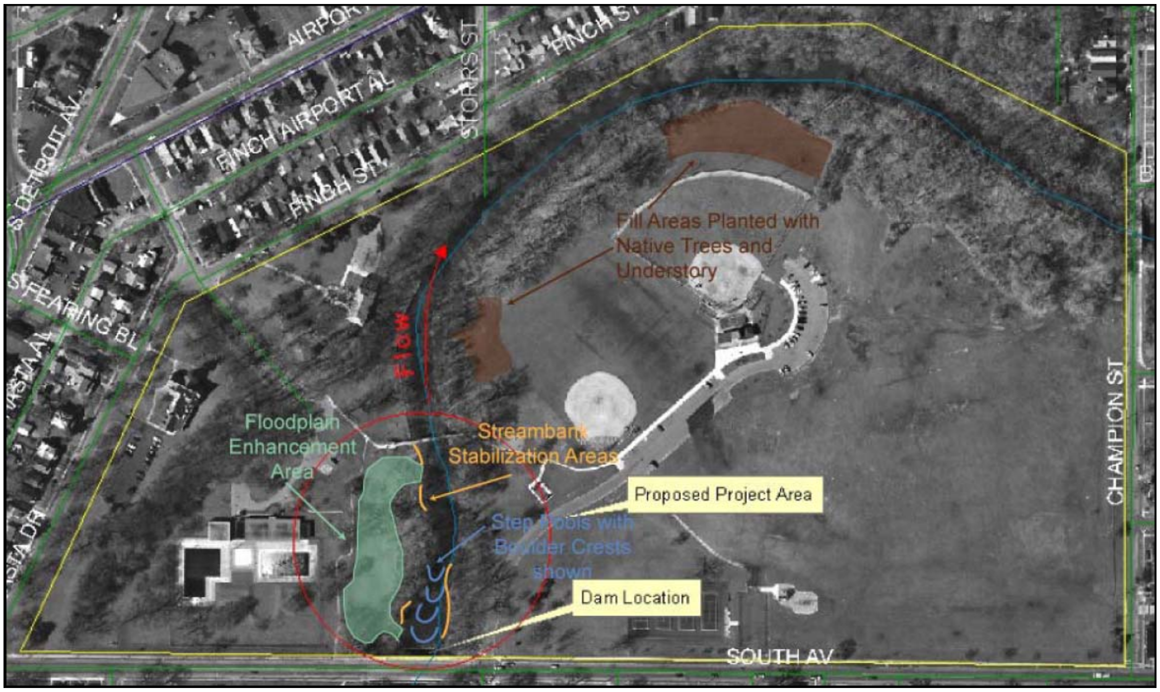
A rigorous hydrologic and hydraulic model evaluation was completed for the study reach of Swan Creek as a part of the Highland Park Dam Mitigation project. The existing HEC-2 model (1972) was obtained from FEMA. Because it arrived in print format only, it had to be re-entered into the HEC-2 program. The surveyed cross-sections were then incorporated into the existing model. Flow data collected during the stream survey work was used to calibrate the existing conditions model to low flow conditions. An early version of the proposed design (4 rock ramp structures) was used in the proposed conditions model. The proposed structures resulted in no significant changes in the flood elevations. See the *Hydraulic Modeling Report in Appendix C* for more details.



3.3 Design Alternatives

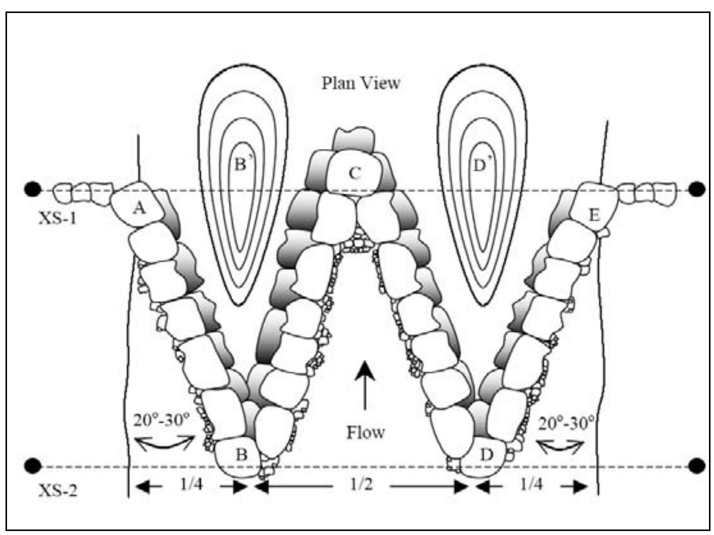
The initial concept of this project envisioned construction of a series of irregularly shaped step-pool drop structures starting from the dam and extending several hundred feet downstream to help ease the drop over the dam. Each step-pool would provide a drop of six to nine inches.

Boulders would be placed in a curving alignment with pools two to three feet deep created between each boulder crest. The pools afford fish some refuge as they moved up the steps. These structures would be sized to withstand the 100-year flood event. However, it was felt these would be expensive to build and might not provide deep enough flow over each step to facilitate fish passage.



Initial conceptual design with step pool drop structures.

As we moved into the design process, we next considered the use of W-weirs. A W-weir is one of a suite of stream restoration structures employed in the natural channel design school of stream restoration. The design of the W-weir (W as looking in the downstream direction) was initially developed to resemble bedrock control channels on larger rivers. The objectives of the structures were to provide grade control, enhance fish habitat, and stabilize stream banks. When examined closely, the structures appear "ramp-like" and are designed to dissipate stream energy as the stream moves up the slope as it flows downstream. W-weir design focuses the majority of low flow over a small portion of the ramp,



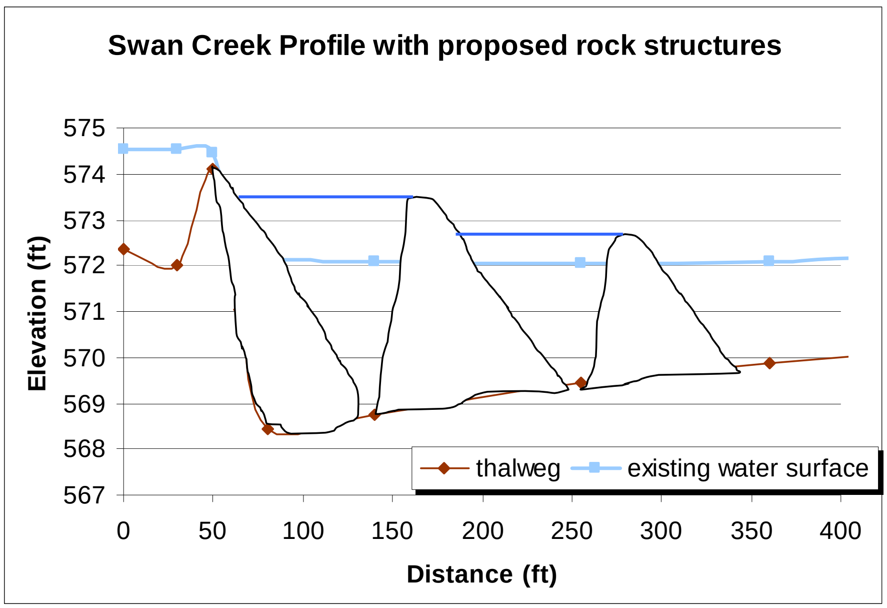
W-weir Plan View (Rosgen, 1996)

compensating for the potential passage problems identified with the step-pool design.

The use of W-weirs for the Highland Park Dam Mitigation project was rejected for several reasons. These included: 1) W-weirs are designed to dissipate energy with a ramp up, which creates an overall larger head drop; 2) W-weirs are not designed to be used in series. A series of W-weirs would be very complicated and time consuming to construct and would be spread over a long stream reach (minimum 200 ft) in order to provide several small elevation drops for fish passage; and 3) Complicated construction with tight slope and angle tolerances.

3.4 Selected Alternative

After the W-weir design was rejected, we investigated the use of a series of engineered rock riffles or rock ramp (ERR) structures. When compared to the W-weirs, the ERR are easier to use in series, much less complicated to construct, and provide fish passage even for species without leaping ability. Initially a series of four rock ramp structures were planned to step down the approximately 18” drop in water surface elevation at low flows. The four structures would extend downstream from the dam to just upstream of the footbridge, necessitating removal of parts of the existing retaining wall to key in the ramps. Because the cost for the amount of rock needed for four structures would take most of the construction budget, the design was changed to three rock ramp structures, each with a 6” -7” drop in water surface elevation.



The ERR structures were designed following the Rock Ramp Design Guidelines (Mooney et. al., 2007) published by the U.S. Department of the Interior’s Bureau of Reclamation. The guidelines include several equations used to design the ramps and to size the stone, the stone filter layer, and the low flow channel. Multiple sizing criteria from the manual were used to create a somewhat redundant, but fairly robust design methodology. The stone sizing calculations are based on the 100-year event flow (9,000 cfs), while the low-flow meandering channel sizing is based on a low flow of 40 cfs. The low-flow channel calculations incorporate interstitial flow, depth-based roughness, and velocity to ensure that flow conditions are suitable for fish passage. The rock ramp design will be stable up to the 100-year flood event, and will have sufficient flow in the low flow channel to allow passage of fish with body length greater than 4 inches.

The design process also included consultation with Dave Derrick, a research hydraulic engineer with the U.S Army Corps of Engineers' Coastal and Hydraulics Laboratory in Vicksburg, Mississippi. To ensure that the rock structures would not adversely affect flood elevations, the preliminary design was modeled using HEC-2.

The ERR were designed to have a D_{50} (median size) of 24-inches and with an underlying stone filter with a D_{50} of 2.5 inches. The rock ramps were designed to be keyed into the banks and into the streambed to provide stability during high flows. Each rock ramp was designed to drop the pool water surface elevation by 0.5 feet. The low flow sinuous notch channel was designed to be 0.75 feet deep and 10 to 20 feet wide (notch top width is different for each rock ramp), with one channel on each ramp. These low flow notches are designed to allow warm-water fish with a body length of 4 inches or more to pass during low flow (approximately 40 cubic feet per second).

3.5 Permits

JFNew prepared all necessary permit applications, including a design basis and a plan set sufficient for permitting and construction. The following permits were obtained: U.S. Army Corps of Engineers Nationwide Permit 27 and the City of Toledo Floodplain Hazard Development permit (see *Appendix D* for submitted applications). Because the Ohio EPA has issued Clean Water Act Section 401 Certifications for Nationwide Permits, an individual 401 Water Quality Certification permit from Ohio EPA was not required.

Silt fences (black in foreground) were installed on land and silt curtains (yellow in background) in the water to control sediment leaving the construction site.

An Ohio EPA Storm Water Permit was not necessary because the total construction area to be disturbed was approximately 0.85 acres, less than the 1 acre threshold. Although a permit was not required, storm water controls were used on-site to reduce the amount of sediment that might reach the stream or that might move downstream during construction.

Silt curtains were installed downstream of the second structure.

4.0 CONSTRUCTION

The construction portion of the project was subcontracted through an invitation to bid process. JFNew sent out three bid invitations to local contractors in the Toledo area. Initially, only one bid was received. The quoted price of $210,000 was higher than the design-build portion of the project budget which as $200,000. Per Dave Derrick's (project consultant from USACE) suggestion, JFNew invited Ecological Restoration (based in Apollo, PA) to bid. Their bid came in at $155,000. Although this price was still higher than the original construction budget, it was significantly lower than the first bid. Ecological Restoration's qualifications also demonstrated a significant amount of experience with in-stream work; more than any of the other solicited firms. Ecological Restoration's bid was accepted.

4.1 Mussel Relocation

The first of several unplanned modifications to this project came when mussels were identified on-site. This required getting permission from the Ohio Department of Natural Resources (ODNR) and US Fish and Wildlife Service (US FWS) before any construction. Since there was not likely to be federally endangered species at this site, a notification of US FWS was all that was required. Permission from ODNR entailed hiring a state recognized malacologist (mussel expert) to conduct an official survey of the site, relocate any mussels found, and then two years later conduct a follow-up survivability survey of the relocated mussels.

Live mussels prepared for relocation.

Prior to an official survey being conducted, it was strongly believed that mussels were located at this site, therefore a suitable site for relocation needed to be determined. The best relocation site was determined to be another small dam located upstream of the Highland Park Dam on Swan Creek. Permission was obtained from the property owners with a contract allowing for relocation and future monitoring of the population.

Matt Horvat helped by tagging each mussel for monitoring purposes.

On August 10, 2008, Jeff Grabarkiewicz and Phil Mathias conducted survey and translocation activities at the Highland Park Dam site. A total of 69 live unionids were collected and relocated, with six species found live and an additional six species represented by shell only (12 total species). It should be noted that none of the species found were state or federally listed as threatened or endangered.

Species Relocated	Number Live	Min (mm)	Max (mm)
fatmucket (*Lampsilis siliquoidea*)	4	45.6	70.3
white heelsplitter (*Lasmigona c. complanata*)	46	38.9	105.3
fragile papershell (*Leptodea fragilis*)	2	47.7	78.3
pink heelsplitter (*Potamilus alatus*)	12	81.0	122.9
giant floater (*Pyganodon grandis*)	2	68.6	69.4
creeper (*Strophitus undulatus*)	3	53.6	61.9

The live mussels were identified, measured, and tagged with a unique tracking number. Shellfish tags were adhered to both valves using instant KRAZY glue gel. After allowing a short time for the glue to dry, tagged unionids were deposited in mesh bags and placed in Swan Creek until translocation. When survey and tagging activities were complete, all mussels were transported via an aerated cooler to the new site.

Unionids were hand placed at the relocation site using a view-bucket and wetsuit. Photos were taken to document the exact area of translocation and a reference measurement from the dam was recorded. These details will be necessary to evaluate survivorship and health of the relocated mussels with an exhaustive sampling survey that will be conducted approximately two years after relocation. All recovered individuals will be measured with a metric caliper to the nearest tenth of a millimeter. Recovery rates will then be calculated and an analysis of overall health will be assessed by comparing shell lengths at the time of translocation and the time of sampling. Positive growth is generally used as an indicator of health.

4.2 Harvesting

One cost saving effort utilized on this project was the local harvesting of plant materials. By harvesting locally native species we were able to save money on the purchase of plants, install more mature plants, and assist local conservation organizations in maintaining their properties.

Harvesting of live stakes from the Oak Openings Metropark.

The Nature Conservancy provided us access to the Kitty Todd Preserve to harvest plant materials from an area that was to be managed for prairie restoration. The management plan called for the removal of all woody growth and had been mowed about five years ago. The resulting growth in this wet prairie area lead to a relatively thick stand of red-osier dogwood (*Cornus sericia*), button-bush (*Cephalanthus occidentalis*), sandbar and heart-leaved willows (*Salix exigua,* and *S. eriocephala*), and eastern cottonwood (*Populus deltoides*). All plant materials that were harvested were used on the project. Some species (in this case eastern cottonwood) are typically not used as live stakes, but we decided to try them since it was available. The Kitty Todd Preserve site was used for harvesting live stakes with assistance from the Toledo ZooTeens on August 12, 2008 and by the workshop attendees on August 26, 2008.

Matt Horvat bundles live stakes with Toledo ZooTeen assistance.

The Toledo Area Metroparks allowed us to harvest along one of the improved trails in the Oak Openings Metropark with more Toledo ZooTeens volunteers on August 13, 2008. At this site several willows (*Salix discolor, S. exigua,* and *S. eriocephala*), dogwoods (*Cornus racemosa, C. amomum*), eastern cottonwood (*Populus deltoides*) and buttonbush (*Cephalanthus occidentalis*) were again harvested.

When harvesting at each site, the live stakes were cut at the base and hauled to an open area for "processing". Once in the open area the stakes had most of their leaves and any small branches removed with hand pruners. They were cut to a length of approximately 5-7 feet long and placed in bundles of approximately 25-35 stakes. Trimming and cutting to length meets two needs. The stakes are easier to handle when bundling, transporting, and installing, and the reduction of plant mass takes some of the biological stress off of the stake when installed. Over 40 bundles were collected over 2 days with the ZooTeens and 23 bundles were collected by the workshop attendees.

Live stakes were soaked to promote growth.

Immediately after each of the two harvesting events in mid-August, the bundles were taken to a secure stream location and soaked for two weeks. Hydrating the stakes helps to increase their chances of survival and rooting once installed on-site. The project was done in late August, a typical dry time of year, so it was important to do anything to help the stakes survive. The materials harvested by the workshop attendees were also soaked but for a less than one day, as they were installed fairly soon after harvesting. Initial results have been promising, but the next growing season will determine how many and which species showed the best survival.

4.3 In-Stream Structures

Approximately one year prior to the beginning of the project, local stone quarries were contacted. Several site visits were made in an effort to select a source for appropriate stone for the project. It was determined that the Ford Street Quarry operated by Shelley Company was the most appropriate source as it was nearby and could produce the size and quantity of stone this project required. Six hundred tons of choke stone (3"-4"average diameter) and 1900 tons of type A rip-rap stone (18"-30" average diameter) was specifically produced for use by this project. We found it is important to set up a supply for any material needed for a project since this size of stone is typically not produced on a daily basis. Most of the local quarries crush their stone into gravel for use on traditional road and construction projects. How the large stone will be trucked also needs to be considered as well, since most trucks have aluminum beds and cannot handle large stone. Trucks with steel bodied beds are needed to transport the large material.

Actual construction began during the week of August 18, 2008 with site preparation. It was necessary to remove three trees (Crabapple (*Malus sp*.), Elderberry (*Sanbucus canadensis*), and Catalpa (*Catalpa speciosa*). The trees had to be removed to construct the temporary haul roads and access points for the project to allow equipment and materials to reach the creek. Federal laws involving US Fish and Wildlife Service came into play due to the potential disruption of Indiana Bat habitat. Once it was determined that there would be no detrimental impact, the trees were allowed to be removed.

An early load of large stone being delivered.

Several loads of fines and gravel were first delivered to create the temporary haul roads leading from the parking lot to the two access points for rock ramp construction. The haul roads were later reshaped to be walking paths between the sidewalk and the river. As rock arrived from the quarry, it was dumped in the channel from the west bank. The excavator, in this case a Komatsu PC200, was used to distribute the material across the stream.

It quickly became evident that it was going to take much more stone than originally estimated to build each structure. This is when another unplanned modification occurred. The team decided that two structures should be built instead of three, each structure with a 9" drop in water surface elevation, rather than the three structures with 6" drops. The second structure would be placed slightly downstream from the original location of the middle structure. It was moved as far downstream as possible without interfering with an existing storm sewer pipe protruding from the east bank.

Heavy equipment was used to move the rock across the stream and to compact it.

As more stone was delivered and dumped, the excavator worked from west to east distributing the stone to create the rock ramps. There is typically a bedding layer of smaller stone placed in the truck along with the armor stone to prevent punctures in the truck bed during loading and unloading. This bedding layer of unsorted smaller material was incorporated into the ramp as construction preceded helping to lock the material in place. The excavator worked to

Rocks were dumped on the west bank and pushed across to form the second structure.

compact and lock-in the stone as it worked. Materials were hammered with the bucket when necessary or just driven over during construction pressing the material well into the bed of the stream. The upstream structure was tied in to an existing concrete wall on the west bank and feathered into the undercut on the eastern bank. A constructed key for the rock ramp was not necessary as the dam was already serving that purpose.

The second downstream structure was created in much the same way. Material was placed from west to east; however more substantial keys were constructed. The soil in the bank was removed creating a notch that extended from slightly below the streambed to approximately 20 feet landward and about 10 feet wide. The key trench was backfilled with some of the larger pieces of the Type A Armor stone and compacted as it was placed. Native soil was also placed in with the stone to fill any voids created. During this process live stakes were also installed on the downstream side of the key reaching to the full depth of the key trench.

The large stone of the ramps were choked with smaller choke stone/gravel (5" diameter average). Placing and working this gravel into the voids of the larger stone helped to lock the stone together to prevent movement during storm events and also to slow infiltration of water through the structures during low water. The effects of the choke stone were easy to see as more water flowed over the structure instead of through it throughout the choking process.

During construction, it was decided that two low-flow channels would be constructed on each rock ramp rather than the planned single channel. This would allow for a "backup" channel if one were to become closed off with debris. The widths and depths of the channels were adjusted in the field (with the help of a few quick calculations) to try to maintain a velocity in each of the twin low-flow channels that would still allow passage of larger than 4" long fish.

The live stakes that were previously harvested and soaked were incorporated into the project along the waterline near the structures during construction, as well as any accessible areas on the bank between the two structures. The live stakes were installed into the keys before they were backfilled. The key areas were also planted with a mixture of native seed and covered with a jute erosion control material.

4.4 Storm Water Drainage Pipe

Another unplanned issue arose during the early stages of the in-stream construction. A submerged storm water outfall was located on the western retaining wall of the dam. This pipe was overlooked during design as it was partially blocked by a sediment bar that had formed in

Unknown discharge entering Swan Creek through submerged storm pipe.

front of it. During the first day of construction, the City of Toledo investigated the submerged storm sewer line, and potential illicit discharge, set in the western retaining wall of the dam. The City of Toledo Dept of Public Utilities was called to investigate whether a break or a cross-connection was causing the discharge.

Concurrently, a sinkhole was found in the wooded area to the west of the stream. The City of Toledo found that a broken sewer line had caused the sink hole and it had no connection to the storm sewer line discovered previously. The broken sewer line was repaired immediately and the sinkhole filled.

In order to avoid covering the storm water pipe outlet in the dam wing wall with the rock ramp, a manhole structure and pipe were connected to the outlet. A second pipe was extended from the manhole that would outlet to the stream. The rock ramp was then constructed around the manhole and over the pipe.

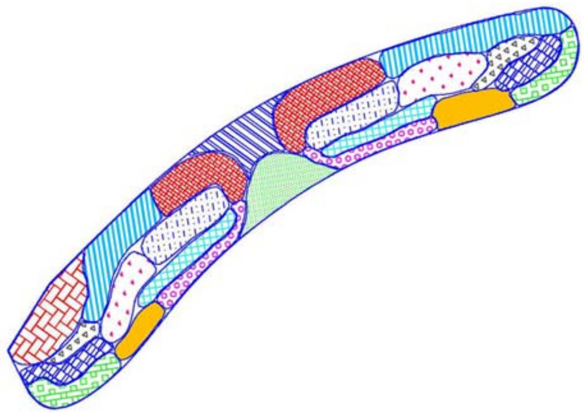
New manhole and storm sewer pipe being connected to an existing storm sewer in the dam's west retaining wall.

4.5 Native Gardens

In addition to the in-stream work, native plant demonstration gardens were planted on the west floodplain. Although the original plan called for one large garden area, it was split into two smaller gardens due to site constraints, including the inability to cut down a tree that may provide Indiana bat habitat and a sinkhole that was caused by a broken sewer pipe in the nearby wooded area.

The turf grass on the native plant garden sites was scraped off with the excavator. Approximately 10 cubic yards of compost was mixed into the top 6"-8" of soil to prepare the planting bed. Volunteers from the workshop spread mulch over the surface of the two planting gardens, and then laid erosion control blanket over the area, keying it into trenches on the perimeter of each garden. Over the course of two days, native plant plugs were installed through the blanket and were watered. After planting was finished, additional mulch was scattered over top of the erosion control blanket for improved aesthetics and to serve as a deterrent to keep vandals from seeing and therefore pulling the blanket up.

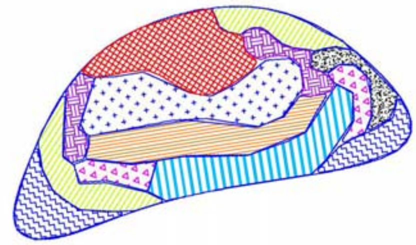
Native plant plugs being planted in the large native garden.



Large Planting Area - West

PLANTING LEGEND

Botanical Name	Common Name	# Plugs
Asclepias tuberosa	Butterfly Milkweed	76
Asclepias syriaca	Common Milkweed	76
Aster oolentangiensis	Sky-Blue Aster	114
Aster levis	Smooth Blue Aster	76
Baptisia lactea	White Wild Indigo	76
Coreopsis lanceolata	Sand Coreopsis	76
Echinacea purpurea	Purple Coneflower	76
Helianthus occidentalis	Western Sunflower	38
Parthenium integrifolium	Wild Quinine	76
Ratibida pinnata	Yellow Coneflower	76
Schizachyrium scoparium	Little Bluestem	76
Solidago speciosa	Showy Goldenrod	76
Verbena stricta	Hoary Vervain	114



Small Planting Area - East

PLANTING LEGEND

Botanical Name	Common Name	# Plugs
Coreopsis tripteris	Tall Coreopsis	114
Elymus canadensis	Canada Wild Rye	114
Panicum virgatum	Switch Grass	114
Penstemon digitalis	Foxglove Beard Tongue	76
Rudbeckia hirta	Black-eyed Susan	76
Schizachyrium scoparium	Little Bluestem	76
Solidago rigida	Stiff Goldenrod	76
Sorghastrum nutans	Indian Grass	114
Veronicastrum virginicum	Culver's Root	76

Approximately 1800 plugs of twenty species were planted in the two gardens. The plants that were installed are listed with the diagrams above.

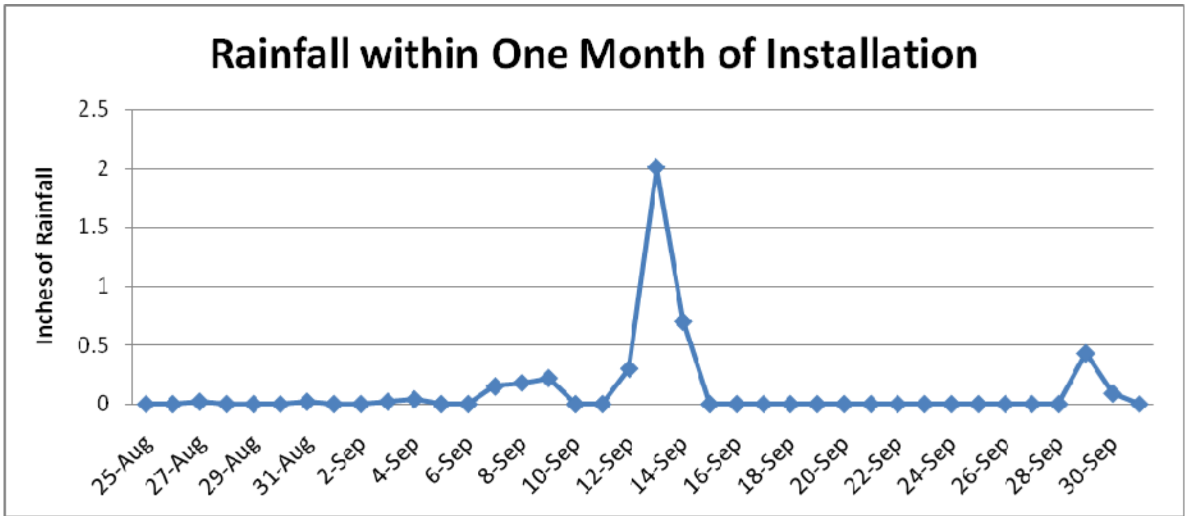
5.0 POST-CONSTRUCTION

5.1 Site Visits

The summer of 2008 in Northwest Ohio started out wet, but it did not take long for drought conditions to develop during the peak of the growing season. Between mid-July and mid-September, the area recorded less than 2 inches of rainfall and was officially considered in a moderate drought. Toledo had received only 44% of normal precipitation (2.64 inches observed vs. 6.03 inches normal). These conditions were very helpful when it came to constructing this project; however, things would quickly change as the remnants of Hurricanes Gustav and Ike made their way into the Midwest.

Wood, leaves, and debris caught in the upstream structure, but they did not affect the movement of water through the low flow channels.

It was expected that the structures would have an opportunity to "settle" before being challenged by Mother Nature. However, within a month of completion there were two smaller and one significant rain event that challenged the structures. The largest was only two weeks after construction. A "drought-buster" rainfall fell on September 13 and Toledo recorded 2.01 inches of rain that day. There was enough rainfall across the area to replenish ground water and nearly remove the drought status.



The structures were tested, but they held and performed as designed. Some wood and debris was caught by the structures, but it did not damage or reduced their function. The debris has since moved downstream naturally without intervention or clearing.

Numerous site visits have been made since construction was completed. Samples of these visits are shown below.

Pre-Construction *(low flow conditions)*

Upstream site looking west

Downstream site from upstream

September 5 *(7 days after install) (low flow conditions)*

Upstream structure looking west

Downstream structure from upstream

September 13 *(15 days after install) (high flow conditions)*

Upstream structure looking west

Downstream structure from upstream

September 18 *(18 days after install) (coming down from high flow conditions)*

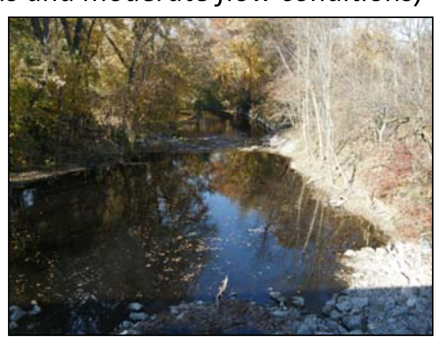
PHOTO NOT AVAILABLE

Upstream structure looking west

Downstream structure from upstream

November 5 *(10 weeks after install) (leaves, debris and moderate flow conditions)*

Upstream structure looking west



Downstream structure from upstream

January 27, 2009 *(21 weeks after install) (low flow, ice and snow conditions)*

Upstream structure looking west

Downstream structure from upstream

5.2 Early Results

The early results of this project are very promising. As illustrated above, the structures have held up to flood conditions, woody debris and leaves, as well as snow and ice. The preliminary results from the live stakes are also looking good. Within two weeks there were stakes with new leaves on them. The local harvesting of plants and soaking to facilitate growth seems to have worked. We will need at least one growing season to see if the stakes have actually rooted and established themselves.

A cottonwood stake 2 weeks after planting.

Willow stakes 2 weeks after planting.

Some early evaluations of conditions in the stream are also available because of some local high school students. Students involved in the Student Watershed Watch (SWW) (a program sponsored by the Toledo Metropolitan Area Council of Governments) collected samples at our project site. The SWW is a program that involves upper elementary, junior high and high school students in a two-phase educational program that includes water quality sampling and analysis, as well as the public reporting of results. The program provides an opportunity for hundreds of students each year to participate in real life scientific investigations and problem solving.

In 2008 the SWW program was expanded to work with The University of Toledo Lake Erie Center (UT LEC). The UT LEC works to links the environmental science learning community by linking graduate student watershed research projects with the SWW program. Their projects center on the environmental study of urbanized and agricultural habitats to

Students are filmed by local media while sampling at Highland Park.

investigate multiple stressors and major ecological community change. Graduate students work to exchange their knowledge and research experience through high school classroom and field exercises.

Students scuff the bottom to "kick-up" macro-invertebrates for collection.

Six weeks after the construction was completed on the Highland Park Dam Mitigation Project, Jahnine Blosser's class at Scott High School, in conjunction with UT doctoral student Todd Crail, collected samples to compare the macroinvertebrate community on two riffles: 1) the new upstream riffle structure (former dam site), and 2) an existing riffle (downstream of the footbridge) that existed before construction.

The students measured the quality of water at each riffle in a series of physical and chemical tests, and sampled macroinvertebrates as a biological index. In the new upstream riffle they scuffed their feet upstream of a benthic seine for one minute and found two orders of macroinvertebrates. This gave them a Steam Quality Measurement (SQM) score of 4 (Poor). In the existing downstream riffle they repeated the method and found six orders of macroinvertebrates. This gave us an SQM score of 17 (Good).

Macroinvertebrates found on the Existing Riffle	
Common Name	**Order**
Cranefly larva	Diptera
Dragonfly larva	Odonata
Clam/mussel	Bivalva
Midge larva	Diptera
Isopod/Sowbug	Isopoda
Gilled snail	Gastropoda
Caddisfly larva	Trichoptera
Leech	Class Hirudinea

Macroinvertebrates found on the New Riffle	
Common Name	**Order**
Midge larva	Diptera
Caddisfly larva	Trichoptera

The students also made note of the fish that were collected in the seines. They found 13 species in 5 families shown in the table below.

Common Name	Family	Species
Emerald shiner	Cyprinidae	*Notropis atherinoides*
Spottail shiner	Cyprinidae	*Notropis hudsonius*
Bluntnose minnow	Cyprinidae	*Pimephales notatus*
White sucker	Catostomidae	*Catostomus commersonii*
Pumpkinseed sunfish	Centrachidae	*Lepomis gibbosus*
Orangespot sunfish	Centrachidae	*Lepomis humilus*
Bluegill sunfish	Centrachidae	*Lepomis macrochirus*
Largemouth bass	Centrachidae	*Micropterus salmoides*
Greenside darter	Percidae	*Etheostoma blennoides*
Johnny darter	Percidae	*Etheostoma nigrum*
Yellow perch	Percidae	*Perca flavescens*
Logperch darter	Percidae	*Percina caprodes*
Round goby	Gobidae	*Apollonia melanostoma*

At the conclusion of the testing, water quality results were the same for both riffles. However, they did not find as many macroinvertebrates in the upstream riffle (new) as the downstream riffle (old). The students hypothesized that the difference in the macroinvertebrate scores was related to the age of the riffles, not water quality.

Scott High School students conducting water quality tests.

They found it surprising that any macroinvertebrates were found on the new riffle, since it was only six weeks old. This may show that downstream drift of larva may be important to colonization for some species. These students intend to sample this site at least one more time during the 2008-09 school year.

The Ohio EPA sampled up and downstream of the dam site in 2006 as a part of the Total Maximum Daily Load (TMDL) sampling program. They plan to re-sample the site with electro-fishing and macroinvertebrate surveys both upstream and downstream of the dam (at the same locations assessed in 2006). These surveys have not yet been scheduled, but are likely to occur in the summer of 2010. This should allow adequate time for system recovery before a formal re-assessment of the site is done.

6.0 WORKSHOP

6.1 Description

An educational workshop was incorporated into Highland Park Dam Mitigation project so that it could serve as a learning tool/model for other areas with similar situations. The workshop was held August 25-27, 2008. A total of 24 workshop attendees came from as far away as Manitoba, Canada and South Dakota. Nearly half of the attendees were from outside the Toledo area.

The workshop included several presentations by Project Management Team (PMT) members (PCS, JFNew, USACE) as well as hands-on activities including live stake harvesting and planting, and native plant garden preparation and planting. The presentations included primers on hydrology and fluvial geomorphology, as well as stream restoration methodologies and case studies from dam removals and rock riffle installations.

Dave Hails, Ecological Restoration Inc, explains the construction that is occurring on site to the workshop attendees.

Workshop attendees harvest live stakes to plant at the Highland Park Dam site.

The workshop also included site visits to both the Highland Park Dam site and the Ottawa Hills/ Secor Road Dam site. The Ottawa Hills/Secor Road Dam project was another recent dam decommissioning project conducted by TMACOG with funding through US EPA's Clean Water Act 319(h) Nonpoint Source Program. These two sites demonstrated two different options for low-head dam restoration: removal versus mitigation. The Ottawa Hills/Secor Road Dam was removed in November 2007. The concrete from the dam was crushed in place to fill the scour hole and create a riffle. Streambank stabilization and enhancement efforts on this site occurred concurrently with the Highland Park Dam project construction, so that workshop attendees could experience two different approaches to a stream restoration.

Dave Derrick, US Army Corps of Engineers, explains rock sizing to attendees.

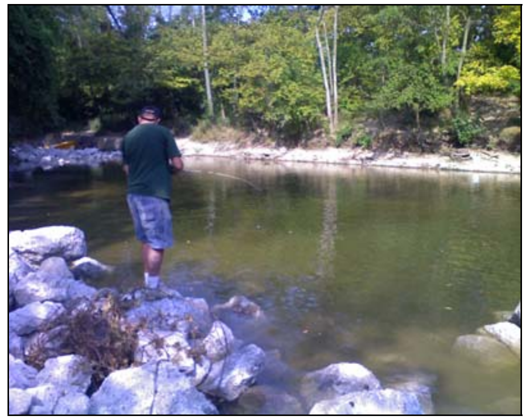
7.0 PUBLIC FEEDBACK AND INFORMATION

7.1 Local Communication and Media Coverage

A couple months prior to construction, Matt Horvat, as Project Leader, attended the Highland Heights Neighborhood meeting on June 12, 2008. Attendees at the meeting were locals from the area. Matt shared with them the focus of The Joyce Foundation's *Great River – Great Lakes Initiative*, the grant given to PCS and the specifics on the Highland Park Dam Mitigation Project.

The group talked about how many kids play in the creek in the area and the safety risks and concerns because of the dam. They also mentioned that there are a lot of people that fish in the area. Matt discussed the project and explained that the dam could not be removed because it encases a major sanitary sewer line.

The group talked about how this project would remove of the safety hazard of the low head dam. Matt provided details of the project including how the rock ramps would be built, where they materials would be placed, and the benefits of the project were discussed. He explained that the project would including creating several natural-looking rock ramp structures across the creek to ease the transition of water elevation from the dam to downstream levels. The group was quite happy with the project as explained, and that anyone actually cared enough to do environmental work in their neighborhood.



Local fisherman couldn't wait until the project was complete to try their luck from the new structures.

This positive response from the neighbors was again shown throughout the two weeks that construction activities were occurring. Several local residents and fishermen stopped by the site and showed excitement in what was going on. Many people asked questions about the project and its goals. A few people were skeptical, however most showed appreciation that something was being done to improve the stream and their immediate environment. A couple of residents even pitched in to help plant and water the native plants.

Some of the comments from neighbors who visited the site include:
Mike Berry was excited to see the project. He said, "It's about time. I've fished here all my life." He caught a steelhead and northern pike under the bridge, bluegill, catfish and white bass and largemouth bass. "I think the walleye may come up here and spawn."

Rich Young and Mike Spyehalski said, ". . . white bass and walleye never used to come here and now they do but the only fish we have seen come over the dam are the white suckers. Now everything can make it."

Several newspaper articles and television stories were run regarding this project, before the construction, as well as during and after. Three of the four local television station ran stories during the two weeks of construction. Local NBS affiliate, WNWO-TV Channel 24, actually did on-site filming during construction to air in their evening newscast. WTOL-TV (CBS-Channel 11) filmed Scott High School when they were on-site collecting samples for the Student Watershed Watch.

Toledo Blade Columnist, Steve Pollick, canoed Swan Creek with PCS in late June 2008. He was able to see first-hand conditions of the creek. He came out to visit the Highland Park Dam site after construction. Based on his observations, on October 7, 2008 he published an article titled *Division of Wildlife to Stock Rainbow Trout in Local Waters,* that included information on the Highland Park Dam Mitigation project. The article read, *". . . anglers who are wondering about the impact of a fish-ladder, dam-mitigation project done in August at Highland Park might heed observations by angler John Jokinen. He landed a smallmouth bass there on a recent trip and watched another angler catch, of all things, a yellow perch. 'It was something different,' Jokinen said of the perch. 'I haven't seen that in a while down there.' Other anglers have watched steelhead threading their way upstream above the old dam."*

7.2 Results Sharing and Presentations

The dissemination of information related to this project is very important to The Joyce Foundation and the Partners for Clean Streams. Several Project Management Team members, as well as PCS, have taken or plan to take opportunities to share information about the Highland Park Dam Mitigation Project. These are highlighted below by organization.

Scott Dierks presenting at the Dam Mitigation Workshop.

Scott Dierks from JFNew made a pre-construction presentation regarding this project at the American Ecological Engineering Society (AEES) Conference in Blacksburg, Virginia (June 11-14, 2008). He also did a poster presentation at the Stewardship Network Conference - The Science, Practice and Art of Restoring Native Ecosystems in East Lansing, Michigan (January 23-24, 2008).

Dave Derrick presents on a stream restoration project.

Since the construction of the project Dave Derrick, Research Hydraulic Engineer with the US Army Corps of Engineers, has incorporated this project into his stream restoration presentations. Dave presents this lecture to 500 to 800 people each year. He has also posted it as a stand-alone case study PowerPoint presentation on his FTP site, which is accessed by fellow professionals several hundred times a year. Dave plans to come back to Toledo for a follow-up workshop during the summer of 2009, where the Highland Park Dam Mitigation Project will be highlighted.

After submitting an abstract for consideration, Patekka Bannister with the City of Toledo Division of Environmental Services was selected to make a presentation at the Ohio Storm Water Conference on May 14-15, 2009 in Mason, Ohio.

This Highland Park Dam Mitigation Project has been included with the rest of PCS's Joyce Foundation funded projects in at least 5 presentations that Kristina Patterson, Executive Director, gave to community groups in 2008. It was also featured at the Partners for Clean Streams Annual General meeting in December 2008. The Partners for Clean Streams will be sharing detailed information on all three of its Joyce Foundation projects; along with the other Joyce Foundation funded projects, at the International Association of Great Lakes Researchers Conference in May 18-22, 2009. The PCS also intends to present this project at other local and regional conferences throughout 2009.

8.0 CONCLUSION

8.1 Lessons Learned

This project almost succeeded in completely meeting the original objectives for the original budget. The objectives for this project were met with the exception of restoring floodplain function. However, the actual project costs of the design-build contract were $227,000, which exceeded the original budget by more than 10%. The Project Management Team believes this is mostly due to the actual construction costs exceeding the original budget. In fact, without the assistance of a very experienced construction contractor, actual construction costs would likely have been even higher.

A number of lessons were learned during this project. They include:

- An experienced stream restoration contractor can help lower construction costs, can provide critical, realistic appraisal of design and construction methods and is particularly important if the project is the "first of its kind" for the region.
- This kind of project lends itself well to the design-build process, particularly for providing flexibility during construction.
- Establish formal, explicit chain of command for field changes. Having multiple designers on site during construction is not always a straightforward benefit.
- Be careful when planning construction access points – dead trees can be as valuable as live trees. For instance, the Indiana Bat (an endangered, federally protected animal) prefers dead and dying trees for habitat.
- Investigate the location of existing infrastructure very carefully (redundant searches, run down every detail). Never assume anyone else will do it for you.
- Spend time and money up front with very detailed site surveys.
- Plan carefully for stone volume – include voids, include "sinkage" factor, include irregularities of surface to be filled. Stone needed on this project exceeded original engineering estimates by over 50%.

- The project team did not necessarily need to estimate flow through ramp. By choking large stone with small stone, and any excavated fill, flow through ramp stone interstices can be minimized up front.

- If silt/turbidity curtain is needed for entirely crossing a river, plan for a long lead time for acquiring. Proper curtains are mostly custom-made. Neither silt curtain, nor turbidity curtains are actually made to traverse a river, perpendicular to flow, to contain suspended sediment.

- If there is a Flood Insurance Study, you need to procure the existing floodplain model and provide ample time in planning to acquire that model. The existing model on this project had to be found by the USACE by going through old microfiche files.

- Be flexible, but do not work outside of original work limits without careful investigation.

- Make contact with the local regulatory agencies. By meeting on-site with the local representatives that have input on your permit, you may be able to avoid complications and/or delays in receiving your permit(s).

8.2 Next Steps

This project seems to have been a success, but that does not mean this site is done. Other peripheral projects were identified when JFNew was on-site surveying for this project in the fall of 2007. These opportunities along with several other issues could be addressed in future projects, including: more stream bank stabilization plantings, native garden enhancement, public access improvement, and educational signage.

Possible site for access improvement project.

Follow-up sampling will be needed to determine the environmental success of improving the water quality attainment of this site. The Ohio EPA plans to re-sample the site with electro-fishing and macroinvertebrate surveys both upstream and downstream of the dam (at the same locations assessed in 2006). These surveys have not yet been scheduled, but are likely to occur in the summer of 2010. This should allow adequate time for system recovery before a formal re-assessment of the site.

The mussels that were relocated by the project also must be sampled to evaluate survivorship and health of the relocated mussels. This will include an exhaustive sampling survey that will be conducted approximately two years after relocation. All recovered individuals will be measured with a metric caliper to the nearest tenth of a millimeter. Recovery rates will then be calculated and an analysis of overall health will be assessed by comparing shell lengths at the time of translocation and the time of sampling. Positive growth is generally used as an indicator of health.

9.0 REFERENCES

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Scott High School, Student Watershed Watch project presentation and poster board. November 2008.

APPENDICES

(Provided in electronic format on enclosed companion CD)

http://www.jfnew.com

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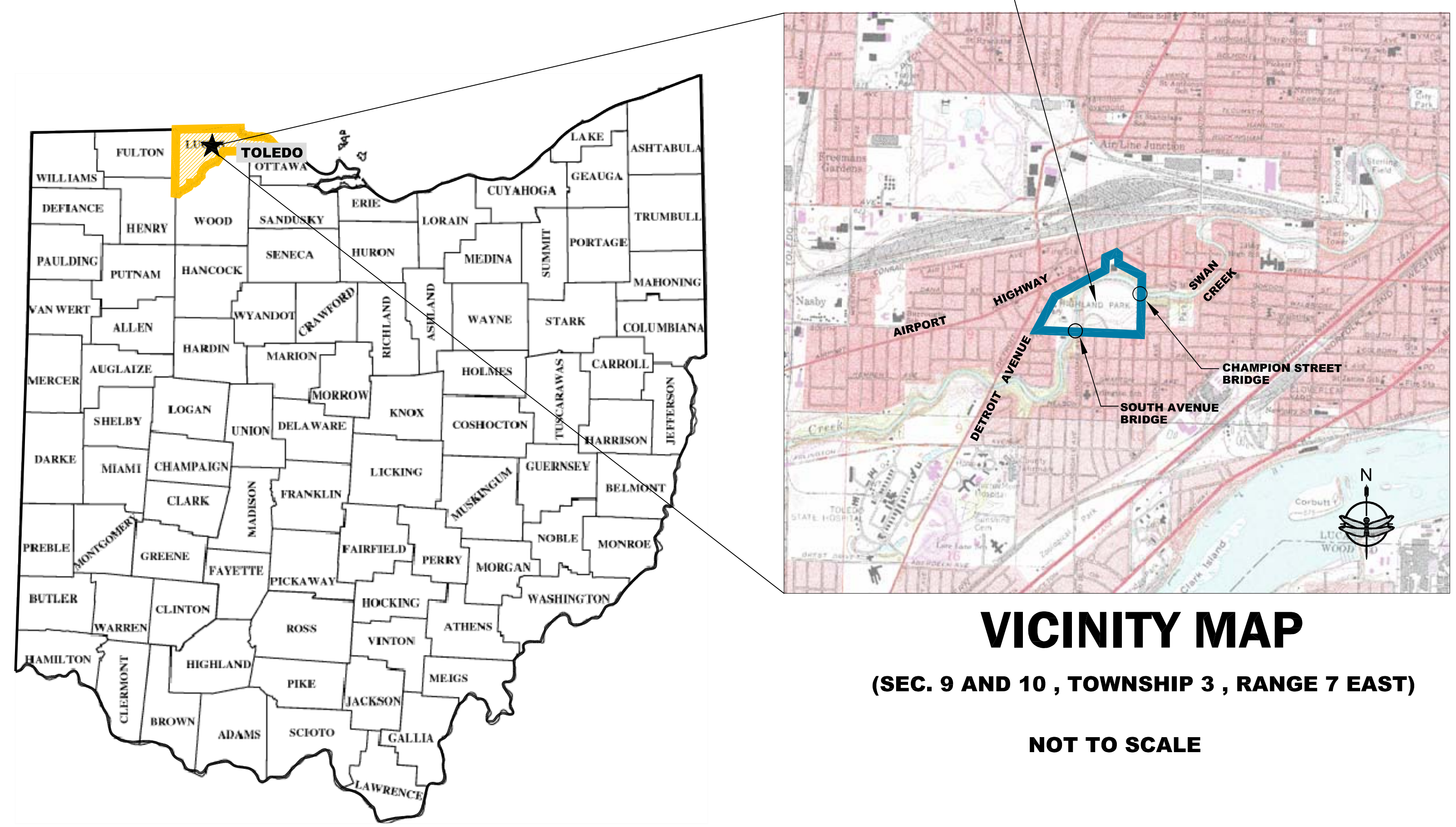
HIGHLAND PARK DAM MITIGATION AND RIPARIAN ENHANCEMENT

LUCAS COUNTY
TOLEDO, OHIO

MAY 2008

SHEET INDEX



VICINITY MAP

(SEC. 9 AND 10 , TOWNSHIP 3 , RANGE 7 EAST)

NOT TO SCALE

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

Our mission is to provide the highest quality environmental services to our clients while positively impacting the lives of our employees and the conservation of natural resources through prosperity and stewardship.

REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County,Toledo, Ohio
TITLE SHEET AND SHEET INDEX MAP

DRAWN BY:	JFH/COD
DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812

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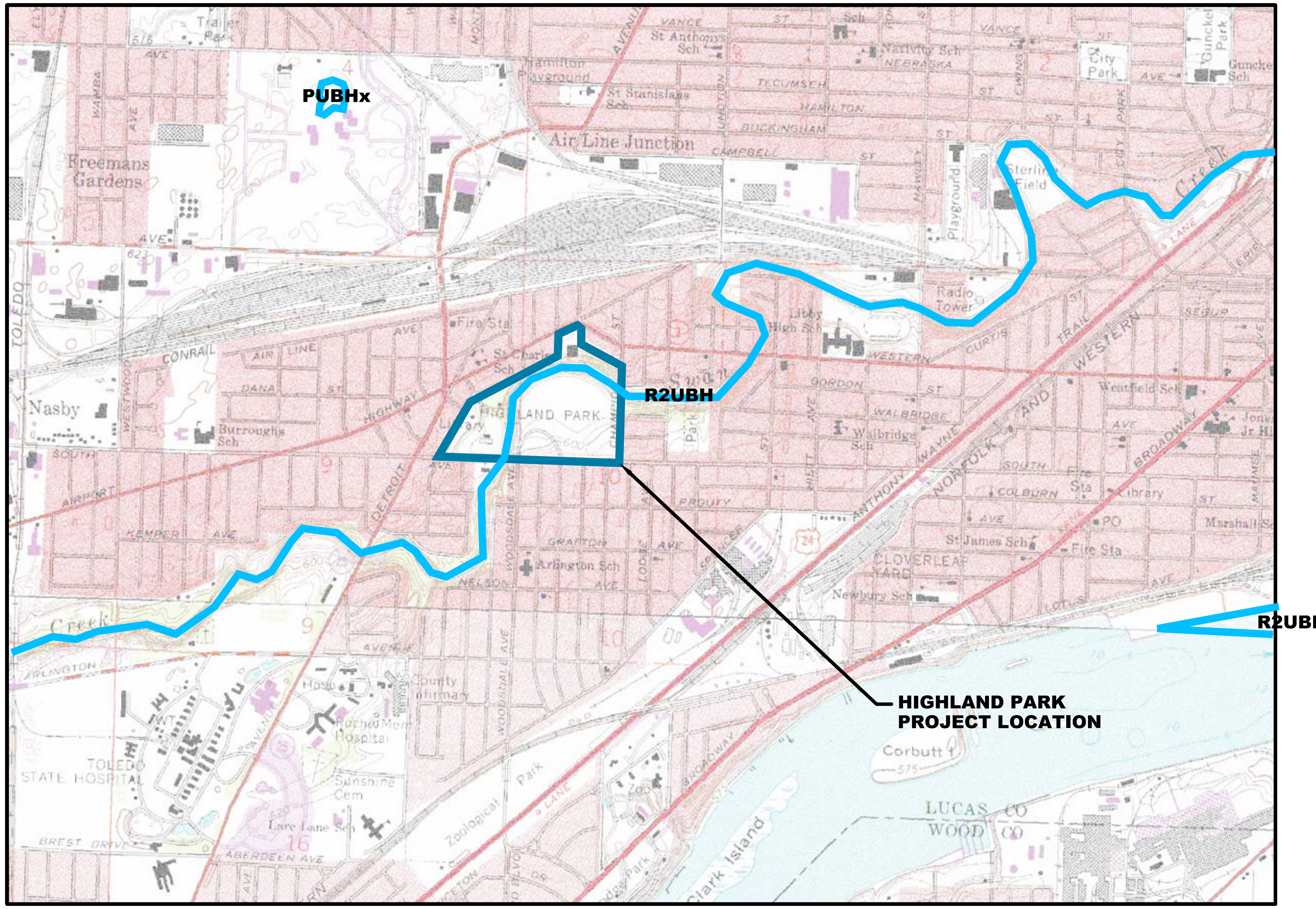
1 OF 9



National Wetland Inventory (NWI) MAP

Toledo (OH, MI) Quadrangle

FRESHWATER WETLAND CLASSIFICATION

P - PALUSTRINE

- **RB ROCK BOTTOM**: 1 Bedrock; 2 Rubble
- **UB UNCONSOLIDATED BOTTOM**: 1 Cobble/Gravel; 2 Sand; 3 Mud; 4 Organic
- **AB AQUATIC BED**: 1 Algal; 2 Aquatic Moss; 3 Rooted Vascular; 4 Floating Vascular; 5 UNK Submergent; 6 UNK Surface
- **US UNCONSOLIDATED SHORE**: 1 Cobble/Gravel; 2 Sand; 3 Mud; 4 Organic; 5 Vegetated
- **ML MOSS-LICHEN**: 1 Mosses; 2 Lichen
- **EM EMERGENT**: 1 Persistent; 2 Nonpersistent
- **SS SHRUB SCRUB**: 1 Broad-Leaved Deciduous; 2 Needle-Leaved Deciduous; 3 Broad-Leaved Evergreen; 4 Needle-Leaved Evergreen; 5 Dead; 6 Deciduous; 7 Evergreen
- **FO FORESTED**: 1 Broad-Leaved Deciduous; 2 Needle-Leaved Deciduous; 3 Broad-Leaved Evergreen; 4 Needle-Leaved Evergreen; 5 Dead; 6 Deciduous; 7 Evergreen
- **OW OPEN WATER**: Unknown Bottom

MODIFYING TERMS

In order to more adequately describe wetland and aquatic habitats water regime, water chemistry, soil of special modifiers may be applied.

WATER REGIME		WATER CHEMISTRY		SOIL	SPECIAL MODIFIERS
NON-TIDAL		INLAND SALINITY	pH MODIFIERS FOR FRESHWATER		
A Temporarily Flooded	J Intermittently Flooded	7 Hypersaline	a Acid	g Organic	b Beaver
B Saturated	K Artificially Flooded	8 Eusaline	t Circumneutral	n Mineral	d Partially Drained/Ditched
C Seasonally Flooded	W Intermittently Flooded/ Temporary	9 Mixosaline	i Alkaline		f Farmed
D Seasonally Flooded/ Well Drained	Y Saturated/Semipermanent/ Seasonal	0 Fresh			h Diked/Impounded
E Seasonally Flooded/Saturated	Z Intermittently Exposed/ Permanent				r Artificial Substrate
F Semipermanently Flooded	U Unknown				s Spoil
G Intermittently Exposed					x Excavated
H Permanently Flooded					

Dominance types must be added by users.

Classification of wetland and deepwater habitats of the U.S. Cowardin et. al. 1979 as modified for national wetland inventory mapping conventions.

FRESHWATER WETLAND CLASSIFICATION

R - RIVERINE

- 1 TIDAL
- 2 LOWER PERENNIAL
- 3 UPPER PERENNIAL
- 4 INTERMITTENT
- 5 UNKNOWN PERENNIAL

- **RB ROCK BOTTOM**: 1 Bedrock; 2 Rubble
- **UB UNCONSOLIDATED BOTTOM**: 1 Cobble/Gravel; 2 Sand; 3 Mud; 4 Organic
- **AB AQUATIC BED**: 1 Algal; 2 Aquatic Moss; 3 Rooted Vascular; 4 Floating Vascular; 5 UNK Submergent; 6 UNK Surface
- **US UNCONSOLIDATED SHORE**: 1 Cobble/Gravel; 2 Sand; 3 Mud; 4 Organic; 5 Vegetated
- **SB STREAMBED ***: 1 Bedrock; 2 Rubble; 3 Cobble-Gravel; 4 Sand; 5 Mud; 6 Organic; 7 Vegetated
- **EM EMERGENT ****: 1 Persistent; 2 Nonpersistent
- **RS ROCKY SHORE**: 1 Bedrock; 2 Rubble
- **OW OPEN WATER**: Unknown Bottom

MODIFYING TERMS

In order to more adequately describe wetland and aquatic habitats water regime, water chemistry, soil of special modifiers may be applied.

WATER REGIME		WATER CHEMISTRY		SOIL	SPECIAL MODIFIERS
NON-TIDAL		INLAND SALINITY	pH MODIFIERS FOR FRESHWATER		
A Temporarily Flooded	J Intermittently Flooded	7 Hypersaline	a Acid	g Organic	b Beaver
B Saturated	K Artificially Flooded	8 Eusaline	t Circumneutral	n Mineral	d Partially Drained/Ditched
C Seasonally Flooded	W Intermittently Flooded/ Temporary	9 Mixosaline	i Alkaline		f Farmed
D Seasonally Flooded/ Well Drained	Y Saturated/Semipermanent/ Seasonal	0 Fresh			h Diked/Impounded
E Seasonally Flooded/Saturated	Z Intermittently Exposed/ Permanent				r Artificial Substrate
F Semipermanently Flooded	U Unknown				s Spoil
G Intermittently Exposed					x Excavated
H Permanently Flooded					

Dominance types must be added by users.

Classification of wetland and deepwater habitats of the U.S. Cowardin et. al. 1979 as modified for national wetland inventory mapping conventions.

* STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.
** EMERGENT IS LIMITED TO TIDAL and LOWER PERENNIAL SUBSYSTEMS. The remaining CLASSES are found in all SUBSYSTEMS.

PRELIMINARY DRAWING:
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N

0 1000'

SCALE IN FEET

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REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
NWI MAP

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DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

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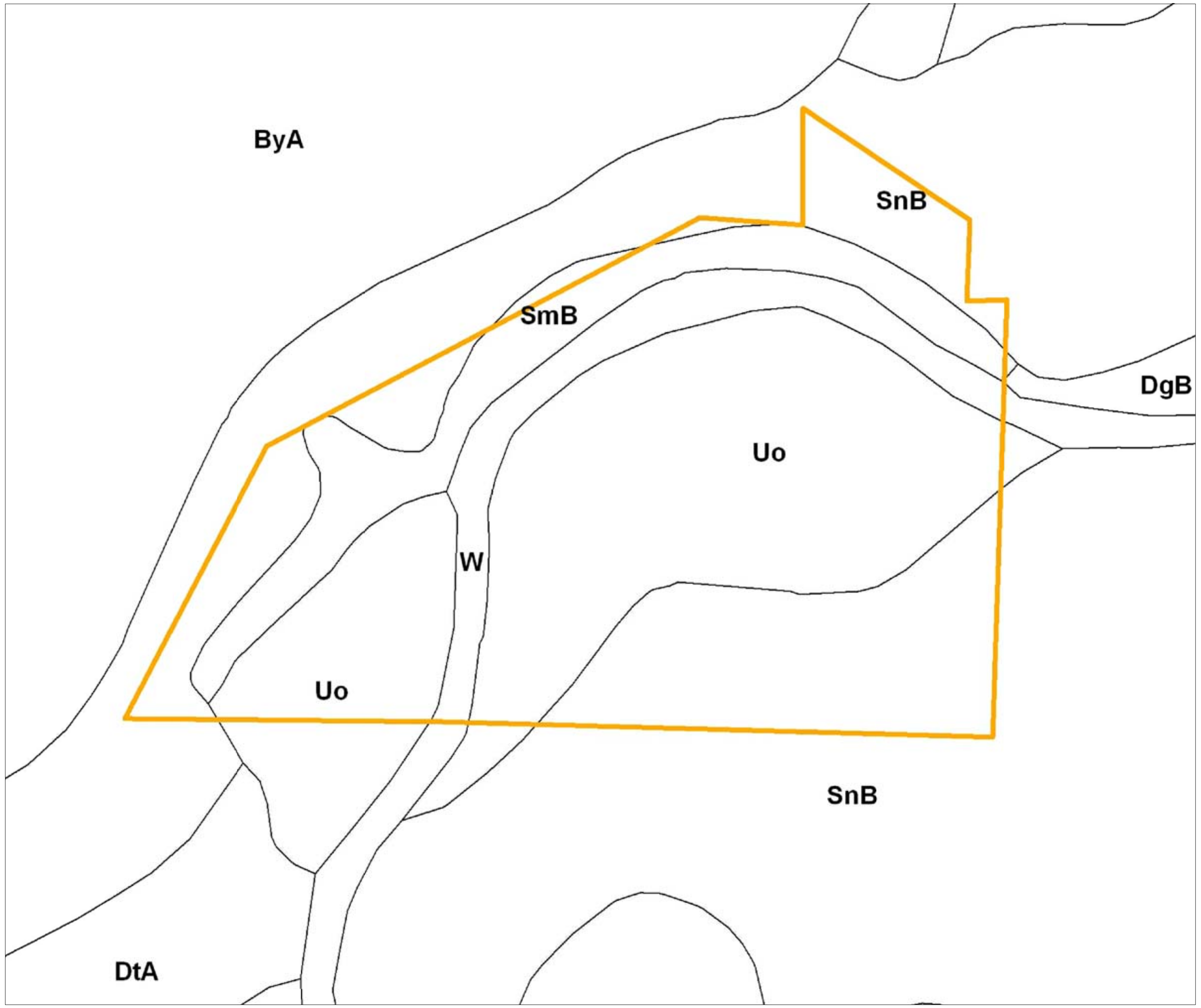
2



SOILS MAP

LEGEND

Highland Park Boundary

SOILS KEY

SnB	Sisson-Urban land complex, 2-12 percent slopes
SmB	Sisson Loam, 2-6 percent slopes
Uo	Udorthents, loamy
W	Water
DgB	Digby, sandy loam, 2-6 percent slopes
DtA	Dixboro-Urban land complex, 0-2 percent slopes

PRELIMINARY DRAWING:
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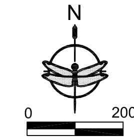

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REVISION

Highland Park Dam Mitigation and Riparian Enhancement
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Lucas County, Toledo, Ohio
SOILS MAP

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DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

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3

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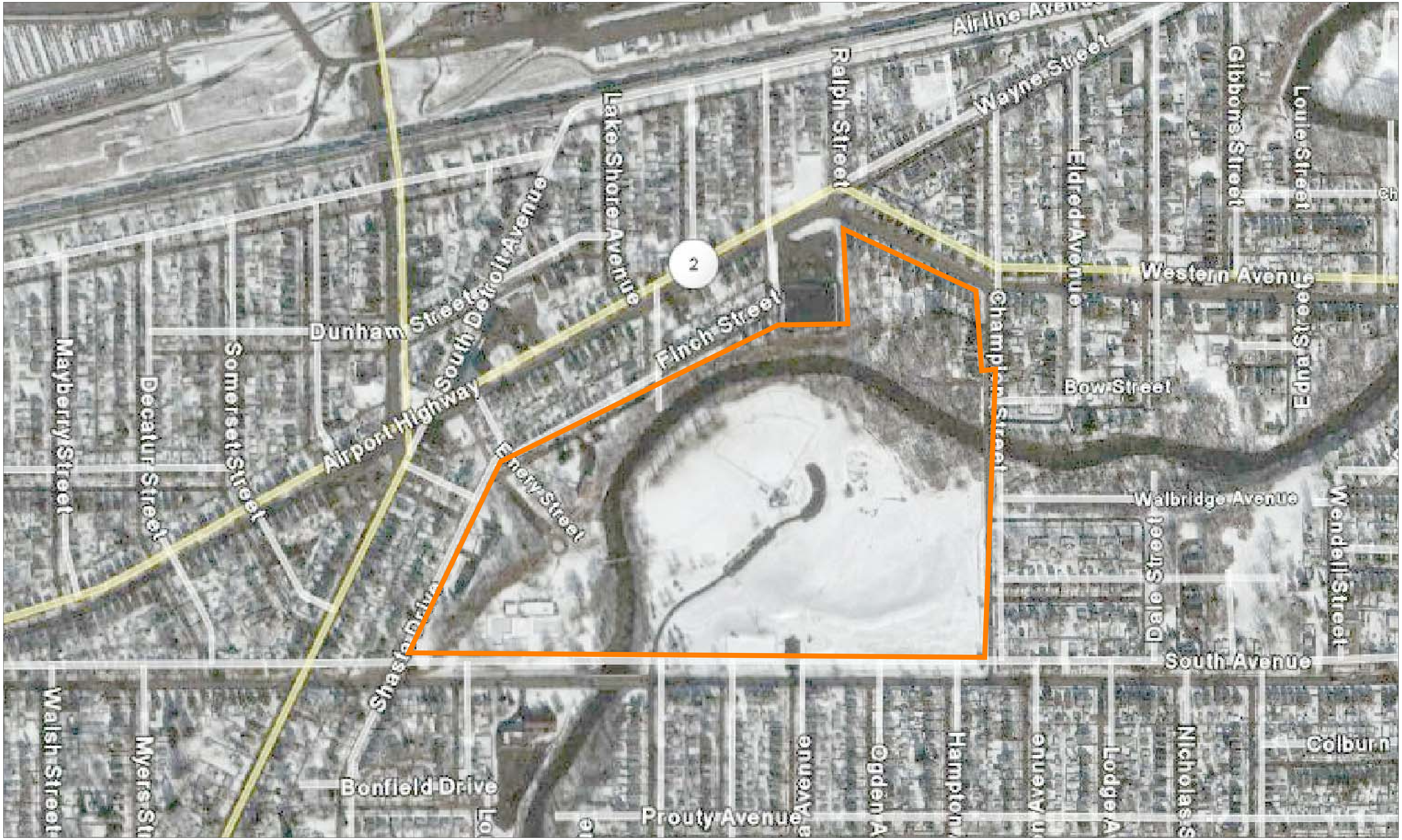
Plotted By:Christine Dittmar Plotted:May 8, 2008, 8:58:22 AM



LEGEND

Highland Park Boundary

NOTE

1.) Aerial obtained from http://earth.google.com/

PROJECT SITE

PRELIMINARY DRAWING:
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N

0 200'

SCALE IN FEET

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PROJECT SITE AERIAL

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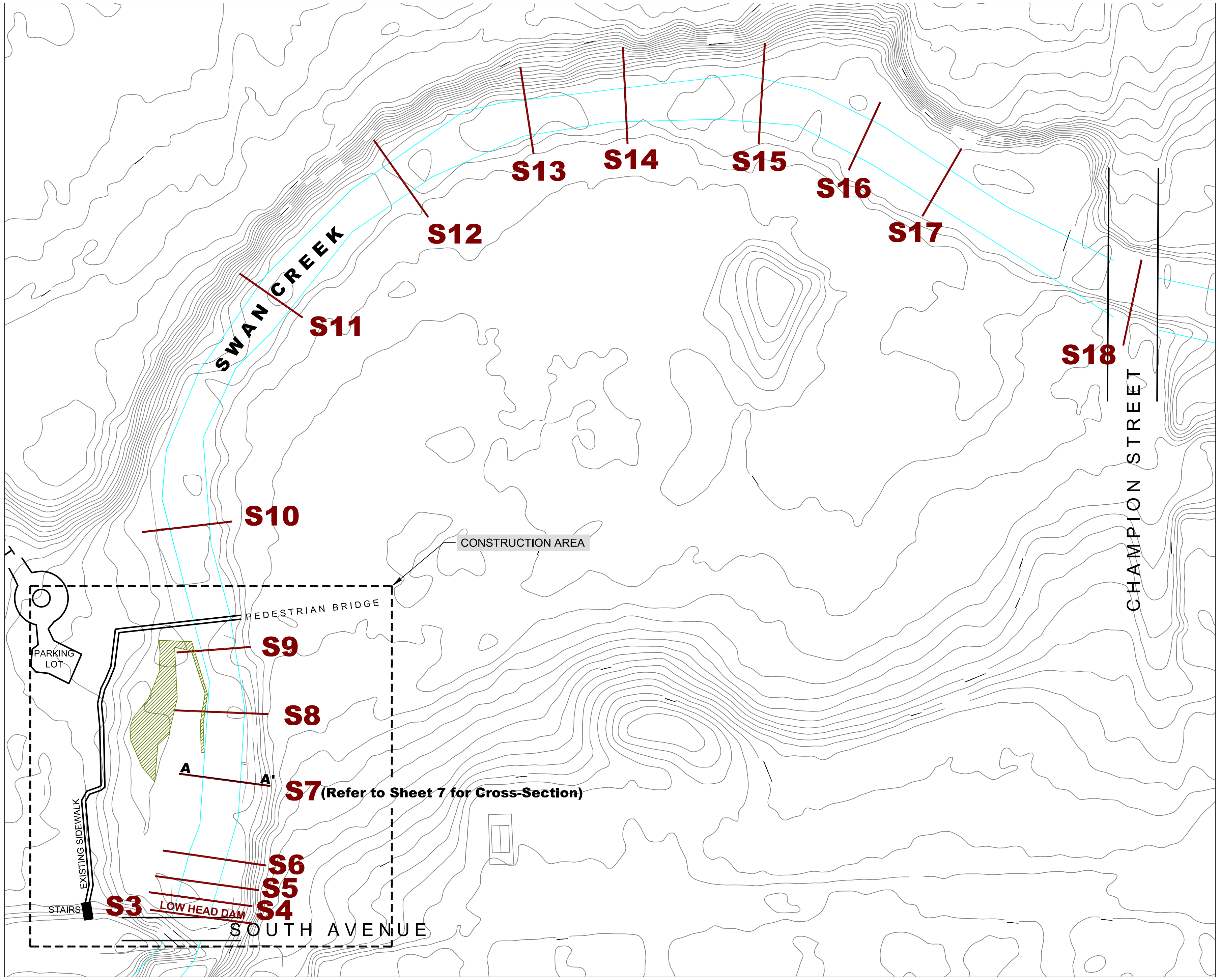
4



EXISTING SITE PLAN

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
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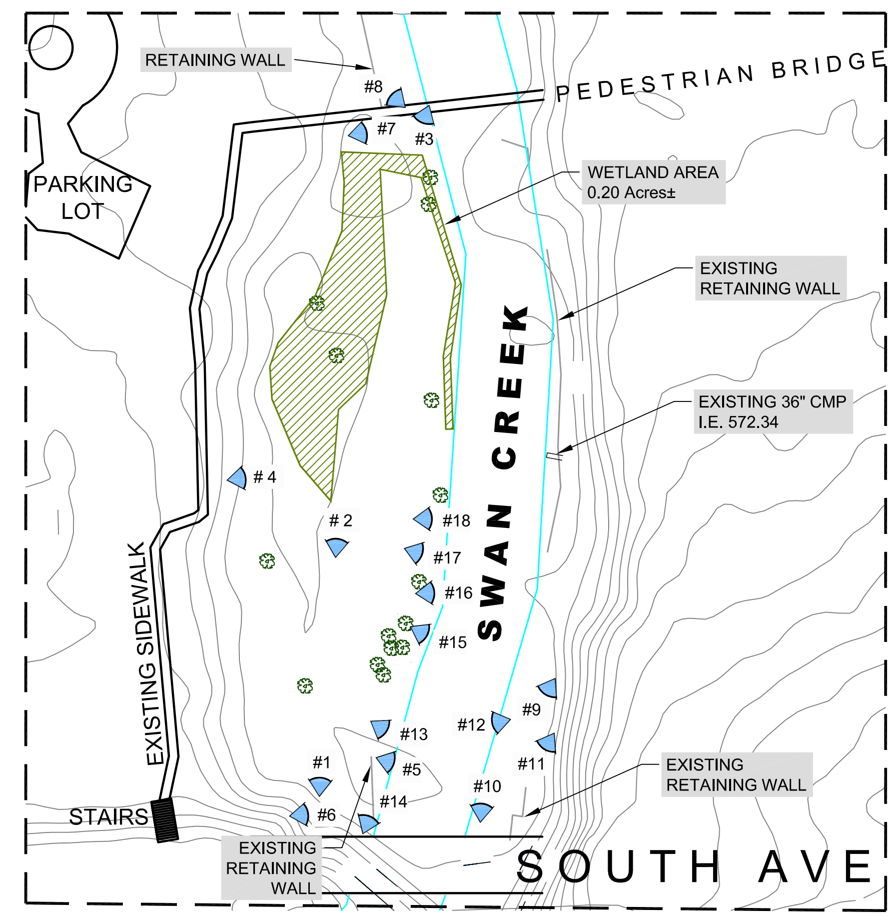
Adjust scale accordingly.

N
0 100'
SCALE IN FEET

LEGEND

- Existing Grade
- S# — Cross-Section Designation / Location
- Existing Trees
- Wetland
- ## Photo Station



CONSTRUCTION AREA

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
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Adjust scale accordingly.

N
0 60'
SCALE IN FEET

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REVISION

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Lucas County, Toledo, Ohio
EXISTING CONDITIONS

DRAWN BY:	COD
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DATE:	MAY 2008
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DRAFT

DRAWING NO.

5

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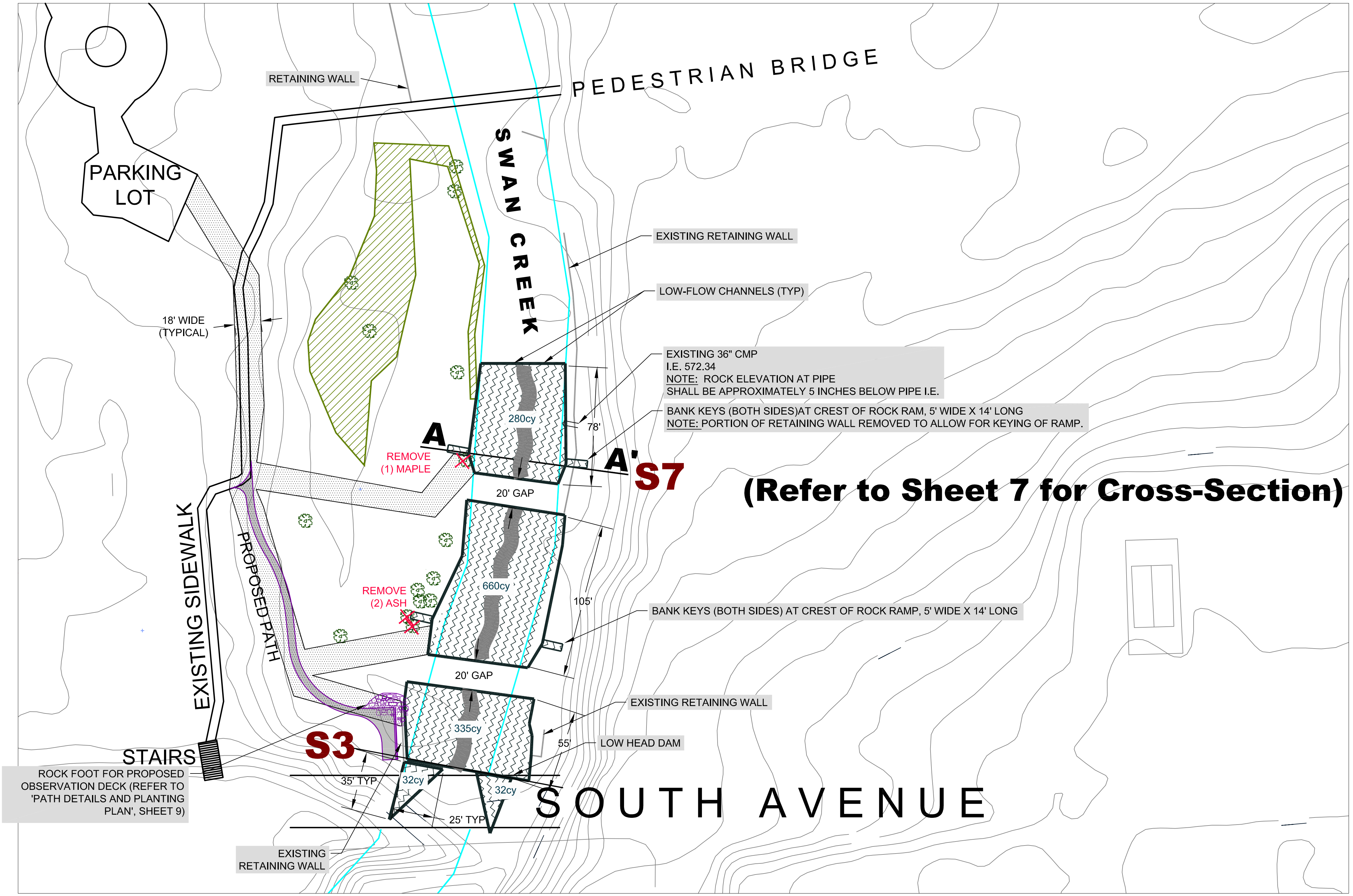
Plotted By:Christine Dittmar Plotted:May 8, 2008, 9:02:39 AM



SITE PLAN

LEGEND

- Existing Grade
- S# Cross-Section Designation / Location
- Existing Trees
- Trees to be removed as specified
- Rock Ramp (Refer to Details, Sheet 8)
- Construction Access (Refer to Details, Sheet 8)
- Wetland

NOTE

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PRELIMINARY DRAWING:
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N

0 40'

SCALE IN FEET

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REVISION

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Lucas County, Toledo, Ohio
PROPOSED PLAN

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JOB NO:	070812.00

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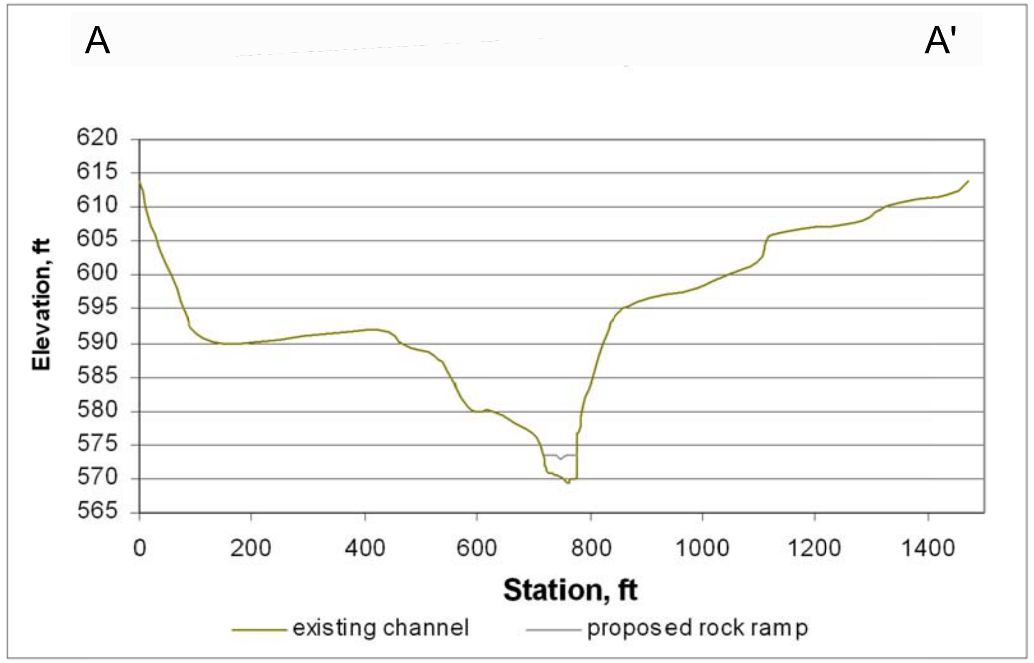
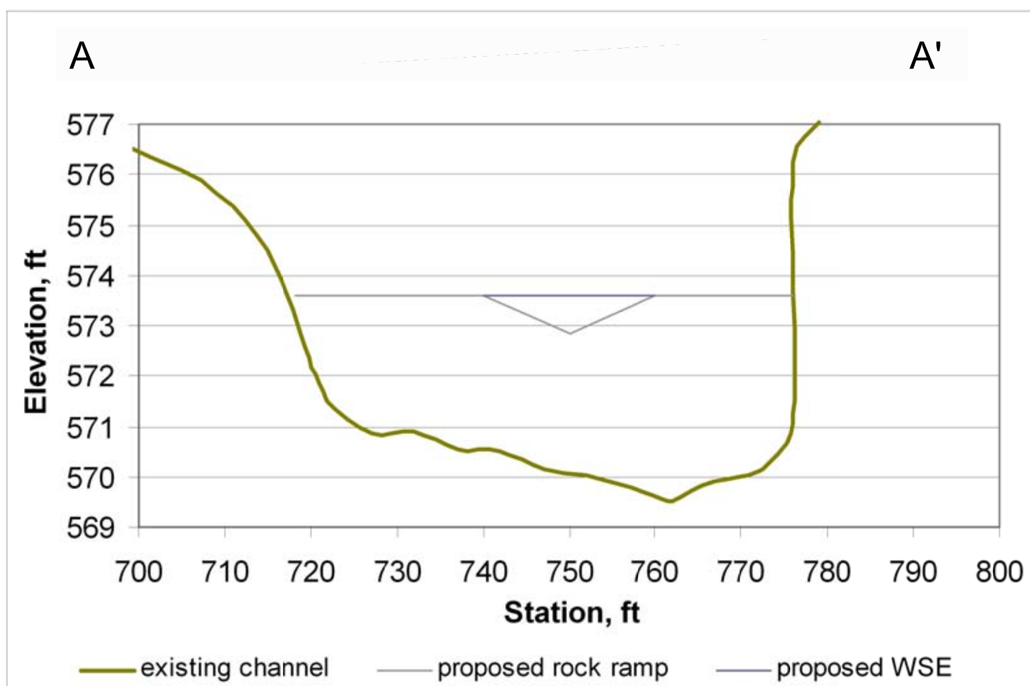
6



EXISTING SECTION A - A' (DETAIL 7/1)

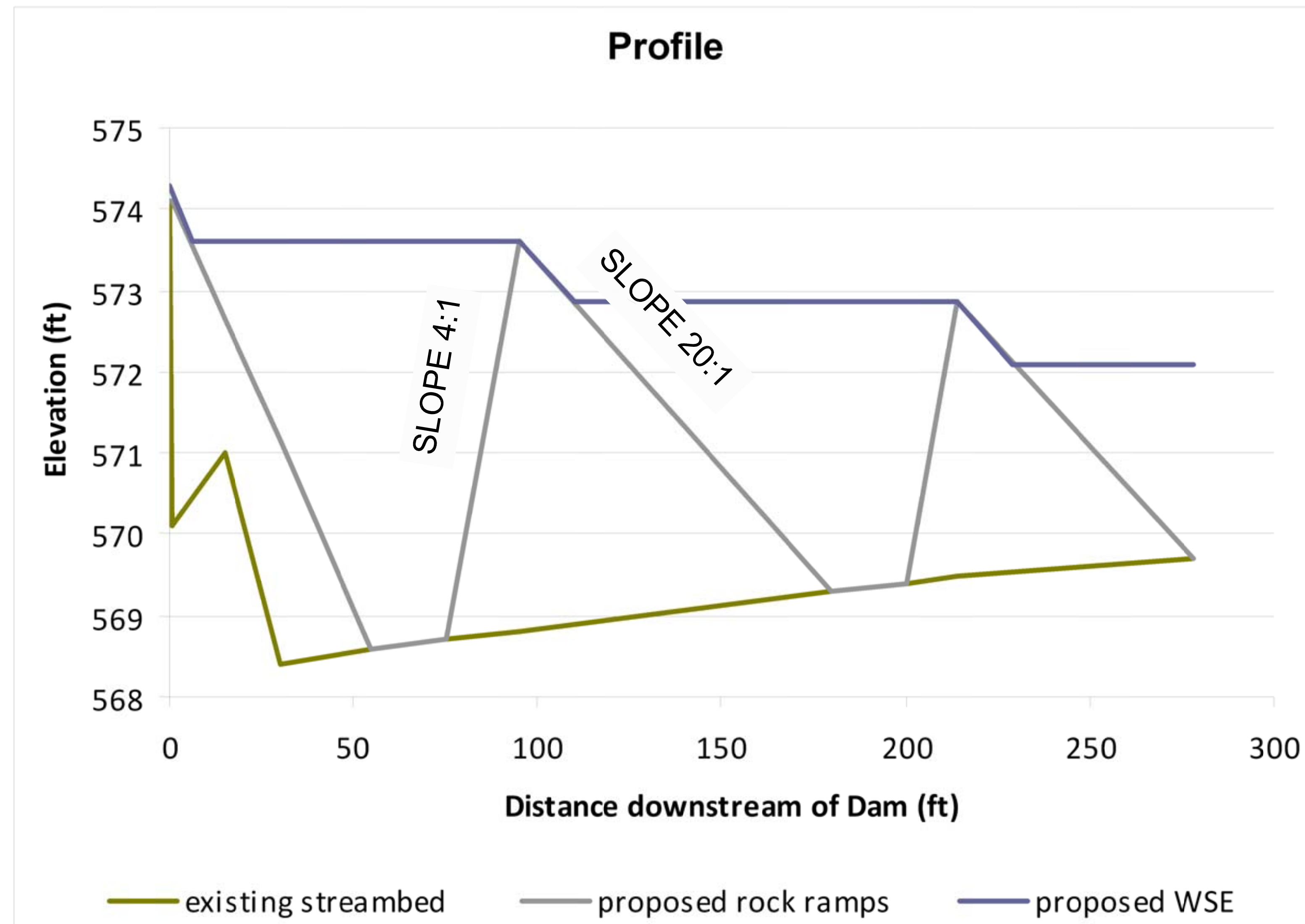
NOT TO SCALE



PROPOSED SECTION A - A' (DETAIL 7/2)

NOT TO SCALE

NOTES:
1) DAM ELEVATION 574.15
2) WATER SURFACE ELEVATION (WSE) 574.35 AT DAM (10/3/08).
3) REFER TO DETAIL 8/1 FOR ROCK RAMP SPECIFICATIONS.



STREAM PROFILE (DETAIL 7/3)

NOT TO SCALE

PRELIMINARY DRAWING:
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REVISION

Highland Park Dam Mitigation and Riparian Enhancement
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Lucas County, Toledo, Ohio
PROFILE AND CROSS-SECTIONS

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DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

DRAFT

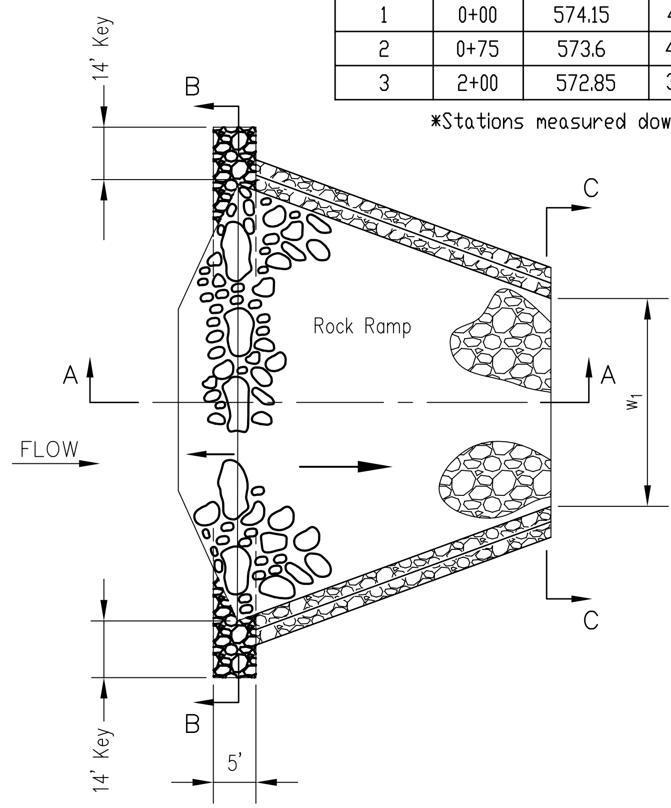
DRAWING NO.

7

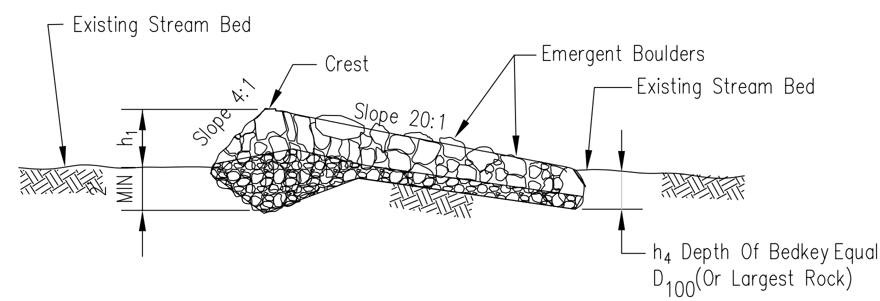
$(h_2 = h_1 + 0.75')$

Riffle No.	*Station	Control Elev.	h_1	h_2	h_3	h_4	W_1
1	0+00	574.15	4	4.75	5.75	3.0	86
2	0+75	573.6	4.75	5.5	6.5	3.0	67
3	2+00	572.85	3.4	4.15	5.15	3.0	56

*Stations measured downstream from dam.



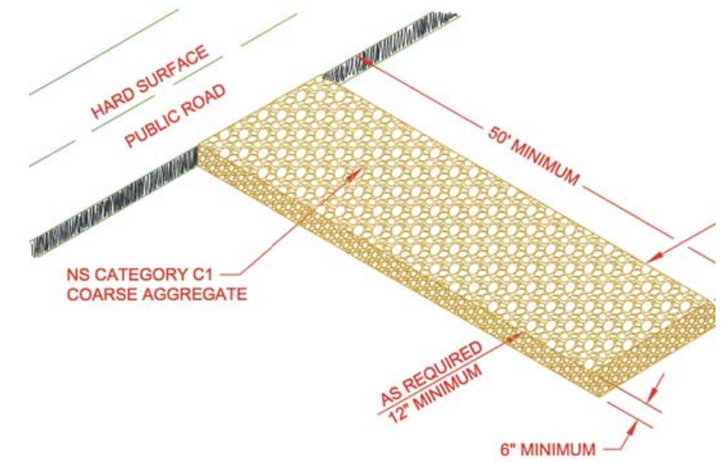
PLAN



SECTION A–A

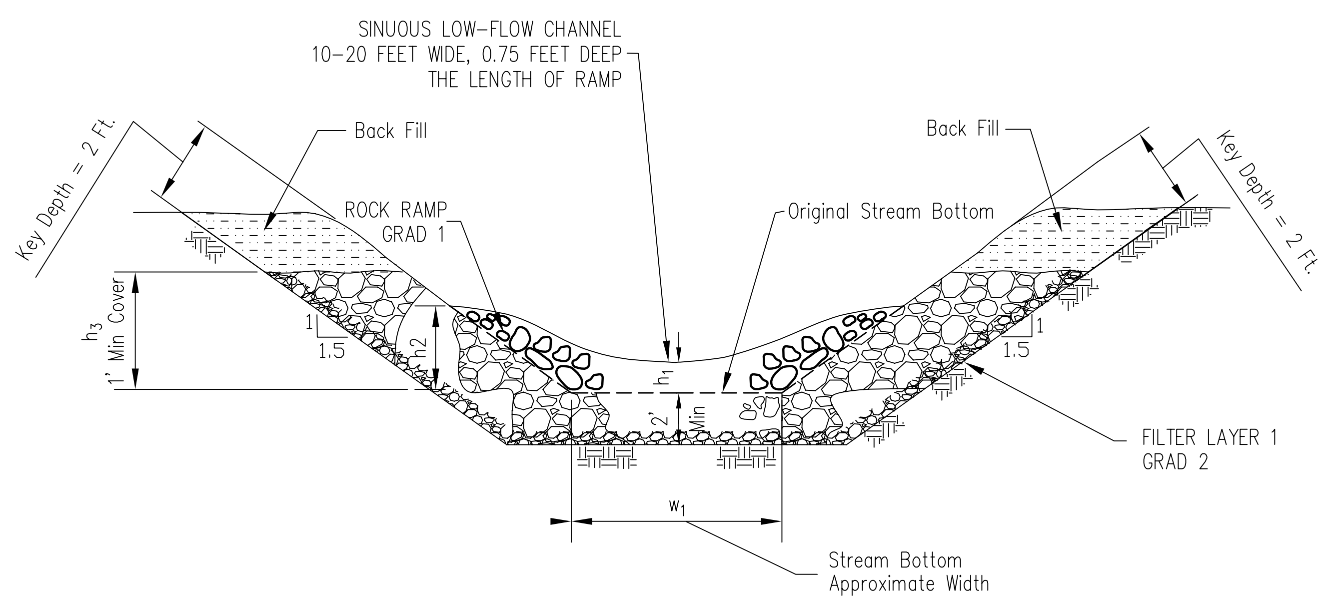
REFERENCE TABLE			
ROCK LAYER NAME	ROCK GRAD.	h_4	D_{50}
ROCK RAMP	1	3.0 Ft.	24 In.
FILTER LAYER 1	2	4.25 In.	2.5 In.

NOTES:
1. Rock gradation shall meet ODOT requirements.
2. Use largest individual stones from available material as shown for the emergent boulders and crest stone.
3. Ramps shall consist of the main Rock Ramp layer and 1 filter layer.
4. Scour holes shall be excavated prior to application of rock.
5. See Profile Detail 7/3 for Proposed Stream Elevations.

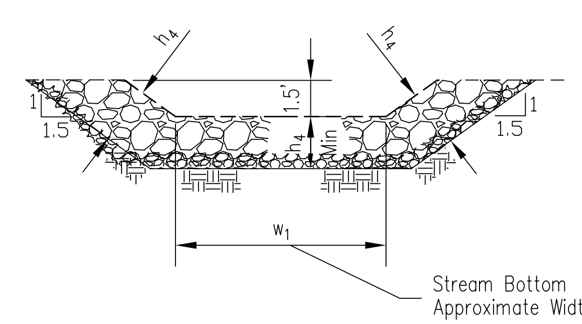


CONSTRUCTION ACCESS DETAIL 8/2

NOT TO SCALE



SECTION B–B



SECTION C–C

ROCK RAMP DETAIL 8/1

NOT TO SCALE

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REVISION

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Lucas County, Toledo, Ohio
DETAILS

DRAWN BY:	SKL/COD
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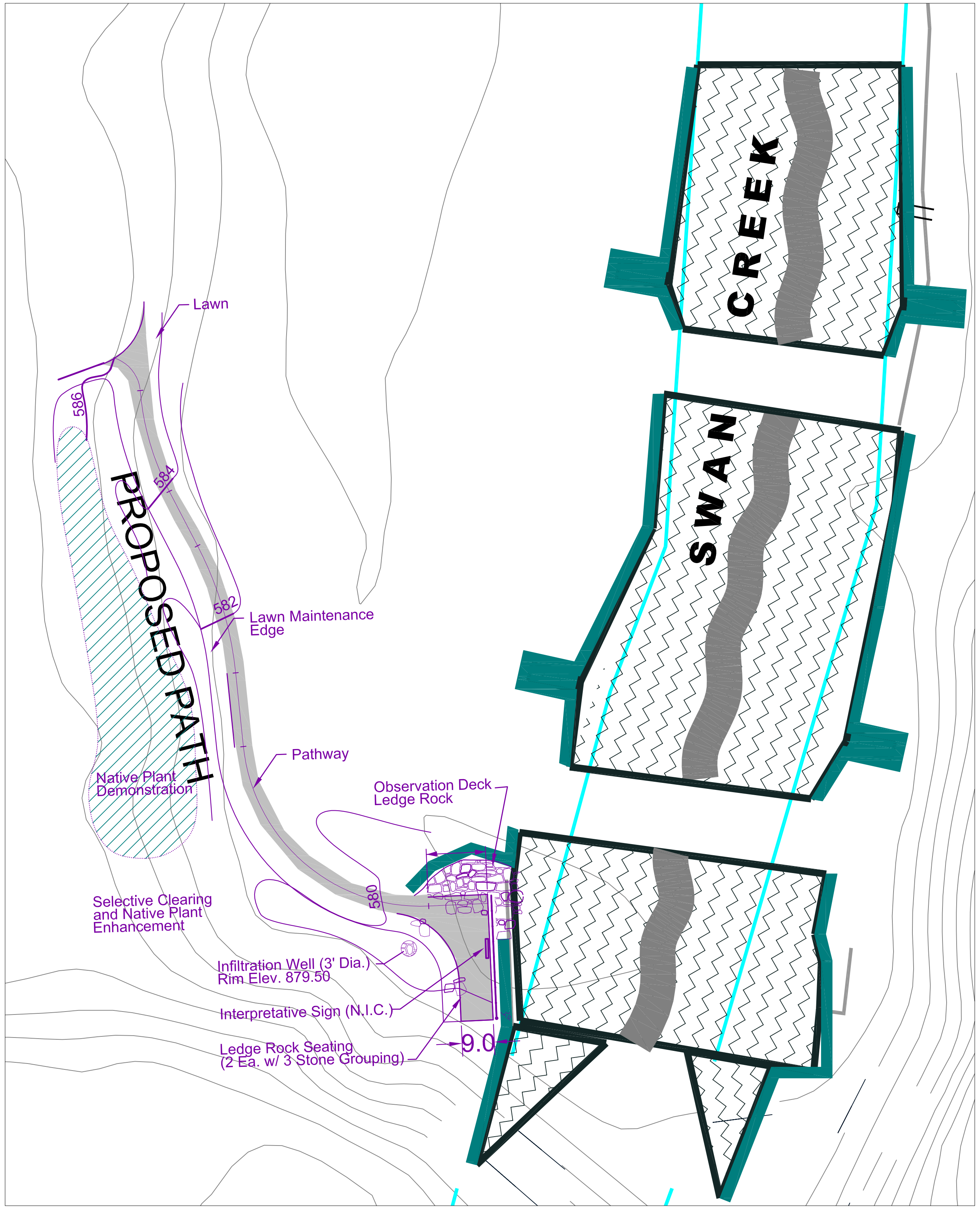
DATE:	MAY 2008
JOB NO:	070812.00

DRAFT

DRAWING NO.

8



SITE PLAN

NOTE

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LEGEND

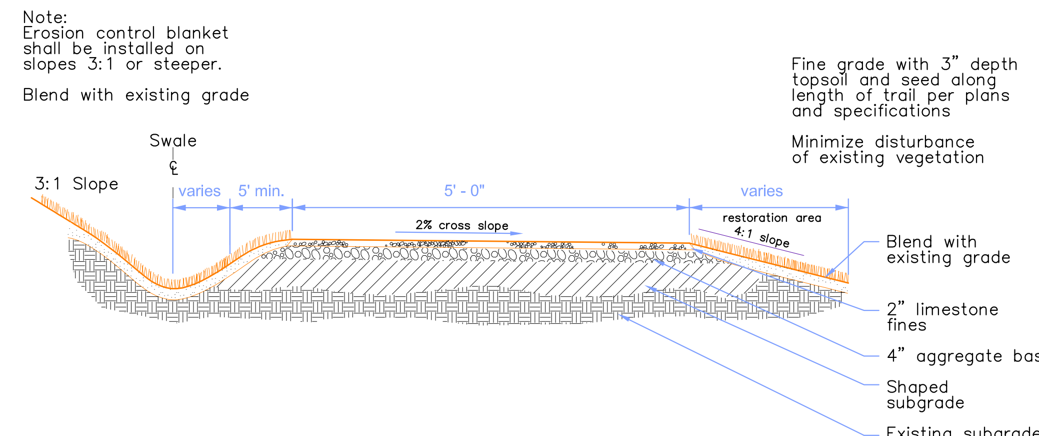
Existing Grade

Rock Ramp

PLANTING LEGEND

Native Seed Mix and Live Stakes

Native Plant Plugs



Limestone Fines Trail with Cross Slope

Scale: Not To Scale

Native Plant Plugs (1'-3' on center)

Botanical Name	Common Name	# Plugs
Grass:		
Elymus canadensis	Canada Wild Rye	114
Panicum virgatum	Switchgrass	114
Schizachyrum scoparium	Little Bluestem	114
Sorghastrum nutans	Indian Grass	114
Forbs:		
Aquilegia canadensis	Columbine	76
Asclepias tuberosa	Butterfly Milkweed	76
Aster azureus	Sky-blue Aster	114
Aster laevis	Smooth Blue Aster	76
Coreopsis lanceolata	Lance-leafed Coreopsis	76
Coreopsis tripteris	Tall Coreopsis	114
Echinacea purpurea	Purple Coneflower	76
Eupatorium rugosum	Snakeroot	76
Euphorbia corollata	Flowering Spurge	76
Helianthus occidentalis	Western Sunflower	38
Helianthus strumosus	Pale-Leaved Sunflower	76
Monarda fistulosa	Bergamot	76
Penstemon hirsutus	Hairy Beard's Tongue	76
Ratibida pinnata	Gray-headed Coneflower	76
Rudbeckia hirta	Black-eyed Susan	76
Solidago nemoralis	Gray Goldenrod	76
Solidago rigida	Stiff Goldenrod	76
Verbena stricta	Hoary Vervain	114
Veronicastrum virginicum	Culver's Root	76
	Total Plugs	1976

Native Seed Mix

Botanical Name	Common Name	PLS Oz Per Acre
Avena sativa	Seed Oats	128
Carex crinita	Fringed sedge	1
Carex emoryi	Riverbank sedge	1
Carex frankii	Bristly cattail sedge	2
Carex grayi	Common bur sedge	0.5
Carex lupulina	Common hop sedge	1
Carex muskingumensis	Swamp oval sedge	1
Carex vulpinoidea	Brown fox sedge	2
Cinna arundinacea	Common wood reed	1
Coreopsis tripteris	Tall coreopsis	1
Elymus riparius	Riverbank wild rye	4
Elymus virginicus	Virginia wild rye	32
Eupatorium maculatum	Spotted joe-pye weed	1
Eupatorium perfoliatum	Common boneset	0.5
Eupatorium purpureum	Purple joe-pye weed	1
Hibiscus moscheutos	Swamp rose mallow	1
Juncus effusus	Common rush	0.25
Juncus tenuis v. dudleyi	Dudley's rush	0.1
Liatris spicata	Marsh blazing star	0.25
Lobelia cardinalis	Cardinal flower	0.25
Lobelia siphilitica	Great blue lobelia	0.25
Lolium multiflorum	Annual rye	40
Monarda fistulosa	Wild bergamot	0.5
Panicum virgatum	Switch grass	2
Rudbeckia laciniata	Wild golden glow	2
Spartina pectinata	Prairie cord grass	2
Verbesina alternifolia	Wingstem	2
Zizia aurea	Golden Alexanders	0.25
	Total PLS Ounces	227.85

Live Stakes (1' on center)

		# Stakes
Cornus stolonifera	Red-osier dogwood	337
Salix exigua	Sandbar willow	337
	Total Stakes	674

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N

0 20'

SCALE IN FEET

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REVISION

Highland Park Dam Mitigation and Riparian Enhancement

Partners for Clean Streams

Lucas County, Toledo, Ohio

PATH DETAILS AND PLANTING PLAN

DRAWN BY: COD

DESIGNED BY: ES

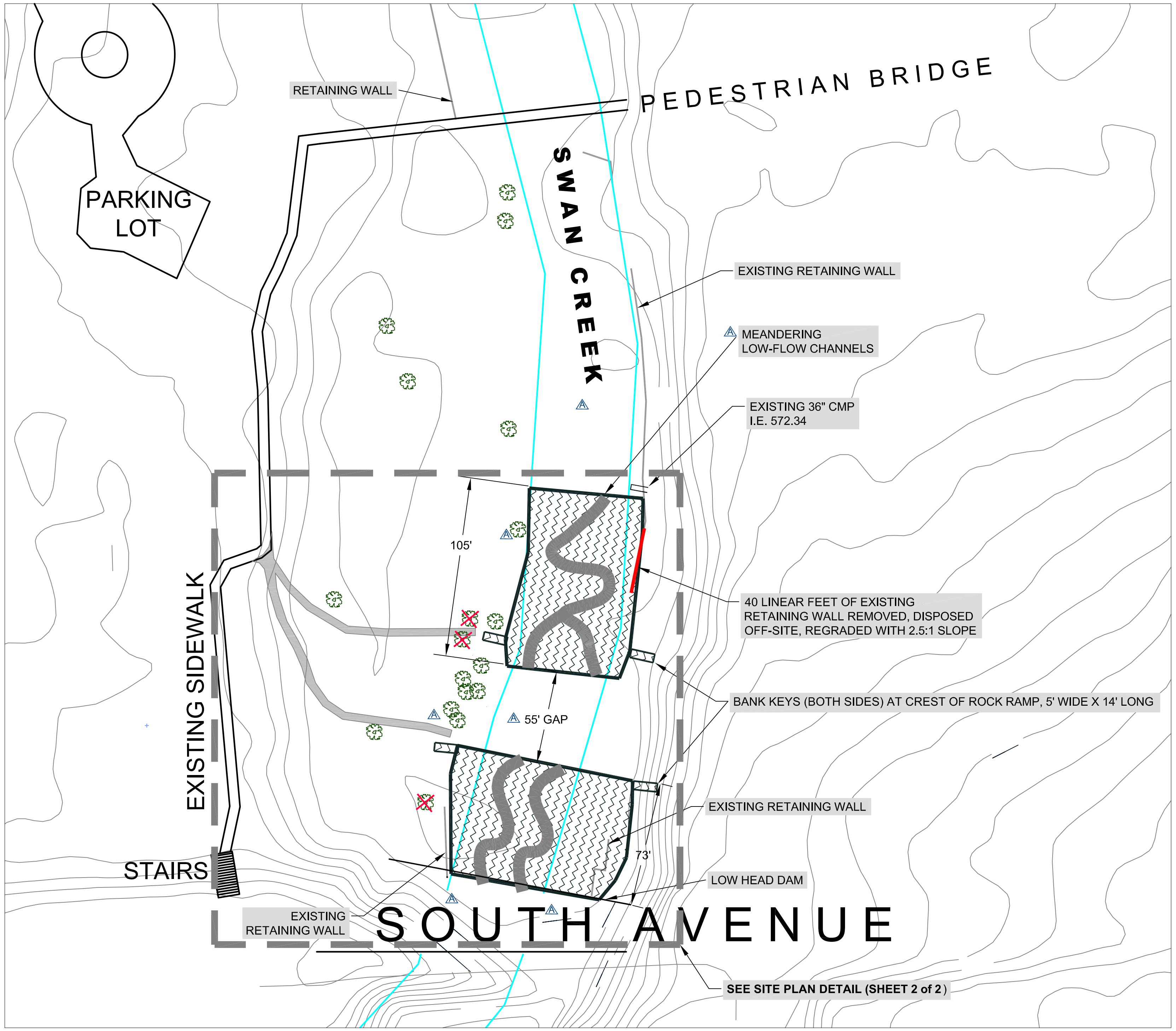
DATE: MAY 2008

JOB NO: 070812.00

DRAFT

DRAWING NO.

9



SITE PLAN

0 40'
SCALE IN FEET

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LEGEND

- Existing Grade
- Existing Trees
- Trees removed
- Rock Ramp

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REVISION		
9/17/08	AS-BUILT REVISIONS	COD

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
SITE PLAN

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	MAY 2008
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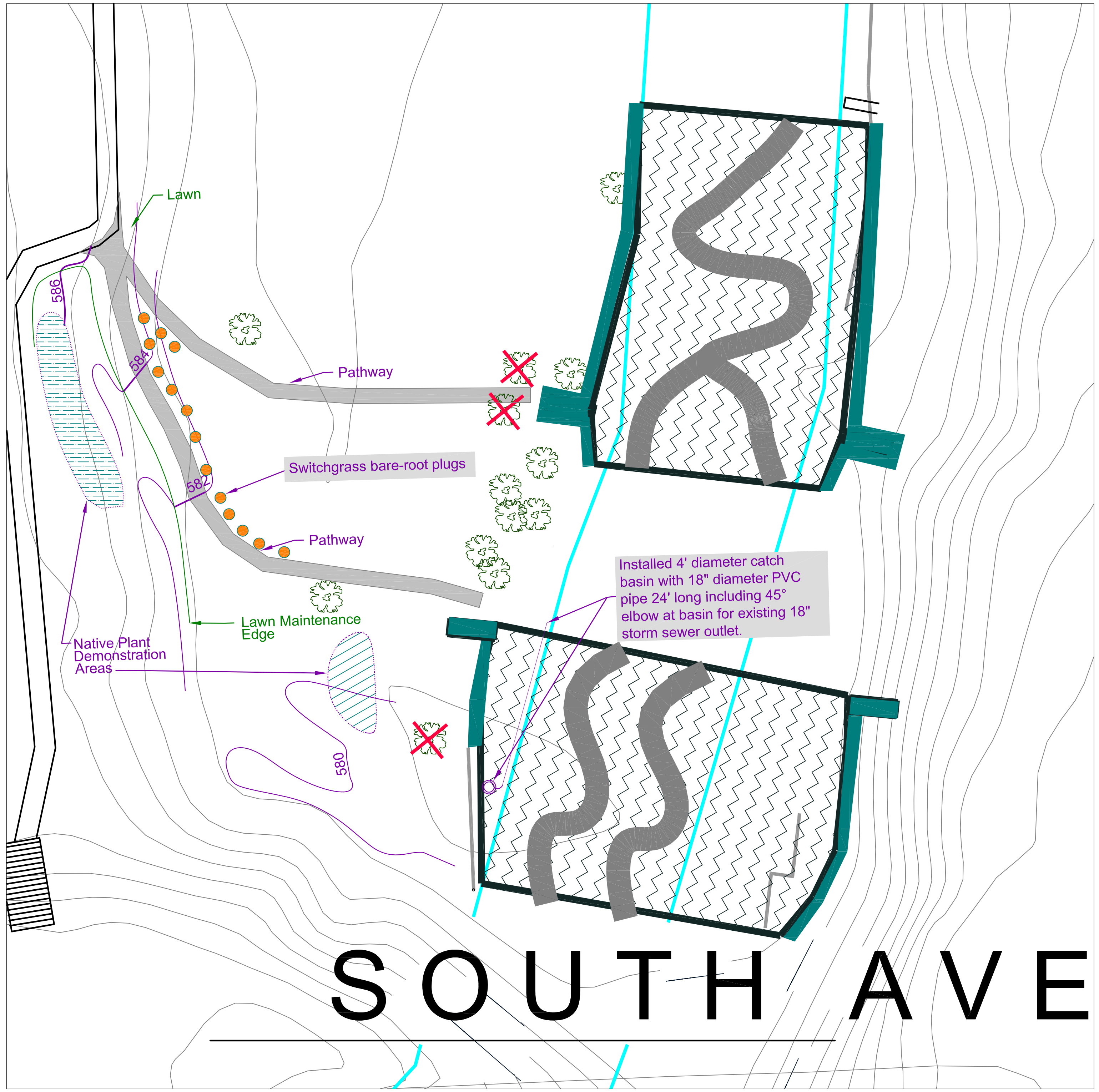
AS-BUILT

DRAWING NO.
1



SITE PLAN DETAIL

GRAPHIC SCALE VERIFICATION
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0 20'
SCALE IN FEET

N

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LEGEND

- Existing Grade
- Existing Trees
- Trees removed
- Rock Ramp

PLANTING LEGEND

- Native Seed Mix and Live Stakes
- Native Plant Plugs

Native Plant Plugs (1'-3' on center)

Height (ft)	Botanical Name	Common Name	# Plugs
2 - 4	*Asclepias syriaca*	Common milkweed	76
1 - 3	*Asclepias tuberosa*	Butterfly Milkweed	76
1 - 4	*Aster azureus*	Sky-blue Aster	114
3 - 5	*Aster laevis*	Smooth Blue Aster	76
3 - 4	*Baptisia leucantha*	White wild indigo	76
1 - 2	*Coreopsis lanceolata*	Lance-leafed Coreopsis	76
3 - 5	*Echinacea purpurea*	Purple Coneflower	76
2 - 4	*Helianthus occidentalis*	Western Sunflower	38
2 - 3	*Parthenium integrifolium*	Wild quinine	76
3 - 6	*Ratibida pinnata*	Gray-headed Coneflower	76
2 - 4	*Schizachyrium scoparium*	Little bluestem	114
1 - 3	*Solidago speciosa*	Showy goldenrod	76
2 - 4	*Verbena stricta*	Hoary Vervain	114
		Total Plugs	**1064**

Native Plant Plugs (1'-3' on center)

Height (ft)	Botanical Name	Common Name	# Plugs
4 - 8	*Coreopsis tripteris*	Tall Coreopsis	114
3 - 6	*Elymus canadensis*	Nodding wild-rye	114
3 - 5	*Panicum virgatum*	Switchgrass	114
2 - 4	*Penstemon digitalis*	Foxglove beardtongue	76
1 - 3	*Rudbeckia hirta*	Black-eyed Susan	76
1 - 5	*Solidago rigida*	Stiff Goldenrod	76
4 - 9	*Sorghastrum nutans*	Indian grass	114
3 - 6	*Veronicastrum virginicum*	Culver's Root	76
		Total Plugs	**760**

Native Seed Mix

Botanical Name	Common Name	PLS Oz Per Acre
Avena sativa	Seed Oats	128
Carex crinita	Fringed sedge	1.5
Carex frankii	Bristly cattail sedge	3
Carex grayi	Common bur sedge	0.75
Carex lupulina	Common hop sedge	1.5
Carex muskingumensis	Swamp oval sedge	1.5
Carex vulpinoidea	Brown fox sedge	3
Coreopsis tripteris	Tall coreopsis	1.5
Elymus riparius	Riverbank wild rye	6
Elymus virginicus	Virginia wild rye	32
Eupatorium maculatum	Spotted joe-pye weed	1.5
Eupatorium perfoliatum	Common boneset	0.75
Eupatorium purpureum	Purple joe-pye weed	1.5
Hibiscus moscheutos	Swamp rose mallow	1.5
Juncus effusus	Common rush	0.375
Juncus tenuis v. dudleyi	Dudley's rush	0.15
Liatris spicata	Marsh blazing star	0.375
Lobelia cardinalis	Cardinal flower	0.375
Lobelia siphilitica	Great blue lobelia	0.375
Lolium multiflorum	Annual rye	40
Monarda fistulosa	Wild bergamot	0.75
Panicum virgatum	Switch grass	3
Rudbeckia laciniata	Wild golden glow	3
Spartina pectinata	Prairie cord grass	3
Verbesina alternifolia	Wingstem	3
Zizia aurea	Golden Alexanders	0.375
	Total PLS Ounces	**238.78**

Live Stakes (1' on center)

Botanical Name	Common Name	# Stakes
Cornus stolonifera	Red-osier dogwood	337
Salix exigua	Sandbar willow	337
	Total Stakes	**674**

PLANTING NOTE:

Plant plugs in groups of 20-30 individuals per species.

JFNew
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708 Roosevelt Road
Walkerton, Indiana 46574
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Eastern Michigan
605 S. Main Street, Suite 1,
Ann Arbor, MI 48104
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REVISION

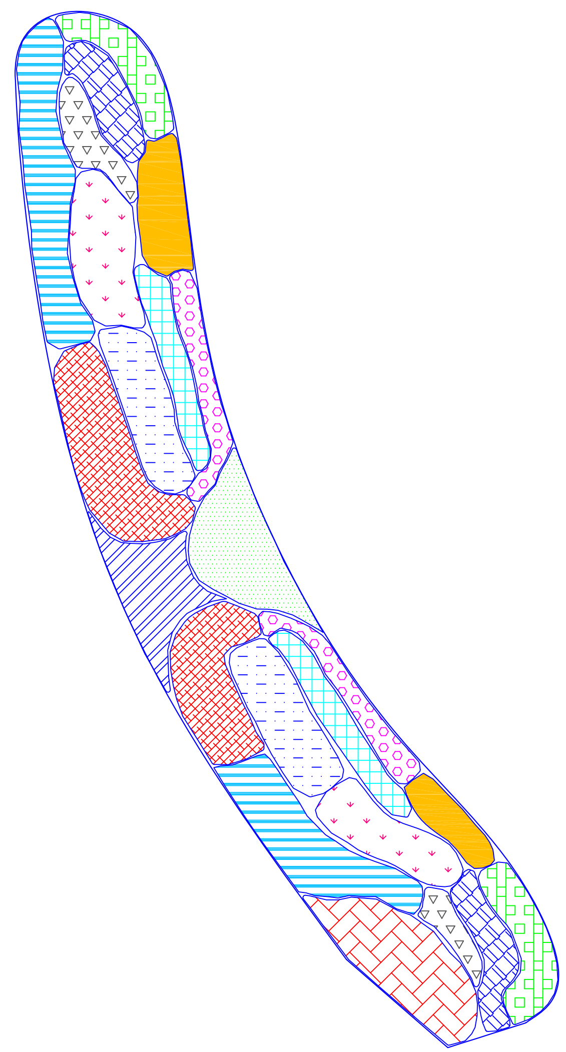
	Date	Revision	By
A	9/17/08	AS-BUILT REVISIONS	COD

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
SITE PLAN DETAIL

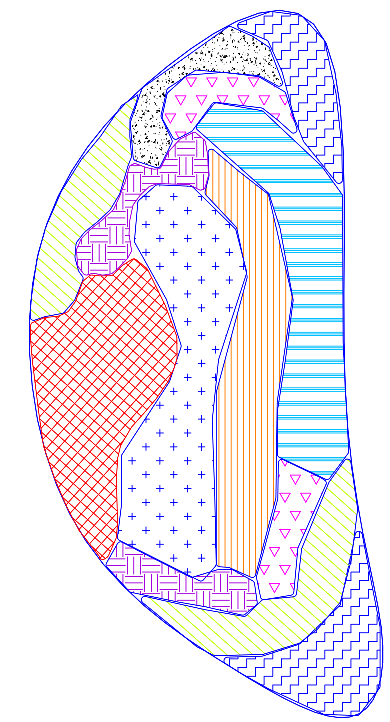
DRAWN BY: COD
DESIGNED BY: ES
DATE: MAY 2008
JOB NO: 070812.00

AS-BUILT

DRAWING NO.
2



Large Planting Area - West



Small Planting Area - East

PLANTING LEGEND

Botanical Name	Common Name	# Plugs
Asclepias tuberosa	Butterfly Milkweed	76
Asclepias syriaca	Common Milkweed	76
Aster oolentangiensis	Sky-Blue Aster	114
Aster levis	Smooth Blue Aster	76
Baptisia lactea	White Wild Indigo	76
Coreopsis lanceolata	Sand Coreopsis	76
Echinacea purpurea	Purple Coneflower	76
Helianthus occidentalis	Western Sunflower	38
Parthenium integrifolium	Wild Quinine	76
Ratibida pinnata	Yellow Coneflower	76
Schizachyrium scoparium	Little Bluestem	76
Solidago speciosa	Showy Goldenrod	76
Verbena stricta	Hoary Vervain	114

PLANTING LEGEND

Botanical Name	Common Name	# Plugs
Coreopsis tripteris	Tall Coreopsis	114
Elymus canadensis	Canada Wild Rye	114
Panicum virgatum	Switch Grass	114
Penstemon digitalis	Foxglove Beard Tongue	76
Rudbeckia hirta	Black-eyed Susan	76
Schizachyrium scoparium	Little Bluestem	76
Solidago rigida	Stiff Goldenrod	76
Sorghastrum nutans	Indian Grass	114
Veronioncastrum virginicum	Culver's Root	76

N

NOT TO SCALE

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REVISION		
2/05/09	AS-BUILT PLANTING PLAN	COD

Highland Park Dam Mitigation and Riparian Enhancement

Partners for Clean Streams

Lucas County, Toledo, Ohio

AS-BUILT PLANTING PLAN

DRAWN BY:	ES
DESIGNED BY:	ES
DATE:	FEB 2009
JOB NO:	070812.00

AS-BUILT

DRAWING NO.

3

605 S. Main Street, Suite 1
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April 30, 2008

Mr. Matt Horvat
Partners for Clean Streams
300 Dr. Martin Luther King Jr. Drive
Toledo, OH 43604

RE: Waters of the U.S. Delineation of the Highland Park Property, Lucas County, Ohio

Dear Mr. Horvat,

Enclosed are two copies of our report. We have completed our delineation of jurisdictional wetlands and other "waters of the United States (U.S.)" within the project area in Highland Park, Lucas County, Ohio. One stream, Swan Creek, and an associated wetland were found on site. Swan Creek is considered "jurisdictional waters of the United States. The wetland was contiguous to Swan Creek and is considered "jurisdictional waters of the U.S.".

Please note the U.S. Army Corps of Engineers (Corps) is the regulatory authority that must make the final determination as to the jurisdictional status of the project area. We strongly recommend that our report be sent to the Corps for verification and would be glad to forward a copy at your request.

Please call if you have any questions or concerns. We appreciate the opportunity to be of service.

Sincerely,
JFNew

Erin N. Switala

Erin Switala
Project Manager

Enclosure

File No. **070812.00**

WETLAND DELINEATION REPORT

HIGHLAND PARK PROPERTY
LUCAS COUNTY, OHIO

April 30, 2008

Prepared for:

Partners for Clean Streams
300 Dr. Martin Luther King Drive
Toledo, OH 43604

Prepared by:

JFNew

605 S. Main Street, Suite 1
Ann Arbor, MI 48104
734-222-9690
734-222-9655

WETLAND DELINEATION REPORT

TABLE OF CONTENTS

WETLAND DELINEATION REPORT:
HIGHLAND PARK PROPERTY
LUCAS COUNTY, OHIO

1.0 INTRODUCTION

1.1 JFNew was contracted to perform a jurisdictional determination and delineation of the boundaries of "waters of the United States (U.S.)," including wetlands, which occur within the Highland Park Property in Toledo, Lucas County, Ohio (**Drawing 1**). The delineation was conducted on April 4, 2008. Approximately 500 linear feet of Swan Creek was identified in the project area, as well as one wetland (Wetland A) totaling approximately 0.20 acre.

1.2 This report identifies the jurisdictional status of the project area based on JFNew's best professional understanding and interpretation of the *Corps of Engineers' Wetland Delineation Manual* (Environmental Laboratory, 1987) and U.S. Army Corps of Engineers' (Corps) guidance documents and regulations. Jurisdictional determinations for other "waters of the U.S." were made based on definitions and guidance found in 33 CFR 328.3, Corps Regulatory Guidance Letters, and the wetland delineation manual. The Corps administers Section 404 of the Clean Water Act (CWA), which regulates the discharge of fill or dredged material into all "waters of the U.S.," and is the regulatory authority that must make the final determination as to the jurisdictional status of the project area.

2.0 REGULATORY DEFINITIONS

2.1 *Waters of the United States*

"Waters of the U.S." are within the jurisdiction of the Corps under the CWA. "Waters of the U.S." is a broad term, which includes waters that are used or could be used for interstate commerce. This includes wetlands, ponds, lakes, territorial seas, rivers, tributary streams including any definable intermittent waterways, and some ditches below the ordinary high water mark (OHWM). Also included are manmade water bodies such as quarries and ponds, which are no longer actively being mined or constructed and are connected to other "waters". Wetlands, mudflats, vegetated shallows, riffle and pool complexes, coral reefs, sanctuaries, and refuges are all considered special aquatic sites which involve more rigorous regulatory permitting requirements. A specific, detailed definition of "waters of the U.S." can be found in the Federal Register (33 CFR 328.3).

On January 9, 2001 the U.S. Supreme Court issued a decision, Solid Waste Agency of Northern Cook County (SWANCC) v. U.S. Army Corps of Engineers (No. 99-1178). The decision reduces the regulation of isolated wetlands under Section 404 of the CWA, which assigns the Corps' authority to issue permits for the discharge of dredge or fill material into "waters of the U.S.". Prior to the SWANCC decision, the Corps had adopted a regulatory definition of "waters of the U.S." that afforded federal protection for almost all of the nation's wetlands. The Supreme Court decision interpreted that the Corps' jurisdiction is restricted to navigable waters, their tributaries, and wetlands that are adjacent to these navigable waterways and tributaries. The decision leaves the majority of "isolated" wetlands unregulated by the CWA. Therefore, most wetlands that are not adjacent to, or contiguous with, any other "waters of the U.S." via a surface drain such as a swale, ditch, or stream are considered isolated and thus no longer jurisdictional by the Corps.

On June 5, 2007 the U.S. Supreme Court issued a decision in the consolidated cases *Rapanos v. United States and Carabell v. United States* (Rapanos). The decision reduces the Federal regulation of some traditionally defined "waters of the U.S." The following waters remain jurisdictional:

- Traditional navigable waters
- Wetlands adjacent to traditional navigable waters
- Non-navigable tributaries that are relatively permanent
- Wetlands directly abutting such tributaries

The preceding list leaves many areas in question. Therefore, under the decision, the Corps is required on a case by case basis to determine if there is a "significant nexus" to a navigable waterway. Areas not determined to contain a "significant nexus" are not federally regulated. The decision also requires interagency coordination for jurisdictional determinations between the Corps and USEPA under many cases.

The Supreme Court's decisions leave the majority of isolated wetlands and many headwater streams and wetlands unregulated by the CWA.

2.2 *Waters of the State*

"Waters of the State" are those waters within the jurisdiction of the Ohio Environmental Protection Agency (OEPA). They are generally defined as surface and underground water bodies, which extend through or exist wholly within the State; these include, but are not limited to, streams and both isolated and non-isolated wetlands. Private ponds, or any pond, reservoir, or facility built for reduction of pollutants prior to discharge are not included in this definition. In addition to "waters of the U.S.", the OEPA also regulates and issues permits for isolated wetland impacts under Chapter 6111.21 of the Ohio Revised Code (ORC).

The State relies on the Corps' jurisdictional authority regarding wetland determinations and delineations including whether or not a wetland is isolated or non-isolated.

2.3 *Wetlands*

Wetlands are a category of "waters of the U.S." for which a specific identification methodology has been developed. As described in detail in the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory, 1987), wetland boundaries are delineated using three criteria: hydrophytic vegetation, hydric soils, and wetland hydrology.

2.3.1 Hydrophytic Vegetation. In the course of developing the wetland determination methodology the Corps, in cooperation with the U.S. Fish and Wildlife Service (USFWS), Environmental Protection Agency (EPA), and the Soil Conservation Service (SCS), compiled a comprehensive list of wetland vegetation. The indicator status of plant species is expressed in terms of the estimated probability of that species occurring in wetland conditions within a given region. The indicator categories as defined by the Corps are:

> Obligate Wetland (OBL): Occurs almost always (estimated probability >99 percent) under natural conditions in wetlands.
>
> Facultative Wetland (FACW): Usually occurs in wetlands (estimated probability

67 to 99 percent), but occasionally found in non-wetlands.

Facultative (FAC): Equally likely to occur in wetlands or non-wetlands (estimated probability 34 to 66 percent).

Facultative Upland (FACU): Usually occurs in non-wetlands, but occasionally found in wetlands (estimated probability 1 to 33 percent).

Obligate Upland (UPL): Occurs almost always (estimated probability >99 percent) in uplands.

Plants that are OBL, FACW, and FAC (except FAC-) are considered wetland species. Positive or negative signs indicate a tendency toward higher (+) or lower (-) frequency of occurrence within a wetland. The percentage of the dominant wetland species in each of the vegetation strata in the sample area determines the hydrophytic or wetland status of the plant community. Soil type and hydroperiod are two factors important in controlling species composition.

2.3.2 Hydric Soils. Hydric soils are defined as soils that are saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part. In general, hydric soils are flooded, ponded, or saturated for a week or more during the growing season when soil temperatures are above 32 degrees Fahrenheit. The anaerobic conditions created by repeated or prolonged saturation or flooding result in permanent changes in soil color and chemistry, which are used to differentiate hydric from non-hydric soils.

In this report, soil colors are described using the Munsell notation system. This method of describing soil color consists of separate notations for hue, value, and chroma that are combined in that order to form the color designation. The hue notation of a color indicates its relation to red, yellow, green, blue, and purple; the value notation indicates its lightness, and the chroma notation indicates its strength or departure from a neutral of the same lightness.

The symbol for hue consists of a number from 1 to 10, followed by the letter abbreviation of the color. Within each letter range, the hue becomes more yellow and less red as the numbers increase. The notation for value consists of numbers from 0 for absolute black, to 10 for absolute white. The notation for chroma consists of numbers beginning with /0 for neutral grays and increasing at equal intervals. A soil described as 10YR 3/1 soil is more gray than a soil designated 10YR 3/6. The Corps' color criteria for hydric soils specify that the chroma must be /1 if the soil has no redoximorphic concentrations (small variegations in color with a higher chroma than the matrix), and /1 or /2 if the soil contains redoximorphic concentrations.

2.3.3 Wetland Hydrology. Wetland hydrology is defined as the presence of water for a significant period of time at or near the surface (within the root zone) during the growing season. Wetland hydrology is present only seasonally in many cases, and is often inferred by indirect evidence. Hydrology is controlled by such factors as seasonal and long-term rainfall patterns, local geology and topography, soil type, local water table conditions, and drainage. Primary indicators of hydrology are inundation, soil saturation in the upper 12 inches of the soil, watermarks, sediment deposits, and drainage patterns. Secondary indicators such as oxidized root channels in the upper 12 inches of the soil, water-stained leaves, local soil survey data, and the FAC-neutral vegetation test are sometimes used to identify hydrology. A primary indicator or two or more secondary indicators are required to establish a positive indication of hydrology.

2.3.4 Wetland Definition Summary. In general, an area must meet all three criteria to be classified as a wetland. In certain problem areas such as seasonal wetlands, which are not wet at all times, or in recently disturbed (atypical) situations, areas may be considered a wetland if only two criteria are met. In special situations, an area that meets the wetland definition may not be within the Corps' jurisdiction due to a specific regulatory exemption.

3.0 BACKGROUND INFORMATION

3.1 *Existing Maps*

Several sources of information were consulted to identify potential wetlands and wetland soil units on the site. These include the USGS Topographic Map Series, USFWS's *National Wetland Inventory* (NWI) and the Natural Resources Conservation Service's (NRCS) *Soil Survey of Lucas County, Ohio* (2007). These maps identify potential wetlands and wetland soil units on the site. The NWI maps were prepared from high altitude photography and in most cases were not field checked. Because of this, wetlands are sometimes erroneously identified, missed, or misidentified. Additionally, the criteria used in identifying these wetlands were different from those currently used by the Corps. The county soil maps, on the other hand, were developed from actual field investigations. However, they address only one of the three required wetland criteria and may reflect historical conditions rather than current site conditions. The resolution of the soil maps limits their accuracy as well. The mapping units are often generalized based on topography and many mapping units contain inclusions of other soil types for up to 15 percent of the area of the unit. The Corps does not accept the use of either of these maps to make wetland determinations.

3.2 *USGS Topographic Map*

The Toledo (OH) Topographic Quadrangle was reviewed to identify mapped water bodies within the project area (**Drawing 1**). One mapped water body was identified as perennial Stream 1, named Swan Creek. No other mapped water bodies were identified. The project is located within the Maumee River Watershed.

3.3 *National Wetland Inventory*

The NWI map of the area (**Drawing 2**) identified one wetland complexes on the site. The wetland (R2UBH) was a jurisdictional floodplain wetland adjacent to both sides of the Swan Creek corridor. The NWI wetland complexes located within the study area are identified in the following table (**Table 1**) along with the corresponding identified feature or data point. A data point was taken in the mapped wetland complex which was field verified.

Table 1. NWI Wetlands Located within the Project Study Area

NWI Wetland Type	***Comments from NWI***	***Feature / Data Point / Comment corresponding with Field Verification***
R2UBH	***Riverine, Lower Perennial, Unconsolidated Bottom, Permanently flooded***	***Wetland A***

3.4 *Soil Survey*

The NRCS *Soil Survey of Lucas County, Ohio* (2007) (**Drawing 3**) identified a two soil series in the project area at Highland Park. The following table (**Table 2**) identifies the soil unit symbol, soil unit name, and whether or not the soil type contains components that meet the hydric soil criteria:

Table 2: Soil Types within the Highland Park Property, Lucas County, Ohio

Symbol	***Description***	***Hydric***
Uo	***Udorthents, loamy***	***No***
W	***Water***	***N/A***

4.0 SITE INVESTIGATION AND DESCRIPTION

4.1 *Investigation Methodology*

The delineation of wetlands and other “waters of the U.S.” on the site were based on the methodology described in the *Corps of Engineers Wetland Delineation Manual* (Environmental Laboratory, 1987) as required by current Corps’ policy.

Prior to the field work, the background information was reviewed to establish the probability and approximate location of streams and potential wetlands on the site. Next a general reconnaissance of the project area was conducted to determine site conditions. The site was then walked with the specific intent of determining wetland boundaries and identifying jurisdictional streams. A data station was established at a location displaying wetland characteristics to document soil characteristics, evidence of hydrology and dominant vegetation. Note that no attempt was made to examine a full soil profile to confirm any soil series designations. However, soils were examined to a depth of at least 16 inches to assess soil characteristics and site hydrology. Complete descriptions of typical soil series can be found in the soil survey for this county.

4.1.1 Site Photographs. Photographs of the site are located in **Appendix A**. These photographs are the visual documentation of site conditions at the time of inspection. The photographs are intended to provide representative visual samples of any streams or other special features found on the site.

4.2 *General Site Conditions*

JFNew inspected the Highland Park Property located in Lucas County, Ohio on April 4, 2008 (**Drawing 1**). The site consists predominantly of old-field/manicured lawn with a forested area along the river. The forest is dominated by sassafras, box elder, cockspur thorn, and sycamore (**Table 3**).

Table 3: Composition of forest vegetation on site

Canopy Layer			***Shrub Layer***		
Common Name	***Scientific Name***	***% Cover***	***Common Name***	***Scientific Name***	***% Cover***
Box elder	*Acer negundo*	*33.3*	*Cockspur thorn*	*Crataegus crus-galli*	*50*
Sycamore	*Platanus occidentalis*	*33.3*	*Sassafras*	*Sassafras albidum*	*50*
Sassafras	*Sassafras albidum*	*33.3*			

The canopy layer consists of a mixed forest with common floodplain and upland tree species. The trees in the canopy layer range in diameter at breast height (dbh) from 8 to 32 inches, with an average of 14 inches.

4.3 *Technical Descriptions*
Data point (DP) and stream locations are labeled throughout the report and can be found on **Exhibit 1**. Resource evaluation and scoring sheets can be found in **Appendix B**.

4.4 ***WETLANDS***

One wetland was identified on-site totalling approximately 0.20 acre.

Wetland Data Point A-1 (0.20 acre)
Data Point (A-1)
This wetland (±0.02 acre) is a palustrine emergent (PEM) wetland which is connected to the floodplain of Swan Creek. The wetland is dominated by sedge (*Carex spp.,* most FAC, FAC+ or wetter), sycamore (*Platanus occidentalis,* FACW-), and moneywort (*Lysimachia nummularia*, OBL). Positive wetland hydrology was indicated by drainage patterns and soil pit hydrology at 14 inches below the soil surface. The soils displayed a matrix color of 10 YR 4/1 to 14 inches and 10YR 4/1 with 10YR 4/4 redoximorphic concentrations to 18 inches with sandy clay and sandy loam textures, respectively. Wetland A is likely to be considered jurisdictional by the Corps due to its connection with Swan Creek.

This area meets the three wetland criteria and is classified as a wetland. This wetland appears to be within the floodplain of Swan Creek, which would indicate the wetland is considered "jurisdictional waters of the U.S."

Upland Data Point A-2
Data Point (A-2)
This data point adjacent to A-1 is characterized by woody and herbaceous vegetation including cockspur thorn (*Crataegus crus-galli*, FACU), Ketucky bluegrass (*Poa pratensis*, FACU) box elder, sassafras (*Sassafras albidum*, FACU-) and tall goldenrod (*Solidago altissima*, FACU-). No hydrologic indicators were observed at this data point at the time of the site visit. The soils from

0-16 inches deep are a 10YR 4/2 with no redoximorphic concentrations and 10YR 3/1 to 21 inches. This area fails to meet any of the three wetland criteria. It is not classified as a wetland.

Wetland A Assessment
Wetland A is classified as a jurisdictional palustrine emergent wetland. The wetland functions as a backwater floodplain wetland of Swan Creek. Wetland A was assessed using Ohio's Rapid Assessment Methodology (ORAM) for wetlands and received an ORAM score of 27 out of a possible 100 points, which classifies it as a Category 1 wetland.

4.5 ***STREAMS***

Swan Creek (500 Linear Feet, Perennial)
Swan Creek is a perennial stream located along the northwest property line and flowing on the property for approximately 500 linear feet through the project area. Swan Creek is approximately 75 feet wide at bankfull width with 5.5 foot high banks. At the time of the site visit the stream had water flowing at a maximum depth of approximately three to six feet. The substrate of the stream consisted of sand, gravel, silt, rip rap, and cobble. Adjacent vegetation consisted of sycamore, box elder, and sassafras. Swan Creek has low sinuosity and has a very low gradient of less than 0.04% from the project site to the mouth of the river. Swan Creek received a QHEI score of 31 out of 100 and is considered modified warm water habitat.

5.0 JURISDICTIONAL ANALYSIS

5.1 *Corps of Engineers and the OEPA*
The Corps has authority over the discharge of fill or dredged material into "waters of the U.S.". This includes authority over any filling, mechanical land clearing, or construction activities that occur within the boundaries of any "waters of the U.S.". A permit must be obtained from the Corps before any of these activities occur. Permits can be divided into two general categories: Individual Permits and Nationwide Permits.

Individual Permits are required for projects that do not fall into one of the specific Nationwide Permits (NWP) or are deemed to have significant environmental impacts. These permits are much more difficult to obtain and receive a much higher level of regulatory agency and public scrutiny and may require several months to more than a year for processing.

Nationwide Permits (NWP) have been developed for projects that meet specific criteria and are deemed to have minimal impact on the aquatic environment.

The OEPA is responsible for issuing Clean Water Act (CWA) Section 401 permits known as Water Quality Certifications (WQC) in conjunction with the Corps' Section 404 permits. The OEPA must issue WQC for all Individual Permits. The Ohio EPA also requires notification for all impacts to isolated wetlands, which includes a permit application and mitigation plan. Water quality certification is granted by the Ohio EPA if the project falls under Nationwide Permit limitations administered by the Corps.

6.0 SUMMARY AND CONCLUSION
JFNew inspected the Highland Park Property located in Lucas County, Ohio on April 4, 2008. One stream (Swan Creek) and one wetland were located in the project area. Approximately 500

linear feet of perennial stream were identified as likely federally "jurisdictional waters of U.S." during the site investigation. We recommend submitting this report to the Corps for verification prior to clearing or development on the site. **Table 4** summarizes the results of the stream identified during the delineation.

Table 4: Stream features identified within the Highland Park Property project study area

ID	Type	Length (LF)	QHEI	"Waters of the U.S."	QHEI Classification
Swan Creek	***Perennial***	***500***	***31***	***Yes***	***Modified warm water habitat***

One jurisdictional wetland totaling approximately 0.20 acre was found on site and is summarized in **Table 5**.

Table 5: Wetland features identified within the Highland Park Property study area

ID	Type	Area (ac)	ORAM	"Waters of the U.S."	ORAM
Wetland A	***PEM***	***0.20***	***27***	***Yes***	***Category 1***

Permits from the Corps and OEPA must be obtained prior to any filling or mechanical land clearing that occurs within the boundaries of any "waters of the U.S."

While this report represents our best professional judgment based on our knowledge and experience, it is important to note that the Huntington District of the U.S. Army Corps of Engineers has final discretionary authority over all jurisdictional determinations of "waters of the U.S." including wetlands under Section 404 of the CWA in this region. It is therefore recommended that a copy of this report be furnished to the Buffalo District of the U.S. Army Corps of Engineers to confirm the results of our findings.

7.0 REFERENCES

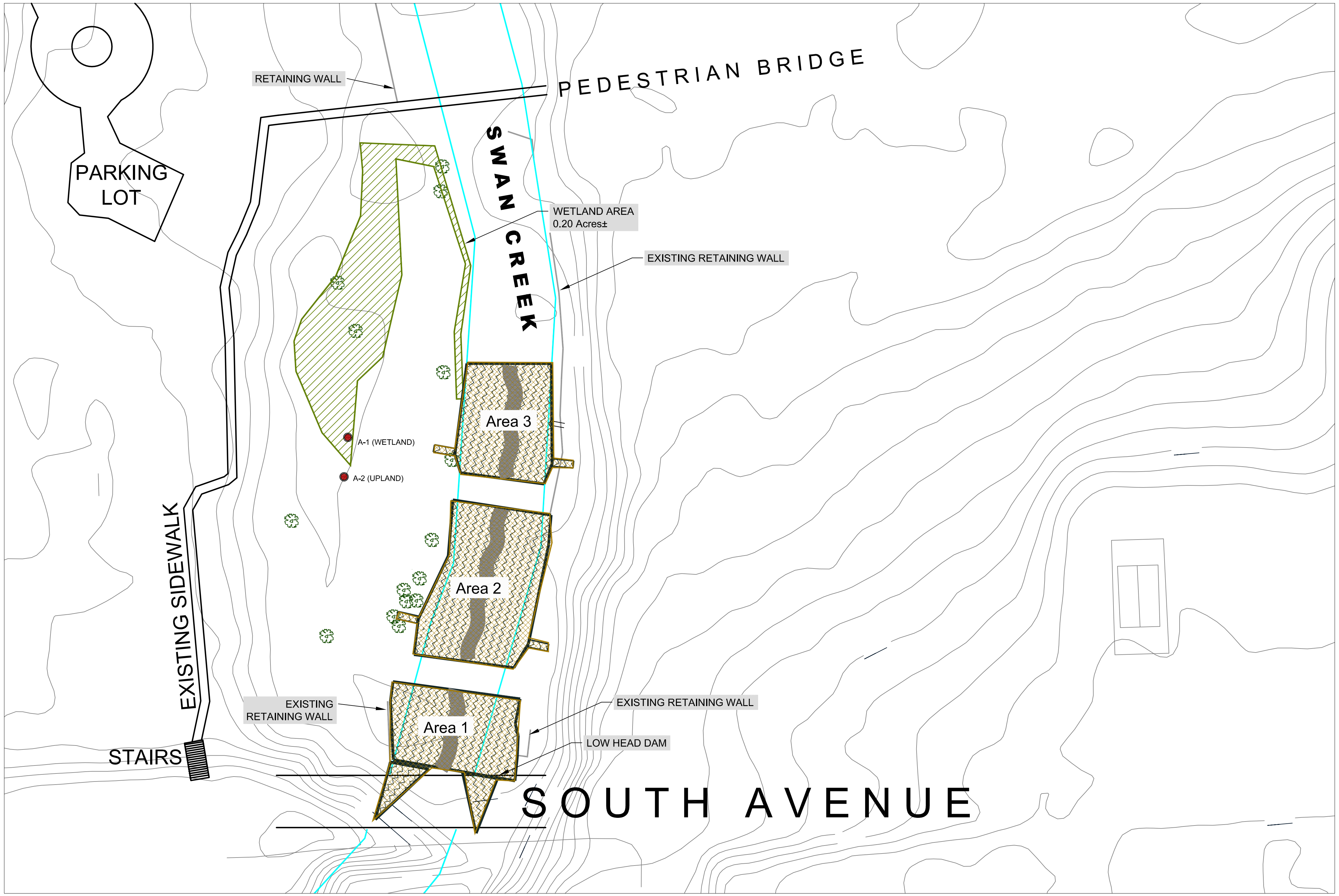
Environmental Laboratory. 1987. *U.S. Army Corps of Engineers' Wetland Delineation Manual*, Technical Report Y-87-1, U.S. Waterways Experiment Station, Vicksburg, MS.

United States Department of Agriculture, Natural Resource Conservation Service (NRCS). 2007. *Soil Survey of Lucas County, Ohio*.

EXHIBIT 1

Locations of Identified Features

WATERS OF THE U.S. DELINEATION REPORT
HIGHLAND PARK PROPERTY
LUCAS COUNTY, OHIO



SITE PLAN

LEGEND

- Existing Grade
- Existing Trees
- Wetland
- Data Point Location / Designation
- * Stream Impact

Area 1	0.13 Acre±
Area 2	0.17 Acre±
Area 3	0.11 Acre±
TOTAL	0.41 Acre±

**** NOTE: Wetland was not impacted with design.***

NOTE

1.) Contours on this document are derived from available public domain DEM data. This data does not constitute professional topographic survey, and may not accurately represent actual field elevations. This data is not intended to support engineering plans or detailed site design.

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N
0 40'
SCALE IN FEET
GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

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REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
EXHIBIT 1

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

DRAFT

EXHIBIT
1

DRAWINGS

WATERS OF THE U.S. DELINEATION REPORT
HIGHLAND PARK PROPERTY
LUCAS COUNTY, OHIO

JFNew

Location: S:\Walkerton\CAD\Chris Dittmar\PROJECT_In_progress\ES 070812 Highland Park\Dam_Mitigation\20080425_cover.dwg
Layout Tab Name: 1cover, Images: 00-ohio.bmp; drg_s_oh095.sid; , Xrefs:
Last Saved By:cdittmar, 4/25/2008 1:49:05 PM
Plotted By:Christine Dittmar Plotted:April 25, 2008, 1:49:51 PM

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Monee, Illinois 60449
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Wisconsin
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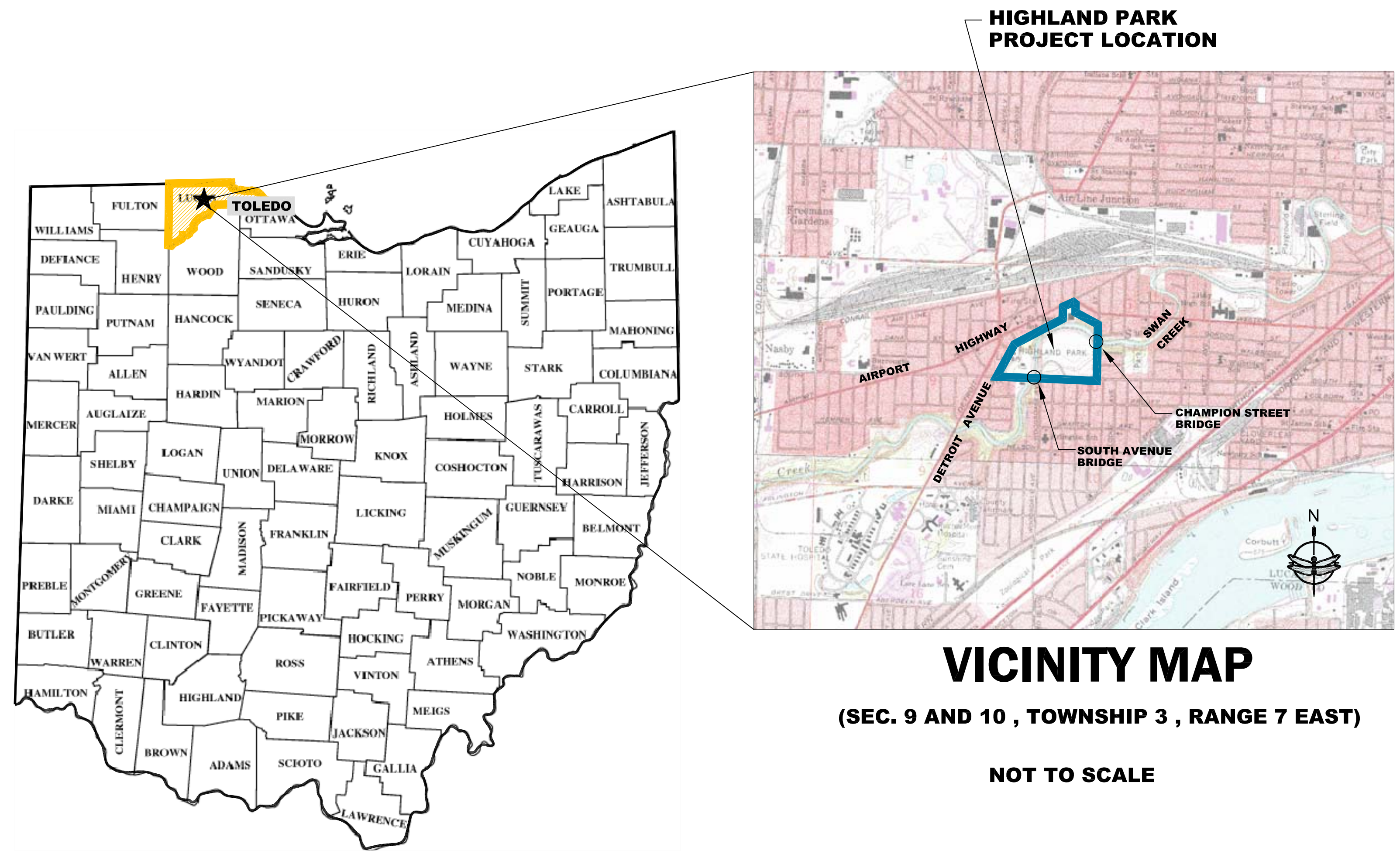
Madison, Wisconsin 53704
608-240-1453

HIGHLAND PARK DAM MITIGATION AND RIPARIAN ENHANCEMENT

LUCUS COUNTY
TOLEDO, OHIO

APRIL 2008

SHEET INDEX



VICINITY MAP

(SEC. 9 AND 10 , TOWNSHIP 3 , RANGE 7 EAST)

NOT TO SCALE

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

Our mission is to provide the highest quality environmental services to our clients while positively impacting the lives of our employees and the conservation of natural resources through prosperity and stewardship.

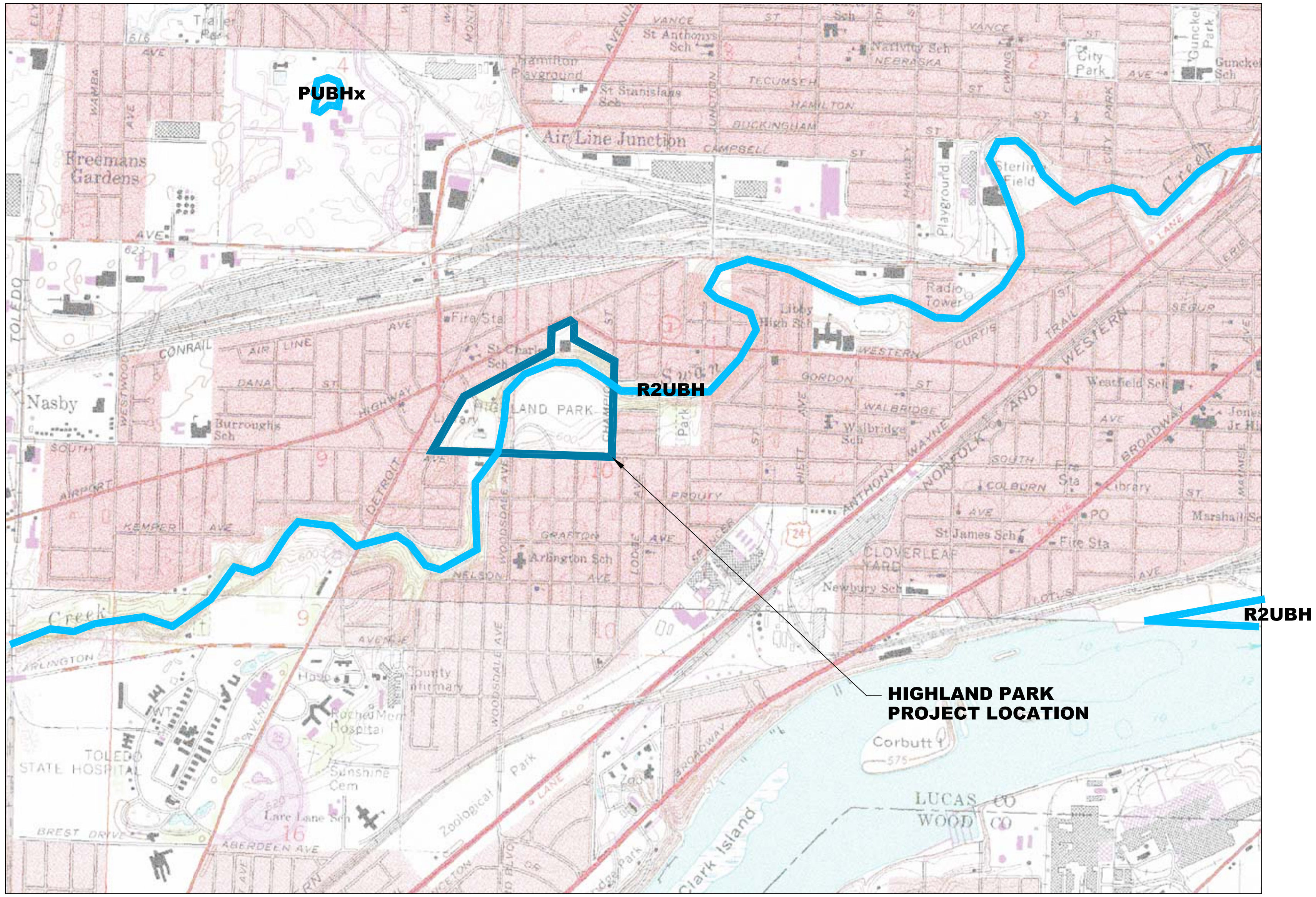
REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County,Toledo, Ohio
TITLE SHEET AND SHEET INDEX MAP

DRAWN BY:	JFH/COD
DESIGNED BY:	ES
DATE:	APRIL 2008
JOB NO:	070812

DRAFT

DRAWING NO.
1



NWI MAP

Toledo (OH, MI) Quadrangle

FRESHWATER WETLAND CLASSIFICATION

P - PALUSTRINE

- RB ROCK BOTTOM: 1 Bedrock, 2 Rubble
- UB UNCONSOLIDATED BOTTOM: 1 Cobble/Gravel, 2 Sand, 3 Mud, 4 Organic
- AB AQUATIC BED: 1 Algal, 2 Aquatic Moss, 3 Rooted Vascular, 4 Floating Vascular, 5 UNK Submergent, 6 UNK Surface
- US UNCONSOLIDATED SHORE: 1 Cobble/Gravel, 2 Sand, 3 Mud, 4 Organic, 5 Vegetated
- ML MOSS-LICHEN: 1 Mosses, 2 Lichen
- EM EMERGENT: 1 Persistent, 2 Nonpersistent
- SS SHRUB SCRUB: 1 Broad-Leaved Deciduous, 2 Needle-Leaved Deciduous, 3 Broad-Leaved Evergreen, 4 Needle-Leaved Evergreen, 5 Dead, 6 Deciduous, 7 Evergreen
- FO FORESTED: 1 Broad-Leaved Deciduous, 2 Needle-Leaved Deciduous, 3 Broad-Leaved Evergreen, 4 Needle-Leaved Evergreen, 5 Dead, 6 Deciduous, 7 Evergreen
- OW OPEN WATER: Unknown Bottom

MODIFYING TERMS

In order to more adequately describe wetland and aquatic habitats water regime, water chemistry, soil of special modifiers may be applied.

WATER REGIME		WATER CHEMISTRY		SOIL	SPECIAL MODIFIERS
NON-TIDAL		INLAND SALINITY	pH MODIFIERS FOR FRESHWATER		
A Temporarily Flooded	J Intermittently Flooded	7 Hypersaline	a Acid	g Organic	b Beaver
B Saturated	K Artificially Flooded	8 Eusaline	t Circumneutral	n Mineral	d Partially Drained/Ditched
C Seasonally Flooded	W Intermittently Flooded/ Temporary	9 Mixosaline	i Alkaline		f Farmed
D Seasonally Flooded/ Well Drained	Y Saturated/Semipermanent/ Seasonal	0 Fresh			h Diked/Impounded
E Seasonally Flooded/Saturated	Z Intermittently Exposed/ Permanent				r Artificial Substrate
F Semipermanently Flooded	U Unknown				s Spoil
G Intermittently Exposed					x Excavated
H Permanently Flooded					

Dominance types must be added by users.

Classification of wetland and deepwater habitats of the U.S. Cowardin et. al. 1979 as modified for national wetland inventory mapping conventions.

FRESHWATER WETLAND CLASSIFICATION

R - RIVERINE

- 1 TIDAL
- 2 LOWER PERENNIAL
- 3 UPPER PERENNIAL
- 4 INTERMITTENT
- 5 UNKNOWN PERENNIAL

- RB ROCK BOTTOM: 1 Bedrock, 2 Rubble
- UB UNCONSOLIDATED BOTTOM: 1 Cobble/Gravel, 2 Sand, 3 Mud, 4 Organic
- AB AQUATIC BED: 1 Algal, 2 Aquatic Moss, 3 Rooted Vascular, 4 Floating Vascular, 5 UNK Submergent, 6 UNK Surface
- US UNCONSOLIDATED SHORE: 1 Cobble/Gravel, 2 Sand, 3 Mud, 4 Organic, 5 Vegetated
- SB STREAMBED *: 1 Bedrock, 2 Rubble, 3 Cobble-Gravel, 4 Sand, 5 Mud, 6 Organic, 7 Vegetated
- EM EMERGENT **: 1 Persistent, 2 Nonpersistent
- RS ROCKY SHORE: 1 Bedrock, 2 Rubble
- OW OPEN WATER: Unknown Bottom

MODIFYING TERMS

In order to more adequately describe wetland and aquatic habitats water regime, water chemistry, soil of special modifiers may be applied.

WATER REGIME		WATER CHEMISTRY		SOIL	SPECIAL MODIFIERS
NON-TIDAL		INLAND SALINITY	pH MODIFIERS FOR FRESHWATER		
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C Seasonally Flooded	W Intermittently Flooded/ Temporary	9 Mixosaline	i Alkaline		f Farmed
D Seasonally Flooded/ Well Drained	Y Saturated/Semipermanent/ Seasonal	0 Fresh			h Diked/Impounded
E Seasonally Flooded/Saturated	Z Intermittently Exposed/ Permanent				r Artificial Substrate
F Semipermanently Flooded	U Unknown				s Spoil
G Intermittently Exposed					x Excavated
H Permanently Flooded					

Dominance types must be added by users.

Classification of wetland and deepwater habitats of the U.S. Cowardin et. al. 1979 as modified for national wetland inventory mapping conventions.

* STREAMBED is limited to TIDAL and INTERMITTENT SUBSYSTEMS, and comprises the only CLASS in the INTERMITTENT SUBSYSTEM.
** EMERGENT IS LIMITED TO TIDAL and LOWER PERENNIAL SUBSYSTEMS. The remaining CLASSES are found in all SUBSYSTEMS.

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N
0 1000'
SCALE IN FEET

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

JFNew
Corporate/Northern Indiana
708 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400

Eastern Michigan
605 S. Main Street, Suite 1,
Ann Arbor, MI 48104
734-222-9690

REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
NWI MAP

DRAWN BY:	SKL/COD
DESIGNED BY:	ES
DATE:	APRIL 2008
JOB NO:	070812.00

DRAFT

DRAWING NO.
2

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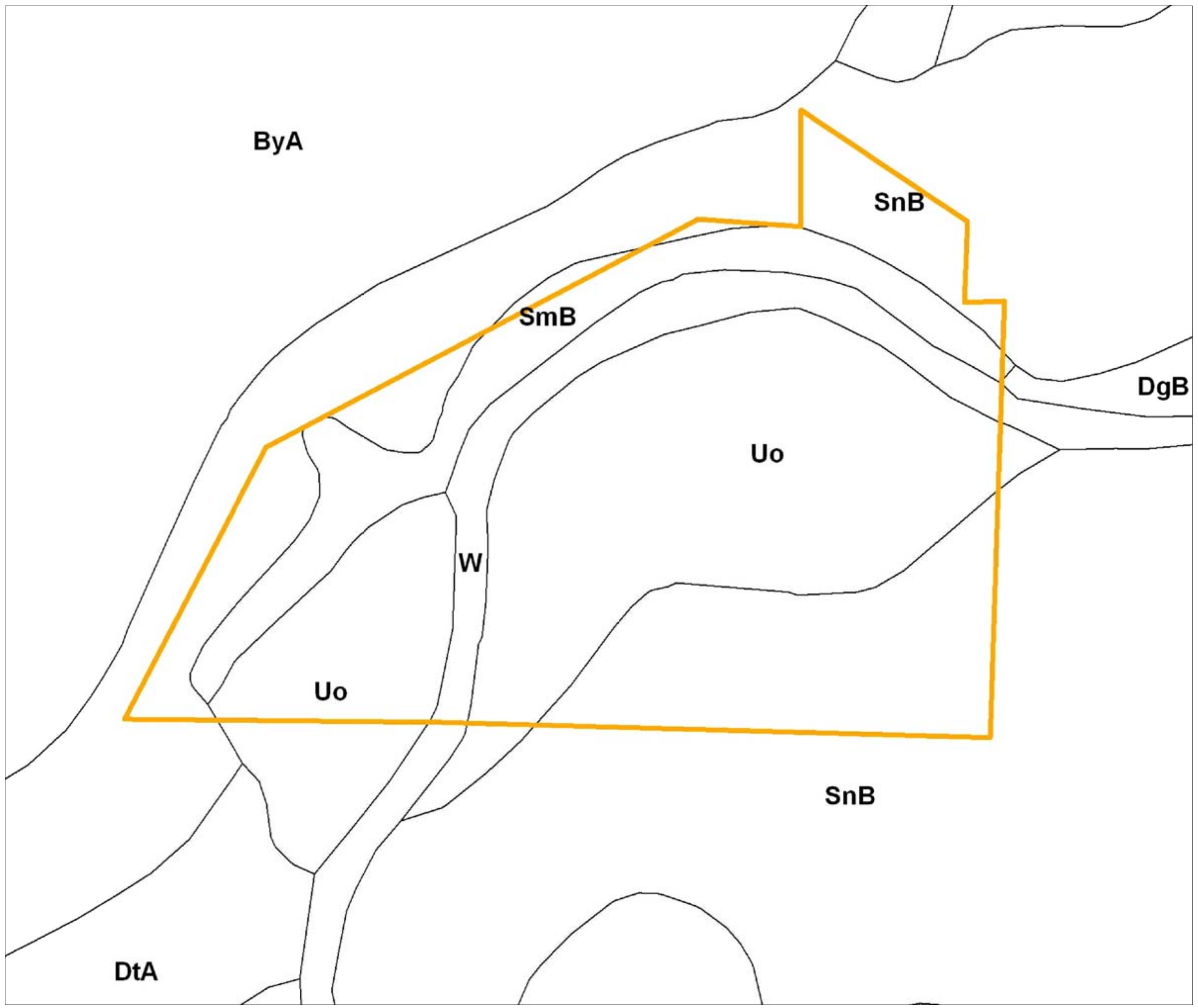
Plotted By:Christine Dittmar Plotted:April 25, 2008, 12:45:22 PM



SOILS MAP

LEGEND

Highland Park Boundary

SOILS KEY

SnB	Sisson-Urban land complex, 2-12 percent slopes
SmB	Sisson Loam, 2-6 percent slopes
Uo	Udorthents, loamy
W	Water
DgB	Digby, sandy loam, 2-6 percent slopes
DtA	Dixboro-Urban land complex, 0-2 percent slopes

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N

0 200'
SCALE IN FEET

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

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REVISION

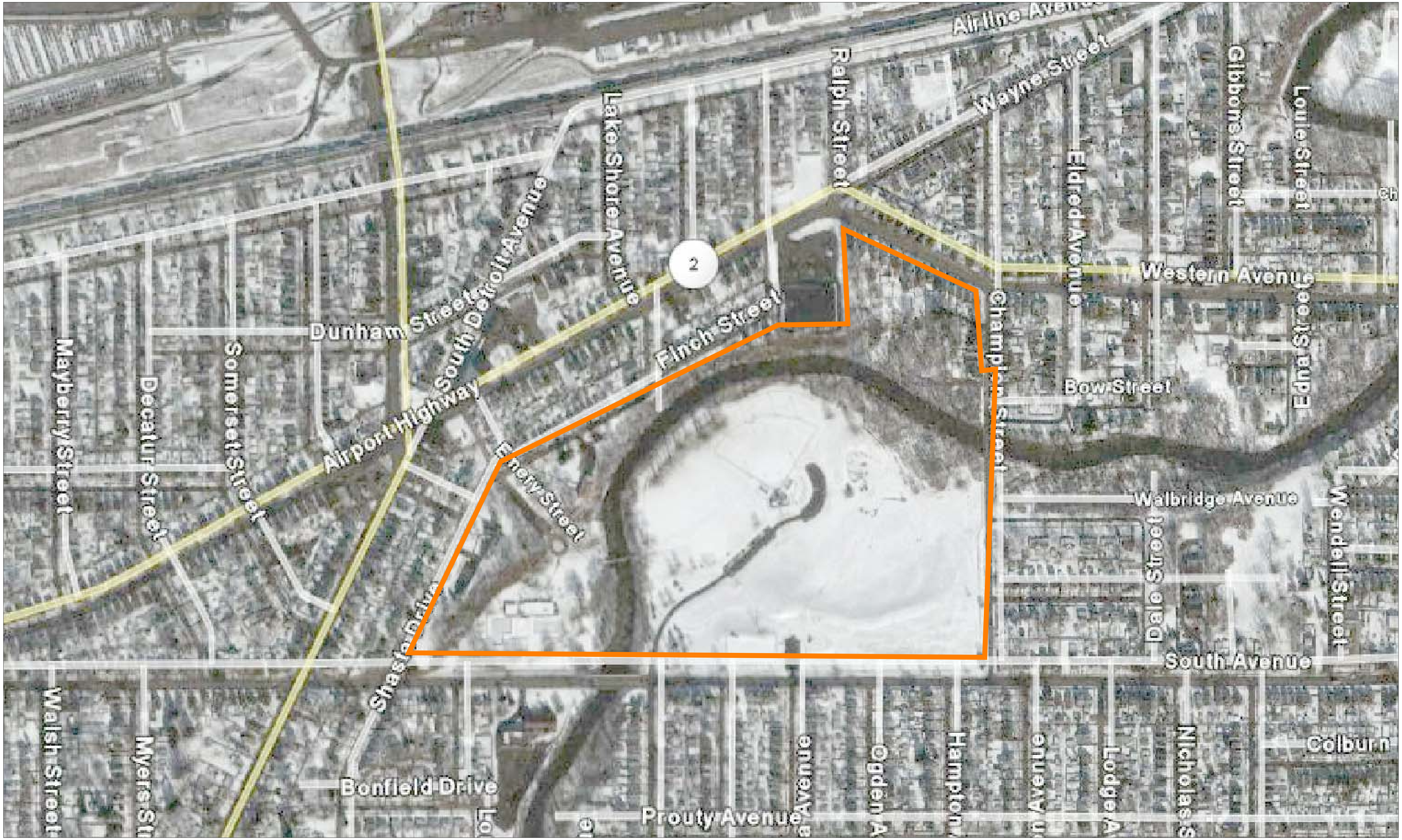
Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
SOILS MAP

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	APRIL 2008
JOB NO:	070812.00

DRAFT

DRAWING NO.
3

3 OF 8



LEGEND

Highland Park Boundary

NOTE

1.) Aerial obtained from http://earth.google.com/

PROJECT SITE

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N

0 200'
SCALE IN FEET

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

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REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County,Toledo, Ohio
PROJECT SITE AERIAL

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	APRIL 2008
JOB NO:	070812.00

DRAFT

DRAWING NO.

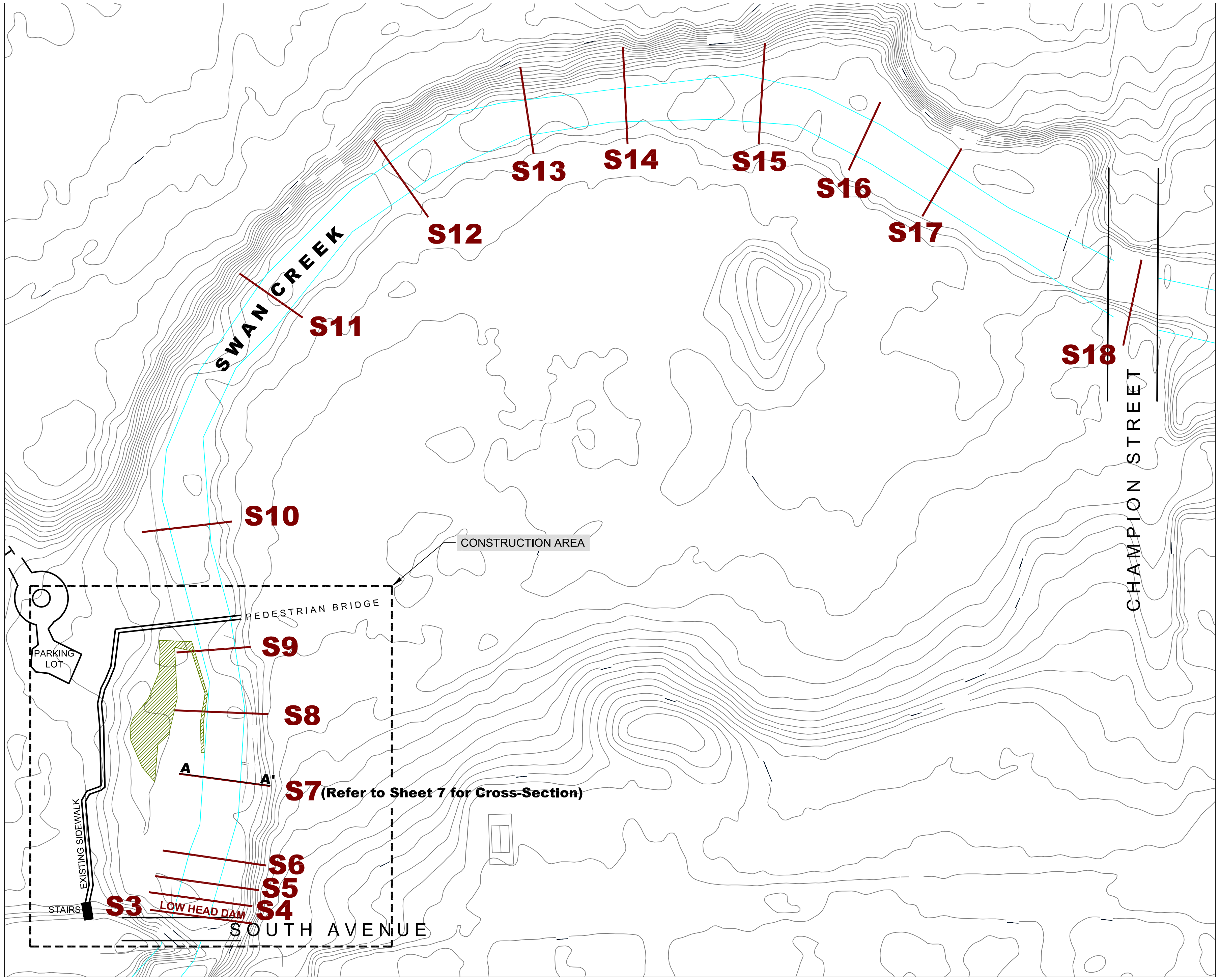
4

APPENDIX A

SITE PHOTOGRAPHS

WATERS OF THE U.S. DELINEATION REPORT
HIGHLAND PARK PROPERTY
LUCAS COUNTY, OHIO

JFNew



EXISTING SITE PLAN

GRAPHIC SCALE VERIFICATION
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or 1/2" on 11"x17" original.
Adjust scale accordingly.

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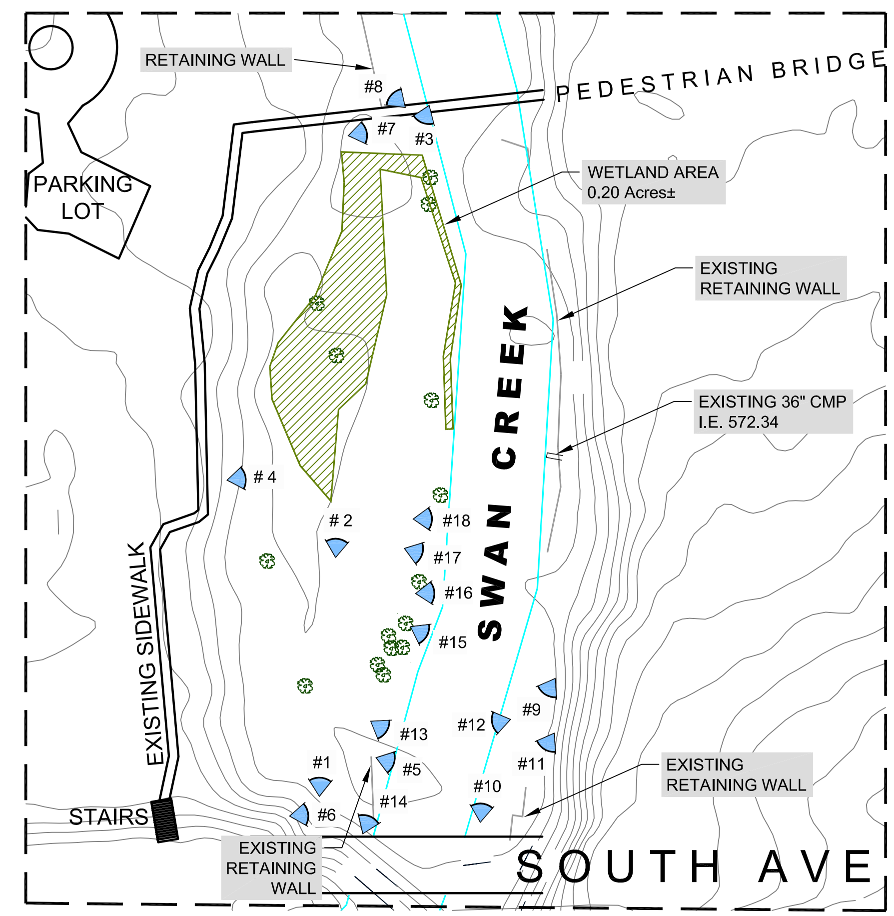
SCALE IN FEET



CONSTRUCTION AREA

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34"
or 1/2" on 11"x17" original.
Adjust scale accordingly.

N
0 60'
SCALE IN FEET

LEGEND

- Existing Grade
- S# Cross-Section Designation / Location
- Existing Trees
- Wetland
- ## Photo Station

NOTE

1.) Contours on this document are derived from available public domain DEM data. This data does not constitute professional topographic survey, and may not accurately represent actual field elevations. This data is not intended to support engineering plans or detailed site design.

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

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Eastern Michigan
605 S. Main Street, Suite 1,
Ann Arbor, MI 48104
734-222-9690

REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
EXISTING CONDITIONS

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

DRAFT

DRAWING NO.
5
5 OF 9

Photo #1: View looking north toward wetland area on West floodplain along Swan Creek

Photo #2: View looking north toward wetland area on West floodplain along Swan Creek

Site Photographs from 04/04/2008 Wetland Delineation
Highland Park, Swan Creek

Lucas County, Ohio

April 4, 2008 **File No. 070812_Highland Park Dam Mitigation**

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Ann Arbor, MI 48104
Phone 734-222-9690 / Fax 734-222-9655

Photo #3: View looking southwest across wetland area on West floodplain along

Photo #4: View looking east at upland point

Site Photographs from 04/04/2008 Wetland Delineation
Highland Park, Swan Creek

Lucas County, Ohio

April 4, 2008 **File No. 070812_Highland Park Dam Mitigation**

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Photo #5: View looking across Swan Creek from left downstream bank at South Avenue Bridge during high

Photo #6: View looking downstream from South Avenue Bridge during high flow

Site Photographs from 04/04/2008
Highland Park, Swan Creek

Lucas County, Ohio

April 4, 2008 **File No. 070812_Highland Park Dam Mitigation**

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Photo #7: View looking towards right downstream bank at Pedestrian Bridge during high flow

Photo #8: View looking toward left downstream bank at Pedestrian Bridge during high

Site Photographs from 04/04/2008
Highland Park, Swan Creek

Lucas County, Ohio

April 4, 2008 **File No. 070812_Highland Park Dam Mitigation**

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Photo #9: View looking upstream towards South Avenue Bridge during low flow

Photo #10: View looking downstream from South Avenue Bridge during low flow

Site Photographs from 10/03/2007
Highland Park, Swan Creek

Lucas County, Ohio

October 3, 2007 **File No. 070812_Highland Park Dam Mitiga-**

JFNew
605 S. Main St, Suite 1
Ann Arbor, MI 48104
Phone 734-222-9690 / Fax 734-222-9655

Photo #11: Existing Low-head Dam

Photo #12: View looking upstream towards South Avenue Bridge

Site Photographs from 10/03/2007
Highland Park, Swan Creek

Lucas County, Ohio

October 3, 2007 **File**

JFNew
605 S. Main St, Suite 1
Ann Arbor, MI 48104
Phone 734-222-9690 / Fax 734-222-9655

Photo #13: Upstream End of Proposed Rock Ramp #1

Photo #14: View looking toward stake marking downstream end of Rock Ramp #1

Site Photographs from 04/04/2008
Highland Park, Swan Creek

Lucas County, Ohio

April 4, 2008 **File No. 070812_Highland Park Dam Mitigation**

JFNew
605 S. Main St, Suite 1
Ann Arbor, MI 48104
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Photo #15: Upstream End of Proposed Rock Ramp #2

Photo #16: View looking toward towards right downstream bank at downstream end of Rock Ramp #2

Site Photographs from 04/04/2008
Highland Park, Swan Creek

Lucas County, Ohio

April 4, 2008 **File No. 070812_Highland Park Dam Mitigation**

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Ann Arbor, MI 48104
Phone 734-222-9690 / Fax 734-222-9655

Photo #17: Upstream End of Proposed Rock Ramp #3

Photo #18: View looking toward towards right downstream bank at downstream end of Rock Ramp #3

Site Photographs from 04/04/2008
Highland Park, Swan Creek

Lucas County, Ohio

April 4, 2008 **File No. 070812_Highland Park Dam Mitigation**

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Phone 734-222-9690 / Fax 734-222-9655

APPENDIX B

STREAM AND WETLAND EVALUATION FORMS (QHEI, ORAM)

WATERS OF THE U.S. DELINEATION REPORT
HIGHLAND PARK PROPERTY
LUCAS COUNTY, OHIO

JFNew

Qualitative Habitat Evaluation Index Field Sheet — QHEI Score: 31

River Code: ______ **RM:** 4.4 **Stream:** Swan Creek, Highland Park, Toledo, OH

Date: 4/04/08 **Location:** Lat/Long: 41.633N /83.585W

Scorers Full Name: Joe VonWalde **Affiliation:** JFNew

1.) SUBSTRATE (Check ONLY Two Substrate TYPE BOXES; Estimate % present)

TYPE	Pool	Riffle	TYPE	Pool	Riffle
☐ ☐-BLDR/SLBS (10)			☒ ☐-GRAVEL (7)	80	
☐ ☒-BOULDER (9)			☐ ☒-SAND (6)		
☐ ☒-COBBLE (8)			☐ ☐-BEDROCK (5)		
☐ ☐-HARDPAN (4)			☐ ☐-DETRITUS (3)		
☐ ☐-MUCK (2)			☒ ☐-ARTIFICIAL (0)	10	
☐ ☐-SILT (2)					

NOTE: Ignore Sludge Originating From Point Sources

NUMBER OF SUBSTRATE TYPES: ☒-4 or More (2) ☐-3 or Less (0)
(High Quality Only, Score 5 or >)

COMMENTS: Gravel, cobble, boulder, sand

SUBSTRATE ORIGIN — Check ONE (OR 2 & AVERAGE)
- ☐-LIMESTONE (1)
- ☒-TILLS (1)
- ☐-WETLANDS (0)
- ☐-HARDPAN (0)
- ☐-SANDSTONE (0)
- ☐-RIP/RAP (0)
- ☐-LACUSTRINE (0)
- ☐-SHALE (-1)
- ☐-COAL FINES (-2)

SUBSTRATE QUALITY — Check ONE (OR 2 & AVERAGE)
- SILT: ☐-SILT HEAVY (-2); ☒-SILT MODERATE (-1); ☐-SILT NORMAL (0); ☐-SILT FREE (1)
- EMBEDDEDNESS: ☐-EXTENSIVE (-2); ☒-MODERATE (-1); ☐-NORMAL (0); ☐-NONE (1)

Substrate: 8 (Max 20)

2.) INSTREAM COVER (Give each cover type a score of 0 to 3; see back for instructions)

(Structure) TYPE: Score All That Occur

Score	Type	Score	Type	Score	Type
0	UNDERCUT BANKS (1)	1	POOLS > 70 cm (2)	0	OXBOWS, BACKWATERS (1)
1	OVERHANGING VEGETATION (1)	0	ROOTWADS (1)	0	AQUATIC MACROPHYTES (1)
0	SHALLOWS (IN SLOW WATER) (1)	1	BOULDERS (1)	1	LOGS AND WOODY DEBRIS (1)
0	ROOTMATS (1)				

COMMENTS:

AMOUNT: (Check ONLY One or Check 2 & AVERAGE)
- ☐ EXTENSIVE >75% (11)
- ☐ MODERATE 25-75% (7)
- ☒ SPARSE 5-25% (3)
- ☐ NEARLY ABSENT <5% (1)

Cover: 8 (Max 20)

3.) CHANNEL MORPHOLOGY (Check ONLY One per Category OR Check 2 & AVERAGE)

SINUOSITY	DEVELOPMENT	CHANNELIZATION	STABILITY
☐-HIGH (4)	☐-EXCELLENT (7)	☐-NONE (6)	☐-HIGH (3)
☐-MODERATE (3)	☐-GOOD (5)	☐-RECOVERED (4)	☐-MODERATE (2)
☒-LOW (2)	☐-FAIR (3)	☐-RECOVERING (3)	☒-LOW (1)
☐-NONE (1)	☒-POOR (1)	☒-RECENT OR NO RECOVERY (1)	

MODIFICATIONS/OTHER
- ☐-SNAGGING ☐-IMPOUND
- ☐-RELOCATION ☐-ISLANDS
- ☐-CANOPY REMOVAL ☐-LEVEED
- ☐-DREDGING ☐-BANK SHAPING
- ☐-ONE SIDE CHANNEL MODIFICATIONS

COMMENTS:

Channel: 5 (Max 20)

4.) RIPARIAN ZONE AND BANK EROSION (Check ONE box per bank OR Check 2 & AVERAGE per bank)

River Right Looking Downstream

RIPARIAN WIDTH (L R, Per Bank)
- ☐ ☐-WIDE >50m (4)
- ☐ ☐-MODERATE 10-50m (3)
- ☒ ☒-NARROW 5-10m (2)
- ☐ ☐-VERY NARROW <5m (1)
- ☐ ☐-NONE (0)

FLOOD PLAIN QUALITY (*Past 100 ft Riparian*) (L R, Most Predominant Per Bank)
- ☐ ☐-FOREST, SWAMP (3)
- ☐ ☐-SHRUB OR OLD FIELD (2)
- ☒ ☒-RESIDENTIAL, PARK, NEW FIELD (1)
- ☐ ☐-FENCED PASTURE (1)
- ☐ ☐-CONSERVATION TILLAGE (1)
- ☐ ☐-URBAN OR INDUSTRIAL (0)
- ☐ ☐-OPEN PASTURE, ROWCROP (0)
- ☐ ☐-MINING/CONSTRUCTION (0)

BANK EROSION (L R, Per Bank)
- ☐ ☐-NONE/ LITTLE (3)
- ☒ ☒-MODERATE (2)
- ☐ ☐-HEAVY/SEVERE (1)

COMMENTS:

Riparian: 5 (Max 10)

5.) POOL/GLIDE AND RIFFLE/RUN QUALITY

MAX. DEPTH (Check 1 ONLY!)
- ☐ >1 m (6)
- ☐ 0.7-1m (4)
- ☒ 0.4-0.7m (2)
- ☐ 0.2-0.4m (1)
- ☐ <0.2m (pool = 0)

MORPHOLOGY (Check 1 or 2 & AVERAGE)
- ☐-POOL WIDTH > RIFFLE WIDTH (2)
- ☐-POOL WIDTH = RIFFLE WIDTH (1)
- ☒-POOL WIDTH < RIFFLE WIDTH (0)

CURRENT VELOCITY (POOLS & RIFFLES!) (Check All that Apply)
- ☐-EDDIES (1) ☐-TORRENTIAL (-1)
- ☐-FAST (1) ☐-INTERSTITIAL (-1)
- ☐-MODERATE (1) ☐-INTERMITTENT (-2)
- ☒-SLOW (1) ☐-VERY FAST (1)

COMMENTS:

Pool/Current: 3 (Max 12)

CHECK ONE OR CHECK 2 & AVERAGE

RIFFLE DEPTH
- ☐-*BEST AREAS >10cm (2)
- ☐-BEST AREAS 5-10cm (1)
- ☐-BEST AREAS <5cm (RIFFLE=0)

RUN DEPTH
- ☐-MAX >50 (2)
- ☐-MAX <50 (1)

RIFFLE/RUN SUBSTRATE
- ☐-STABLE (e.g., Cobble, Boulder (2)
- ☐-MOD. STABLE (e.g., Large Gravel (1)
- ☐-UNSTABLE (Fine Gravel, Sand) (0)

RIFFLE/RUN EMBEDDEDNESS
- ☐-NONE (2)
- ☐-LOW (1)
- ☐-MODERATE (0)
- ☐-EXTENSIVE (-1)

COMMENTS: ☐ NO RIFFLE (Metric=0)

Riffle/Run: 0 (Max 8)

Gradient: 2 (Max 10)

6.) GRADIENT (ft.mi): <0.16 DRAINAGE AREA (sq. mi.): 197

Very low – low (2-4)

%POOL:	10	%GLIDE	90
%RIFFLE:		%RUN	

**Best areas must be large enough to support a population of riffle-obligate species*

Is Sampling Reach Representative of the Stream? (Y/N) ____________ If Not, Explain ____________

Reach impacted by low-head dam and walls; further downstream of this reach, pools and riffles start to form (with pools >1m)

Aesthetics: Excess turbidity

Measurements: Width, depth, bankfull width, bankfull depth, floodprone x^2 width

Major Suspected Sources of Impacts (Check All That Apply):
None ☐
Industrial ☐
WWTP ☐
Ag ☐
Livestock ☐
Silviculture ☐
Construction ☐
Urban Runoff ☐
CSOs ☐
Suburban Impacts ☐
Mining ☐
Channelization ☐
Riparian Removal ☐
Landfills ☐
Natural ☐
Dams ☐
Other Flow Alteration ☐
Other: ______

Subjective Rating (1-10): ☐

Aesthetic Rating (1-10): ☐

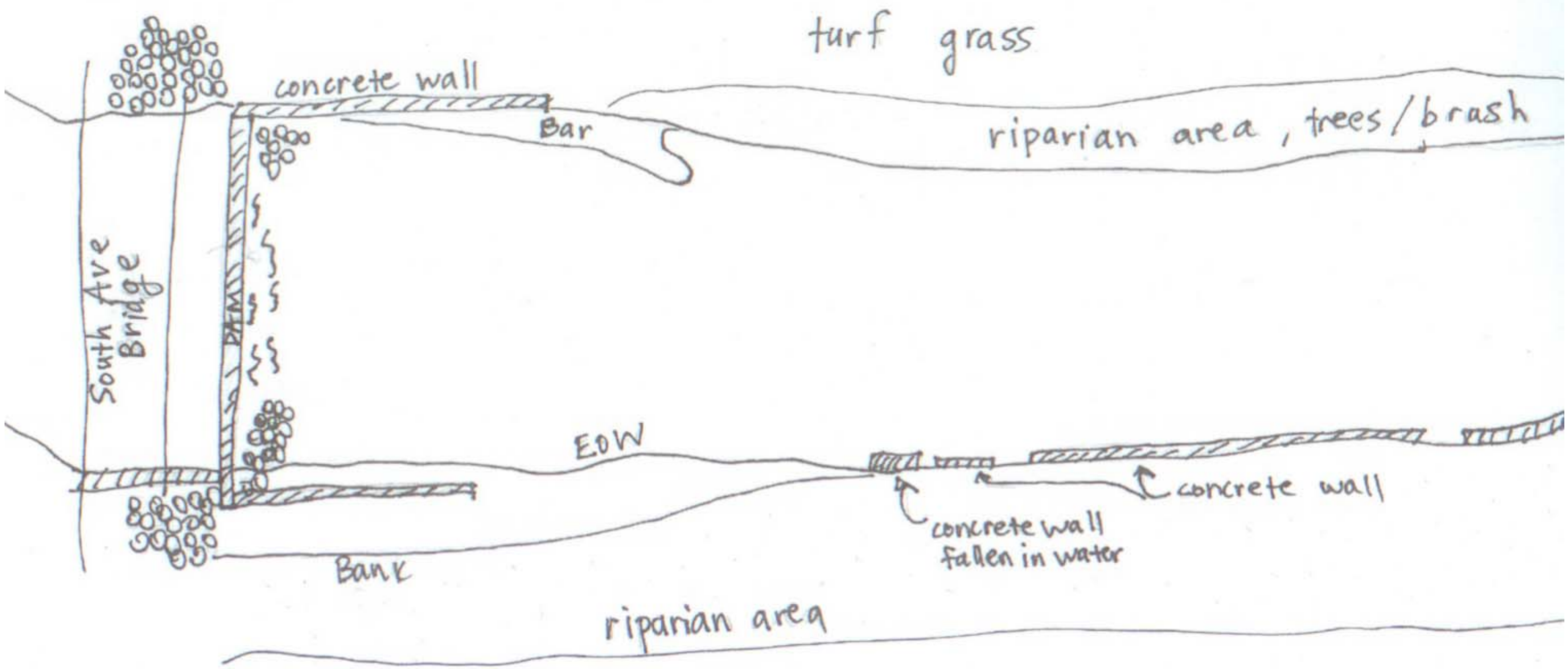
	Gear:	Distance:	Water Clarity:	Water Stage:	Canopy-% Open:
First Sampling Pass	**L.Line**	**0.12Km**			**55% - <85%**

Gradient:
☐ Low ☐ Moderate ☐ High

Stream Measurements:

Average Width	Average Depth	Maximum Depth	Av. Bankfull Width	Bankfull Mean Depth	W/D Ratio	Bankfull Max Depth	Floodprone Area Width	Entrench. Ratio

Stream Drawing:



Site: Swan Creek	Rater(s): JVW	Date: 04/04/2008

1	1
max 6 pts.	subtotal

Metric 1. Wetland Area (size).

Select one size class and assign score.

- ☐ >50 acres (>20.2ha) (6 pts)
- ☐ 25 to <50 acres (10.1 to <20.2ha) (5 pts)
- ☐ 10 to <25 acres (4 to <10.1ha) (4 pts)
- ☐ 3 to <10 acres (1.2 to <4ha) (3 pts)
- ☐ 0.3 to <3 acres (0.12 to <1.2ha) (2 pts)
- ☒ 0.1 to <0.3 acres (0.04 to <0.12ha) (1 pt)
- ☐ <0.1 acres (0.04ha) (0 pts)

7	8
max 14 pts.	subtotal

Metric 2. Upland Buffers and Surrounding Land Use.

2a. Calculate average buffer width. Select only one and assign score. Do not double check.

- ☐ WIDE. Buffers average 50 m (164 ft) or more around wetland perimeter (7)
- ☒ MEDIUM. Buffers average 25 m to <50 m (82 to <164 ft) around wetland perimeter (4)
- ☐ NARROW. Buffers average 10 m to <25 m (32 ft to <82 ft) around wetland perimeter (1)
- ☐ VERY NARROW. Buffers average <10 m (<32 ft) around wetland perimeter (0)

2b. Intensity of surrounding land use. Select one or double check and average.

- ☐ VERY LOW. 2nd growth or older forest, prairie, savannah, wildlife area, etc. (7)
- ☐ LOW. Old field (>10 years), shrubland, young second growth forest. (5)
- ☒ MODERATELY HIGH. Residential, fenced pasture, park conservation tillage, new fallow field. (3)
- ☐ HIGH. Urban, industrial, open pasture, row cropping, mining, construction. (1)

11	19
max 30 pts.	subtotal

Metric 3. Hydrology.

3a. Sources of Water. Score all that apply.

- ☐ High ph groundwater (5)
- ☐ Other groundwater (3)
- ☒ Precipitation (1)
- ☒ Seasonal/Intermittent surface water (3)
- ☐ Perennial surface water (lake or stream) (5)

3b. Connectivity. Score all that apply.

- ☒ 100 year floodplain (1)
- ☒ Between stream/lake and other human use (1)
- ☐ Part of wetland/upland (e.g. forest), complex (1)
- ☒ Part of riparian or upland corridor (1)

3c. Maximum water depth. Score only one and assign score.

- ☐ >0.7 (27.6 in) (3)
- ☐ 0.4 to 0.7 m (15.7 to 27.6 in) (2)
- ☒ <0.4 m (<15.7 in) (1)

3d. Duration inundation/saturation. Score one or dbl check.

- ☐ Semi- to permanently inundated/saturated (4)
- ☐ Regularly inundated/saturated (3)
- ☒ Seasonally inundated (2)
- ☐ Seasonally saturated in upper 30 cm (12 in) (1)

3e. Modifications to natural hydrologic regime. Score one or double check and average.

- ☐ None or none apparent (12)
- ☐ Recovered (7)
- ☐ Recovering (3)
- ☒ Recent or no recovery (1)

Check all disturbances observed

- ☐ ditch
- ☐ tile
- ☐ dike
- ☐ weir
- ☐ stormwater input
- ☐ point source (nonstormwater)
- ☐ filling/grading
- ☐ road bed/RR track
- ☐ dredging
- ☐ other _____

5	24
max 20 pts.	subtotal

Metric 4. Habitat Alteration and Development.

4a. Substrate disturbance. Score one or double check and average.

- ☐ None or none apparent (4)
- ☐ Recovered (3)
- ☐ Recovering (2)
- ☒ Recent or no recovery (1)

4b. Habitat development. Select only one and assign score.

- ☐ Excellent (7)
- ☐ Very good (6)
- ☐ Good (5)
- ☐ Moderately good (4)
- ☒ Fair (3)
- ☐ Poor to fair (2)
- ☐ Poor (1)

4c. Habitat alteration. Score one or double check and average.

- ☐ None or none apparent (9)
- ☐ Recovered (6)
- ☐ Recovering (3)
- ☒ Recent or no recovery (1)

Check all disturbances observed

- ☒ mowing
- ☐ grazing
- ☐ clearcutting
- ☐ selective cutting
- ☐ woody debris removal
- ☐ toxic pollutants
- ☐ shrub/sapling removal
- ☐ herbaceous/aquatic bed removal
- ☒ sedimentation
- ☐ dredging
- ☐ farming
- ☐ nutrient enrichment

24
subtotal this page

Site: Swan Creek	Rater(s):	Date: 04/04/2008

3 subtotal this page

0 (max 10 pts.) | **0** (subtotal)

Metric 5. Special Wetlands.

Check all that apply and score as indicated.

- ☐ Bog (10)
- ☐ Fen (10)
- ☐ Old growth forest (10)
- ☐ Mature forested wetland (5)
- ☐ Lake Erie coastal/tributary wetland-unrestricted hydrology (10)
- ☐ Lake Erie coastal/tributary wetland-restricted hydrology (5)
- ☐ Lake Plain sand prairies (oak openings) (10)
- ☐ Relict wet prairies (10)
- ☐ Known occurrence state/federal threatened or endangered species (10)
- ☐ Significant migratory songbird/water fowl habitat or usage (10)
- ☐ Category 1 wetland. See Question 1 Qualitative Rating (-10)

3 (max 20 pts.) | **3** (subtotal)

Metric 6. Plant Communities, Interspersion, Microtopography.

6a. Wetland Vegetation Communities.
Score all present using 0 to 3 scale.

- **0** Aquatic bed
- **1** Emergent
- **0** Shrub
- **0** Forest
- **0** Mudflats
- **0** Open water
- **0** Other _____

6b. Horizontal (plan view) interspersion.
Select only one.

- ☐ High (5)
- ☐ Moderately high (4)
- ☐ Moderate (3)
- ☐ Moderately low (2)
- ☒ Low (1)
- ☐ None (0)

6c. Coverage of invasive plants. Refer to Table 1 ORAM long form for list. Add or deduct points for coverage

- ☐ Extensive >75% cover (-5)
- ☐ Moderate 25-75% cover (-3)
- ☐ Sparse 5-25% cover (-1)
- ☐ Nearly absent <5% cover (0)
- ☒ Absent (1)

6d. Microtopography.
Score all present using 0 to 3 scale.

- **0** Vegetated hummucks/tussucks
- **0** Coarse woody debris >15 cm (6 in)
- **0** Standing dead >25 cm (10 in) dbh
- **0** Amphibian breeding pools

Vegetation Community Cover Scale

0	Absent or comprises <0.1ha (0.2471 acres) contiguous area
1	Present and either comprises small part of wetland's vegetation and is of moderate quality, or comprises a significant part but is of low quality
2	Present and either comprises significant part of wetland's vegetation and is of moderate quality, or comprises a small part and is of high quality
3	Present and comprises significant part, or more, of wetland's vegetation and is of high quality

Narrative Description of Vegetation Quality

low	Low spp diversity and/or predominance of nonnative or disturbance tolerant native species
mod	Native spp are dominant component of the vegetation, although nonnative and/or disturbance tolerant native spp can also be present, and species diversity moderate to moderately high, but generally w/o presence of rare threatened or endangered spp
high	A predominance of native species, with nonnative spp and/or disturbance tolerant native spp absent or virtually absent, and high spp diversity and often, but not always, the presence of rare, threatened, or endangered spp

Mudflat and Open Water Class Quality

0	Absent <0.1ha (0.247 acres)
1	Low 0.1 to <1ha (0.247 to 2.47 acres)
2	Moderate 1 to <4ha (2.47 to 9.88 acres)
3	High 4ha (9.88 acres) or more

Microtopography Cover Scale

0	Absent
1	Present very small amounts or if more common of marginal quality
2	Present in moderate amounts, but not of highest quality or in small amounts of highest quality
3	Present in moderate or greater amounts and of highest quality

27 **GRAND TOTAL (max 100 pts)**

Refer to the most recent ORAM Score Calibration Report for the scoring break points between wetland categories at the following address: http://www.epa.state.oh.us/dswl/401/401.html

DATA SHEET:
WETLAND DELINEATION

Project/Site:	Highland Park	Date:	4/4/2008
Client:	Partners for Clean Streams	County:	Lucas
Investigator(s):	J. von Wahlde	State:	Ohio

WETLAND

STATION #	A-1	Distance from Stake:			
Normal Circumstances?		Yes/No	Y		
Significantly Disturbed?		Yes/No	N		
Potential Problem Area?		Yes/No	N		

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Carex sp.	Herb	FACW
Lysimachia annularis	Herb	OBL
Platanus occidentalis	Tree	FACW-

Percent of Species OBL, FACW, FAC (excl. FAC-) 100%

Remarks:
- ☑ Meets the hydrophytic vegetation criterion.
- ☐ Does not meet the hydrophytic vegetation criterion.
- ☐ Other:

HYDROLOGY

Field Indicators:
- Depth of Surface Water: 6"
- Depth to Free Water: 14"
- Depth to Saturated Soil: 12"

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated	x 6"	Ox. root channels	
Saturated <12"	x 14"	Water-stained leaves	x
Water marks		Local soil survey data	
Sediment deposit		FAC- Neutral test	
Drainage patterns	x	Other (ex. in Remarks)	

Remarks:
- ☑ Meets the wetland hydrology criterion.
- ☐ Does not meet the wetland hydrology criterion.
- ☐ Other:

SOILS

Map Unit Name: Udorthents, loamy

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0-14"	10YR 4/1	none	sandy clay
14-18"+	10YR 4/1	10YR 4/4	sandy loam

HYDRIC SOIL INDICATORS

Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	
Gleyed		National hydric soils list	
Low Chroma	x	Other (ex. in Remarks)	

Remarks:
- ☑ Meets the hydric soil criterion.
- ☐ Does not meet the hydric soil criterion.
- ☐ Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	x Yes	__ No
Wetland hydrology present?	x Yes	__ No
Hydric soils present?	x Yes	__ No

Remarks:
- ☑ Qualifies as a wetland.
- ☐ Does not qualify as a wetland.
- ☐ Other:

WETLAND

STATION #	A-2	Distance from Stake:			
Normal Circumstances?		Yes/No	Y		
Significantly Disturbed?		Yes/No	N		
Potential Problem Area?		Yes/No	N		

VEGETATION

DOMINANT SPECIES	STRATUM	INDICATOR
Crataegus crus-galli	Tree	FACU
Acer negundo	Tree	FACW-
Sassafras albidum	Tree	FACU-
Solidago altissima	Herb	FACU
Poa pratensis	Herb	FACU

Percent of Species OBL, FACW, FAC (excl. FAC-) 0%

Remarks:
- ☐ Meets the hydrophytic vegetation criterion.
- ☑ Does not meet the hydrophytic vegetation criterion.
- ☐ Other:

HYDROLOGY

Field Indicators:
- Depth of Surface Water: none
- Depth to Free Water: >16"
- Depth to Saturated Soil: >16"

PRIMARY INDICATORS		SECONDARY INDICATORS	
Inundated		Ox. root channels	
Saturated <12"		Water-stained leaves	
Water marks		Local soil survey data	
Sediment deposit		FAC- Neutral test	
Drainage patterns		Other (ex. in Remarks)	

Remarks:
- ☐ Meets the wetland hydrology criterion.
- ☑ Does not meet the wetland hydrology criterion.
- ☐ Other:

SOILS

Map Unit Name: Udorthents, loamy

Profile Description:

DEPTH	MATRIX	MOTTLE	TEXTURE
0-16"	10YR 4/2	none	clay loam
16-21"	10YR 3/1	none	clay loam

HYDRIC SOIL INDICATORS

Histosol		Concretions	
Histic epipedon		Organic content	
Sulfidic odor		Organic streaking	
Aquic moisture reg.		Local hydric soils list	
Gleyed		National hydric soils list	
Low Chroma		Other (ex. in Remarks)	

Remarks:
- ☐ Meets the hydric soil criterion.
- ☑ Does not meet the hydric soil criterion.
- ☐ Other:

WETLAND DETERMINATION

Hydrophytic vegetation present?	__ Yes	x No
Wetland hydrology present?	__ Yes	x No
Hydric soils present?	__ Yes	x No

Remarks:
- ☐ Qualifies as a wetland.
- ☑ Does not qualify as a wetland.
- ☐ Other:

TETRA TECH, INC.

TECHNICAL MEMORANDUM

TO: Scott Dierks, JFNew

FROM: Anne Thomas

DATE: May 21, 2008

SUBJECT: Highland Park Dam Mitigation and Riparian Enhancement Project – Task 3 Hydrologic/Hydraulic Analysis

Background

Partners for Clean Streams, a non-profit organization in Toledo, OH, hired JFNew to design and build a dam mitigation and riparian enhancement project in Highland Park in Toledo, OH. Highland Park is located along Swan Creek and adjacent to Highland Park Dam, an existing low-head dam. The goals of the project include effectively eliminating the barrier to fish passage, eliminating the safety hazard to fisherman and curious park guests, and improving aquatic and riparian habitat without removing the dam structure.

The proposed project includes a series of rock dams downstream of the dam which will effectively "lift up" the downstream bed to meet the existing dam. In addition, a rock channeling structure is proposed immediately upstream of the existing dam to provide more depth over the weir for fish passage. To determine the effect of the proposed mitigation measures on the floodplain, a hydraulic analysis was conducted of Swan Creek. Although the countywide Flood Insurance Study (FIS) was published in 2000, the hydrologic and hydraulic analyses for Toledo were finished in April 1978. The JFNew Team performed a detailed field analysis of creek geomorphology between the South Avenue Bridge and Champion Street Bridge (upstream and downstream of Highland Park) and documented bankfull indicators, "low flow" water levels, and cross-sectional elevations of the creek channel and flood plain. The 1978 HEC-2 model was obtained from the Federal Emergency Management Agency (FEMA) for Swan Creek as a basis for the hydraulic analysis.

Goals

The goals of the hydraulic analysis include 1) assisting with the design of the dam mitigation alternative and 2) determining the effect of the dam mitigation alternative on the flood plain.

Methodology

The following steps were taken to complete the hydraulic analysis:

Model Creation

1. The latest Swan Creek hydraulic model was obtained from FEMA (HEC-2, 1978). This was provided to us in paper form only.
2. The original model was re-typed into HEC-2 from a hardcopy printout of the model code.

3. Several pages of code were missing from the HEC-2 model hardcopy so assumptions were made to recreate this section. Missing from the hardcopy were cross-sections S, T, and U (as denoted in the FIS Swan Creek profile) which were within the Highland Park study area. A copy of the original code and the recreated code are included in Attachment A. Due to these missing cross-sections, the water surface elevation (WSE) for the cross-section upstream of the missing code was 0.32 feet higher than the original model for the 10-year flood event. This makes it difficult to use the recreated model as the basis for floodplain change comparison.
4. Because of the missing code in the original model, we used existing cross-section data to create the base model to which we compared proposed changes to the floodplain. Eighteen new cross-sections through the project area were incorporated into the original model to create the base model. The new cross-sections were measured in the field in November 2007. A printout of the existing conditions base code is attached (Attachment B).

Existing Conditions Low Flow Analysis

5. A "low flow" event was simulated to match the water levels observed in the field. The low flow was confirmed to match the observed flow over the dam. To calibrate the model to observed water levels, only the Highland Park portion of the model was executed.

Evaluation of Proposed Cross-Sections

6. The proposed cross-sections, representing the rock dams and channel upstream of the dam, were incorporated into the model. A printout of the code with proposed cross-sections is attached (Attachment C).
7. With the proposed cross-sections, the low flow event was simulated to predict the water level over the Highland Park Dam and the rock dams.
8. Shear forces and velocities of the flood events were analyzed using the HEC-2 model so that appropriate rock size could be determined for construction of the rock dams.
9. With the proposed cross-sections, the 100-year flood event was simulated resulting in no change to the flood plain as compared to the base model results (existing conditions).

Results

Model Recreation

As discussed previously, by unfortunate coincidence, the cross-sections for the project area were missing from the hard-copy printout of the original HEC-2 model, which includes the Highland Park Pedestrian Bridge and the South Bridge. Therefore, the existing conditions model was used as the base model. For reference, a comparison of the model results are included in Table 1; Figure 1, Figure 2, and Figure 3 show graphical comparisons of the model for the 10-year, 50-year, and 100-year flood events.

10-year flood event = 5,900 cfs (from Lucas County, Ohio FIS, 2000)
50-year flood event = 8,000 cfs (from Lucas County, Ohio FIS, 2000)
100-year flood event = 9,000 cfs (from Lucas County, Ohio FIS, 2000)

"Original" – The results of the original HEC-2 model as printed on the hardcopy sent to us from FEMA.
"Recreated" – The recreated model calibrated to the original results.
"Existing" – The results of the model with the existing cross-sections through Highland Park.

Table 1 Comparison of Water Surface Elevations (feet) between the Original, Recreated, and Existing Conditions Models

SECTION NO.	RIVER MILES	Original 10-yr	Recreated 10-yr	Existing 10-yr	Difference (O-R) 10	Difference (O-E) 10	Original 50-yr	Recreated 50-yr	Existing 50-yr	Difference (O-R) 50	Difference (O-E) 50	Original 100-yr	Recreated 100-yr	Existing 100-yr	Difference (O-R) 100	Difference (O-E) 100
0.1	0.00	577.17	577.17	577.17	0	0	578.17	578.17	578.17	0	0	578.51	578.51	578.51	0	0
0.2	0.01	577.08	577.08	577.08	0	0	578.02	578.02	578.02	0	0	578.32	578.32	578.32	0	0
0.3	0.02	577.14	577.14	577.14	0	0	578.11	578.11	578.11	0	0	578.43	578.44	578.44	-0.01	-0.01
0.4	0.03	577.51	577.51	577.51	0	0	578.7	578.71	578.71	-0.01	-0.01	579.16	579.17	579.17	-0.01	-0.01
0.5	0.11	577.78	577.78	577.78	0	0	579.07	579.07	579.07	0	0	579.57	579.58	579.58	-0.01	-0.01
0.6	0.12	577.75	577.75	577.75	0	0	579.01	579.02	579.02	-0.01	-0.01	579.5	579.51	579.51	-0.01	-0.01
0.7	0.13	577.78	577.79	577.79	-0.01	-0.01	579.06	579.07	579.07	-0.01	-0.01	579.56	579.56	579.56	0	0
0.8	0.13	577.82	577.82	577.82	0	0	579.15	579.15	579.15	0	0	579.67	579.68	579.68	-0.01	-0.01
2	0.28	578.38	578.38	578.38	0	0	579.89	579.89	579.89	0	0	580.51	580.51	580.51	0	0
2.1	0.39	578.78	578.78	578.78	0	0	580.41	580.41	580.41	0	0	581.09	581.09	581.09	0	0
2.2	0.40	578.82	578.83	578.83	-0.01	-0.01	580.46	580.47	580.47	-0.01	-0.01	581.15	581.15	581.15	0	0
2.3	0.42	578.88	578.89	578.89	-0.01	-0.01	580.54	580.55	580.55	-0.01	-0.01	581.23	581.24	581.24	-0.01	-0.01
3	0.44	578.79	578.8	578.8	-0.01	-0.01	580.43	580.45	580.45	-0.02	-0.02	581.12	581.14	581.14	-0.02	-0.02
3.05	0.46	579.01	579.02	579.02	-0.01	-0.01	580.7	580.71	580.71	-0.01	-0.01	581.41	581.42	581.42	-0.01	-0.01
3.1	0.50	579.33	579.34	579.34	-0.01	-0.01	581.02	581.03	581.03	-0.01	-0.01	581.7	581.72	581.72	-0.02	-0.02
3.11	0.50	579.34	579.35	579.35	-0.01	-0.01	581.03	581.04	581.04	-0.01	-0.01	581.71	581.72	581.72	-0.01	-0.01
3.19	0.51	579.38	579.39	579.39	-0.01	-0.01	581.08	581.1	581.1	-0.02	-0.02	581.78	581.79	581.79	-0.01	-0.01
3.2	0.51	579.38	579.39	579.39	-0.01	-0.01	581.09	581.1	581.1	-0.01	-0.01	581.78	581.8	581.8	-0.02	-0.02
3.3	0.52	579.92	579.93	579.93	-0.01	-0.01	581.94	581.95	581.95	-0.01	-0.01	582.8	582.81	582.81	-0.01	-0.01
5	0.70	580.61	580.62	580.62	-0.01	-0.01	582.74	582.75	582.75	-0.01	-0.01	583.65	583.66	583.66	-0.01	-0.01
5.1	0.80	580.94	580.95	580.95	-0.01	-0.01	583.11	583.12	583.12	-0.01	-0.01	584.04	584.05	584.05	-0.01	-0.01
5.15	0.88	581.29	581.29	581.29	0	0	583.49	583.5	583.5	-0.01	-0.01	584.42	584.43	584.43	-0.01	-0.01
5.2	0.89	581.62	581.62	581.62	0	0	583.9	583.9	583.9	0	0	584.87	584.87	584.87	0	0
5.3	0.90	581.64	581.64	581.64	0	0	583.92	583.93	583.93	-0.01	-0.01	584.89	584.9	584.9	-0.01	-0.01
7	0.94	581.63	581.62	581.62	0.01	0.01	583.9	583.88	583.88	0.02	0.02	584.87	584.85	584.85	0.02	0.02
7.1	1.05	582.03	582.02	582.02	0.01	0.01	584.33	584.31	584.31	0.02	0.02	585.31	585.29	585.29	0.02	0.02
7.8	1.06	582.03	582.01	582.01	0.02	0.02	584.32	584.3	584.3	0.02	0.02	585.29	585.28	585.28	0.01	0.01
7.81	1.06	582.03	582.02	582.02	0.01	0.01	584.33	584.32	584.32	0.01	0.01	585.31	585.29	585.29	0.02	0.02
7.89	1.07	582.05	582.04	582.04	0.01	0.01	584.36	584.34	584.34	0.02	0.02	585.33	585.32	585.32	0.01	0.01
7.9	1.07	582.1	582.08	582.08	0.02	0.02	584.41	584.39	584.39	0.02	0.02	585.39	585.38	585.38	0.01	0.01
7.12	1.08	582.53	582.52	582.52	0.01	0.01	584.95	584.93	584.93	0.02	0.02	585.98	585.95	585.95	0.03	0.03

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“Recreated” – The recreated model calibrated to the original results.
“Existing” – The results of the model with the existing cross-sections through Highland Park.

SECTION NO.	RIVER MILES	Original 10-yr	Recreated 10-yr	Existing 10-yr	Difference (O-R) 10	Difference (O-E) 10	Original 50-yr	Recreated 50-yr	Existing 50-yr	Difference (O-R) 50	Difference (O-E) 50	Original 100-yr	Recreated 100-yr	Existing 100-yr	Difference (O-R) 100	Difference (O-E) 100
7.13	1.09	582.54	582.52	582.52	0.02	0.02	584.96	584.94	584.94	0.02	0.02	585.98	585.96	585.96	0.02	0.02
7.14	1.09	582.54	582.53	582.53	0.01	0.01	584.96	584.94	584.94	0.02	0.02	585.99	585.97	585.97	0.02	0.02
7.15	1.09	582.52	582.5	582.5	0.02	0.02	584.93	584.92	584.92	0.01	0.01	585.96	585.94	585.94	0.02	0.02
7.16	1.10	582.52	582.51	582.51	0.01	0.01	584.94	584.92	584.92	0.02	0.02	585.97	585.95	585.95	0.02	0.02
8	1.16	582.62	582.61	582.61	0.01	0.01	585.03	585.01	585.01	0.02	0.02	586.05	586.03	586.03	0.02	0.02
8.1	1.21	582.81	582.74	582.74	0.07	0.07	585.25	585.16	585.16	0.09	0.09	586.28	586.18	586.18	0.1	0.1
8.11	1.21	582.81	582.73	582.73	0.08	0.08	585.22	585.1	585.1	0.12	0.12	586.23	586.08	586.08	0.15	0.15
8.19	1.22	582.82	582.75	582.75	0.07	0.07	585.26	585.15	585.15	0.11	0.11	586.28	586.15	586.15	0.13	0.13
8.2	1.22	582.83	582.78	582.78	0.05	0.05	585.31	585.27	585.27	0.04	0.04	586.38	586.35	586.35	0.03	0.03
8.3	1.24	582.87	582.86	582.86	0.01	0.01	585.35	585.37	585.37	-0.02	-0.02	586.42	586.46	586.46	-0.04	-0.04
9	1.35	583.02	583.03	583.03	-0.01	-0.01	585.44	585.48	585.48	-0.04	-0.04	586.48	586.54	586.54	-0.06	-0.06
9.1	1.54	584.21	584.18	584.18	0.03	0.03	586.7	586.67	586.67	0.03	0.03	587.77	587.75	587.75	0.02	0.02
9.11	1.55	584.17	584.14	584.14	0.03	0.03	586.6	586.57	586.57	0.03	0.03	587.62	587.61	587.61	0.01	0.01
9.19	1.56	584.19	584.17	584.17	0.02	0.02	586.65	586.63	586.63	0.02	0.02	587.68	587.68	587.68	0	0
9.2	1.56	584.3	584.28	584.28	0.02	0.02	586.92	586.92	586.92	0	0	588.08	588.09	588.09	-0.01	-0.01
9.3	1.58	584.34	584.32	584.31	0.02	0.03	586.95	586.95	586.95	0	0	588.13	588.14	588.14	-0.01	-0.01
11	1.68	584.61	584.57	584.59	0.04	0.02	587.23	587.21	587.21	0.02	0.01	588.39	588.39	588.39	0	-0.01
12	1.94	585.21	585.17	585.21	0.04	0	587.73	587.75	587.75	-0.02	-0.04	588.83	588.87	588.87	-0.04	-0.06
13	2.18	585.55	585.58	585.61	-0.03	-0.06	587.77	587.9	587.9	-0.13	-0.16	588.82	588.97	588.97	-0.15	-0.17
13.1	2.29	585.99	586.02	586.04	-0.03	-0.05	588.22	588.34	588.34	-0.12	-0.14	589.2	589.33	589.33	-0.13	-0.15
13.11	2.29	586	586.03	586.05	-0.03	-0.05	588.23	588.35	588.35	-0.12	-0.14	589.22	589.35	589.35	-0.13	-0.14
13.19	2.29	586.07	586.09	586.12	-0.02	-0.05	588.33	588.44	588.44	-0.11	-0.13	589.32	589.44	589.44	-0.12	-0.14
13.2	2.30	586.08	586.11	586.13	-0.03	-0.05	588.34	588.46	588.46	-0.12	-0.14	589.33	589.46	589.46	-0.13	-0.14
14	2.34	586.71	586.73	586.76	-0.02	-0.05	589.15	589.25	589.25	-0.1	-0.12	590.22	590.33	590.33	-0.11	-0.12
16	2.58	587.33	587.35	587.37	-0.02	-0.04	589.83	589.92	589.92	-0.09	-0.1	590.9	591	591	-0.1	-0.11
16.1	2.62	587.47	587.49	587.51	-0.02	-0.04	589.89	589.97	589.97	-0.08	-0.09	590.93	591.02	591.02	-0.09	-0.1
16.2	2.62	587.64	587.66	587.68	-0.02	-0.04	590.29	590.37	590.37	-0.08	-0.09	591.47	591.56	591.56	-0.09	-0.11
16.3	2.63	587.77	587.77	587.79	0	-0.02	590.51	590.55	590.55	-0.04	-0.06	591.72	591.78	591.78	-0.06	-0.08
17	2.82	587.89	587.93	587.93	-0.04	-0.04	590.61	590.72	590.72	-0.11	-0.09	591.82	591.95	591.95	-0.13	-0.11
19	3.10	588.07	588.14	588.14	-0.07	-0.07	590.76	590.9	590.9	-0.14	-0.13	591.97	592.12	592.12	-0.15	-0.14
20	3.20	588.13	588.13	588.2	0	-0.07	590.81	590.9	590.9	-0.09	-0.12	592.01	592.12	592.12	-0.11	-0.14

“Original” – The results of the original HEC-2 model as printed on the hardcopy sent to us from FEMA.
“Recreated” – The recreated model calibrated to the original results.
“Existing” – The results of the model with the existing cross-sections through Highland Park.

SECTION NO.	RIVER MILES	Original 10-yr	Recreated 10-yr	Existing 10-yr	Difference (O-R) 10	Difference (O-E) 10	Original 50-yr	Recreated 50-yr	Existing 50-yr	Difference (O-R) 50	Difference (O-E) 50	Original 100-yr	Recreated 100-yr	Existing 100-yr	Difference (O-R) 100	Difference (O-E) 100
20.1	3.45	588.36	588.36	588.42	0	-0.06	591	591.08	591.08	-0.08	-0.11	592.17	592.27	592.27	-0.1	-0.13
20.2	3.46	588.8	588.8	588.86	0	-0.06	591.62	591.67	591.67	-0.05	-0.08	592.45	592.49	592.49	-0.04	-0.06
22	3.50	588.98	589.13	589.03	-0.15	-0.05	591.7	591.91	591.91	-0.21	-0.08	592.54	592.75	592.75	-0.21	-0.05
23	3.66	589.31	589.27	589.37	0.04	-0.06	592.05	592.08	592.08	-0.03	-0.08	592.92	592.94	592.94	-0.02	-0.06
24	3.82	589.48	589.41	589.51	0.07	-0.03	592.2	592.19	592.19	0.01	-0.04	593.07	593.05	593.05	0.02	-0.02
24.1	3.87	589.51	589.44	589.53	0.07	-0.02	592.34	592.32	592.32	0.02	-0.03	593.22	593.18	593.18	0.04	0
24.2	3.88	589.51	589.44	589.54	0.07	-0.03	592.28	592.27	592.27	0.01	-0.04	593.15	593.14	593.14	0.01	-0.03
24.3	3.89	589.87	589.76	589.85	0.11	0.02	592.57	592.48	592.48	0.09	0.04	593.44	593.34	593.34	0.1	0.06
25	4.03	589.9	589.79		0.11		592.61	592.52		0.09		593.49	593.38		0.11	
25.1	4.25	590.25	590.16		0.09		592.85	592.78		0.07		593.72	593.63		0.09	
**25.2	4.26	590.25	590.17		0.08		592.66	592.79		-0.13		593.73	593.64		0.09	
**31	4.90	591.21	591.53	593.16	-0.32	-1.95	593.78	593.85	595.96	-0.07	-2.45	594.7	594.66	596.84	0.04	-2.42
31.1	5.00	591.17	591.69	593.25	-0.52	-2.08	593.68	593.97	596.01	-0.29	-2.59	594.57	594.77	596.88	-0.2	-2.58
31.2	5.01	591.22	591.71	593.27	-0.49	-2.05	593.74	594	596.02	-0.26	-2.53	594.63	594.8	596.87	-0.17	-2.5
31.3	5.02	591.43	591.91	593.45	-0.48	-2.02	594.09	594.34	596.37	-0.25	-2.54	595.06	595.22	597.35	-0.16	-2.56

** Note that cross-sections S, T, and U were missing from the original model which includes Highland Park Footbridge and the South Avenue Bridge between Sections 25.2 and 31. A discrepancy in water surface elevations is expected upstream of this area due to the missing data. The recreated model attempts to approximate the missing data as much as possible. The existing conditions model should be relied upon to predict water surface elevations.

Figure 1 10-year Flood Event Comparison

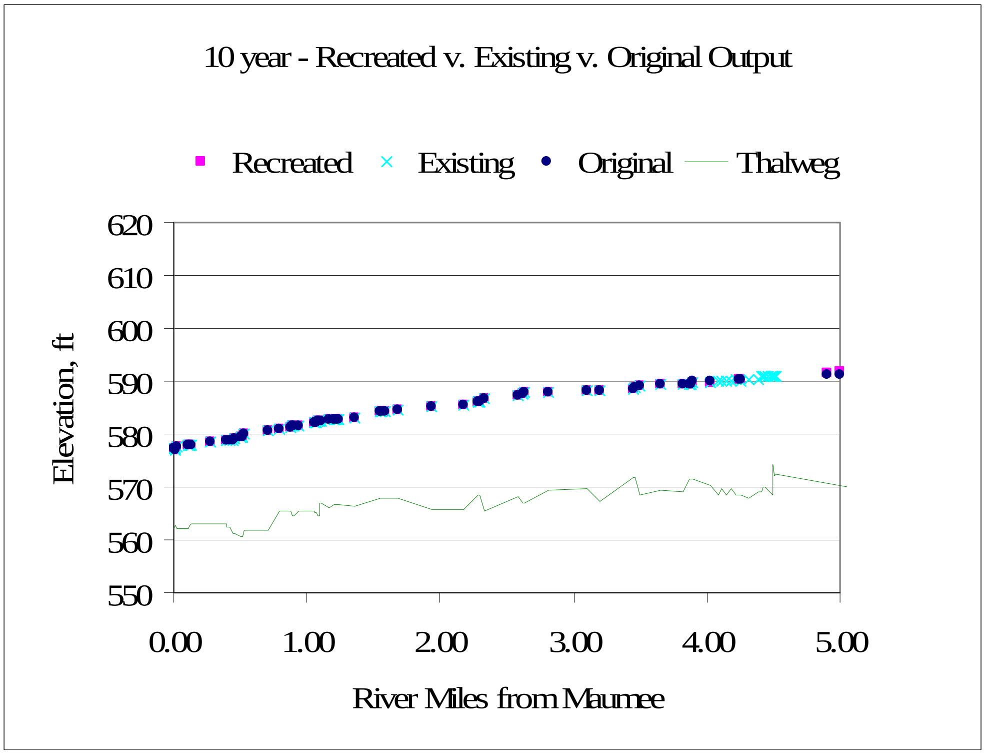


Figure 2 50-year Flood Event Comparison

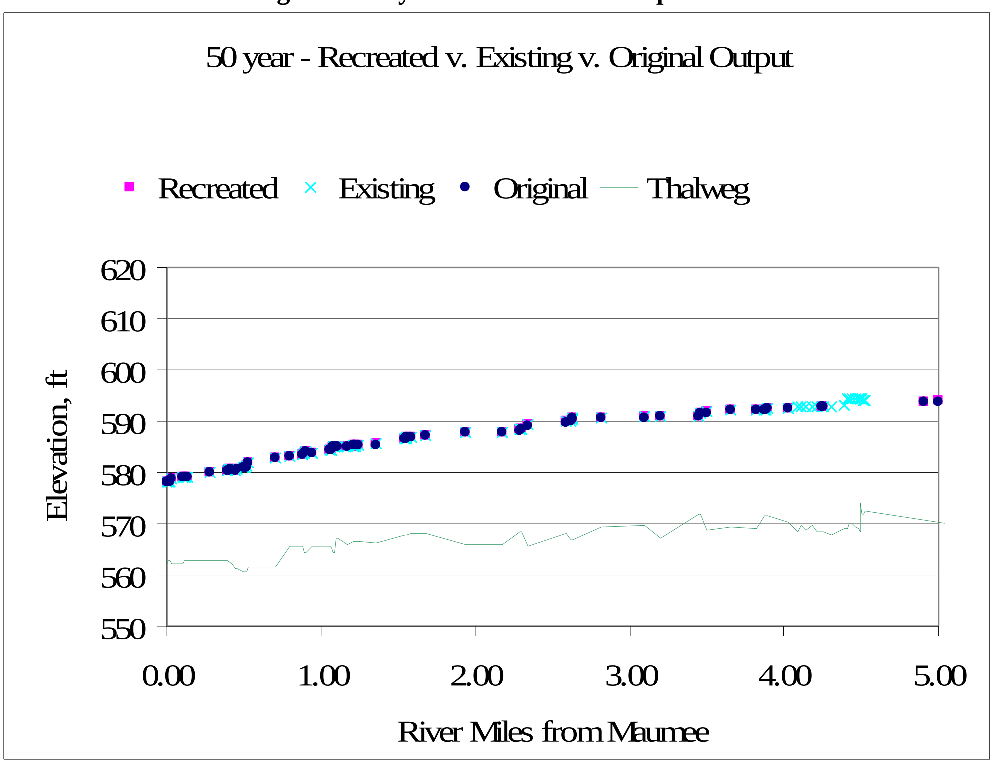
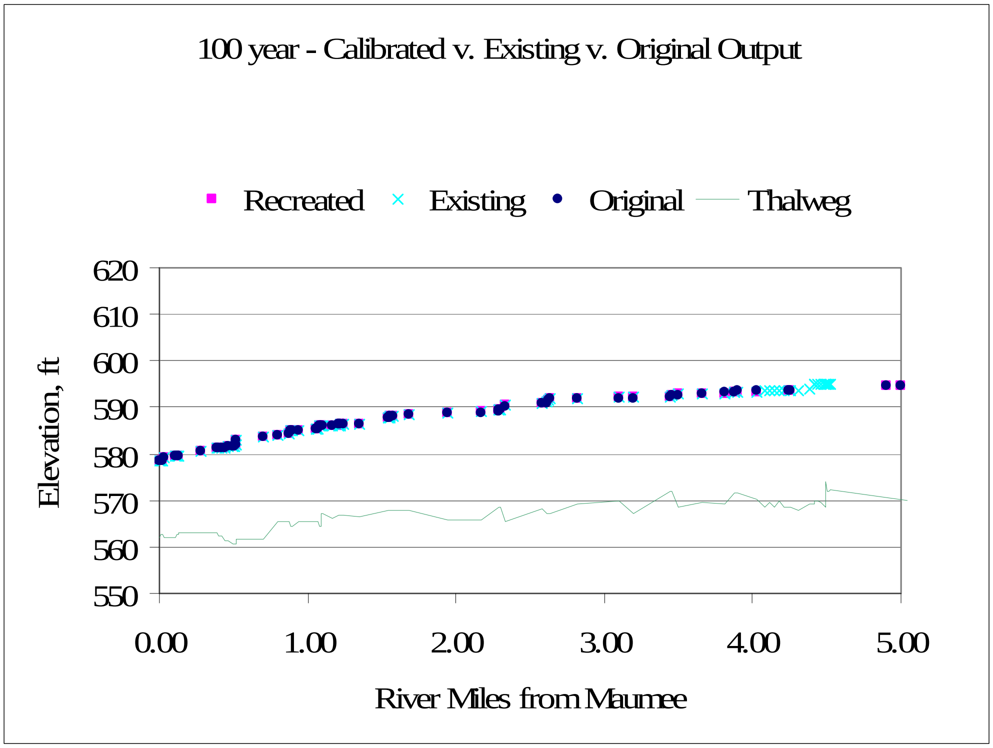


Figure 3 100-year Flood Event Comparison



Existing Conditions Low Flow Analysis
JFNew staff observed in November 2007 low flow conditions. Their observations included an edge-of-water elevation measurement of 574.44 ft at the dam, cross-section 3. Based on this elevation, the theoretical flow rate over the existing dam would be approximately 22 cfs assuming a spillway coefficient, C, of 3.33, a weir length, b, of 59 feet, and an average water depth, H, of 0.23 feet ($Q = CbH^{(3/2)}$).

The flow rate in the model was adjusted to match the observed elevation measurement. The corresponding model flow rate was determined to be 30 cfs. In addition to adjusting the flow rate, the HEC-2 model was truncated to just the portion through Highland Park. This was done due to a downstream control in the original model which controls the flow so that the water level is approximately 10 feet higher than observed levels.

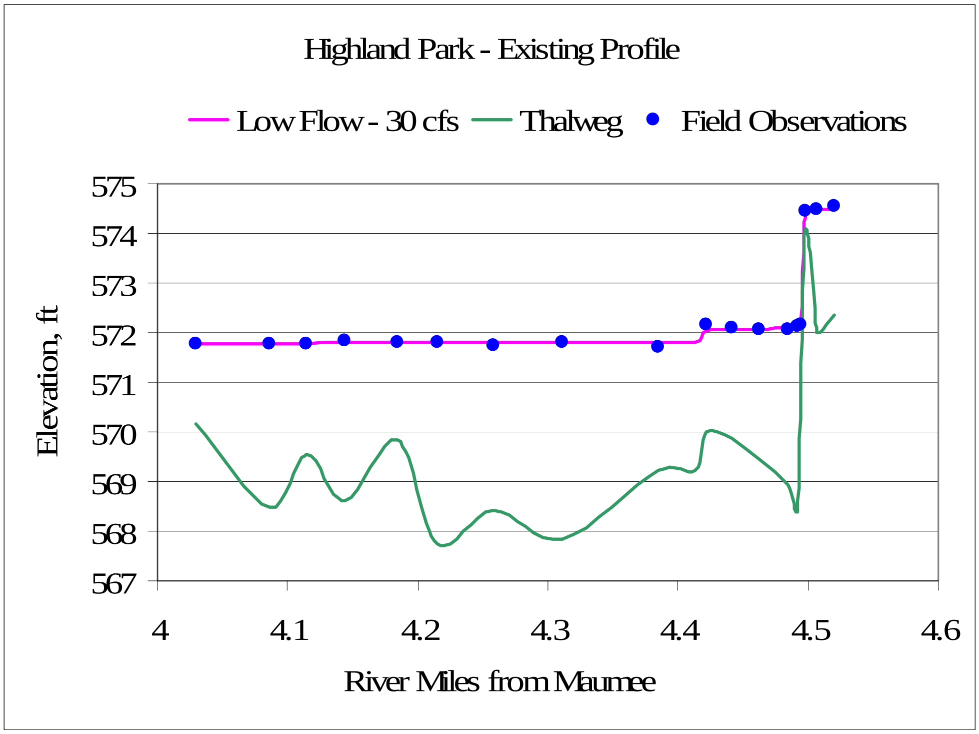
Table 2 shows the results of simulating 30 cfs through the model as compared to the observed water surface elevations at a perceived low flow. The greatest difference between the observed and modeled data is 0.12 feet. Figure 4 shows this comparison graphically.

Table 2 Comparison of WSE at 30 cfs to Observed Data

SECTION NO.	CROSS-SECTION (Nov. 2007)	RIVER MILES	MODEL WSE (30 cfs)	OBSERVED WSE	DIFFERENCE (M-0)
24.318	18	4.03	571.76	571.76	0
24.327	17	4.09	571.78	571.77	0.01
24.336	16	4.11	571.78	571.76	0.02
24.345	15	4.14	571.8	571.84	-0.04
24.354	14	4.18	571.81	571.81	0
24.363	13	4.21	571.81	571.81	0

SECTION NO.	CROSS-SECTION (Nov. 2007)	RIVER MILES	MODEL WSE (30 cfs)	OBSERVED WSE	DIFFERENCE (M-0)
24.372	12	4.26	571.82	571.74	0.08
24.381	11	4.31	571.82	571.81	0.01
24.39	10	4.39	571.82	571.71	0.11
24.4	Ped Bridge	4.41	571.82		
24.409	9	4.42	572.04	572.16	-0.12
24.418	8	4.44	572.07	572.09	-0.02
24.427	7	4.46	572.08	572.05	0.03
24.436	6	4.48	572.09	572.08	0.01
24.445	5	4.49	572.09	572.14	-0.05
24.454	4	4.49	572.08	572.15	-0.07
24.463	3	4.50	574.41	574.44	-0.03
24.472	2	4.51	574.5	574.5	0
24.475	South Bridge	4.51	574.5		
24.481	1	4.52	574.5	574.55	-0.05

Figure 4 Low Flow Calibration to Field Observations



In addition, the following comparisons were made:

Table 3 Additional Comparisons

Field Observation	Model Results
Velocity just upstream of dam = 0.27 ft/s	Velocity just upstream of dam = 0.24 ft/s
Calculated flow over dam based on edge of water observation = 22 cfs*	Flow calibrated to edge of water elevations = 30 cfs

* Note:

$$Q = CbH^{3/2}$$

$$C = 3.33\frac{ft^{0.5}}{\sec}\text{ (assumed)}$$

$$b = 59\,ft\text{ (estimated length of weir)}$$

$$H = 0.23\,ft\text{ (average depth over weir)}$$

$$Q = 22cfs$$

Evaluation of Proposed Cross-Sections

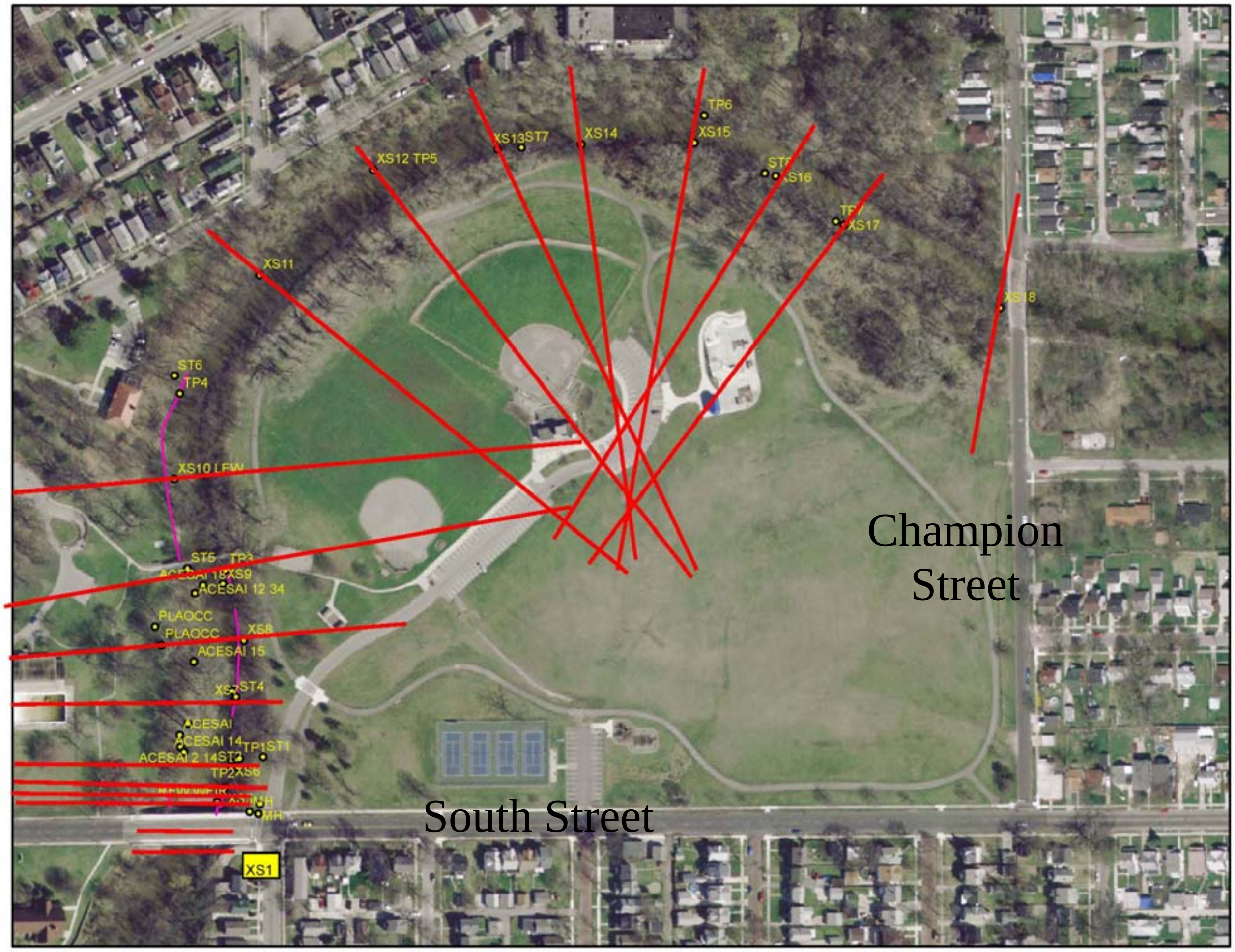
The cross-sections for the proposed rock dams were received from JFNew and were incorporated into the model with the following top elevations. See Figure 5 for a map of the cross-section locations in Highland Park.

Rock Dam 1 (Cross-section 6) = 573.6 ft
Rock Dam 2 (Cross-section 7) = 573.1 ft
Rock Dam 3 (Cross-section 8) = 572.6 ft

The elevation of the thalweg for the existing dam is 574.1 ft with each successive rock dam being another 6 inches lower than the previous. Each rock dam would be constructed with a v-shaped low flow channel which has a thalweg 0.75 feet below the top of the rock dam.

Figure 6**,** Figure 7**,** and Figure 8 show the cross-section of each proposed rock dam including low flow channels. The low flow (30 cfs) water surface elevation is also shown based on model results.

Figure 5 Cross-Section Locations



Note: The cross-sections in Figure 5 were provided by JFNew. We understand that in hydrologic/hydraulic analyses the cross-sections are not supposed to overlap, however, this was not a problem in this analysis since the water surface never reached the overlapping elevations.

Figure 6 Rock Dam 1 Cross-Section

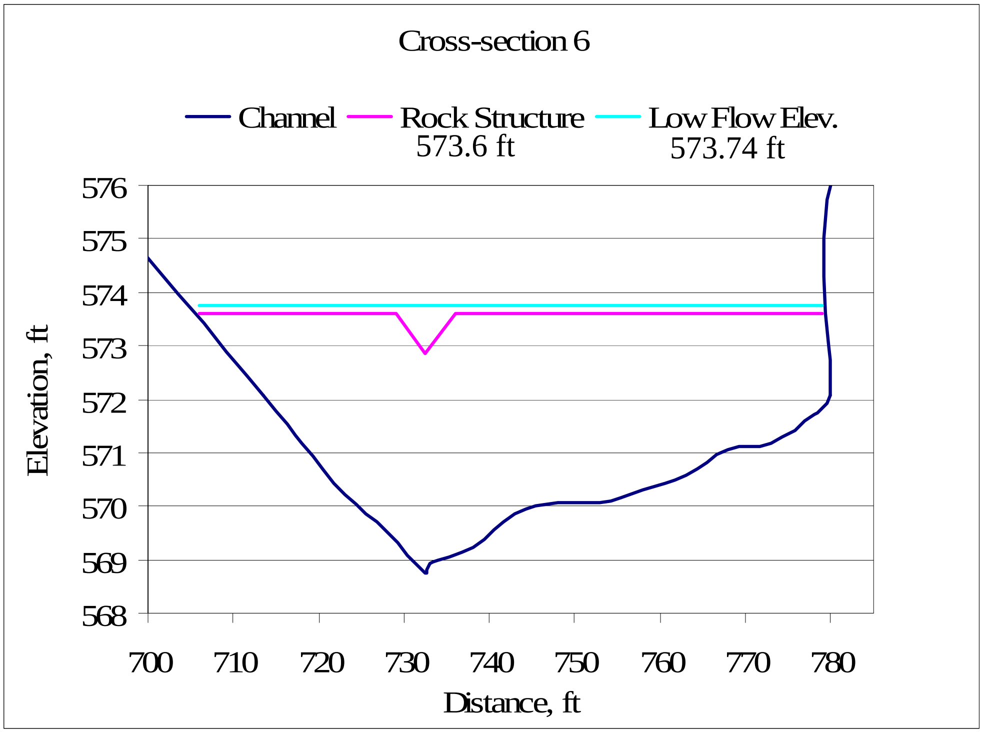


Figure 7 Rock Dam 2 Cross-Section

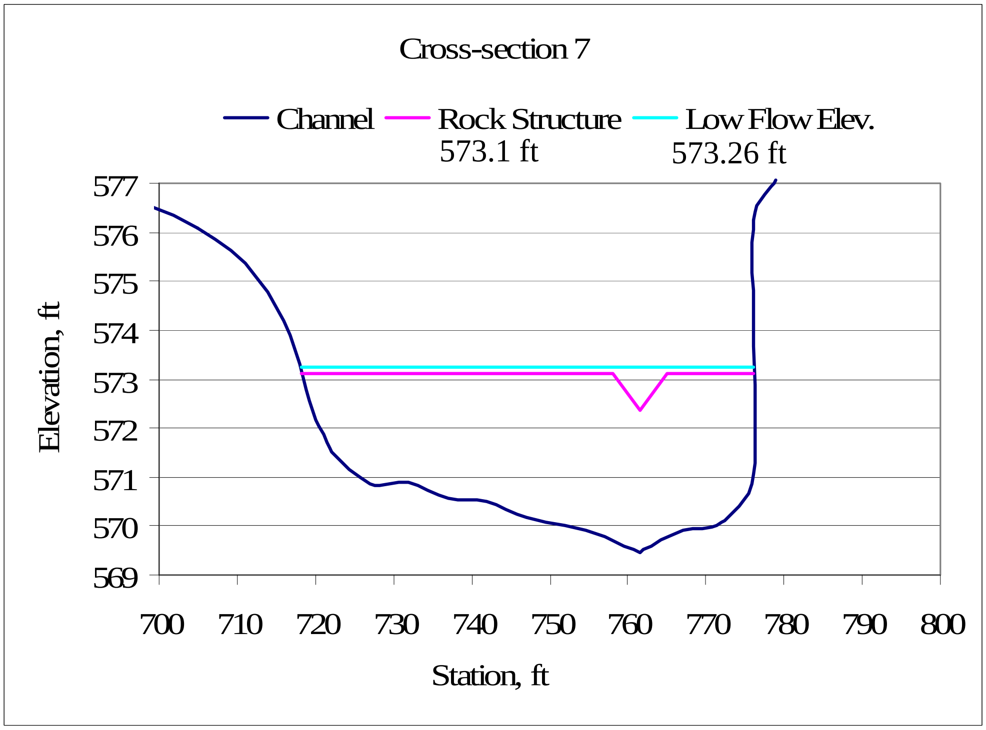


Figure 8 Rock Dam 3 Cross-Section

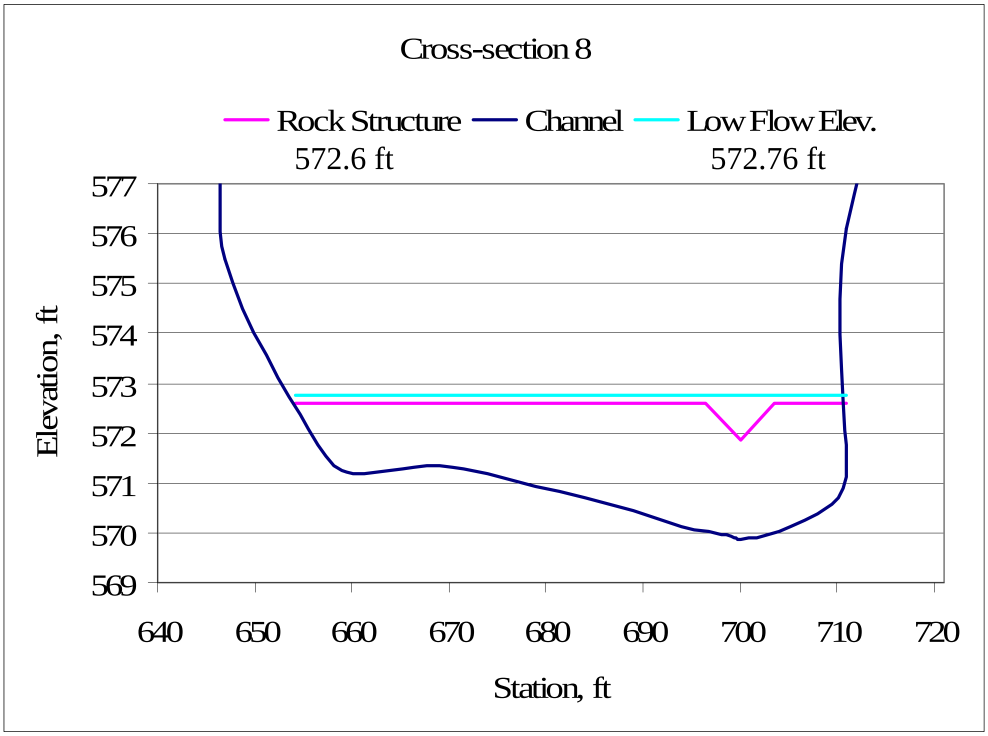


Figure 9 shows the profile of the stretch of Swan Creek through Highland Park with the proposed rock dams. The low flow (30 cfs) is shown over the rock dams and also under existing conditions. See Table 4 for a comparison of WSE between the existing and proposed conditions model at 30 cfs. There is no difference between the two profiles downstream of the proposed cross-sections.

Table 4 Comparison of WSE for Existing and Proposed Conditions at 30 cfs

			30 cfs		
SECTION NO.	**CROSS-SECTION**	**RIVER MILES**	**WSE (Proposed)**	**WSE (Existing)**	**DIFFERENCE (P-E)**
24.318	18	4.02	571.76	571.76	0
24.327	17	4.08	571.78	571.78	0
24.336	16	4.11	571.78	571.78	0
24.345	15	4.14	571.8	571.8	0
24.354	14	4.18	571.81	571.81	0
24.363	13	4.21	571.81	571.81	0
24.372	12	4.25	571.82	571.82	0
24.381	11	4.30	571.82	571.82	0
24.39	10	4.38	571.82	571.82	0
24.4	Ped Bridge	4.40	571.82	571.82	0
24.409	9	4.41	572.04	572.04	0
24.418	8	4.42	572.06	572.07	-0.01
24.428	8 - proposed rock crest	4.43	572.76		
24.438	8 - proposed pool	4.43	572.86		
24.447	7 - proposed rock crest	4.45	573.26		
24.457	7 - pool	4.45	573.36	572.08	1.28
24.466	6 - proposed rock crest	4.47	573.74		

			30 cfs		
SECTIO N NO.	CROSS-SECTION	RIVER MILES	WSE (Proposed)	WSE (Existing)	DIFFERENCE (P-E)
24.486	6 - pool	4.48	573.83	572.09	1.74
24.495	5	4.48	573.83	572.09	1.74
24.504	4	4.49	573.83	572.08	1.75
24.513	3-Dam	4.49	574.55	574.41	0.14
24.522	2-proposed	4.49	574.7	574.5	0.2
24.532	2	4.50	574.7		
24.542	2-proposed	4.50	574.7		
24.55	South Bridge	4.50	574.7	574.5	0.2
24.551	1	4.51	574.7	574.5	0.2

Figure 9 Profile of Rock Dams

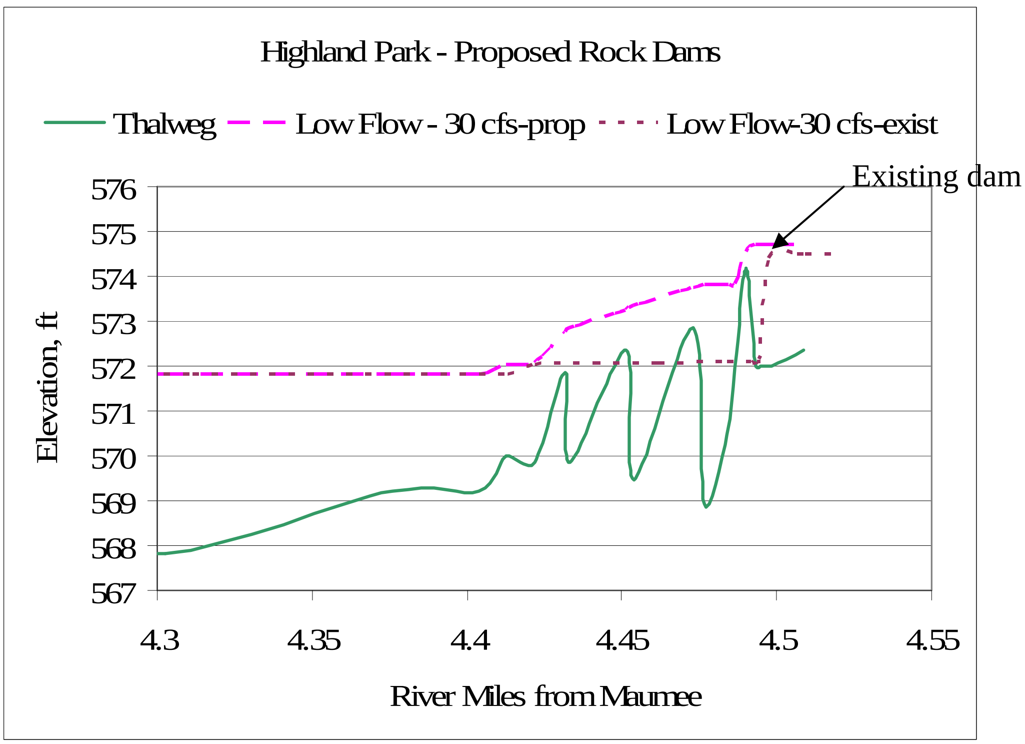


Table 5 and Table 6 contain the shear stresses and velocities, respectively, for the stretch of Swan Creek through Highland Park for the 1, 2, 10, 50, and 100-year events and the low flow event (30 cfs). These shear stresses and velocities can be used to size rocks for the proposed dams.

Table 5 Shear Stresses

	Shear Stresses (lb/ft^2)					
Cross-Section (Nov. 2007)	**Low Flow 30 cfs**	**1-year 2,905 cfs**	**2-year 3,811 cfs**	**10-year 5,900 cfs**	**50-year 8,000 cfs**	**100-year 9,000 cfs**
18	0.01	3.64	2.86	4.98	5.71	6
17	0	0.83	1	1.23	1.34	1.37
16	0.01	0.79	0.92	1.11	1.21	1.25
15	0.01	2.55	3.41	5.72	8.75	11.28
14	0	0.34	0.42	0.6	0.77	0.83
13	0	0.38	0.5	0.78	1.05	1.16
12	0	0.4	0.53	0.82	1.1	1.22
11	0	0.3	0.38	0.56	0.69	0.74
10	0	0.25	0.3	0.39	0.46	0.48
Ped Bridge	0.32	61.82	79.2	116.54	5.59	5.16
9	0.76	19.04	15.47	9.58	12.98	8.97
8-dwnstrm	0	0	0.02	0.05	0.09	0.1
8-rock crest	0	0	0.02	0.06	0.11	0.11
8-pool	0	0	0.02	0.05	0.09	0.09
7-rock crest	0.5	0.32	0.36	0.42	0.62	0.63
7-pool	0	0.23	0.28	0.37	0.55	0.57
6-rock crest	0.48	0.33	0.39	0.49	0.72	0.75
6-pool	0	0.19	0.25	0.35	0.54	0.58
5	0	0.18	0.23	0.33	0.5	0.53
4	0	0.24	0.31	0.44	0.67	0.71
3-existing dam	0.64	0.5	0.6	0.78	1.21	1.27
2c-rock channeling	0	0.24	0.31	0.44	0.68	0.73
2b-rock channeling	0	0.25	0.32	0.45	0.68	0.73
2a-rock channeling	0	0.25	0.32	0.45	0.68	0.73
South Bridge	0	0.25	0.32	0.45	0.71	0.78
1	0	0.55	0.73	1.09	1.8	1.97

Table 6 Velocity

	Velocity (ft/sec)					
Cross-Section (Nov. 2007)	**Low Flow 30 cfs**	**1-year 2,905 cfs**	**2-year 3,811 cfs**	**10-year 5,900 cfs**	**50-year 8,000 cfs**	**100-year 9,000 cfs**
18	0.52	11.21	5.94	5.76	7.6	6.08
17	0.28	5.94	6.64	7.67	8.23	8.42
16	0.45	5.76	6.36	7.24	7.8	8.01
15	0.36	7.6	8.96	11.89	14.89	16.89
14	0.49	6.08	6.95	8.63	9.98	10.52
13	0.3	6.56	7.67	9.84	11.64	12.34
12	0.3	6.83	7.97	10.21	12.07	12.8
11	0.29	5.86	6.78	8.43	9.62	10.05
10	0.33	5.37	6.06	7.2	7.93	8.19
Ped Bridge	0.33	6.09	7.04	8.84	1.98	1.93
9	0.49	3.24	2.96	2.39	2.81	2.36
8-dwnstrm	0	0.1	0.55	1.13	1.51	1.62
8-rock crest	0	0.14	0.65	1.26	1.67	1.76
8-pool	0	0.12	0.56	1.13	1.51	1.61

	Velocity (ft/sec)					
Cross-Section (Nov. 2007)	Low Flow 30 cfs	1-year 2,905 cfs	2-year 3,811 cfs	10-year 5,900 cfs	50-year 8,000 cfs	100-year 9,000 cfs
7-rock crest	2.55	3.69	4	4.48	5.48	5.59
7-pool	0.18	3.22	3.6	4.2	5.18	5.33
6-rock crest	2.42	3.85	4.27	4.93	6.08	6.25
6-pool	0.13	3.09	3.57	4.36	5.44	5.67
5	0.15	2.94	3.39	4.16	5.2	5.43
4	0.3	3.29	3.8	4.63	5.78	6.02
3-existing dam	3.05	4.61	5.18	6.14	7.71	7.98
2c-rock channeling	0.21	3.3	3.8	4.67	5.85	6.12
2b-rock channeling	0.21	3.31	3.81	4.68	5.85	6.12
2a-rock channeling	0.21	3.31	3.81	4.67	5.85	6.12
South Bridge	0.21	3.31	3.81	4.71	5.96	6.31
1	0.29	5.02	5.85	7.37	9.55	10.09

Table 7 shows that the proposed rock dams and upstream channeling do not affect the flood plain downstream or upstream of the project area as compared to the base model.

Table 7 Comparison of WSE for the Proposed and Base (Existing Conditions) Model for the 100-year Event

BASE SECTION NO.	BASE RIVER MILES	WSE (Base)	PROPOSED SECTION NO.	PROPOSED RIVER MILES	WSE (Proposed)	DIFFERENCE (P-B)
0.1	0.00	578.51	0.1	0.00	578.51	0
0.2	0.01	578.32	0.2	0.01	578.32	0
0.3	0.02	578.44	0.3	0.02	578.44	0
0.4	0.03	579.17	0.4	0.03	579.17	0
0.5	0.11	579.58	0.5	0.11	579.58	0
0.6	0.12	579.51	0.6	0.12	579.51	0
0.7	0.13	579.56	0.7	0.13	579.56	0
0.8	0.13	579.68	0.8	0.13	579.68	0
2	0.28	580.51	2	0.28	580.51	0
2.1	0.39	581.09	2.1	0.39	581.09	0
2.2	0.40	581.15	2.2	0.40	581.15	0
2.3	0.42	581.24	2.3	0.42	581.24	0
3	0.44	581.14	3	0.44	581.14	0
3.05	0.46	581.42	3.05	0.46	581.42	0
3.1	0.50	581.72	3.1	0.50	581.72	0
3.11	0.50	581.72	3.11	0.50	581.72	0
3.19	0.51	581.79	3.19	0.51	581.79	0
3.2	0.51	581.8	3.2	0.51	581.8	0
3.3	0.52	582.81	3.3	0.52	582.81	0
5	0.70	583.66	5	0.70	583.66	0
5.1	0.80	584.05	5.1	0.80	584.05	0
5.15	0.88	584.43	5.15	0.88	584.43	0
5.2	0.89	584.87	5.2	0.89	584.87	0
5.3	0.90	584.9	5.3	0.90	584.9	0
7	0.94	584.85	7	0.94	584.85	0
7.1	1.05	585.29	7.1	1.05	585.29	0

BASE SECTION NO.	BASE RIVER MILES	WSE (Base)	PROPOSED SECTION NO.	PROPOSED RIVER MILES	WSE (Proposed)	DIFFERENCE (P-B)
7.8	1.06	585.28	7.8	1.06	585.28	0
7.81	1.06	585.29	7.81	1.06	585.29	0
7.89	1.07	585.32	7.89	1.07	585.32	0
7.9	1.07	585.38	7.9	1.07	585.38	0
7.12	1.08	585.95	7.12	1.08	585.95	0
7.13	1.09	585.96	7.13	1.09	585.96	0
7.14	1.09	585.97	7.14	1.09	585.97	0
7.15	1.09	585.94	7.15	1.09	585.94	0
7.16	1.10	585.95	7.16	1.10	585.95	0
8	1.16	586.03	8	1.16	586.03	0
8.1	1.21	586.18	8.1	1.21	586.18	0
8.11	1.21	586.08	8.11	1.21	586.08	0
8.19	1.22	586.15	8.19	1.22	586.15	0
8.2	1.22	586.35	8.2	1.22	586.35	0
8.3	1.24	586.46	8.3	1.24	586.46	0
9	1.35	586.54	9	1.35	586.54	0
9.1	1.54	587.75	9.1	1.54	587.75	0
9.11	1.55	587.61	9.11	1.55	587.61	0
9.19	1.56	587.68	9.19	1.56	587.68	0
9.2	1.56	588.09	9.2	1.56	588.09	0
9.3	1.58	588.14	9.3	1.58	588.14	0
11	1.68	588.4	11	1.68	588.39	-0.01
12	1.94	588.89	12	1.94	588.87	-0.02
13	2.18	588.99	13	2.18	588.97	-0.02
13.1	2.29	589.35	13.1	2.29	589.33	-0.02
13.11	2.29	589.36	13.11	2.29	589.35	-0.01
13.19	2.29	589.46	13.19	2.29	589.44	-0.02
13.2	2.30	589.47	13.2	2.30	589.46	-0.01
14	2.34	590.34	14	2.34	590.33	-0.01
16	2.58	591.01	16	2.58	591	-0.01
16.1	2.62	591.03	16.1	2.62	591.02	-0.01
16.2	2.62	591.58	16.2	2.62	591.56	-0.02
16.3	2.63	591.8	16.3	2.63	591.78	-0.02
17	2.82	591.93	17	2.82	591.95	0.02
19	3.10	592.11	19	3.10	592.12	0.01
20	3.20	592.15	20	3.20	592.12	-0.03
20.1	3.45	592.3	20.1	3.45	592.27	-0.03
20.2	3.46	592.51	20.2	3.46	592.49	-0.02
22	3.50	592.59	22	3.50	592.75	0.16
23	3.66	592.98	23	3.66	592.94	-0.04
24	3.82	593.09	24	3.82	593.05	-0.04
24.1	3.87	593.22	24.1	3.87	593.18	-0.04
24.2	3.88	593.18	24.2	3.88	593.14	-0.04
24.3	3.89	593.38	24.3	3.89	593.34	-0.04
24.318	**4.03**	**593.31**	**24.318**	**4.03**	**593.27**	**-0.04**
24.327	**4.09**	**593.63**	**24.327**	**4.09**	**593.6**	**-0.03**
24.336	**4.11**	**593.64**	**24.336**	**4.11**	**593.6**	**-0.04**
24.345	**4.14**	**593.64**	**24.345**	**4.14**	**593.63**	**-0.01**
24.354	**4.18**	**593.66**	**24.354**	**4.18**	**593.58**	**-0.08**

BASE SECTION NO.	BASE RIVER MILES	WSE (Base)	PROPOSED SECTION NO.	PROPOSED RIVER MILES	WSE (Proposed)	DIFFERENCE (P-B)
24.363	**4.22**	**593.68**	**24.363**	**4.22**	**593.59**	**-0.09**
24.372	**4.26**	**593.73**	**24.372**	**4.26**	**593.63**	**-0.1**
24.381	**4.31**	**593.71**	**24.381**	**4.31**	**593.57**	**-0.14**
24.39	**4.39**	**593.87**	**24.39**	**4.39**	**593.81**	**-0.06**
24.4	**4.41**	**595.01**	**24.4**	**4.41**	**594.99**	**-0.02**
24.409	**4.42**	**595**	**24.409**	**4.42**	**594.97**	**-0.03**
24.418	**4.44**	**595.02**	**24.418**	**4.43**	**594.99**	**-0.03**
			24.428	**4.44**	**594.99**	
			24.438	**4.44**	**594.99**	
			24.447	**4.46**	**594.98**	
24.427	**4.46**	**595.01**	**24.457**	**4.46**	**594.98**	**-0.03**
			24.466	**4.48**	**594.98**	
24.436	**4.48**	**595.01**	**24.486**	**4.49**	**594.98**	**-0.03**
24.445	**4.49**	**595.01**	**24.495**	**4.49**	**594.99**	**-0.02**
24.454	**4.49**	**595.01**	**24.504**	**4.50**	**594.98**	**-0.03**
24.463	**4.50**	**594.96**	**24.513**	**4.50**	**594.93**	**-0.03**
			24.522	**4.50**	**594.93**	
24.472	**4.51**	**594.96**	**24.532**	**4.51**	**594.93**	**-0.03**
			24.542	**4.51**	**594.93**	
24.475	**4.51**	**594.89**	**24.55**	**4.51**	**594.87**	**-0.02**
24.481	**4.52**	**594.82**	**24.551**	**4.52**	**594.8**	**-0.02**
31	5.17	597.12	31	5.17	597.1	-0.02
31.1	5.26	597.15	31.1	5.26	597.14	-0.01
31.2	5.27	597.13	31.2	5.27	597.12	-0.01
31.3	5.28	597.62	31.3	5.28	597.6	-0.02
33	5.44	597.87	33	5.44	597.85	-0.02
35	5.76	598.14	35	5.76	598.12	-0.02
37	6.08	598.35	37	6.08	598.33	-0.02
38	6.29	598.51	38	6.29	598.51	0
38.1	6.32	598.55	38.1	6.32	598.54	-0.01
38.2	6.33	598.58	38.2	6.33	598.57	-0.01
38.3	6.34	598.7	38.3	6.35	598.68	-0.02
40	6.58	598.8	40	6.58	598.78	-0.02
42	6.81	598.93	42	6.81	598.91	-0.02
44	7.33	599.1	44	7.33	599.08	-0.02
44.1	7.49	599.13	44.1	7.50	599.11	-0.02
44.2	7.51	599.04	44.2	7.52	599.02	-0.02
44.21	7.51	599.04	44.21	7.52	599.02	-0.02
44.29	7.53	599.09	44.29	7.53	599.07	-0.02
44.3	7.53	599.09	44.3	7.53	599.07	-0.02
46	7.62	599.48	46	7.63	599.46	-0.02
48	7.93	599.69	48	7.93	599.68	-0.01
50	8.31	600.12	50	8.32	600.11	-0.01
52	8.61	600.38	52	8.61	600.37	-0.01
54	8.97	600.97	54	8.98	600.96	-0.01
56	9.17	601.2	56	9.17	601.19	-0.01
58	9.39	601.01	58	9.39	601	-0.01
58.1	9.40	601.71	58.1	9.40	601.72	0.01
58.2	9.40	602.41	58.2	9.40	602.4	-0.01

BASE SECTION NO.	BASE RIVER MILES	WSE (Base)	PROPOSED SECTION NO.	PROPOSED RIVER MILES	WSE (Proposed)	DIFFERENCE (P-B)
58.3	9.41	602.42	58.3	9.41	602.4	-0.02
59	9.63	602.69	59	9.63	602.63	-0.06
60	9.83	602.81	60	9.83	602.74	-0.07
62	10.22	603.16	62	10.22	603.09	-0.07
64	10.50	603.41	64	10.50	603.35	-0.06
64.1	10.69	603.62	64.1	10.69	603.56	-0.06
64.2	10.71	603.55	64.2	10.71	603.49	-0.06
64.3	10.71	603.59	64.3	10.72	603.53	-0.06
64.4	10.72	604.23	64.4	10.72	604.17	-0.06
66	10.80	604.51	66	10.80	604.46	-0.05
68	10.90	604.58	68	10.90	604.53	-0.05
70	11.22	604.73	70	11.22	604.69	-0.04
Note: Bolded text indicates existing cross-sections and proposed cross-sections. The remainder of the cross-sections follows the original HEC-2 model.						

ATTACHMENT A

1. **Recreated HEC-2 Code**

2. **Copy of Hardcopy Printout of Original HEC-2 Code**

ORIGINAL

```
T1      Type 19 FIS
T2      Toledo Ohio 10 Year
T3      Swan Creek
J1   -10       2                                                577.17
J2     1              -1
NC  0.05    0.05    0.04       1     0.3
QT     5    5900    8000    9000   11000    9000
X1   0.1      11               115
GR   590       0   563.1       0   562.1      10   562.1      57   564.6      67
GR 570.3      86   574.7     115   583.4     122   583.6     150     584     250
GR   604     250
NC  0.05    0.05    0.04     0.3     0.5
X1   0.2      10     272     355      50      50      50
X3    10                                                     583   582.2
GR   590     272     572     272     563     300   562.8     313     563     330
GR 569.3     355     583     400   582.2     425     583     560   584.7     655
SB           1.5     2.8              56       0    1200     0.8     563     563
X1   0.3                              43      43      43
X2                     1   580.3   582.2
X3    10                                                     583   582.2
BT     8     272     590     590     272     583   580.3     355     583   580.3
BT   355   580.3   569.3     400     583     583     425   582.2   582.2     560
BT   583     583     655   584.7   584.7
NC  0.06    0.05    0.04     0.2     0.4
X1   0.4      11       0     115      50      50      50
GR   590       0   563.1       0   582.1      10   562.1      57   564.6      67
GR 570.3      86   574.7     115   583.4     122   583.6     150     584     250
GR   604     250
NC  0.06    0.04    0.04     0.1     0.3
X1   0.5                             425     425     425
NC  0.06    0.04    0.04     0.3     0.5
X1   0.6      11     168     250      50      50      50
X3    10                                                     584   583.6
GR   590     140     585     140     585     168   569.3     168  562.75     179
GR562.75     209  562.75     239   569.2     250     583     250   583.6     280
GR   584     370
SB           1.5     2.8              76       0    1575    0.15     563     563
X1   0.7                              42      42      42
X2                     1     583   583.6
X3    10                                                     584   583.6
BT     9     140     590     590     140     585     585     168     585     585
BT   168     585     583     209   585.1     583     250   585.2     583     250
BT 584.4     583     280   583.6   583.6     370     584     584
NC  0.05    0.04    0.04     0.3     0.5
X1   0.8      11      33     131      50      50      50
GR   610       0   590.4       0   572.4      33   566.4      45   562.9      78
GR 564.4     114   571.4     123   574.4     125   581.4     131   583.9     174
GR   604     174
NC  0.07    0.06    0.04     0.1     0.3
X1     2                             750     750     750
NC  0.07    0.06    0.04     0.1     0.3
X1   2.1                             610     610     610
NC  0.06    0.06    0.04     0.3     0.4
X1   2.2      24     334     436      50      50      50
X3    10                                                     594     600
GR   594             583             583     140     582     210     582     210
GR   582     245   580.3     273   580.2     317   573.3     334   577.1     354
GR 570.6     354   562.5     370   562.5     410   568.4     436   588.8     436
GR   590     480     591     523     592     560   592.8     580     594     610
GR   596     650     598     670     600     690     606     710
SB           1.5     2.9              69       0    2480     0.6     563     563
X1   2.3                              80      80      80
X2                     1   591.9     594
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ORIGINAL

*		SHEET 2								
BT	20	0	594	594	0	594	583	140	596	583
BT	210	597.6	532	245	598.2	582	273	598.8	580.3	317
BT	599.5	530.3	334	599.8	573.3	334	599.8	590.2	436	601
BT	591.9	436	601	588.8	480	602	590	523	602.8	591
BT	560	603.5	592	580	604	592.8	610	604.5	594	650
BT	605	596	670	605.3	598	690	605.5	600	710	606
BT	606									
NC	0.06	0.05	0.04	0.2	0.4					
X1	3	28	317	437	125	125	125			
GR	603	0	603	50	583	50	583	90	603	90
GR	603	145	583	145	582	210	602	210	602	245
GR	582	245	580.3	273	580.2	317	572.3	333	565.2	371
GR	561.2	385	568.2	394	572.3	401	588.8	437	591	523
GR	592	560	594	610	596	650	598	670	600	690
GR	602	700	604	720	606	780				
X1	3.05				100	100	100			
NC	0.06	0.05	0.04	0.3	0.5					
X1	3.1	27	125	254	225	225	225			
X3	10							590	594	
GR	590	0	590	30	590	60	590	110	588	120
GR	586.5	125	584	129	565.5	130	561	135	560.7	140
GR	551	155	570.8	183	582.4	183	582.4	196	587.3	196
GR	587.7	218	584.3	218	586.1	251	588.2	251	588.2	254
GR	590.1	254	592	275	593	290	594	300	596	378
GR		598	460	600	510					
NC	0.06	0.06	0.025	0.3	0.5					
X1	3.11				5	5	5			
X3	10							590	594	
BT	14	0	590	590	30	590.5	590	60	591	590
BT	110	590.8	590	120	592	588	125	592	586.5	254
BT	593.6	588.2	254	593.6	590.1	275	593.8	592	290	594
BT	593	300	594	594	370	596	596	460	598	598
BT	510	600	600							
X1	3.19				55	55	55			
X2							1			
X3	10							590	594	
NC	0.07	0.07	0.04	0.3	0.5					
X1	3.2				5	5	5			
X3	10							590	594	
NC	0.07	0.07	0.04	0.2	0.4					
X1	3.3	10	25	125	50	50	50			
GR	586	0	580	25	571.9	35	565	51	561.7	76
GR	564.9	94	572.4	114	580	125	590	142	592	150
NC	0.07	0.06	0.04	0.1	0.3					
X1	5	10	180	315	955	955	955			
GR	585	0	584.4	150	584	180	571.9	219	565	235
GR	561.7	260	564.9	278	574.4	298	603.4	315	603.4	365
NC	0.07	0.06	0.04	0.1	0.3					
X1	5.1	11	65	210	500	500	500			
GR	594	0	592	60	590	70	586	85	572.4	89
GR	565.6	119	565.9	140	570.1	162	573	179	584	210
GR	590	240								
X1	5.15				425	425	425			
NC	0.05	0.06	0.04	0.5	0.7					
X1	5.2	13	139	323	50	50	50			
X3	10							586	590	
GR	586	0	589	139	584.5	139	582.2	139	571.8	164
GR	568.5	195	564.5	230	567.5	265	572.7	300	586.6	323
GR	581.8	323	587.2	410	593	480				
SB	1.25	1.5	3		72	8	2590	2.6	565	565
X1	5.3				66	66	66			
X2			1	586.6	586					

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X3    10                                                          586     590
BT     7       0     586     586     139     589     589     139     589   584.5
BT   323   591.1   586.6     323   591.1   581.8     410     592   587.2     480
BT
*      SHEET 3         MISSING A BT
NC  0.04    0.04    0.04     0.4     0.5
X1     7      13     168     300     200     200     200
GR   586       0     586      85     646      85     606     155   587.8     155
GR 584.8     168   572.4     173   565.6     209   565.9     230   570.1     252
GR   573     264   590.2     300   591.7     480
NC  0.04    0.04    0.04     0.1     0.3
X1   7.1                             600     600     600
NC  0.05    0.05    0.04     0.5     0.7
X1   7.8      36     117     286      50      50      50
X3    10                                                          596   597.5
GR   596      40   596.2      77     594      90     592     100   586.1     117
GR 581.5  129.45   595.6  129.45   595.6  130.55     541  139.55   576.8  142.45
GR 595.7  142.45   595.7  143.55   578.5  143.55   572.3  157.45     596  157.45
GR   596  158.55     572  158.55     571     167   591.4     167   591.4     173
GR 568.3     173   565.3     198   567.6     223   559.9     223   596.3     236
GR 573.6     238   575.3     247     584     247     583     270     593     270
GR   597     270     597     272   589.3     272   592.2     286   298.2     286
GR   599     370
NC  0.03    0.03    0.03     0.1     0.3
X1  7.81                               5       5       5
X3    10                                                          596   597.8
BT    23      40     596     596      77   596.2   596.2      90   596.3     594
BT   100   596.4     592     117   596.7   586.1     117   596.7   595.5  129.45
BT 596.7   595.6  130.55   596.7   595.6  142.45   596.9   595.7  143.55   596.9
BT 595.7  157.45     597     596  158.55     597     596     167     597     596
BT   167     597   591.4     173   597.2   591.4     223   597.5   589.9     238
BT 597.8   590.3     270     598     593     270     598     597     272     598
BT   597     266   598.2   592.2     286   598.2   598.2     370     599     599
X1  7.89                              15      15      15
X2                                                     1
X3    10                                                          596   597.5
NC  0.06    0.05    0.04
X1   7.9                              25      25      25
X3    10                                                          596   597.5
NC  0.06    0.05    0.04     0.2     0.4
X1  7.12      11      45     265      25      25      25
X3    10                                                          594     594
GR   594       0     596      45     588      45   586.8      45   571.5      90
GR 566.2     103   564.4     156   571.7     195   589.9     265   598.4     265
GR 598.6     290
SB   0.9     1.5     2.9              58       6    3320     3.2     566     566
X1  7.13                              50      50      50
X2                     1   591.1     594                              0.89
X3    10                                                          594     594
BT     6             594     594      45     596     596      45     596     588
BT   265   598.4   591.1     265   598.4   598.4     290   598.6   598.6
NC  0.05    0.05    0.04     0.2     0.4
X1  7.14                              20      20      20
NC  0.05    0.05    0.04     0.2     0.4
X1  7.15       9      50     270      20      20      20
X3    10                                                        597.6   597.6
GR   597       0   597.6      50   590.3      50     571     100   567.1     150
GR 571.3     200   591.1     270   599.6     270     600     340
SB   0.9     1.3     2.9              85       6    3510     2.9     569     567
X1  7.16                              55      55      55
X2                     1   592.4     597                              .87
X3    10                                                        597.6   597.6
BT     6       0     597     597      50   597.6   597.6      54   597.6   590.3
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                                      ORIGINAL
BT   270   599.6   592.4     270   599.6   599.6     340     600     600
NC   0.1    0.06    0.04     0.2     0.4
X1     8      15      92     232     325     325     325
GR   606       0     606      40     586      40   584.2      92   572.7     103
GR 569.5     126     566     159   568.5     181   572.7     202   586.5     232
GR   594     240     596     250     597     270     596     280     590     300
NC  0.06    0.06    0.04     0.2     0.4
*       SHEET 4         X1 IS IMPROVISED.
X1   8.1      14                     220     220     220
X3    10                                                     590   587.5
GR   594       0   593.8      27   585.1      27     575      72   568.8      84
GR 568.7     117   569.6     153   572.8     184   579.3     214     580     230
GR 557.5     244     590     249     600     254     606     289
NC  0.03    0.03    0.03     0.2     0.4
X1  8.11                               5       5       5
X3    10                                                     590   587.5
BT    10       0     594     594      27   593.8   593.8      27   593.8   587.2
BT   214   558.3   581.7     214   588.3   579.3     230     588     580     244
BT 587.5   587.5     249     590     590     254     600     600     289     606
BT   606
X1  8.19                              65      65      65
X2                                                     1
X3    10                                                     590   587.5
NC  0.06    0.06    0.04     0.2     0.4
X1   8.2                               5       5       5
X3    10                                                     590   587.5
X1   8.3                             100     100     100
NC   0.1    0.08    0.05     0.1     0.3
X1     9      20      20     180     605     605     605
GR 589.7       0   588.6      50   575.3      73   573.8      88   572.6      95
GR   569     103   568.9     117   566.6     139   572.9     146   593.9     180
GR   606     250     606     390     608     430     610     440     612     590
GR   612     600     632     600     632     635     612     635     613     770
NC   0.1     0.1    0.05
X1   9.1      50     416     559    1005    1005    1005
X3    10                                                   588.6   591.2
GR 601.4       0   601.4       0   601.2      10     601      20   600.8      30
GR   600      60     598     100     596     140     594     170     592     210
GR   591     230     590     250   588.6     340     590     375   591.6     413
GR   532     413     580     416   574.4     416   574.6     420   574.3     424
GR   574     431   573.6     438   573.5     442   573.2     446   572.3     452
GR 571.9     456   571.2     460     570     469   569.1     475   568.7     479
GR 567.9     485     568     486   568.1     489   568.3     493     569     497
GR 569.8     504   570.3     512   570.8     516   571.2     520     572     526
GR 572.8     530   572.6     532   573.8     534   574.9     540     577     548
GR 577.1     552   578.2     554     580     556   591.2     559     596     760
NC 0.025   0.025     0.3     0.5
X1  9.11                               5       5       5
X3    10                                                   58836   591.2
BT    37     413   591.6     582     413   592.2     582     416   592.2     580
BT   420   592.2   583.4     424   592.2   584.9     431   592.2   586.3     438
BT 592.2   584.9     442   592.2   583.4     446   592.2     580     446   592.2
BT 573.2     452   592.2   572.3     452   592.2     580     456   592.2   583.4
BT   450   592.2   584.9     469   592.2   586.3     475   592.2   584.9     479
BT 592.2   583.4     486   592.2     580     486   592.2     568     489   592.1
BT 568.1     489   592.1     580     493   592.1   583.4     497   592.1   584.9
BT   504   592.1   586.3     512   592.1   584.9     516   592.1   583.4     520
BT   592     580     520     592   571.2     526     592     572     526     592
BT   580     530     592   583.4     536     592   584.9     540     592   586.3
BT   548     592   583.4     552     592   584.9     556     592     580     559
BT 592.1   591.2
X1  9.19                              55      55      55
X2                                                     1
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X3	10							588.6	591.2	
NC	0.08	0.08	0.045	0.3	0.5					
X1	9.2				5	5	5			
X3	10							588.6	591.2	
NC	0.08	0.08	0.045	0.2	0.4					
X1	9.3	14	400	554	130	130	130			
GR	594	0	592	10	590	20	587	30	587	230
GR	587	375	587.1	400	572.8	435	569.8	460	568	480
GR	566.3	508	572.5	517	591.3	554	596	760		
NC	0.05	0.1	0.04	0.1	0.3					
X1	11				520	520	520			
*	SHEET 5		GRs FOR X1 ABOVE??							
X1	12	19	57	260	1365	725	1365			
GR	598.9	0	583.4	32	581.8	57	572.6	76	568.9	84
GR	565.9	100	568.9	114	572.9	125	576.5	135	578.3	155
GR	580	260	582	280	584	340	584	450	584	950
GR	584	1220	584	1250	586	1280	590	1320		
NC	0.06	0.1	0.04	0.1	0.3					
X1	13	11	485	618	1250	660	1250			
GR	590	0	588	140	586.3	435	586.3	485	575	509
GR	573	533	567	539	566.4	550	565.9	562	572.3	575
GR	590.8	618								
NC	0.05	0.05	0.04	0.4	0.6					
X1	13.1	19	219	330	590	590	590			
X3	10							600	600	
GR	602.2	0	601.9	219	574.2	219	572.9	226	568.5	235
GR	568.4	244	568.5	255	571.6	269	586.6	269	593.7	280
GR	597.6	280	597.96	286	586.6	286	586.6	297	575.3	297
GR	594.1	330	597.3	330	601.7	330	600	820		
NC	0.05	0.05	0.04	0.3	0.5					
X1	13.11				5	5	5			
X3	10							600	600	
BT	8	0	602.2	602.2	219	601.9	601.9	219	601.9	593.7
BT	280	601.7	593.7	280	601.7	597.6	330	601.7	597.3	330
BT	601.7	601.7	820	600	600					
X1	13.19				32	32	32			
X2							1			
X3	10							600	600	
NC	0.05	0.05	0.04	0.3	0.5					
X1	13.2				5	5	5			
X3	10							600	600	
NC	0.06	0.07	0.04	0.2	0.4					
X1	14	16	200	300	215	215	215			
GR	590.9	0	590	50	588	70	586	150	585.1	155
GR	579.9	175	578.5	200	571.9	220	565.6	232	566.8	244
GR	569	259	571.1	274	588.1	275	603.6	300	604	340
GR	624	340								
NC	0.06	0.08	0.04	0.1	0.3					
X1	16	22	520	722	1305	1305	1305			
GR	600	0	590	35	589	100	609	100	609	135
GR	588	135	588	440	590	475	591.7	520	591.6	565
GR	590.9	585	572.2	614	568.7	624	568.2	632	568.4	645
GR	572.2	653	576.7	690	590.2	722	592	740	594	780
GR	596	812	598	825						
NC	0.06	0.08	0.04	0.3	0.5					
X1	16.1	33	471	569	170	170	170			
X3	10							592	592.3	
GR	608	30	608	50	608	70	606	80	604	90
GR	600	100	598.5	170	598	250	596	330	594	400
GR	592	420	590	430	585	450	576	471	572.9	477
GR	567	505	567	520	567	535	573	563	573.9	569
GR	578.2	620	583.6	680	584	700	854.5	720	584.9	740
GR	585.8	790	586	800	587.5	850	588	870	590	880

GR	596	900	600	910	604	910				
SB		1.5	3		71	0	1525	0.75	567	567
X1	16.2				50	50	50			
X2			1	585.6	592					0.87
X3	10							592	592.3	
BT	30	30	608	608	50	608	608	70	608	608
BT	80	606	606	90	604	604	100	600	600	170
BT	598.5	598.5	250	596	596	330	596	596	400	594
BT	594	420	592	592	430	592.3	590	450	592.8	585
BT	471	593.2	576	471	594.5	585.3	569	594.5	585.3	569
BT	593.2	573.9	620	592.3	576.2	680	593.5	583.6	700	594
BT	584	720	595	584.5	740	596	584.9	790	598	585.8
BT	800	598.3	586	850	600	587.5	870	601.2	588	880
BT	602	590	900	603	580	910	600	600	910	604
*		SHEET 6								
NC	0.06	0.06	0.46	0.3	0.4					
X1	16.3				50	50	50			
NC	0.06	0.06	0.04	0.1	0.3					
X1	17	26	450	630	960	960	960			
GR	608	0	608	30	608	30	608	70	606	80
GR	604	90	600	100	598.5	170	598	250	596	330
GR	594	400	592	420	590	430	569.1	450	572.1	481
GR	670.3	499	569.3	520	569.3	536	572.1	547	583.6	680
GR	584.5	729	588	800	588	870	590	880	596	900
GR	600	910								
NC	0.1	0.07	0.04	0.1	0.3					
X1	19	22	70	122	1475	1385	1475			
GR	619.3	0	572	70	570.9	83	569.8	97	570.5	108
GR	572	122	578.3	135	578	250	576	270	580	370
GR	582	390	584	400	586	420	586.7	500	588	550
GR	590	730	592	780	612	780	612	810	592	810
GR	564	1060	596	1080						
NC	0.1	0.07	0.04	0.1	0.3					
X1	20	36	40	149	535	320	535			
GR	600	0	590	30	590.3	40	572.6	75	569.2	86
GR	567.2	100	568.7	116	572.2	129	579.3	149	578.7	278
GR	582.5	360	582.1	360	585	400	568	450	490	490
GR	590	555	610	555	610	585	590	585	592	650
GR	612	655	612	730	592	730	592	850	592	880
GR	612	880	612	910	592	910	592	980	592	990
GR	612	990	612	1040	592	1040	594	1080	596	1240
GR	600	1260								
NC	0.1	0.1	0.04	0.3	0.5					
X1	20.1	20	1141	1238	1315	1315	1315			
X3	10			1010				590	570	
GR	598	0	596	80	594	160	592	400	590	1010
GR	587.5	1030	586	1040	584	1090	582	1110	582.2	1116
GR	582.7	1130	584.5	1141	575.9	1154	572.4	1167	571.8	1190
GR	572.9	1212	579	1230	586.9	1238	597.2	1262	600	1320
SB		1.5	2.8		43		1040	1.8	572	572
X1	20.2				65	65	65			
X2			1	586.9	590				0.88	
X3	10			1010				590	597	
BT	17	0	596	596	80	596	596	160	594	594
BT	400	592	592	1010	590	590	1030	590	587.5	1040
BT	590.4	586	1090	592.8	584	1110	593.8	582	1118	594
BT	582.2	1118	598.3	582.2	1130	598.5	582.7	1141	598.7	584.5
BT	1238	600.2	586.9	1262	600.7	597.2	1262	597.2	597.2	1320
BT	600	600								
NC	0.1	0.07	0.04	0.3	0.5					
X1	22	36	1162	1262	205	205				
X3				1010						
GR	600	0	598	120	618	120	618	180	596	180

GR	594	220	614	220	614	270	594	270	594	280
GR	614	280	614	330	594	330	592	490	592	690
GR	612	690	612	930	592	940	612	940	612	940
GR	612	980	592	980	596	1010	586	1040	554	1090
GR	582	1110	582.7	1130	576.6	1152	576.8	1162	572.4	1167
GR	569.2	1176	568.6	1190	570.2	1206	572.9	1215	602.9	1262
GR	604	1280								
NC	0.06	0.08	0.04	0.1	0.3					
X1	23	38	807	892	850	850				
GR	594	0	596	70	594	160	594	190	614	190
GR	614	220	594	220	592	330	592	360	612	360
GR	612	400	590	400	590	480	610	480	610	500
GR	590	500	590	520	610	520	610	540	590	540
GR	586	586	586	670	584	730	582	750	580	800
GR	580	807	572.5	822	570.6	832	569.5	850	569.9	871
GR	572.5	885	577.6	892	578.5	898	585.4	912	590	930
GR	594	950	596	960	600	970				
*	SHEET 7									
X1	24	53	432	508	840	840	840			
GR	618	0	618	10	598	10	596	20	618	20
GR	618	40	598	40	596	60	616	60	616	90
GR	594	90	594	100	614	100	614	130	594	130
GR	594	135	614	135	614	150	594	150	594	160
GR	612	180	614	180	592	180	592	190	612	190
GR	612	210	592	210	592	220	612	220	612	240
GR	592	240	590	260	610	260	210	290	690	290
GR	588.9	356	586.4	397	578.4	410	578.4	432	572.5	442
GR	571	456	569.1	470	569.5	486	572.5	497	560	504
GR	592	546	580	570	580	620	584	630	590	640
GR	592	650	598	660	600	670				
NC	0.08	0.06	0.04	0.4	0.6					
X1	24.1	26	170	290	290	290	290			
X3	10							591.1	589.9	
GR	600	0	590	17	580	30	578	35	578	50
GR	578	70	578	170	585.2	170	575.1	200	571.5	230
GR	575.8	260	585.5	290	578	290	588	330	588.4	380
GR	588	400	589.4	520	590	575	592	590	594	640
GR	596	700	598	750	600	800	602	860	604	880
GR	606	910								
SB		1.5	3		60	0	1350	2	573	573
X1	24.2				40	40	40			
X2			1	588.2	589.9					0.95
X3	10								591.1	589.9
BT	24	0	600	600	17	598.2	590	30	597.3	580
BT	35	597	578	50	593	578	70	594.6	578	170
BT	591.1	578	170	591.1	588	230	591.6	588.2	290	591.1
BT	588	290	591.1	578	330	590.1	588	380	589.9	588.4
BT	400	589.8	520	590	589.4	575	591.4	590	590	
BT	592	592	640	594	594	700	596	596	750	598
BT	589	800	600	600	860	602	602	880	604	604
BT	910	606	606							
NC	0.07	0.08	0.04	0.3	0.5					
X1	24.3	19	170	590	80	80	80			
GR	600	0	590	17	580	30	578	35	578	170
GR	575.1	200	571.5	230	575.8	260	578	290	588	330
GR	590	575	592	590	594	640	598.7	680	598	750
GR	600	800	602	860	604	880	606	910		
NC	0.05	0.08	0.04	0.1	0.3					
X1	25	23	160	280	710	735	710			
GR	637	0	637	70	617	70	616	110	614	120
GR	610	130	600	150	590.3	160	572.9	205	570.5	214
GR	571.8	230	571.8	246	572.9	255	586.1	280	588	400

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GR 588.7     680   588.4     700     590     810     592     830     594     850
GR   596     860     598     890     600     910
NC  0.05    0.05    0.04     0.2     0.4
X1  25.1      32     505     635    1160     615    1160
GR   616       0     614      20     612      30     610      40     608      60
GR   606      70     604      80     602     100     600     110     598     140
GR   595     150     594     170     592     190     590     210     588     300
GR   586     410     584     430     582     450   578.2     490   580.1     505
GR 576.8     535   573.8     560   572.8     585   575.3     605   585.1     625
GR 583.1     635     590     650     592     920     597     990     596    1030
GR   598    1070     600    1100
NC  0.05    0.05    0.04     0.3     0.5
X1  25.2      47     505     635      50      50      50
X3    10                                                     586     590
GR   616       0     614      20     612      30     610      40     608      60
GR   606      70     604      80     602     100     600     110     596     140
GR   596     150     594     170     592     190     590     210     588     300
GR   586     410     584     430     582     450   578.2     490   580.1     505
GR   579     515     578     525     577   533.2   582.2   533.7   582.2     535
GR 582.2   536.3   576.4   536.8   575.5     545   574.2     555   573.6     560
GR 573.5     565   573.1     575   572.1     585   574.1     595     575   603.2
*   SEC 25.2  ESTIMATED GR DATA
GR   585     625     584     630     583     635     585     640     587     645
GR   590     650     590     700     592     920     597     990     596    1030
GR   598    1070     600    1100
*    MISSING SHEET (25.21 TO 29; CROSS-SECTIONS S, T,AND U) ESTIMATED DATA
X1 25.21                               1       1       1
x1 25.29                              10      10      10
X1  25.3                               1       1       1
X1    27                             320     320     320
X1  27.1                             135     135     135
X1 27.11                               5       5       5
X1 27.19                              60      60      60
X1  27.2                               5       5       5
X1    29      41                    1100    1100    1100
GR   590       0     590      20     590      30     590      40     590      60
GR   590      70     590      80     590     100     590     110     590     140
GR   590     150     590     170     592     190     590     210     588     300
*       SHEET 8
GR   588     410     588     530     608     530     605     550     588     550
GR   588     550     608     580     608     600     588     600     586     640
GR 587.8     760     590     780     590     790     588     870     584     880
GR   580     900     580     920   578.8     955     550     985   576.9     989
GR 570.4    1002   568.4    1010   569.4    1019   576.4    1027   580.6    1038
GR 617.3    1108
NC   0.1     0.1   0.045     0.1     0.3
X1    31      25     184     360    1775    1775    1775
GR   600       0     598      20     598      60     618      60     618      90
GR   598      90     596     100     594     110     592     120   591.2     161
GR 591.6     184   576.9     222   574.7     242     570     260   570.9     284
GR 576.2     302   582.2     314   582.8     360     584     550     586     560
GR   588     580     590     590     594     600     596     610     600     620
NC   0.1     0.1   0.045     0.3     0.5
X1  31.1      27     435     520     490     490     490
X3    10                                                   595.3     598
GR   602       0     600      60     598     110     596     190   595.3     260
GR   596     340     597     395   596.8     410   596.2     420     596     430
GR 592.9     435   576.1     449   574.5     470   573.9     490   576.1     494
GR 581.6     520     585     544     586     550     588     580     590     600
GR   590     630     592     640   593.5     650     596     660     598     680
GR   600     700     606     700
SB           1.5     2.9            66.5       0    1545    0.45     575     575
X1  31.2                              60      60      60
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X2			1	595.4	595.3					
X3	10							595.3	598	
BT	26		602	602	60	600	600	110	598	598
BT	190	596	596	250	595.3	595.3	340	596	596	395
BT	597	597	410	597.2	596.8	420	597.3	596.2	430	598
BT	596	435	598.5	592.9	435	600.6	595.4	520	601	595.4
BT	520	601	581.6	544	601.2	585	544	599.2	585	550
BT	599.5	586	580	602	588	600	602.5	590	630	603.4
BT	590	640	603.7	592	650	604	593.5	660	604.3	596
BT	680	605.2	598	700	606	600	700	606	606	
NC	0.07	0.07	0.04	0.4	0.6					
X1	31.3				50	50	50			
NC	0.07	0.07	0.045	0.1	0.3					
X1	33	21	67	144	830	830	830			
GR	619.5		592.5	67	578	91	575.5	100	573.5	106
GR	576	128	583.3	144	585.3	157	581.9	174	582	210
GR	584	250	586	310	588	320	590	330	592	370
GR	594	400	596	430	596	500	600	520	602	530
GR	604	550								
NC	0.07	0.1	0.045	0.1	0.3					
X1	35	23	294	357	1690	1690	1690			
GR	604		602	30	600	40	598	70	596	100
GR	594	120	592	130	590	140	588	150	586	160
GR	582.4	169	581.9	294	576.1	308	572.1	323	572.1	330
GR	572.1	342	576.1	355	581.1	357	587.1	370	590	400
GR	596	410	600	420	604	430				
NC	0.06	0.1	0.04	0.1	0.3					
X1	37	16	233	337	1690	1690	1690			
GR	604		602	60	600	90	598	160	596	170
GR	594	180	584	183	580	233	576.7	255	575.4	280
GR	576	290	574.7	314	576.7	327	584.4	337	589.4	372
GR	620.2	437								
NC	0.08	0.1	0.04							
X1	38	22	332	403	1100	1100	1100			
GR	604		600	10	596	20	592	90	590	180
GR	588	270	585.2	300	582.3	316	583.4	332	577.1	343
GR	574.1	351	574	360	573.5	374	577.1	390	585.3	403
GR	585.3	407	563.5	428	589.4	452	596	460	598	470
GR	600	520	604	530						
NC	0.06	0.06	0.045	0.4	0.6					
X1	38.1	27	305	555	180	180	180			
*	SHEET 9									
X3	10							620	620	
GR	623.7		604	35	602	45	598	55	592	65
GR	590	75	588	85	586	95	584	115	582.5	145
GR	584	205	586	265	586	305	613.9	305	611.2	306
GR	586.2	355	581.2	385	575	425	575	445	581.9	485
GR	586.7	525	605.4	540	611.5	562	613.9	565	606.8	565
GR	621.3	622	623.7	630						
SB	1.25	1.5	3		110	22	6012	2	577	577
X1	38.2				30	30	30			
X2			1	613.9	623.7				0.85	
X3	10							620	620	
BT	18		623.7	623.7	35	623.7	604	45	623.7	602
BT	55	623.7	598	65	623.7	592	75	623.7	590	85
BT	623.7	588	95	623.7	586	115	623.7	584	145	623.7
BT	582.5	205	623.7	584	265	623.7	586	305	623.7	586
BT	305	623.7	613.9	565	623.7	613.9	565	623.7	606.8	622
BT	623.7	621.3	630	623.7	623.7					
NC	0.08	0.08	0.045	0.3	0.5					
X1	38.3				100	100	100			
NC	0.08	0.08	0.045	0.1	0.3					
X1	40	26	365	429	1240	1240	1240			

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GR   604             602      10     596      20     592      30     590      40
GR   588      50     586      60     584      80   582.5     110     584     170
GR   586     230     586     290     584     310     584     320     584     350
GR   582     360   583.1     365   577.6     383   575.8     393     576     400
GR 575.1     409   577.1     418   583.1     429   594.1     491   609.4     539
GR 621.3     587
NC  0.08     0.1   0.045     0.1     0.3
X1    42      25     629     697    1225    1225    1225
GR   604             600      10     596      20     594      30     592      40
GR   588      60     588     160     590     280     590     410     590     440
GR   590     510     588     520     586     540     584     610   584.9     629
GR 578.2     664   576.6     670   576.8     680   575.9     688   577.9     697
GR 586.2     708     600     750     612     780     620     800   621.7     808
NC  0.08     0.1   0.045     0.1     0.3
X1    44      23     951    1045    1315    1600    2750
GR   604             602      10     600      20     596      40     594      50
GR   592      70   590.8     130     590     190     588     520   586.5     600
GR   588     680     588     750   586.9     951   579.7     968   575.8     971
GR 577.8     979   578.3     984   579.3     992   605.2    1045   606.2    1046
GR   610    1056   611.9    1058   613.7    1064
NC  0.07    0.07    0.04     0.1     0.3
X1  44.1                             340     860     860
NC  0.07    0.07    0.04     0.4     0.6
X1  44.2      33      31     175     100     100     100
X3    10                                                     607   606.3
GR 607.3             602       5   596.7      14   592.1      31   580.8   73.35
GR 600.8   73.35   600.8   76.65     580   76.65   578.9     103   579.4  129.35
GR 600.8  129.35   600.8  132.65     580  132.65     591     175   586.9     193
GR 587.5     270     588     330   587.1     340     588     350     590     380
GR   590     410     590     450     590     460   590.6     480     592     530
GR   594     570     596     590     598     600     600     610     604     620
GR   610     640     612     650     616     660
NC  0.07    0.07    0.04     0.3     0.5
X1 44.21                               5       5       5
X3    10                                                     607   606.3
BT    31           607.3   607.3       5   607.3     602      14   607.3   596.7
BT    31   607.3   592.1      31   607.3   603.1   73.35     607   600.8   76.65
BT   607   600.8     103     607   603.6  129.35   606.8   600.8  132.65   606.8
BT 600.8     175   606.5   602.5     175   606.5     591     193   606.3   586.9
BT   270     608   587.5     330   608.8     588     340     609   587.1     350
BT   609     588     380   609.5     590     410     610     590     450   610.1
BT   590     460   610.4     590     480     612   590.6     530     613     592
BT   570     614     594     590   614.4     596     600   614.6     598     610
BT 614.8     600     620     615     605     640   615.4     610     650   615.8
BT   612     660     616     616
*       SHEET 10        X1 IS IMPROVISED.
X1 44.29                              70      70      70
X2                                                     1
X3    10                                                     607   606.3
NC   0.1    0.07    0.04     0.3     0.5
X1  44.3                               5       5       5
X3    10                                                     607   606.3
NC   0.1    0.07    0.04     0.2     0.4
X1    46      26       1     140     500     405     500
GR 619.3       1     614      10     610      20     606      30     600      40
GR   596      50     590      60   580.4      85   575.9      93   577.3     103
GR 579.8     113   588.6     128   586.2     140     588     330   587.1     340
GR   588     350     590     350     590     450     590     460     592     530
GR   594     576     596     590     595     600     600     610     604     620
GR   610     640     612     650     616     660
NC  0.08    0.08   0.045     0.1     0.3
X1    48      21     110     171    1075    1075    1635
GR 620.9           618.5      32   609.4      62   588.4     110   581.8     111
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GR	579.3	121	579.6	133	579.6	138	581.8	147	589.8	171
GR	588	330	586	350	586	360	590	380	592	400
GR	594	410	596	420	598	430	600	440	602	450
GR	604	460								
NC	0.1	0.08	0.04	0.1	0.3					
X1	50	26	866	950	980	2010	2010			
GR	610		608	20	606	40	604	70	602	90
GR	600	140	598	160	596	180	594	190	592	200
GR	590	210	588	220	588	470	590	570	592	690
GR	592	790	590	860	589.2	866	582.8	894	581.3	906
GR	581.1	920	581.2	928	582.8	945	590.6	950	611.7	991
GR	619.7	1032								
NC	0.08	0.08	0.045	0.1	0.3					
X1	52	23	267	349	1800	1600	1560			
GR	610		604	10	598	20	594	30	590	40
GR	590	90	590	180	590	190	590	280	592	287
GR	584.9	302	583.9	307	582.9	315	583.4	326	585.7	338
GR	596.9	349	598	390	600	440	602	510	604	580
GR	606	720	608	770	610	820				
NC	0.08	0.08	0.045	0.1	0.3					
X1	54	27	214	276	1600	885	1930			
GR	610		608	20	606	40	602	50	600	60
GR	596	70	594	80	592	160	591.6	175	589.8	214
GR	584.6	227	582.4	240	581.7	250	582.8	260	583.6	266
GR	591.6	276	592	350	592	400	594	440	596	640
GR	598	730	600	760	602	780	604	810	606	820
GR	608	850	610	870						
NC	0.08	0.08	0.045	0.1	0.3					
X1	56	52	660	734	530	1030	1030			
GR	610		608	40	606	90	604	150	602	210
GR	600	220	598	240	594	250	592	260	590.5	320
GR	592	380	592	570	594	590	596	600	594	640
GR	597.5	660	584.8	678	583.8	690	583.7	700	583.5	712
GR	584.8	724	592.3	734	592	760	590	770	590	790
GR	592	830	592	860	592	980	594	1010	596	1030
GR	596	1230	594	1310	592	1370	590	1410	590	1420
GR	594	1430	598	1440	602	1450	608	1460	610	1470
GR	610	1480	608	1490	606	1500	604	1510	602	1520
GR	600	1530	600	1590	602	1630	604	1650	606	1670
GR	608	1680	610	1690						
NC	0.08	0.08	0.045	0.1	0.3					
QT	5	5400	7200	8100	9850	8100				
X1	58	18	779	844	400	1160	1160			
GR	610		608	50	606	140	604	200	602.2	350
GR	602	450	600	550	596	680	596	720	595.5	739
GR	595	779	585.1	785	582.3	794	581.7	800	581.5	808
GR	585.1	813	598.7	844	610	850				
NC	0.08	0.08	0.045	0.3	0.5					
X1	58.1	24	668	736	55	55	55			
*		SHEET 11								
GR	510		608	50	606	120	604	140	604	160
GR	684	230	602	450	600	530	595	610	595.4	661
GR	593	668	589.1	683	585.6	683	582.3	700	564.9	713
GR	596.2	736	597.6	740	600	750	602	760	610	780
GR	616	920	616	990	616	1030	614.9	1080		
SB	0.9	1.5	2.7		41	5	1035	0.7	584	584
X1	58.2				16	16	16			
X2			1	603.2	598					
X3	10							598	604	
BT	22		610	610	50	608	608	120	606	606
BT	149	604	504	160	604	604	230	604	604	450
BT	602	602	530	600	600	610	598	598	661	603.9
BT	595.4	668	603.9	593	668	603.9	602.3	736	604.8	603.2

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BT   736   604.8   596.2     740   604.8   597.6     750     606     600     760
BT 607.3     602     780     610     610     920     616     616     990     616
BT   616    1030     616     616    1080   614.9   614.9
NC  0.08    0.08    0.04     0.3     0.5
X1  58.3                              50      50      50
NC   0.1    0.08   0.045     0.1     0.3
X1    59      32     660     740    1000     870    1155
GR   623           623.2      40     622     210     620     240     618     250
GR   616     260     614     270     610     280     600     290     598     300
GR   596     310     594     320     590     330     590     380     588     450
GR   588     650   593.5     660   586.8     674     585     678   582.8     700
GR 584.6     720   586.5     727   596.5     740     598     830     598     890
GR   598     920     600     970     602     990     604    1010     606    1020
GR   605    1040     510    1060
NC   0.1     0.1    0.04     0.1     0.3
X1    60      31     650     715    1035    1035    1035
GR   610             606      20     604      30     602      40     600      50
GR   598      70     596     180     594     500     592     640   594.2     650
GR 586.8     670   582.8     680   582.2     690   582.9     700   586.8     711
GR 591.4     715     599     746     614     750     616     760     620     780
GR   622     790     622     840     620     850     618     870     616     880
GR   614     890     612     900     610     920     608     940     608     970
GR   610     980
NC   0.1    0.08   0.045     0.1     0.3
X1    62      22     496     639     800    1900    2080
GR   610             608      20     606      70     604      82     594     125
GR 592.1     200     594     330     596     467     596     496   595.6     550
GR 591.9     562   591.9     565   587.2     575   584.8     581   584.3     596
GR 584.3     610   586.8     618   595.8     639     598     640     598     840
GR   598     910     610     950
NC  0.05    0.08    0.04     0.1     0.3
X1    64      23     222     273     950    1300    1460
GR   610             608      10     606      20     604      30     600      50
GR 598.1     120   598.2     158   598.2     222   587.6     233   584.4     241
GR 583.9     250   584.6     258   587.6     267   593.2     273   594.3     282
GR 594.9     380   594.9     580     596     630     598     650     600     660
GR   604     680     608     690     610     710
NC  0.08    0.08    0.04     0.1     0.3
X1  64.1      35     580     670     750     750    1000
GR   626             624     140     622     170     620     230     618     270
GR   616     320     614     360   612.2     400     610     410     604     441
GR 601.5     490     600     545     598     565     593     580   603.2     580
GR   592     585   587.8     598   583.8     625     588     646     594     664
GR 603.2     670     598     672     596     695     596     755   597.4     800
GR   598     815     600     850     602     855     604     875     606     885
GR   607     920   608.5     955     610    1060     612    1150     614    1220
NC  0.08    0.08    0.04     0.4     0.6
X1  64.2                             100     100     100
X3    10                                                   607.5   607.7
SB           1.5       3              48            1225    1.18   585.5   585.5
X1  64.3                              38      38      38
X2                     1   603.2   607.5
*       SHEET 12        X3 - IS IMPROVISED
X3    10                                                   607.5   607.7
BT    30             626     626     140     624     624     170     622     622
BT   230     620     620     270     618     618     320     616     616     360
BT   614     614     400   612.2   612.2     410   611.5     610     441   611.1
BT   604     490     610   601.5     545   608.4     600     565     608     596
BT   580   607.5     593     580   610.5   603.2     670   610.5   603.2     672
BT 607.7     598     695   607.7     596     755   607.7     596     800   607.7
BT 597.4     815   607.7     598     850   607.8     600     655   607.8     602
BT   875   607.9     604     885   607.9     606     920     608     607     955
BT 608.5   608.5    1060     610     610    1150     612     612    1220     614
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BT    614
NC   0.06    0.08    0.04     0.4     0.6
X1   64.4                              50      50      50
NC   0.08    0.08    0.04     0.1     0.3
QT      5    5120    6800    7520    9170    7570
X1     66      19     580     673     410     410     410
GR    610             600      31     590      45     592      85     594     125
GR    596     165     596     280     596     420   594.9     580   590.6     587
GR  587.6     592   584.3     601   587.6     611   590.6     616   601.6     629
GR  602.4     640   607.8     651   606.2     658   605.5     673
NC   0.08    0.08    0.04     0.1     0.3
X1     68      31     620     655     430     240     535
GR    614             612      10     606      25     604      30     600      40
GR    598      50     596      60   595.8     110     596     200   596.8     330
GR    596     420     594     590   595.7     609   592.9     620   588.6     625
GR  587.3     630   585.2     635   585.4     643   588.6     649   595.9     655
GR    594     670     596     690   595.2     720     596     770     596     840
GR    595     850     600     870     604     880     608     890     612     900
GR    614    1000
NC   0.06    0.05    0.04     0.1     0.3
X1     70      48     688     769    1140    1600    1680
GR    614             612      50     612      70     632      70     632     120
GR    612     120     610     130     630     130     630     150     610     150
GR  608.7     170     608     180     606     270     604     310     602     330
GR    600     440     620     440     620     470     600     470     600     490
GR    598     520     596     560   595.3     640   597.5     688   594.9     701
GR  589.9     709   587.3     718   586.8     730   587.6     738   589.1     752
GR  601.8     769   601.4     860     600    1000     598    1150    5960    1180
GR    598    1240     598    1280   599.4    1330     598    1420     598    1460
GR    596    1560     598    1580     598    1590     598    1600     600    1610
GR    604    1620     610    1640     614    1650
NC   0.06    0.07    0.04     0.1     0.3
X1   70.1      29     712     508     700     700     700
GR    614             612     100     610     240     608     310     606     360
GR  593.3     412   591.1     425   594.1     436   592.9   458.5   592.9   461.5
GR  588.6     473   587.1     490   587.1     508     594     508     596     640
GR     60     660     602     665     602     880     600     890     598     925
GR    598    1010   598.7    1100     600    1260     600    1285   600.8    1370
GR  601.4    1460   601.8    1510     602    1521   616.5    1565
NC   0.07    0.07    0.04     0.1     0.3
X1   70.2                             100     100     100
X3     10                                                     608     606
NC  0.025   0.025   0.025     0.3     0.5
X1  70.21                               5       5       5
X3     10                                                     608     606
BT     26             614     614     100     612     612     240     610     610
BT    310     608     608     360     608     606     412   607.7     594     412
BT    608   603.3   458.5   607.8     603   458.5   607.8   592.9   461.5   607.8
BT  592.9   461.5   607.8     603     508   607.5   602.7     508   602.2     594
BT    640     607     596     660     607     600     666   606.8     602     880
BT  606.5     602     890   606.5     600     925   606.3     596    1010     606
BT    598    1100     606   598.7    1260     608     600    1285   608.3     600
BT   1370     610   600.8    1460     612   601.4    1510     614   601.8    1521
BT  614.5     602    1565   616.5   616.5
X1  70.29                            82.5    82.5    82.5
X2                                                      1
*       SHEET 13        X3 IS IMPROVISED.
X3     10                                                     608     606
NC   0.07   0.055    0.04     0.3     0.5
X1   70.3                               5       5       5
X3     10                                                     606     606
NC   0.07   0.055    0.04     0.2     0.4
X1   70.4                             100     100     100
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ORIGINAL

NC	0.07	0.055	0.04	0.1	0.3					
X1	72	31	43	68	660	660	660			
GR	612.9		612.3	15	596.9	36	596.1	43	589.6	54
GR	587.5	61	587	67	587.8	72	589.6	80	595.4	88
GR	596	100	596	170	596	190	596	220	600	330
GR	600	430	598	470	595	590	590	600	590	610
GR	598	630	598	640	598	740	690	780	602	860
GR	604	900	606	930	608	950	640	960	612	1010
GR	614	1040								
NC	0.07	0.055								
X1	74	31	1152	1191	1730	920	2275			
GR	616		612	10	608	20	604	30	606	40
GR	598	60	598	130	600	150	602	260	602.2	290
GR	602	350	602	610	602.2	710	602	760	600	830
GR	596	996	596	1000	596	1020	596	1110	589.3	1123
GR	597.4	1152	598.4	1163	588.1	1168	587.7	1180	588.1	1191
GR	590.7	1197	598.8	1207	610.3	1214	612	1350	514	1450
GR	616	1490								
NC	0.07	0.055	0.04	0.4	0.3					
QT	5	4500	6250	7100	9000	7160				
X1	76	39	375	428	1395	1480	1685			
GR	616		614	70	612	140	614	220	612.8	250
GR	612	290	610.8	317	598	339	597.1	375	591	384
GR	588	392	587.5	400	589	411	591	418	598.4	420
GR	599.5	590	598	720	598	870	600	920	602	930
GR	604	940	608	950	612	960	612	1030	611.8	1070
GR	610	1340	608	1410	606	1450	604	1500	602	1510
GR	601.8	1730	600	1850	600	2000	602	2040	604	2050
GR	608	2070	610	2080	614	2090	616	2100		
NC	0.07	0.1	0.04	0.1	0.3					
X1	78	63	1496	1548	1710	1000	1710			
GR	618		616	10	614	30	612	50	610	60
GR	608	80	606	100	604	130	604	140	604	450
GR	604	460	606	480	608	490	608	520	606	550
GR	604	560	600	570	598	580	598	620	600	710
GR	600	740	598	760	595	790	596	830	598	850
GR	598	900	596	920	596	950	593	960	600	980
GR	600	1010	600	1030	600	1040	600	1050	600	1060
GR	600	1070	602	1090	604	1100	604	1110	598	1120
GR	598	1200	600	1210	602	1220	601.4	1456	599.1	1468
GR	594.6	1478	595.1	1496	592.3	1499	591.8	1509	591.7	1520
GR	591.8	1529	592.6	1539	600.7	1548	602	1600	602	1610
GR	602	1620	602	1900	602	1950	602	2000	604	2060
GR	608	2070	612	2080	618	2090				
NC	0.07	0.07	0.04	0.1	0.3					
X1	79	28	1746	1801	1200	1200	1200			
GR	624		622	20	620	60	618	120	616	180
GR	614	240	612	270	610	310	608	370	606	510
GR	606	590	603	670	608	840	606	1160	604	1315
GR	604	1375	604	1575	604	1675	604	1725	602.7	1746
GR	593.5	1758	591.7	1765	591.5	1775	592.2	1783	593.5	1791
GR	597.9	1801	589.7	1864	616	1885				
NC	0.07	0.07	0.04	0.2	0.4					
X1	79.1	28	1491.1	1491.9	770	100	770			
GR	620		618	55	616	110	614	260	612	480
GR	610	520	608	770	606	1125	604	1135	604	1235
GR	604	1275	602	1365	300	1395	598.77	1419.1	598.77	1429
GR	592	1435	592	1475	598.75	1481.4	598.75	1490.9	600	1525
GR	602	1585	604	1615	604	1675	602	1695	600	1735
GR	606	1785	606	1795	610	1805				
*	SHEET 14									
X1	79.2	28	1419.1	1490.9	5	5	5			
GR	620		616	55	616	110	614	260	612	480

GR	610	520	608	770	606	1125	604	1135	604	1235
GR	604	1275	602	1365	600	1395	598.77	1419.1	598.77	1429
GR	596.82	1431.1	596.73	1479.9	598.75	1481.4	598.75	1490.9	600	1525
GR	602	1585	604	1615	604	1675	602	1695	600	1735
GR	606	1785	606	1795	610	1805				
NC	0.07	0.07	0.04	0.2	0.4					
X1	79.3	28	1419.1	1490.9	5	5	5			
GR	620		618	55	616	110	614	260	612	480
GR	610	520	608	770	606	1125	604	1135	604	1235
GR	604	1275	602	1365	600	1395	598.77	1419.1	598.77	1429
GR	592	1435	592	1475	598.75	1481.4	598.75	1490.9	600	1525
GR	602	1585	604	1615	604	1675	602	1695	600	1735
GR	604	1785	606	1795	610	1805				
NC	0.06	0.07	0.04							
X1	80	25	930	991	5	550	705			
GR	620		618	55	616	110	614	260	612	480
GR	620	520	607.5	930	597.2	940	593.7	950	593.2	960
GR	592.7	970	592.2	985	601.6	991	602	1010	602	1130
GR	602	1210	602.7	1260	602	1300	600	1330	600	1350
GR	602	1360	604	1370	606	1380	610	1390	616	1410
NC	0.07	0.07	0.04							
X1	80.1	24	974	1047	50	100	100			
X3	10							610	602	
GR	620	220	618	275	616	330	614	480	612.3	560
GR	614	720	614	830	612	860	610	970	610.6	974
GR	608.3	974	592	995	592.8	1010	592	1025	602.6	1047
GR	608.3	1047	602	1060	602	1385	604	1410	608	1420
GR	610	1430	612	1440	618	1460	620	1470		
SB		1.5	3		38		950	1.2	591.8	591.8
X1	80.2				5	5	5			
X2			1	608.3	602					
X3	10							610	602	
BT	22	220	620	620	275	618	618	330	616	616
BT	480	614	614	560	612.3	612.3	720	614	614	830
BT	614	614	860	612	612	970	610	610	974	610.6
BT	610.6	974	610.6	608.3	1010	611.8	608.3	1047	610.6	608.3
BT	1047	608.3	608.3	1060	602	602	1385	602	602	1410
BT	604	604	1420	608	608	1430	610	610	1440	612
BT	612	1460	618	618	1470	620	620			
NC	0.02	0.08	0.04	0.2	0.4					
X1	80.3				50	50	50			
NC	0.08	0.08	0.04	0.1	0.3					
X1	82	25	265	396	1225	1035	1390			
GR	620		618	10	610	30	608	40	606	50
GR	604	210	603.2	265	597.1	275	594.9	290	595.1	300
GR	595	320	597.1	345	597.1	353	594.1	373	597.1	385
GR	601.6	396	604	630	604	650	606	740	610	750
GR	612	760	614	780	616	910	618	1000	620	1060
NC	0.08	0.06	0.045	0.1	0.3					
X1	85	22	520	583	1300	720	1590			
GR	620		618	30	617	140	618	240	618.6	270
GR	618	290	616	330	614	350	612	360	610	370
GR	608	380	606	390	604.1	520	597	528	593.5	540
GR	593.5	550	594	564	597	576	602.4	583	612	600
GR	618	630	620	670						
NC	0.07	0.07	0.04	0.1	0.3					
X1	87	24	421	491	1260	1260	1260			
GR	622		620	40	616	60	614	110	612	120
GR	610	140	608	150	606	170	602	210	602	260
GR	604	360	604	400	603.5	421	597	434	595.8	442
GR	595.4	450	595.8	458	597	466	608	491	614	500
GR	620	520	622	530	626	540	630	560		
NC	0.05	0.06	0.04	0.1	0.3					

(1)

Mouth of Maumee

T1	TYPE 19 F15									
T2	TOLEDO OHIO 10 YEAR									
T3	S.AM CREEK									
J1	-10	2								
J2	1		-1						577.17	
NC	.05	.05	.04	1	.3					
QT	5	5900	8000	9000	11000	9000				
X1	.1	11		115						
GR	590	0	563.1	0	562.1	10	562.1	57	564.6	67
GR	570.3	86	574.7	115	583.4	122	583.6	150	584	250
GR	604	250								
NC	.05	.05	.04	.3	.5					
X1	.2	10	272	355	50	50	50			
X3	10							583	582.2	
GR	590	272	572	272	563	300	562.8	313	563	330
GR	569.3	355	583	400	582.2	425	583	560	584.7	655
SB		1.5	2.8		56	0	1200	.8	563	563
X1	.3				43	43	43			
X2			1	580.3	582.2					
X3	10							583	582.2	
BT	8	272	590	590	272	583	580.3	355	583	580.3
BT	355	580.3	569.3	400	583	583	425	582.2	582.2	560
BT	583	583	655	584.7	584.7					
NC	.06	.05	.04	.2	.4					
X1	.4	11	0	115	50	50	56			
GR	590	0	563.1	0	562.1	10	562.1	57	564.6	67
GR	570.3	86	574.7	115	583.4	122	583.6	150	584	250
GR	604	250								
NC	.06	.04	.04	.1	.3					
X1	.5				425	425	425			
NC	.06	.04	.04	.3	.5					
X1	.6	11	168	250	50	50	50			
X3	10							584	583.6	
GR	590	140	585	140	585	168	569.3	168	562.75	179
GR	562.75	209	562.75	239	569.2	250	583	250	583.6	280
GR	584	370								
SB		1.5	2.8		76	0	1575	.15	563	563
X1	.7				42	42	42			
X2			1	583	583.6					
X3	10							584	583.6	
BT	9	140	590	590	140	585	585	168	585	585
BT	168	585	583	209	585.1	583	250	585.2	583	250
BT	584.4	583	280	583.6	583.6	370	584	584		
NC	.05	.04	.04	.3	.5					
X1	.8	11	33	131	50	50	50			
GR	610	0	590.4	0	[illegible]	33	566.4	45	562.9	78
GR	564.4	114	571.4	123	574.4	125	581.4	131	583.9	174
GR	604	174								
NC	.07	.06	.04	.1	.3					
X1	2				750	750	750			
NC	.07	.06	.04	.1	.3					
X1	2.1				610	610	610			
NC	.06	.06	.04	.3	.4					
X1	2.2	24	334	436	50	50	50			
X3	10							594	600	
GR	594		583		583	140	582	210	582	210
GR	582	245	580.3	273	580.2	317	573.3	334	577.1	354
GR	570.6	354	562.5	370	562.5	410	568.4	436	588.8	436
GR	590	480	591	523	592	560	592.8	580	594	610
GR	596	650	598	670	600	690	606	710		
SB		1.5	2.9		69	0	2480	.6	563	563
X1	2.3				80	80	80			
X2			1	591.9	594					
BT	20	0	594	594	0	594				

2.

BT	20	0	594	594	0	594	583	140	596	583
BT	210	597.6	592	245	598.2	582	273	598.8	580.3	317
BT	599.5	580.3	334	599.8	573.3	334	599.8	590.2	436	601
BT	591.9	436	601	588.8	480	602	590	523	602.8	591
BT	560	603.5	592	580	604	592.5	610	604.5	594	650
BT	605	596	670	605.3	598	690	605.5	600	710	606
BT	606									
NC	.06	.05	.04	.2	.4					
X1	3	29	317	437	125	125	125			
GR	603	0	603	50	583	50	583	90	603	90
GR	603	145	593	145	582	210	602	210	602	245
GR	582	245	580.3	273	580.2	317	572.3	333	565.2	371
GR	561.2	385	568.2	394	572.3	431	588.8	437	591	523
GR	592	560	594	610	596	650	598	670	600	690
GR	602	700	604	720	606	780				
X1	3.05				100	100	100			
NC	.06	.05	.04	.3	.5					
X1	3.1	27	125	254	225	225	225			
X3	10							590	594	
GR	590	0	590	30	590	60	590	110	588	120
GR	586.5	125	584	129	565.5	130	561	135	560.7	140
GR	561	155	570.8	183	582.4	183	582.4	196	587.3	196
GR	587.7	218	584.3	218	586.1	251	588.2	251	588.2	254
GR	590.1	254	592	275	593	290	594	300	596	370
GR	596	460	600	510						
NC	.06	.06	.025	.3	.5					
X1	3.11				5	5	5			
X3	10							590	594	
BT	14	0	590	590	30	590.5	590	60	591	590
BT	110	590.8	590	120	592	588	125	592	586.5	254
BT	593.6	588.2	254	593.6	590.1	275	593.8	592	290	594
BT	593	300	594	594	370	596	596	460	598	598
BT	510	600	600							
X1	3.19				55	55	55			
X2							1			
X3	10							590	594	
NC	.07	.07	.04	.3	.5					
X1	3.2				5	5	5			
X3	10							590	594	
NC	.07	.07	.04	.2	.4					
X1	3.3	10	25	125	50	50	50			
GR	586	0	580	25	571.9	35	565	51	561.7	76
GR	564.9	94	572.4	114	580	125	590	142	592	150
NC	.07	.06	.04	.1	.3					
X1	5	10	180	315	955	955	955			
GR	585	0	584.4	150	584	180	571.9	219	565	235
GR	561.7	260	564.9	278	574.4	298	603.4	315	603.4	365
NC	.07	.06	.04	.1	.3					
X1	5.1	11	65	210	500	500	500			
GR	594	0	592	60	590	70	586	85	572.4	89
GR	565.6	119	565.9	140	570.1	162	573	179	584	210
GR	590	240								
X1	5.15				425	425	425			
NC	.05	.06	.04	.5	.7					
X1	5.2	13	139	323	50	50	50			
X3	10							586	590	
GR	586	0	589	139	584.5	139	582.2	139	571.8	164
GR	568.5	195	564.5	230	567.5	265	572.7	300	586.6	323
GR	581.8	323	587.2	410	593	480				
SB	1.25	1.5	3		72	8	2590	2.6	565	555
X1	5.3				66	66	66			
X2			1	586.6	586					
X3	10							586	590	
BT	7	0	586	586	139	589	589	139	589	584.5
BT	323	591.1	586.6	323	591.1	591.8	410	592	587.2	480

NC	.04	.04	.04	.4	.5		
X1	7	13	168	300	200	200	200

3

NC	.04	.04	.04	.4	.5					
X1	7	13	160	300	200	200	200			
GR	596	0	596	85	606	85	606	155	587.80	155
GR	584.8	168	572.4	173	565.6	204	565.9	230	570.1	252
GR	573	269	590.2	300	591.7	440				
NC	.04	.04	.04	.1	.3					
X1	7.1				600	600	600			
NC	.05	.05	.04	.5	.7					
X1	7.8	36	117	286	50	50	50			
X3	10							596	597.5	
GR	596	40	596.2	77	594	90	592	100	586.1	117
GR	581.5	129.45	595.6	129.45	595.6	130.55	581	131.55	576.8	142.45
GR	595.7	142.45	595.7	143.55	576.5	143.55	572.3	157.45	596	157.45
GR	596	158.55	572	158.55	571	167	591.4	167	591.4	173
GR	568.3	173	565.3	198	567.6	223	559.9	223	590.3	238
GR	573.6	238	575.3	247	584	247	588	270	593	270
GR	597	270	597	272	589.3	272	592.2	286	598.2	286
GR	599	370								
NC	.03	.03	.03	.1	.3					
X1	7.81				5	5	5			
X3	10							596	597.8	
BT	23	40	596	596	77	596.2	596.2	90	596.3	594
BT	100	596.4	592	117	596.7	586.1	117	596.7	595.5	129.45
BT	596.7	595.6	130.55	596.7	595.6	142.45	596.9	595.7	143.55	596.9
BT	595.7	157.45	597	596	158.55	597	596	167	597	596
BT	167	597	591.4	173	597.2	591.4	223	597.5	589.9	238
BT	597.8	590.3	270	598	593	270	598	597	272	598
BT	597	286	598.2	592.2	286	598.2	598.2	370	599	599
X1	7.99				15	15	15			
[illegible]							1			
X3	10							596	597.5	
NC	.06	.05	.04							
X1	7.9				25	25	25			
X3	10							596	597.5	
NC	.06	.05	.04	.2	.4					
X1	7.12	11	45	265	25	25	25			
X3	10							594	594	
GR	594	0	596	45	588	45	586.8	45	571.5	90
GR	566.2	103	564.4	159	571.7	195	569.9	265	598.4	265
GR	598.6	290								
SB	.9	1.5	2.9		58	6	3320	3.2	566	566
X1	7.13				50	50	50			
X2			1	591.1	594				.89	
X3	10							594	594	
BT	6		594	594	45	596	596	45	596	588
BT	265	598.4	591.1	265	598.4	598.4	290	598.6	598.6	
NC	.05	.05	.04	.2	.4					
X1	7.14				20	20	20			
NC	.05	.05	.04	.2	.4					
X1	7.15	9	50	270	20	20	20			
X3	10							597.6	597.6	
GR	597	0	597.6	50	590.3	50	571	100	567.1	150
GR	571.3	200	591.1	270	599.6	270	600	340		
SS	.9	1.5	2.9		85	6	3510	2.9	569	567
X1	7.16				55	55	55			
X2			1	592.4	597				.67	
X3	10							597.6	597.6	
BT	6	0	597	597	50	597.6	597.6	50	597.6	590.3
BT	270	599.6	592.4	270	599.6	599.6	340	600	600	
NC	.1	.06	.04	.2	.4					
X1	8	15	92	232	325	325	325			
GR	606	0	606	40	586	40	584.2	92	572.7	103
GR	569.5	126	566	159	568.5	181	572.7	202	586.5	232
GR	594	240	596	250	597	270	596	280	590	300
NC	.06	.06	.04	.2	.4					

↑ Missing a BT w/ 3 data sets

3

4

X3	[illegible]							590	587.5	
GR	[illegible]	0	593.8	27	585.1	27	575	72	568.8	84
GR	568.7	117	569.6	153	572.8	184	579.3	214	580	230
GR	587.5	244	590	249	600	254	606	289		
NC	.03	.03	.03	.2	.4					
X1	8.11				5	5	5			
X3	10							590	587.5	
BT	10	0	594	594	27	593.8	593.8	27	593.8	587.2
BT	214	558.3	581.7	214	588.3	579.3	230	588	580	244
BT	587.5	587.5	249	590	590	254	600	600	289	606
BT	606									
X1	8.19				65	65	65			
X2							1			
X3	10							590	587.5	
NC	.06	.06	.04	.2	.4					
X1	8.2				5	5	5			
X3	10							590	587.5	
X1	8.3				100	100	100			
NC	.1	.08	.05	.1	.3					
X1	9	20	50	180	605	605	605			
GR	589.7	0	588.6	50	575.3	75	573.8	88	572.6	95
GR	569	103	[illegible]	117	566.6	139	572.9	146	593.9	180
GR	606	250	606	390	608	430	610	440	612	590
GR	612	600	632	600	632	635	612	635	613	770
NC	.1	.1	.05							
X1	9.1	50	416	559	1005	1005	1005			
X3	10							588.6	591.2	
GR	601.4	0	601.4	0	601.2	10	601	20	600.8	30
GR	600	60	598	100	596	140	594	170	592	210
GR	591.6	230	590.0	250	588.6	340	590	375	591.6	413
GR	582	413	580	416	574.4	416	574.6	420	574.3	424
GR	574	431	573.6	438	573.5	442	573.2	446	572.3	452
GR	571.?	456	571.2	460	570	469	569.1	475	568.7	479
GR	567.9	485	568	486	568.1	489	568.3	493	569	497
GR	569.8	504	570.3	512	570.8	516	571.2	520	572	526
GR	572.8	530	572.6	532	573.8	534	574.9	540	577	548
GR	577.1	552	578.2	554	580	556	591.2	559	596	760
NC	.025	.025	.025	.30	.5					
X1	9.11				5	5	5			
X3	10							588.6	591.2	
BT	37	413	591.6	582	413	592.2	582	416	592.2	580
BT	420	592.2	583.4	424	592.2	584.9	431	592.2	586.3	438
BT	592.2	584.9	442	592.2	583.4	446	592.2	580	446	592.2
BT	573.2	452	592.2	572.3	452	592.2	580	456	592.2	583.4
BT	460	592.2	584.9	469	592.2	586.3	475	592.2	584.9	479
BT	592.2	583.4	486	592.2	580	486	592.2	568	489	592.1
BT	568.1	489	592.1	580	493	592.1	583.4	497	592.1	584.9
BT	504	592.1	586.3	512	592.1	584.9	516	592.1	583.4	520
BT	592	580	520	592	571.2	526	592	572	526	592
BT	580	530	592	583.4	534	592	584.9	540	592	586.3
BT	548	592	583.4	552	592	584.9	556	592	580	559
BT	592.1	591.2								
X1	9.19				55	55	55			
X2							1			
X3	10							588.6	591.2	
NC	.08	.08	.045	.3	.5					
X1	9.2				5	5	5			
X3	10							588.6	591.2	
NC	.08	.08	.045	.2	.4					
X1	9.3	14	400	554	130	130	130			
GR	594	0	592	10	590	20	587	30	587	230
GR	587	375	587.1	400	572.8	435	569.8	460	568	480
GR	566.3	508	572.5	517	591.3	554	596	760		
NC	.05	.1	.04	.1	.3					
X1	11				520	520	520			

↑ Missing X1 - 8.10

4

Missing GRs? after X1 11

X1	12	19	57	260	1365	725	1365			
GR	5?8.9	0	583.4	32	581.8	57	572.8	76	568.9	84
GR	565.9	100	[illegible]							

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X1	12	19	57	260	1365	725	1365			
GR	594.9	0	583.4	32	581.8	57	572.6	76	564.9	84
GR	565.9	100	568.9	114	572.9	125	576.5	135	578.3	155
GR	580	260	582	280	584	340	584	450	584	950
GR	584	1220	584	1250	586	1280	590	1320		
NC	.06	.1	.04	.1	.3					
X1	13	11	465	618	1250	660	1250			
GR	590	0	588	140	586.3	435	586.3	485	575	509
GR	573	533	567	539	566.4	550	565.9	562	572.3	575
GR	590.8	618								
NC	.05	.05	.04	.4	.6					
X1	13.1	19	219	330	590	590	590			
X3	10							600	600	
GR	602.2	0	601.9	219	574.2	219	572.9	226	568.5	235
GR	568.4	244	568.5	255	571.6	269	586.6	269	593.7	280
GR	597.6	280	597.6	286	586.6	286	586.6	297	575.3	297
GR	594.1	330	597.3	330	601.7	330	600	820		
NC	.05	.05	.04	.3	.5					
X1	13.11				5	5	5			
X3	10							600	600	
BT	8	0	602.2	602.2	219	601.9	601.9	219	601.9	593.7
BT	280	601.7	593.7	280	601.7	597.6	330	601.7	597.3	330
BT	601.7	601.7	820	600	600					
X1	13.19				32	32	32			
X2							1			
X3	10							600	600	
NC	.05	.05	.04	.3	.5					
X1	13.2				5	5	5			
X3	10							600	600	
NC	.06	.07	.04	.2	.4					
X1	14	16	200	300	215	215	215			
GR	595.9	0	590	50	588	70	586	150	585.1	155
GR	579.9	175	578.5	200	571.9	220	565.6	232	566.8	244
GR	569	259	571.1	274	588.1	275	603.6	300	604	340
GR	624	340								
NC	.06	.08	.04	.1	.3					
X1	16	22	520	722	1305	1305	1305			
GR	600	0	590	35	589	100	609	100	609	135
GR	588	135	588	440	590	475	591.7	520	591.6	565
GR	590.9	585	572.2	614	568.7	624	568.2	632	568.4	645
GR	572.2	653	576.7	690	590.2	722	592	740	594	780
GR	596	612	598	825						
NC	.06	.08	.04	.3	.5					
X1	16.1	33	471	569	170	170	170			
X3	10							592	592.3	
GR	608	30	608	50	606	70	606	80	604	90
GR	600	100	598.5	170	596	250	596	330	594	400
GR	592	420	590	430	585	450	576	471	572.9	477
GR	567	505	567	520	567	535	573	563	573.9	569
GR	578.2	620	583.6	680	584	700	584.5	720	584.9	740
GR	585.8	790	586	890	587.5	850	588	870	590	880
GR	596	900	600	910	604	910				
SB		1.5	3.0		71	0	1525	.75	567	567
X1	16.2				50	50	50			
X2			1	585.6	592					.87
X3	10							592	592.3	
BT	30	30	608	608	50	608	608	70.	608	608
BT	80	606	606	90	604	604	100	600	600	170
BT	596.5	596.5	250	596	596	330	596	596	400	594
BT	594	420	592	592	430	592.3	590	450	592.8	585
BT	471	593.2	576	471	594.5	585.3	569	594.5	585.3	569
BT	593.2	573.9	620	592.3	576.2	640	593.5	583.6	700	594
BT	584	720	595	584.5	740	596	584.9	790	598	585.8
BT	800	598.3	586	850	600	587.5	870	601.2	588	880
BT	602	590	900	603	596	910	604	600	910	604

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NC	[illegible]	.06	.046	.3	.4					
X1	[illegible]				50	50	50			
NC	.06	.06	.04	.1	.3					
X1	17	26	450	680	960	960	960			
GR	608	0	608	30	608	50	608	70	606	80
GR	604	90	600	100	598.5	170	598	250	596	330
GR	594	400	592	420	590	430	565.1	450	572.1	481
GR	570.3	499	569.3	520	569.3	536	572.1	547	583.6	666
GR	584.5	729	586	800	588	870	590	880	596	900
GR	600	910								
NC	.1	.07	.04	.1	.3					
X1	19	22	70	122	1475	1385	1475			
GR	610.3	0	572	70	570.9	83	569.8	97	570.5	108
GR	572	122	578.3	135	578	250	578	270	580	370
GR	582	390	584	400	586	420	586.7	500	588	550
GR	590	730	592	780	612	780	612	810	592	610
GR	594	1060	596	1080						
NC	.1	.07	.04	.1	.3					
X1	20	36	40	149	535	320	535			
GR	600	0	590	30	590.3	40	572.6	75	569.2	86
GR	567.2	100	570.7	116	572.2	129	579.3	149	578.7	278
GR	582.5	[illegible]	582.1	350	585	400	588	450	590	[illegible]
GR	590	555	610	555	610	555	590	565	592	650
GR	612	650	612	730	592	730	592	850	592	880
GR	612	880	612	910	592	910	592	980	592	990
GR	612	996	612	1040	592	1040	594	1080	596	1240
GR	600	1250								
NC	.1	.1	.04	.3	.5					
X1	20.1	20	1141	1238	1315	1315	1315			
X3	10			1010				590	597	
GR	598	0	596	80	594	160	592	400	590	1010
GR	587.5	1030	586	1040	584	1090	582	1110	582.2	1118
GR	582.7	1130	584.5	1141	575.9	1154	572.5	1167	571.8	1190
GR	572.9	1212	579	1230	586.9	1238	597.2	1262	600	1320
SB		1.5	2.8		43		1040	1.8	572	572
X1	20.2				65	65	65			
X2			1	586.9	590				.88	
X3	10			1010				590	597	
BT	17	0	598	598	80	596	596	160	594	594
BT	400	592	592	1010	590	590	1030	590	587.5	1040
BT	590.4	586	1090	592.6	584	1110	593.8	582	1118	594
BT	582.2	1118	598.3	582.2	1130	598.5	582.7	1141	598.7	584.5
BT	1238	600.2	586.9	1262	600.7	597.2	1262	597.2	597.2	1320
BT	600	600								
NC	.1	.07	.04	.3	.5					
X1	22	36	1162	1262	205	205	205			
X3				1010						
GR	600	0	598	120	618	120	616	180	596	180
GR	594	220	614	220	614	270	594	270	594	280
GR	614	280	614	330	594	330	592	490	592	690
GR	612	690	612	930	592	930	592	940	612	940
GR	612	980	592	980	590	1010	566	1040	564	1090
GR	582	1110	582.7	1130	576.6	1152	576.8	1162	572.4	1167
GR	569.8	1176	568.6	1190	570.2	1206	572.9	1215	602.9	1262
GR	604	1280								
NC	.06	.06	.04	.1	.3					
X1	23	38	807	892	850	850	850			
GR	598	0	596	70	594	160	594	190	614	190
GR	614	220	594	220	592	330	592	360	612	360
GR	612	400	590	400	590	480	610	480	610	500
GR	590	500	590	520	610	520	610	540	590	540
GR	586	580	586	670	584	730	582	750	580	800
GR	580	807	572.5	822	570.6	832	569.5	850	569.9	871
GR	572.5	885	577.6	892	578.5	898	585.4	912	590	930
GR	594	950	596	960	600	970				

X1	24	53	432	508	840	840	840			
GR	618	0	618	10	596	10	596	20	618	20
GR	618	40	598	40	596	60	616	60	616	90
GR	594	90	594	100	614	100	614	130	594	130
GR	596	135	614	135	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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X1	24	53	432	508	840	840	840			
GR	618	0	618	10	596	10	596	20	616	20
GR	618	40	596	40	596	60	616	60	616	90
GR	594	90	594	100	614	100	614	130	594	130
GR	594	135	614	135	614	150	594	150	594	160
GR	614	160	614	184	592	190	592	190	612	190
GR	612	210	592	210	592	220	612	220	612	240
GR	592	240	590	260	610	260	610	290	590	290
GR	588.9	356	586.4	397	576.4	410	576.4	432	572.5	442
GR	571	456	569.1	470	569.5	486	572.5	497	560	509
GR	560.9	546	580	570	580	620	584	630	590	640
GR	592	650	598	660	600	670				
NC	.08	.06	.04	.4	.6					
X1	24.1	26	170	290	290	290	290			
X3	10							591.1	589.9	
GR	600	0	590	17	580	30	578	35	578	50
GR	578	70	578	170	585.2	170	575.1	200	571.5	230
GR	575.8	260	585.5	290	578	290	588	330	588.4	380
GR	588	400	589.4	520	590	575	592	590	594	640
GR	596	700	598	750	600	800	602	860	604	880
GR	606	910								
SB		1.5	3.0		60	0	1350	2	573	573
X1	24.2				40	40	40			
X2			1	588.2	589.9				.95	
X3	10							591.1	589.9	
BT	24	0	600	600	17	598.2	590	30	597.3	580
BT	35	597	578	50	596	578	70	594.6	578	170
BT	591.1	578	170	591.1	588	230	591.3	588.2	290	591.1
BT	588	290	591.1	578	330	590.1	588	380	589.9	588.4
BT	400	589.8	588	520	590	589.4	575	591.4	590	590
BT	592	592	640	594	594	700	596	596	750	598
BT	598	800	600	600	860	602	602	880	604	604
BT	910	606	606							
NC	.07	.08	.04	.3	.5					
X1	24.3	19	170	290	80	80	80			
GR	600	0	590	17	580	30	578	35	578	170
GR	575.1	200	571.5	230	575.8	260	578	290	588	330
GR	593	575	592	590	594	640	588.7	680	598	750
GR	600	800	602	860	604	880	606	910		
NC	.05	.08	.04	.1	.3					
X1	25	23	160	280	710	735	710			
GR	637	0	637	70	617	70	616	110	614	120
GR	610	130	600	150	590.3	160	572.9	205	570.5	214
GR	571.8	230	571.8	246	572.9	255	586.1	280	588	400
GR	586.7	680	588.4	700	590	810	592	830	594	850
GR	596	860	598	890	600	910				
NC	.05	.05	.04	.2	.4					
X1	25.1	32	505	635	1160	615	1160			
GR	616	0	614	20	612	30	610	40	608	60
GR	606	70	604	80	602	100	600	110	596	140
GR	595	150	594	170	592	190	590	210	588	300
GR	586	410	584	430	582	450	578.2	490	580.1	505
GR	576.8	535	573.8	560	572.6	585	575.3	605	581.1	625
GR	583.1	635	590	650	592	920	594	990	596	1030
GR	598	1070	600	1100						
NC	.05	.05	.04	.3	.5					
X1	25.2	47	505	635	50	50	50			
X3	10							586	590	
GR	616	0	614	20	612	30	610	40	608	60
GR	606	70	604	80	602	100	600	110	598	140
GR	596	150	594	170	592	190	590	210	588	300
GR	586	410	584	430	582	450	578.2	490	580.1	505
GR	579	515	578	525	577	533.2	582.2	533.7	582.2	535
GR	582.2	536.3	576.4	536.8	575.5	545	574.2	555	573.6	560
GR	573.5	565	573.1	575	572.6	585	574.1	595	575	603.2

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GR	588	410	588	530	606	530	606	550	588	550
GR	588	550	608	580	606	600	566	600	586	640
GR	587.8	760	590	780	590	790	588	870	584	880
GR	580	900	580	920	578.8	955	550	985	576.9	989
GR	570.4	1002	568.4	1010	569.4	1019	576.4	1027	560.6	1038
GR	617.3	1103								
NC	.10	.1	.045	.1	.3					
X1	31	25	184	360	1775	1775	1775			
GR	600	0	598	20	598	60	618	60	618	90
GR	596	90	596	100	594	110	592	120	591.2	161
GR	591.6	184	576.9	222	574.7	242	570	260	570.9	284
GR	576.2	302	582.2	314	582.5	360	584	550	586	560
GR	588	580	590	590	594	600	596	610	600	620
NC	.10	.1	.045	.3	.5					
X1	31.1	27	435	520	490	490	490			
X3	10							595.3	598	
GR	602	0	600	60	598	110	596	190	595.3	260
GR	596	340	597	395	596.8	410	596.2	420	596	430
GR	592.9	435	576.1	449	574.5	470	573.9	490	575.1	494
GR	581.6	520	585	544	586	550	588	580	590	600
GR	590	630	592	640	593.5	650	596	660	598	680
GR	600	700	606	700						
SB		1.5	2.9		66.5	0	1545	.45	575	575
X1	31.2				60	50	60			
X2			1	595.4	595.3					
X3	10							595.3	598	
BT	26		602	602	60	600	600	110	598	598
BT	190	596	596	250	595.3	595.3	340	596	596	395
BT	597	597	410	597.2	596.8	420	597.3	596.2	430	598
BT	596	435	598.5	592.9	435	600.6	595.4	520	601	595.4
BT	520	601	581.6	544	601.2	595	544	599.2	585	550
BT	599.5	586	580	602	588	600	602.5	590	630	603.4
BT	590	640	603.7	592	650	604	593.5	660	604.3	596
BT	680	605.2	598	700	606	600	700	606	606	
NC	.07	.07	.04	.4	.6					
X1	31.3				50	50	50			
NC	.07	.07	.045	.1	.3					
X1	33	21	67	144	830	830	830			
GR	619.5		592.5	67	570	91	575.5	100	573.5	106
GR	576	128	583.3	144	585.3	157	581.9	174	582	210
GR	584	250	586	310	588	320	590	330	592	370
GR	594	400	596	430	596	500	600	520	602	530
GR	604	550								
NC	.07	.1	.045	.1	.3					
X1	35	23	294	357	1690	1690	1690			
GR	604		602	30	600	40	598	70	596	100
GR	594	120	592	130	590	140	588	150	586	160
GR	582.4	169	581.9	294	576.1	308	572.1	323	572.1	330
GR	572.1	342	576.1	355	581.1	357	587.1	370	590	400
GR	596	410	600	420	604	430				
NC	.06	.1	.04	.1	.3					
X1	37	16	233	337	1690	1690	1690			
GR	604		602	50	600	90	598	160	596	170
GR	594	180	584	183	580	233	576.7	255	575.4	280
GR	576	290	574.7	314	576.7	327	584.4	337	589.4	372
GR	620.2	437								
NC	.08	.1	.04							
X1	38	22	332	403	1100	1100	1100			
GR	604		600	10	596	20	592	90	590	180
GR	588	270	585.2	300	582.3	316	583.4	332	577.1	343
GR	574.1	351	574	360	573.5	374	577.1	390	585.3	403
GR	585.3	407	563.5	428	589.4	452	596	460	598	470
GR	600	520	604	530						
NC	.06	.06	.045	.4	.6					
X1	38.1	27	305	555	160	180	160			

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X3	10							620	620	
GR	623.7		604	35	602	45	598	55	592	65
GR	590	75	588	85	586	95	584	115	582.5	145
GR	584	205	586	265	586	305	[illegible]	[illegible]	[illegible]	[illegible]
GR	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

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X3	10							620	620	
GR	623.7		604	35	602	45	598	55	592	65
GR	590	75	588	85	586	95	584	115	582.5	145
GR	584	205	586	265	586	305	613.9	305	611.2	306
GR	586.2	355	581.2	385	575	425	575	445	581.9	485
GR	586.7	525	605.4	540	611.5	562	613.9	565	606.8	565
GR	621.3	622	623.7	630						
SB	1.25	1.5	3		110	22	6012	2	577	577
X1	38.2				30	30	30			
X2			1	613.9	623.7				.85	
X3	10							620	620	
BT	18		623.7	623.7	35	623.7	604	45	623.7	602
BT	55	623.7	598	65	623.7	592	75	623.7	590	85
BT	623.7	588	95	623.7	586	115	623.7	584	145	623.7
BT	582.5	205	623.7	584	265	623.7	586	305	623.7	586
BT	305	623.7	613.9	565	623.7	613.9	565	623.7	606.8	622
BT	623.7	621.3	630	623.7	623.7					
NC	.08	.08	.045	.3	.5					
X1	38.3				100	100	100			
NC	.08	.08	.045	.1	.3					
X1	40	26	365	429	1240	1240	1240			
GR	604		602	10	598	20	592	30	590	40
GR	588	50	586	60	584	80	582.5	110	584	170
GR	586	230	586	290	584	310	584	320	584	350
GR	582	360	583.1	365	577.6	383	575.8	393	576	400
GR	575.1	409	577.1	418	583.1	429	594.1	491	609.4	539
GR	621.3	587								
NC	.08	.1	.045	.1	.3					
X1	42	25	629	697	1225	1225	1225			
GR	604		600	10	596	20	594	30	592	40
GR	588	60	588	160	590	280	590	410	590	440
GR	590	510	588	520	586	540	584	610	584.9	629
GR	578.2	664	576.6	670	576.8	680	575.9	688	577.9	697
GR	586.2	708	600	750	612	780	620	800	621.7	808
NC	.08	.1	.045	.1	.3					
X1	44	23	951	1045	1315	1600	2750			
GR	604		602	10	600	20	596	40	594	50
GR	592	70	590.8	130	590	190	588	520	586.5	600
GR	588	680	588	750	586.9	951	579.7	968	575.6	971
GR	577.8	979	578.3	984	579.3	992	605.2	1045	606.2	1046
GR	610	1056	611.9	1058	613.7	1064				
NC	.07	.07	.04	.1	.3					
X1	44.1				340	860	660			
NC	.07	.07	.04	.4	.6					
X1	44.2	33	31	175	100	100	100			
X3	10							607	606.3	
GR	607.3		602	5	596.7	14	592.1	31	586.8	73.35
GR	600.8	73.35	600.8	75.65	580	76.65	578.9	103	579.4	129.35
GR	600.8	129.35	600.8	132.65	580	132.65	591	175	586.9	193
GR	587.5	270	588	330	587.1	340	588	350	590	380
GR	590	410	590	450	590	460	590.6	480	592	530
GR	594	570	596	590	596	600	600	610	604	620
GR	610	640	612	650	616	660				
NC	.07	.07	.04	.3	.5					
X1	44.21				5	5	5			
X3	10							607	606.3	
BT	31		607.3	607.3	5	607.3	602	14	607.3	596.7
BT	31	607.3	592.1	31	607.3	603.1	73.35	607	600.8	76.65
BT	607	600.8	103	607	[illegible]	129.35	606.8	600.8	132.65	606.8
BT	600.8	175	606.5	602.5	175	606.5	591	193	606.3	586.9
BT	270	608	587.5	330	608.8	588	340	609	587.1	350
BT	609	588	380	609.5	590	410	610	590	450	610.1
BT	590	460	610.4	590	480	612	590.6	530	613	592
BT	570	614	594	590	614.4	596	600	614.6	598	610
BT	614.8	600	620	615	605	640	615.4	610	650	615.8
BT	612	660	616	616						

X2										
X3	10					1				
NC	.1	.07	.04	.3				607	606.3	

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X2										
X3	10						1			
NC	.1	.07	.04	.3	.5			607	606.3	
X1	44.3									
X3	10				5	5	5			
NC	.1	.07	.04	.2	.4			607	606.3	
X1	46	26	1	140	500	405	500			
GR	619.3	1	614	10	610	20	606	30	600	40
GR	596	50	590	60	580.4	85	575.9	93	577.3	103
GR	579.6	113	580.6	128	586.2	140	586	330	587.1	340
GR	588	350	590	380	590	450	599	460	592	530
GR	594	570	596	590	595	600	600	610	604	620
GR	610	640	612	650	616	660				
NC	.08	.08	.045	.1	.3					
X1	48	21	110	171	1075	1075	1635			
GR	620.9		618.5	32	609.4	62	588.4	119	581.8	111
GR	579.3	121	579.6	133	579.6	138	581.8	147	589.8	171
GR	588	330	586	350	586	360	590	380	592	400
GR	594	410	596	420	598	430	600	440	602	450
GR	604	460								
NC	.1	.08	.04	.1	.3					
X1	50	26	866	950	980	2010	2010			
GR	610		608	20	605	40	604	70	602	90
GR	600	140	598	160	596	180	594	190	592	200
GR	594	210	588	220	588	470	590	570	592	690
GR	592	790	590	860	589.2	866	582.8	894	581.3	906
GR	581.1	920	581.2	928	582.8	945	590.6	950	611.7	991
GR	619.7	1032								
NC	.08	.08	.045	.1	.3					
X1	52	23	267	349	1800	1600	1560			
GR	610		604	10	598	20	594	30	590	40
GR	590	90	590	180	590	190	590	280	592	287
GR	584.9	302	583.9	307	582.9	315	583.4	326	585.7	338
GR	596.9	349	592	390	600	440	602	510	604	580
GR	606	720	608	770	610	820				
NC	.08	.08	.045	.1	.3					
X1	54	27	214	276	1600	885	1930			
GR	610		608	20	606	40	602	50	600	60
GR	596	70	594	80	592	160	591.6	175	589.8	214
GR	584.6	227	582.4	240	581.7	250	582.8	260	583.6	266
GR	591.6	276	592	350	592	400	594	440	596	640
GR	598	730	600	760	602	780	604	810	606	820
GR	608	850	610	870						
NC	.08	.08	.045	.1	.3					
X1	56	5[illegible]	660	734	530	1030	1030			
GR	610		608	40	606	70	604	150	602	210
GR	600	220	598	240	594	250	592	260	590.5	320
GR	592	380	592	570	594	590	596	600	594	640
GR	597.5	669	584.8	678	583.8	690	583.7	700	583.5	712
GR	584.8	724	592.3	734	592	760	590	770	590	790
GR	592	830	592	860	592	980	594	1010	596	1030
GR	596	1230	594	1310	592	1370	590	1410	590	1420
GR	594	1430	598	1440	602	1450	608	1460	610	1470
GR	610	1480	608	1490	606	1500	604	1510	602	1520
GR	600	1530	600	1590	602	1630	604	1650	606	1670
GR	608	1680	610	1690						
NC	.08	.08	.045	.1	.3					
QT	5	5400	7200	8100	9850	8100				
X1	58	18	779	844	400	1160	1160			
GR	610		608	50	606	140	604	200	602.2	350
GR	602	450	600	550	596	660	596	720	595.5	739
GR	595	779	585.1	785	582.3	794	561.7	800	561.5	808
GR	585.1	813	590.7	844	610	850				
NC	.08	.08	.045	.3	.5					
X1	58.1	24	608	736	55	55	55			

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GR	610		608	50	606	120	604	140	604	160
GR	604	230	602	450	600	530	594	610	595.4	661
GR	593	668	589.1	683	585.6	683	582.3	700	584.9	713
GR	596.2	736	597.6	740	600	750	602	760	610	780
GR	616	920	616	990	616	1030	614.9	1080		
SB	.9	1.5	2.9		41	5	1035	.7	584	584
X1	56.2				16	16	16			
X2			1	603.2	598					
X3	10							598	604	
BT	22		610	610	50	608	608	120	606	606
BT	140	604	604	160	604	604	230	604	604	450
BT	602	602	530	600	600	610	598	598	661	603.9
BT	595.4	668	603.9	593	668	603.9	602.3	736	604.8	603.2
BT	736	604.8	596.2	740	604.8	597.6	750	606	600	760
BT	607.3	602	780	610	610	920	616	616	990	616
BT	616	1030	616	616	1080	614.9	614.9			
NC	.08	.08	.04	.3	.5					
X1	58.3				50	50	50			
NC	.1	.08	.045	.1	.3					
X1	59	32	660	740	1000	870	1155			
GR	623		623.2	40	622	210	620	240	618	250
GR	616	260	614	270	610	280	600	290	598	300
GR	596	310	594	320	590	330	590	380	588	450
GR	588	650	593.5	660	586.8	674	585	678	582.8	700
GR	584.6	720	586.5	727	596.5	740	598	830	598	890
GR	598	920	600	970	602	990	604	1010	606	1020
GR	606	1040	610	1060						
NC	.1	.1	.04	.1	.3					
X1	60	31	650	715	1035	1035	1035			
GR	610		606	20	604	30	602	40	600	50
GR	598	70	596	180	594	500	592	640	594.2	650
GR	586.8	670	582.8	680	582.2	690	582.9	700	586.8	711
GR	591.4	715	599	746	614	750	616	760	620	780
GR	622	790	622	840	620	850	618	870	616	880
GR	614	890	612	900	610	920	608	940	608	970
GR	610	980								
NC	.1	.08	.045	.1	.3					
X1	62	22	496	639	800	1900	2080			
GR	610		608	20	606	70	604	82	594	125
GR	592.1	200	594	330	595	467	596	496	595.6	550
GR	591.9	562	591.9	565	587.2	575	584.8	581	584.3	596
GR	584.3	610	586.8	618	595.8	639	598	640	598	840
GR	599	910	610	950						
NC	.05	.08	.04	.1	.3					
X1	64	23	222	273	950	1300	1460			
GR	610		608	10	606	20	604	30	600	50
GR	598.1	120	598.2	158	598.2	222	587.6	233	584.4	241
GR	583.9	250	584.6	258	587.6	267	593.2	273	594.3	[illegible]
GR	594.9	380	594.9	580	596	630	598	650	600	660
GR	604	680	608	690	610	710				
NC	.08	.08	.04	.1	.3					
X1	64.1	35	580	670	750	750	1000			
GR	626		624	140	622	170	620	230	618	270
GR	616	320	614	360	612.2	400	610	410	604	441
GR	601.5	490	600	545	598	565	593	580	603.2	580
GR	592	585	587.8	598	583.8	625	588	646	594	664
GR	603.2	670	598	672	596	695	596	755	597.4	800
GR	595	815	600	850	602	855	604	875	606	885
GR	607	920	608.5	955	610	1060	612	1150	614	1220
NC	.08	.08	.04	.4	.6					
X1	64.2				100	100	100			
X3	10							607.5	607.7	
SB		1.5	3		48		1225	1.18	585.5	585.5
X1	64.3				38	38	38			
X2			1	603.2	607.5					

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BT	3		626	626	140	624	624	170	622	622
BT	230	629	620	270	618	618	320	616	616	360
BT	614	614	400	612.2	612.2	410	611.4	610	441	611.1
BT	604	490	610	601.5	545	608.4	600	565	608	596
BT	580	607.5	593	580	610.5	603.2	670	610.5	603.2	672
BT	607.7	595	645	607.7	596	755	607.7	596	600	607.7
BT	597.4	815	607.7	598	850	607.6	600	555	607.6	602
BT	875	607.9	604	885	607.9	606	920	608	607	455
BT	608.5	608.5	1060	610	610	1150	612	612	1220	614
BT	614									
NC	.08	.08	.04	.4	.6					
X1	64.4				50	50	50			
NC	.08	.08	.04	.1	.3					
QT	5	5120	6600	7570	9170	7570				
X1	66	19	580	673	410	410	410			
GR	616		600	31	590	45	592	85	594	125
GR	596	165	596	280	596	420	594.9	580	590.6	587
GR	587.6	592	584.3	601	587.6	611	590.6	619	601.6	629
GR	602.4	640	607.8	651	606.2	658	605.5	673		
NC	.08	.08	.04	.1	.3					
X1	68	31	620	655	430	240	535			
GR	614		612	10	608	29	604	30	600	40
GR	598	50	596	60	595.8	110	596	200	596.6	330
GR	596	420	594	590	595.7	609	592.9	620	588.6	625
GR	587.3	630	585.2	635	585.4	643	588.6	649	595.9	655
GR	594	670	596	690	595.2	720	596	770	596	840
GR	598	850	600	870	604	880	608	890	612	900
GR	614	1000								
NC	.06	.05	.04	.1	.3					
X1	70	48	688	769	1140	1600	1680			
GR	614		612	50	612	70	632	70	632	120
GR	612	120	610	130	630	130	630	150	610	150
GR	608.7	170	608	180	606	270	604	310	602	330
GR	600	440	620	440	620	470	600	470	600	490
GR	598	520	596	560	595.3	643	597.5	688	594.9	701
GR	589.9	709	587.3	718	586.8	730	587.6	738	589.1	752
GR	601.6	769	601.4	860	600	1000	598	1150	596	1180
GR	598	1240	598	1280	599.4	1330	598	1420	598	1460
GR	596	1560	598	1580	598	1590	598	1600	600	1610
GR	604	1620	610	1640	614	1650				
NC	.06	.07	.04	.1	.3					
X1	70.1	29	412	508	700	700	700			
GR	614		612	100	610	240	608	310	606	360
GR	593.3	412	594.1	425	594.1	436	592.9	458.5	592.9	461.5
GR	588.6	473	587.1	490	587.1	508	594	508	596	640
GR	600	660	602	665	602	880	600	890	598	925
GR	595	1010	598.7	1100	600	1260	600	1285	600.8	1370
GR	601.4	1460	601.8	1510	602	1521	616.5	1565		
NC	.07	.07	.04	.1	.3					
X1	70.2				100	100	100			
X3	10							608	606	
NC	.025	.025	.025	.3	.5					
X1	70.21				5	5	5			
X3	10							608	606	
BT	26		614	614	100	612	612	240	610	610
BT	310	608	608	360	606	606	412	607.7	594	412
BT	602	603.3	458.5	607.8	603	458.5	607.8	592.9	461.5	607.8
BT	592.9	461.5	607.8	603	508	607.5	602.7	508	602.2	594
BT	640	607	596	660	607	600	665	606.8	602	880
BT	606.5	602	890	606.5	600	925	606.3	596	1010	606
BT	598	1100	606	598.7	1260	608	600	1285	608.3	600
BT	1370	610	600.8	1460	612	601.4	1510	614	601.8	1521
BT	614.5	602	1565	616.5	616.5					
X1	70.29				82.5	82.5	82.5			
KP							1			

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NC	.07	.055	.04	.3	.5					
X1	70.5									
X3	10				5	5	5	606	606	
NC	.07	.055	.04	.2	.4					
X1	70.1				100	100	100			
NC	.07	.055	.04	.1	.3					
X1	72	31	43	68	660	660	660			
GR	616.5		612.3	15	596.9	36	596.1	43	589.6	54
GR	587.5	61	587.2	67	587.8	72	589.6	80	595.4	88
GR	595	100	596	170	596	190	598	220	600	330
GR	600	430	598	470	595	590	594	600	596	610
GR	596	630	598	640	598	740	600	780	602	860
GR	604	900	606	930	608	950	610	960	612	1010
GR	614	1040								
NC	.07	.055	.04	.1	.3					
X1	74	31	1152	1191	1730	920	2275			
GR	616		612	10	606	20	604	30	600	40
GR	598	60	598	130	600	150	602	260	602.2	290
GR	602	350	602	610	602.2	710	602	760	600	830
GR	596	990	596	1000	596	1020	596	1110	598.3	1123
GR	597.4	1152	598.4	1163	588.1	1168	587.7	1180	588.1	1191
GR	590.7	1197	598.8	1207	610.3	1235	612	1350	614	1450
GR	616	1490								
NC	.07	.055	.04	.1	.3					
ET	5	4500	6250	7100	9000	7160				
X1	76	39	375	428	1395	1430	1685			
GR	616		614	70	612	140	612	220	612.8	250
GR	612	290	610.8	317	597	339	597.1	375	591	384
GR	588	392	587.5	400	589	411	591	418	598.4	428
GR	599.5	590	598	720	598	870	600	920	602	950
GR	604	940	608	950	612	960	612	1030	611.8	1070
GR	610	1340	608	1410	606	1450	604	1500	602	1510
GR	601.8	1730	600	1850	600	2000	602	2040	604	2050
GR	606	2070	610	2080	614	2090	616	2100		
NC	.07	.1	.04	.1	.3					
X1	78	63	1496	1548	1710	1000	1710			
GR	616		616	10	614	30	612	50	610	60
GR	608	80	606	100	604	130	604	140	604	450
GR	604	460	606	480	606	490	608	520	606	550
GR	604	560	600	570	598	580	598	670	600	710
GR	600	740	598	760	595	790	596	830	598	850
GR	598	900	596	920	596	950	598	960	600	980
GR	600	1010	600	1030	600	1040	600	1050	600	1060
GR	600	1070	602	1090	604	1100	604	1110	598	1120
GR	598	1200	600	1210	602	1220	601.4	1456	599.7	1468
GR	594.6	1475	595.1	1496	592.3	1499	591.8	1509	591.7	1520
GR	591.8	1529	592.3	1539	600.7	1548	602	1600	602	1610
GR	602	1620	602	1700	602	1950	602	2000	604	2060
GR	608	2070	612	2080	618	2090				
NC	.07	.07	.04	.1	.3					
X1	79	28	1746	1801	1200	1200	1200			
GR	624		622	20	620	60	618	120	616	180
GR	614	240	612	270	610	310	608	370	606	510
GR	606	590	603	670	608	840	606	1160	604	1315
GR	604	1375	604	1575	604	1675	604	1725	602.7	1746
GR	593.5	1758	591.7	1765	591.5	1775	592.2	1783	593.5	1791
GR	597.9	1801	598.7	1864	616	1885				
NC	.07	.07	.04	.2	.4					
X1	79.1	28	1419.1	1490.9	770	100	770			
GR	620		618	55	616	110	614	260	612	480
GR	610	520	608	770	606	1125	604	1135	604	1235
GR	604	1275	602	1365	600	1395	598.77	1419.1	598.77	1429
GR	592	1435	592	1475	598.75	1481.4	598.75	1490.9	600	1525
GR	602	1585	604	1615	604	1675	602	1695	600	1735
GR	604	1745	606	1795	610	1805				
X1	79.2	28	1419.1	1490.9	5	5	5			
GR	620		616	55	616	110	614	260	612	480
GR	610	520	608	770	606	1125	604	1135	604	1235
GR	604	1275	602	1365	600	[illegible]				
GR	596.82	1431.1	[illegible]							

X1	79.2	28	1419.1	1490.9	5	5	5			
GR	620		618	55	616	110	614	260	612	480
GR	610	520	608	770	606	1125	604	1135	604	1235
GR	604	1275	602	1365	600	1395	598.77	1419.1	598.77	1429
GR	596.82	1431.1	596.73	1479.9	598.75	1481.4	598.75	1490.9	600	1525
GR	602	1585	604	1615	604	1675	602	1695	600	1735
GR	604	1785	606	1795	610	1805				
NC	.07	.07	.04	.2	.4					
X1	79.3	28	1419.1	1490.9	5	5	5			
GR	620		618	55	616	110	614	260	612	480
GR	610	520	608	770	606	1125	604	1135	604	1235
GR	604	1275	602	1365	600	1395	598.77	1419.1	598.77	1429
GR	592	1435	592	1475	598.75	1481.4	598.75	1490.9	600	1525
GR	602	1585	604	1615	604	1675	602	1695	600	1735
GR	604	1785	606	1795	610	1805				
NC	.06	.07	.04							
X1	80	25	930	991	5	550	705			
GR	620		618	55	616	110	614	260	612	480
GR	610	520	607.5	930	597.2	940	593.7	950	593.2	960
GR	592.7	970	592.2	985	601.6	991	602	1010	602	1130
GR	602	1210	602.7	1260	602	1300	600	1330	600	1350
GR	602	1360	604	[illegible]	606	[illegible]	610	1390	616	1410
NC	.07	.07	.04							
X1	80.1	24	974	1047	50	100	100			
X3	10							610	602	
GR	620	220	618	275	616	330	614	480	612.3	560
GR	614	720	614	830	612	860	610	970	610.6	974
GR	608.3	974	592	995	591.6	1010	592	1025	602.6	1047
GR	608.3	1047	602	1060	602	1385	604	1410	608	1420
GR	610	1430	612	1440	618	1460	620	1470		
SB		1.5	3		38		950	1.2	591.8	591.8
X1	80.2				5	5	5			
X2			1	608.3	602					
X3	10							610	602	
BT	22	220	620	620	275	618	618	330	616	616
BT	480	614	614	560	612.3	612.3	720	614	614	830
BT	614	614	860	612	612	970	610	610	974	610.6
BT	610.6	974	610.6	608.3	1010	611.8	608.3	1047	610.6	608.3
BT	1047	608.3	608.3	1060	602	602	1385	602	602	1410
BT	604	604	1420	608	608	1430	610	610	1440	612
BT	612	1460	618	618	1470	620	620			
NC	.32	.08	.04	.2	.4					
X1	80.3				50	50	50			
NC	.09	.08	.04	.1	.3					
X1	82	25	265	396	1225	1035	1390			
GR	620		618	10	610	30	606	40	606	50
GR	604	210	603.2	265	597.1	275	594.9	290	595.1	300
GR	595	320	597.1	345	597.1	353	594.1	373	597.1	385
GR	601.6	396	604	630	604	650	606	740	610	750
GR	612	760	614	780	616	910	618	1000	620	1060
NC	.08	.06	.045	.1	.3					
X1	85	22	520	583	1300	720	1590			
GR	620		618	30	617	140	618	240	618.6	270
GR	618	290	616	330	614	350	612	360	610	375
GR	608	380	606	390	604.1	520	597	528	593.5	540
GR	593.5	550	594	564	597	576	602.4	583	612	600
GR	618	630	620	670						
NC	.07	.07	.04	.1	.3					
X1	87	24	421	491	1260	1260	1260			
GR	622		620	40	618	60	614	110	612	120
GR	610	140	608	150	606	170	602	210	602	260
GR	604	360	604	400	603.5	421	597	434	595.8	442
GR	595.4	450	595.8	458	597	466	608	491	614	500
GR	620	520	622	530	626	540	630	560		
NC	.05	.06	.04	.1	.3					

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GR	622		618	30	616	70	614	90	612	130
GR	608	170	606	200	605.7	365	597.2	395	595.5	401
GR	595.4	415	596.1	425	597.2	430	610.5	464	614	480
GR	619	490	624	510	626	520				
NC	.05	.06	.04	.1	.3					
X1	68.1	22	610	471	200	200	200			
X3	10							616	620	
GR	620		618	140	616	150	612	190	610	220
GR	606	260	605.2	310	604	410	594.9	410	594	440
GR	594.9	471	600	471	610	490	612	500	614	510
GR	616	520	618	530	620	540	622	550	624	560
GR	626	650	627.6	790						
SB		1.5	3		61		1217		595	595
X1	88.2				45	45	45			
X2			1	615.7	616					
X3	10							616	620	
BT	20		620	620	140	618	616	160	617.8	616
BT	190	617.5	612	220	617.3	610	260	615.7	606	310
BT	616	605.2	410	620	604	410	622.6	614	471	621.4
BT	615.7	490	622	610	500	622.2	612	510	622.3	614
BT	520	622.7	616	530	623	618	540	623.3	620	550
BT	623.5	622	560	624	624	650	626	626	790	627.6
BT	627.6									
NC	.05	.06	.04	.1	.3					
X1	88.3	16	264	367	130	130	130			
GR	622		622	10	618	30	614	50	610	70
GR	608	80	607.9	100	606	130	604	264	600.1	274
GR	597.9	279	597	286	597.9	321	600.3	327	615.1	367
GR	624	680								
NC	.05	.06	.04	.4	.6					
X1	88.4	17	234	367	210	210	210			
X3	10							620	620	
GR	622		618	30	614	50	610	70	608	80
GR	667.5	100	606	130	604.6	234	615.2	234	600.1	274
GR	597.9	279	597	286	597.9	321	600.3	327	615.1	367
GR	620.6	367	624	680						
SB	.95	1.5	3		50	2.6	1763	2.1	597.5	597.5
X1	88.5				40	40	40			
X2			1	617.3	620.5				.91	
X3	10							620	620	
BT	11		622	622	30	621.7	618	50	621.4	614
BT	70	621.1	610	100	621	607.5	130	621	606	234
BT	620.5	604.6	234	620.5	617.2	367	620.6	617.3	367	620.6
BT	620.6	680	624	624						
NC				.3	.5					
X1	88.6				100	100	100			
NC	.05	.07	.04	.1	.3					
X1	89	20	230	315	420	420	420			
GR	620		618	10	616	20	614	30	612	40
GR	610	50	608.5	80	606.3	150	602.8	190	603	210
GR	604.6	230	597.6	239	596.6	250	596.6	260	596.1	270
GR	597.6	234	609.6	315	612	320	618	340	622	360
EJ										
T1		TYPE 19 FIS								
T2		TOLEDO, OHIO	50 YEAR							
T3		SWAN CREEK								
J1	-10	3								
J2	2		-1						578.17	
T1		TYPE 19 FIS								
T2		TOLEDO, OHIO	100 YEAR							
T3		SWAN CREEK								
J1	-10	4								
J2	3		-1						57[illegible].51	
T1		TYPE 19 FIS								
T2		TOLEDO, OHIO	500 YEAR							

↑ Missing X1 - 88

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T3      SWAN CREEK
J1  -10         5
J2   15                  -1                          579.23

ER
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SUMMARY PRINTOUT FOR MULTIPLE PROFILES

SWAN CREEK

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
.10	0.00	0.00	0.00	562.10	5900.00	577.17	0.00	577.48	116.99	6.75	0.00	0.00
.10	0.00	0.00	0.00	562.10	8000.00	578.17	0.00	578.66	117.79	9.47	0.00	0.00
.10	0.00	0.00	0.00	562.10	9000.00	578.51	0.00	579.09	118.07	10.99	0.00	0.00
.10	0.00	0.00	0.00	562.10	11000.00	579.23	0.00	580.01	118.64	13.76	0.00	0.00
.20	50.00	0.00	0.00	562.80	5900.00	577.08	0.00	577.66	83.00	11.42	.00	1.31
.20	50.00	0.00	0.00	562.80	8000.00	578.02	0.00	578.93	83.00	16.45	.00	1.42
.20	50.00	0.00	0.00	562.80	9000.00	578.32	0.00	579.42	83.00	19.30	.00	1.46
.20	50.00	0.00	0.00	562.80	11000.00	578.97	0.00	580.45	83.00	24.75	.00	1.54
.30	43.00	582.20	580.30	562.80	5900.00	577.14	0.00	577.71	83.00	11.25	.00	2.27
.30	43.00	582.20	580.30	562.80	8000.00	578.11	0.00	579.00	83.00	16.10	.00	2.46
.30	43.00	582.20	580.30	562.80	9000.00	578.43	0.00	579.51	83.00	18.82	.00	2.52
.30	43.00	582.20	580.30	562.80	11000.00	579.56	0.00	580.92	83.00	21.65	.00	2.67
A .40	50.00	0.00	0.00	562.10	5900.00	577.51	0.00	577.81	117.26	6.14	.01	3.60
.40	50.00	0.00	0.00	562.10	8000.00	578.70	0.00	579.15	118.22	8.27	.01	3.92
.40	50.00	0.00	0.00	562.10	9000.00	579.16	0.00	579.68	118.59	9.37	.01	4.03
.40	50.00	0.00	0.00	562.10	11000.00	580.49	0.00	581.14	119.66	10.32	.00	4.32
.50	425.00	0.00	0.00	562.10	5900.00	577.78	0.00	578.06	117.47	5.71	.04	16.97
.50	425.00	0.00	0.00	562.10	8000.00	579.07	0.00	579.49	118.51	7.57	.03	18.71
.50	425.00	0.00	0.00	562.10	9000.00	579.57	0.00	580.07	118.92	8.49	.03	19.38
.50	425.00	0.00	0.00	562.10	11000.00	580.95	0.00	581.56	120.03	9.35	.02	21.25
.60	50.00	0.00	0.00	562.75	5900.00	577.75	0.00	578.15	82.00	7.42	.04	18.43
.60	50.00	0.00	0.00	562.75	8000.00	579.01	0.00	579.63	82.00	10.59	.03	20.32
.60	50.00	0.00	0.00	562.75	9000.00	579.50	0.00	580.24	82.00	12.23	.03	21.04
.60	50.00	0.00	0.00	562.75	11000.00	580.84	0.00	581.78	82.00	14.41	.03	23.08
.70	42.00	583.60	583.00	562.75	5900.00	577.78	0.00	578.18	82.00	7.36	.04	19.55
.70	42.00	583.60	583.00	562.75	8000.00	579.06	0.00	579.68	82.00	10.49	.03	21.54
.70	42.00	583.60	583.00	562.75	9000.00	579.56	0.00	580.29	82.00	12.10	.03	22.30
.70	42.00	583.60	583.00	562.75	11000.00	580.91	0.00	581.85	82.00	14.24	.03	24.44
.80	50.00	0.00	0.00	562.90	5900.00	577.82	0.00	578.22	104.86	7.46	.04	20.89
.80	50.00	0.00	0.00	562.90	8000.00	579.15	0.00	579.74	108.43	9.84	.03	23.02
.80	50.00	0.00	0.00	562.90	9000.00	579.67	0.00	580.36	109.86	10.99	.03	23.84
.80	50.00	0.00	0.00	562.90	11000.00	581.11	0.00	581.94	113.71	11.96	.03	26.14
B 2.00	750.00	0.00	0.00	562.90	5900.00	578.38	0.00	578.74	106.36	6.50	.09	41.66
2.00	750.00	0.00	0.00	562.90	8000.00	579.89	0.00	580.42	110.46	8.31	.07	46.43
2.00	750.00	0.00	0.00	562.90	9000.00	580.51	0.00	581.12	112.10	9.18	.07	48.33
2.00	750.00	0.00	0.00	562.90	11000.00	582.02	0.00	582.76	126.27	9.91	.06	53.51
2.10	610.00	0.00	0.00	562.90	5900.00	578.78	0.00	579.12	107.45	5.88	.12	59.26
2.10	610.00	0.00	0.00	562.90	8000.00	580.41	0.00	580.90	111.83	7.41	.10	66.44
2.10	610.00	0.00	0.00	562.90	9000.00	581.09	0.00	581.65	113.66	8.11	.09	69.35
2.10	610.00	0.00	0.00	562.90	11000.00	582.65	0.00	583.34	138.28	8.67	.08	77.12

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SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
2.20	50.00	0.00	0.00	562.50	5900.00	578.82	0.00	579.16	102.00	6.87	.12	60.72
2.20	50.00	0.00	0.00	562.50	8000.00	580.46	0.00	580.95	102.00	8.53	.10	68.10
2.20	50.00	0.00	0.00	562.50	9000.00	581.15	0.00	581.70	102.00	9.30	.10	71.09
2.20	50.00	0.00	0.00	562.50	11000.00	582.71	0.00	583.38	102.00	10.14	.09	79.07
2.30	80.00	594.00	591.90	562.50	5900.00	578.88	0.00	579.21	102.00	6.76	.13	63.06
2.30	80.00	594.00	591.90	562.50	8000.00	580.54	0.00	581.02	102.00	8.37	.11	70.75
2.30	80.00	594.00	591.90	562.50	9000.00	581.23	0.00	581.78	102.00	9.12	.10	73.87
2.30	80.00	594.00	591.90	562.50	11000.00	582.80	0.00	583.47	102.00	9.95	.09	82.13
3.00	125.00	0.00	0.00	561.20	5900.00	578.79	0.00	579.50	95.30	19.00	.13	66.14
C 3.00	125.00	0.00	0.00	561.20	8000.00	580.[illegible]3	0.00	581.35	147.88	21.67	.11	74.32
3.00	125.00	0.00	0.00	561.20	9000.00	581.12	0.00	582.13	160.78	22.23	.10	77.69
3.00	125.00	0.00	0.00	561.20	11000.00	582.74	0.00	583.90	226.64	20.65	.09	86.61
3.05	100.00	0.00	0.00	561.20	5900.00	579.01	0.00	579.69	96.24	17.77	.14	68.18
3.05	100.00	0.00	0.00	561.20	8000.00	580.70	0.00	581.57	152.88	19.97	.12	76.76
3.05	100.00	0.00	0.00	561.20	9000.00	581.41	0.00	582.36	166.09	20.42	.11	80.39
3.05	100.00	0.00	0.00	561.20	11000.00	583.01	0.00	584.01	284.37	19.06	.10	90.01
3.10	225.00	0.00	0.00	560.70	5900.00	579.33	0.00	580.12	53.75	15.76	.15	72.64
3.10	225.00	0.00	0.00	560.70	8000.00	581.02	0.00	582.19	53.84	21.71	.12	81.95
3.10	225.00	0.00	0.00	560.70	9000.00	581.70	0.00	583.07	53.88	24.65	.11	[illegible]
3.10	225.00	0.00	0.00	560.70	11000.00	583.22	0.00	584.92	66.96	34.22	.10	96.64
3.11	5.00	590.00	600.00	560.70	5900.00	579.34	0.00	580.12	53.75	6.15	.15	72.73
3.11	5.00	590.00	600.00	560.70	8000.00	581.03	0.00	582.19	53.84	8.47	.12	82.05
3.11	5.00	590.00	600.00	560.70	9000.00	581.71	0.00	583.08	53.88	9.61	.11	86.07
3.11	5.00	590.00	600.00	560.70	11000.00	583.24	0.00	584.93	66.96	13.33	.10	96.76
3.19	55.00	590.00	600.00	560.70	5900.00	579.38	0.00	580.16	53.75	6.11	.15	73.78
3.19	55.00	590.00	600.00	560.70	8000.00	581.08	0.00	582.24	53.84	8.39	.12	83.22
3.19	55.00	590.00	600.00	560.70	9000.00	581.78	0.00	583.13	53.88	9.52	.12	87.28
3.19	55.00	590.00	600.00	560.70	11000.00	583.34	0.00	585.01	66.96	13.09	.11	98.10
3.20	5.00	0.00	0.00	560.70	5900.00	579.38	0.00	580.16	53.75	15.63	.15	73.88
3.20	5.00	0.00	0.00	560.70	8000.00	581.09	0.00	582.25	53.84	21.47	.12	83.33
3.20	5.00	0.00	0.00	560.70	9000.00	581.78	0.00	583.14	53.88	24.35	.12	87.39
3.20	5.00	0.00	0.00	560.70	11000.00	583.35	0.00	585.02	66.96	33.46	.11	98.22
3.30	50.00	0.00	0.00	561.70	5900.00	579.92	0.00	580.29	99.78	7.03	.15	75.05
3.30	50.00	0.00	0.00	561.70	8000.00	581.94	0.00	582.44	111.39	7.71	.13	84.67
3.30	50.00	0.00	0.00	561.70	9000.00	582.80	0.00	583.36	116.46	7.98	.12	88.82
3.30	50.00	0.00	0.00	561.70	11000.00	584.64	0.00	585.30	127.26	8.03	.11	99.82
D 5.00	955.00	0.00	0.00	561.79	5900.00	580.61	0.00	580.93	110.72	6.36	.21	102.38
5.00	955.00	0.00	0.00	561.70	8000.00	582.74	0.00	583.16	118.84	7.27	.18	117.02
5.00	955.00	0.00	0.00	561.70	9000.00	583.65	0.00	584.12	122.32	7.61	.17	123.46
5.00	955.00	0.00	0.00	561.70	11000.00	585.53	0.00	586.05	304.53	7.44	.15	141.27

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SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
5.10	500.00	0.00	0.00	565.60	5900.00	580.94	0.00	581.30	114.90	8.01	.24	116.80
5.10	500.00	0.00	0.00	565.60	8000.00	583.11	0.00	583.57	121.66	8.53	.20	134.32
5.10	500.00	0.00	0.00	565.60	9000.00	584.04	0.00	584.53	124.66	8.73	.19	142.04
5.10	500.00	0.00	0.00	565.60	11000.00	585.89	0.00	586.46	134.44	8.46	.18	163.51
5.15	425.00	0.00	0.00	565.60	5900.00	581.29	0.00	581.63	115.97	7.30	.27	128.91
5.15	425.00	0.00	0.00	565.60	8000.00	583.49	0.00	583.92	122.82	7.83	.23	148.97
5.15	425.00	0.00	0.00	565.60	9000.00	584.42	0.00	584.89	126.65	7.96	.21	157.82
5.15	425.00	0.00	0.00	565.60	11000.00	586.27	0.00	586.81	137.37	7.78	.20	181.64
5.20	50.00	0.00	0.00	564.50	5900.00	581.62	0.00	581.75	174.36	2.47	.27	130.79
5.20	50.00	0.00	0.00	564.50	8000.00	583.90	0.00	584.07	179.53	2.65	.23	151.23
5.20	50.00	0.00	0.00	564.50	9000.00	584.87	0.00	585.05	181.13	2.73	.22	160.25
5.20	50.00	0.00	0.00	564.50	11000.00	586.77	0.00	586.99	219.74	2.81	.20	184.42
5.30	66.00	586.00	586.60	564.50	5900.00	581.64	0.00	581.77	174.43	2.46	.28	133.85
5.30	66.00	586.00	586.60	564.50	8000.00	583.92	0.00	584.09	179.56	2.64	.24	154.90
5.30	66.00	586.00	586.60	564.50	9000.00	584.89	0.00	585.07	181.17	2.72	.22	164.18
5.30	66.00	586.00	586.60	564.50	11000.00	586.98	0.00	587.19	229.21	2.69	.21	188.93
E 7.00	200.00	0.00	0.00	565.60	5900.00	581.63	0.00	581.96	113.75	6.51	.29	141.44
7.00	200.00	0.00	0.00	565.60	8000.00	583.90	0.00	584.31	119.85	6.97	.25	164.03
7.00	200.00	0.00	0.00	565.60	9000.00	584.87	0.00	585.32	122.67	7.16	.23	173.98
7.00	200.00	0.00	0.00	565.60	11000.00	586.94	0.00	587.44	220.42	6.81	.22	200.46
7.10	600.00	0.00	0.00	565.60	5900.00	582.03	0.00	582.33	114.82	5.89	.33	159.51
7.10	600.00	0.00	0.00	565.60	8000.00	584.33	0.00	584.72	121.00	6.35	.28	185.79
7.10	600.00	0.00	0.00	565.60	9000.00	585.31	0.00	585.73	125.37	6.50	.26	197.37
7.10	600.00	0.00	0.00	565.60	11000.00	587.37	0.00	587.83	223.04	6.19	.25	228.92
7.80	50.00	0.00	0.00	565.30	5900.00	582.03	0.00	582.51	94.67	21.42	.33	160.88
7.80	50.00	0.00	0.00	565.30	8000.00	584.32	0.00	584.93	102.72	25.97	.28	187.45
7.80	50.00	0.00	0.00	565.30	9000.00	585.29	0.00	585.95	110.96	28.26	.27	199.16
7.80	50.00	0.00	0.00	565.30	11000.00	587.35	0.00	588.06	124.99	29.68	.25	231.07
7.81	5.00	596.00	599.00	565.30	5900.00	582.03	0.00	582.52	94.69	12.03	.33	161.00
7.81	5.00	596.00	599.00	565.30	8000.00	584.33	0.00	584.94	102.79	14.59	.28	187.59
7.81	5.00	596.00	599.00	565.30	9000.00	585.31	0.00	585.96	111.04	15.87	.27	199.31
7.81	5.00	596.00	599.00	565.30	11000.00	587.37	0.00	588.07	125.04	16.67	.25	231.26
7.89	15.00	596.00	599.00	565.30	5900.00	582.05	0.00	582.54	94.76	11.97	.33	161.37
7.89	15.00	596.00	599.00	565.30	8000.00	584.36	0.00	584.96	103.05	14.53	.28	188.04
7.89	15.00	596.00	599.00	565.30	9000.00	585.33	0.00	585.99	111.32	15.79	.27	199.79
7.89	15.00	596.00	599.00	565.30	11000.00	587.40	0.00	588.10	125.24	16.57	.25	231.82
7.90	25.00	0.00	0.00	565.30	5900.00	582.10	0.00	582.58	94.84	21.16	.33	161.97
7.90	25.00	0.00	0.00	565.30	8000.00	584.41	0.00	585.01	103.41	25.66	.28	188.77
7.90	25.00	0.00	0.00	565.30	9000.00	585.39	0.00	586.04	111.71	27.86	.27	200.59
7.90	25.00	0.00	0.00	565.30	11000.00	587.46	0.00	588.15	125.52	29.20	.25	232.76

SECTION CHANNEL MIN EL OF MAX EL OF MIN EL DISCHARGE CWSEL CRIWS EG TOPWID 10K*S TIME VOL

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
7.12	25.00	0.00	0.00	564.40	5900.00	582.53	0.00	582.65	179.10	2.44	.33	162.87
7.12	25.00	0.00	0.00	564.40	8000.00	584.95	0.00	585.11	195.52	2.59	.29	189.86
7.12	25.00	0.00	0.00	564.40	9000.00	585.98	0.00	586.15	202.48	2.64	.27	201.77
7.12	25.00	0.00	0.00	564.40	11000.00	588.08	0.00	588.27	213.00	2.58	.25	234.13
7.13	50.00	594.00	591.10	564.40	5900.00	582.54	0.00	582.66	179.13	2.43	.34	165.21
7.13	50.00	594.00	591.10	564.40	8000.00	584.96	0.00	585.11	195.56	2.58	.29	192.73
7.13	50.00	594.00	591.10	564.40	9000.00	585.98	0.00	586.15	202.52	2.64	.27	204.87
7.13	50.00	594.00	591.10	564.40	11000.00	588.09	0.00	588.28	213.02	2.57	.26	237.74
7.14	20.00	0.00	0.00	564.40	5900.00	582.54	0.00	582.67	179.17	2.43	.34	166.15
7.14	20.00	0.00	0.00	564.40	8000.00	584.96	0.00	585.12	195.59	2.58	.29	193.87
7.14	20.00	0.00	0.00	564.40	9000.00	585.99	0.00	586.16	202.56	2.64	.28	206.11
7.14	20.00	0.00	0.00	564.40	11000.00	588.09	0.00	588.28	213.04	2.57	.26	239.18
7.15	20.00	0.00	0.00	567.10	5900.00	582.52	0.00	582.70	169.49	3.90	.34	167.02
7.15	20.00	0.00	0.00	567.10	8000.00	584.93	0.00	585.15	184.30	3.86	.29	194.94
7.15	20.00	0.00	0.00	567.10	9000.00	585.96	0.00	586.19	190.59	3.85	.28	207.27
7.15	20.00	0.00	0.00	567.10	11000.00	588.[illegible]	0.00	588.31	203.48	3.66	.26	240.53
7.16	55.00	597.00	592.40	567.10	5900.00	582.52	0.00	582.70	169.53	3.89	.35	169.21
7.16	55.00	597.00	592.40	567.10	8000.00	584.94	0.00	585.15	184.35	3.85	.30	197.67
7.16	55.00	597.00	592.40	567.10	9000.00	585.97	0.00	586.20	190.63	3.84	.28	210.24
7.16	55.00	597.00	592.40	567.10	11000.00	588.07	0.00	588.32	203.53	3.65	.26	244.03
F 8.00	325.00	0.00	0.00	566.00	5900.00	582.62	0.00	582.86	130.07	4.58	.37	181.29
8.00	325.00	0.00	0.00	566.00	8000.00	585.03	0.00	585.33	160.77	4.75	.32	212.59
8.00	325.00	0.00	0.00	566.00	9000.00	586.05	0.00	586.37	191.02	4.79	.30	226.55
8.00	325.00	0.00	0.00	566.00	11000.00	588.14	0.00	588.49	193.75	4.49	.28	263.39
8.10	220.00	0.00	0.00	566.70	5900.00	582.81	0.00	582.96	176.78	3.28	.39	189.78
8.10	220.00	0.00	0.00	566.70	8000.00	585.25	0.00	585.43	187.00	3.18	.34	223.03
8.10	220.00	0.00	0.00	566.70	9000.00	586.28	0.00	586.48	187.00	3.10	.32	237.93
8.10	220.00	0.00	0.00	566.70	11000.00	588.39	0.00	588.60	218.78	2.71	.30	277.30
8.11	5.00	587.50	606.00	566.70	5900.00	582.81	0.00	582.97	176.79	2.84	.39	189.99
8.11	5.00	587.50	606.00	566.70	8000.00	585.22	0.00	585.45	187.00	4.99	.34	223.29
8.11	5.00	587.50	606.00	566.70	9000.00	586.23	0.00	586.51	187.00	7.30	.32	238.20
8.11	5.00	587.50	605.00	566.70	11000.00	588.28	0.00	588.68	218.56	10.53	.30	277.60
8.19	65.00	587.50	606.00	566.70	5900.00	582.82	0.00	582.99	176.88	2.83	.39	192.72
8.19	65.00	587.50	606.00	566.70	8000.00	585.26	0.00	585.48	187.00	4.98	.34	226.39
8.19	65.00	587.50	606.00	566.70	9000.00	586.28	0.00	586.56	187.00	7.30	.32	241.37
8.19	65.00	587.50	606.00	566.70	11000.00	588.35	0.00	588.75	218.70	11.62	.30	280.86
8.20	5.00	0.00	0.00	566.70	5900.00	582.83	0.00	582.99	176.89	3.26	.39	192.93
8.20	5.00	0.00	0.00	566.70	8000.00	585.31	0.00	585.50	187.00	3.13	.34	226.64
8.20	5.00	0.00	0.00	566.70	9000.00	586.38	0.00	586.58	187.00	3.02	.32	241.64
8.20	5.00	0.00	0.00	566.70	11000.00	588.59	0.00	588.79	219.18	2.60	.30	281.16

SECTION NUMBER CHANNEL LENGTH MIN EL OF ROADWAY MAX EL OF LOW CHORD MIN EL GROUND DISCHARGE (CFS) CWSEL CRIWS EG TOPWID 10K*S TIME VOL

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SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
8.30	100.00	0.00	0.00	566.70	5900.00	582.87	0.00	583.02	198.36	3.17	.40	197.27
8.30	100.00	0.00	0.00	566.70	8000.00	585.35	0.00	585.53	212.99	2.98	.35	232.09
8.30	100.00	0.00	0.00	566.70	9000.00	586.42	0.00	586.61	215.00	2.86	.33	247.58
8.30	100.00	0.00	0.00	566.70	11000.00	588.62	0.00	588.82	219.24	2.59	.31	288.37
G 9.00	605.00	0.00	0.00	566.40	5900.00	583.02	0.00	583.48	101.90	15.81	.43	218.16
9.00	605.00	0.00	0.00	566.40	8000.00	585.44	0.00	585.99	110.37	16.04	.38	258.33
9.00	605.00	0.00	0.00	566.40	9000.00	586.48	0.00	587.07	114.02	16.10	.36	276.24
9.00	605.00	0.00	0.00	566.40	11000.00	588.63	0.00	589.27	122.64	15.45	.34	322.08
9.10	1005.00	0.00	0.00	567.90	5900.00	584.21	0.00	584.39	141.13	5.62	.52	250.36
9.10	1005.00	0.00	0.00	567.90	8000.00	586.70	0.00	586.93	141.79	5.76	.45	297.56
9.10	1005.00	0.00	0.00	567.90	9000.00	587.77	0.00	588.02	142.08	5.86	.43	318.57
9.10	1005.00	0.00	0.00	567.90	11000.00	589.87	0.00	590.16	258.67	5.44	.40	371.89
9.11	5.00	591.60	591.20	567.90	5900.00	584.17	0.00	584.44	141.12	3.90	.52	250.54
9.11	5.00	591.60	591.20	567.90	8000.00	586.60	0.00	587.04	141.77	8.63	.45	297.76
9.11	5.00	591.60	591.20	567.90	9000.00	587.62	0.00	588.17	142.04	11.03	.43	318.78
9.11	5.00	591.60	591.20	567.90	11000.00	589.61	0.00	590.42	235.93	15.85	.40	372.1[illegible]
9.19	55.00	591.60	591.20	567.90	5900.00	584.19	0.00	584.46	141.12	3.88	.52	252.33
9.19	55.00	591.60	591.20	567.90	8000.00	586.65	0.00	587.08	141.78	8.63	.45	299.66
9.19	55.00	591.60	591.20	567.90	9000.00	587.68	0.00	588.24	142.06	11.03	.43	320.68
9.19	55.00	591.60	591.20	567.90	11000.00	589.70	0.00	590.51	244.22	15.80	.40	374.10
9.20	5.00	0.00	0.00	567.90	5900.00	584.30	0.00	584.49	141.15	4.44	.52	252.51
9.20	5.00	0.00	0.00	567.90	8000.00	586.92	0.00	587.15	141.85	4.45	.45	299.87
9.20	5.00	0.00	0.00	567.90	9000.00	588.08	0.00	588.33	142.17	4.46	.43	320.90
9.20	5.00	0.00	0.00	567.90	11000.00	590.40	0.00	590.68	288.27	3.98	[illegible]	374.35
9.30	130.00	0.00	0.00	568.00	5900.00	584.34	0.00	584.57	133.54	5.81	.53	257.34
9.30	130.00	0.00	0.00	568.00	8000.00	586.95	0.00	587.24	145.09	5.84	.46	305.79
9.30	130.00	0.00	0.00	568.00	9000.00	588.13	0.00	588.41	521.51	5.43	.44	327.94
9.30	130.00	0.00	0.00	568.00	11000.00	590.50	0.00	590.74	534.94	4.17	.41	384.01
H 11.00	520.00	0.00	0.00	568.00	5900.00	584.61	0.00	584.83	134.71	4.30	.57	275.62
11.00	520.00	0.00	0.00	568.00	8000.00	587.23	0.00	587.50	516.72	4.33	.50	328.93
11.00	520.00	0.00	0.00	568.00	9000.00	588.39	0.00	588.65	522.88	3.89	.48	358.21
11.00	520.00	0.00	0.00	568.00	11000.00	590.72	0.00	590.92	536.42	2.83	.46	429.12
I 12.00	1365.00	0.00	0.00	565.90	5900.00	585.21	0.00	585.30	1239.67	2.86	.72	340.99
12.00	1365.00	0.00	0.00	565.90	8000.00	587.73	0.00	587.77	1274.23	1.17	.72	432.20
12.00	1365.00	0.00	0.00	565.90	9000.00	588.83	0.00	588.86	1287.53	.87	.72	484.62
12.00	1365.00	0.00	0.00	565.90	11000.00	591.03	0.00	591.06	1303.76	.53	.74	602.56
J 13.00	1250.00	0.00	0.00	565.90	5900.00	585.55	0.00	585.85	119.21	6.05	.80	397.87
13.00	1250.00	0.00	0.00	565.90	8000.00	587.77	0.00	588.12	430.55	6.24	.79	524.88
13.00	1250.00	0.00	0.00	565.90	9000.00	588.82	0.00	589.16	530.71	5.69	.79	597.17
13.00	1250.00	0.00	0.00	565.90	11000.00	591.00	0.00	591.25	618.00	4.14	.82	758.96

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
13.10	590.00	0.00	0.00	568.40	5900.00	585.99	0.00	586.66	68.76	18.96	.82	413.08
13.10	590.00	0.00	0.00	568.40	8000.00	588.22	0.00	589.08	86.19	24.75	.81	544.91
13.10	590.00	0.00	0.00	568.40	9000.00	589.20	0.00	590.13	89.44	25.62	.81	621.27
13.10	590.00	0.00	0.00	568.40	11000.00	591.19	0.00	592.22	95.99	26.11	.84	793.07
13.11	5.00	600.00	602.20	568.40	5900.00	586.00	0.00	586.67	68.77	18.94	.82	413.18
13.11	5.00	600.00	602.20	568.40	8000.00	588.23	0.00	589.09	86.21	24.71	.81	545.03
13.11	5.00	600.00	602.20	568.40	9000.00	589.22	0.00	590.15	89.46	25.58	.81	621.40
13.11	5.00	600.00	602.20	568.40	11000.00	591.20	0.00	592.24	96.02	26.07	.84	793.23
13.19	32.00	600.00	602.20	568.40	5900.00	586.07	0.00	586.73	68.89	18.69	.82	413.84
13.19	32.00	600.00	602.20	568.40	8000.00	588.33	0.00	589.17	85.55	24.19	.81	545.82
13.19	32.00	600.00	602.20	568.40	9000.00	589.32	0.00	590.23	89.81	25.04	.81	622.26
13.19	32.00	600.00	602.20	568.40	11000.00	591.30	0.00	592.32	96.38	25.55	.84	794.22
13.20	5.00	0.00	0.00	568.40	5900.00	586.08	0.00	586.74	68.90	18.66	.82	413.95
13.20	5.00	0.00	0.00	568.40	8000.00	588.34	0.00	589.18	86.59	24.13	.81	545.95
13.20	5.00	0.00	0.00	568.40	9000.00	589.33	0.00	590.24	89.86	24.98	.81	622.39
13.20	5.00	0.00	0.00	568.40	11000.00	591.32	0.00	592.34	96.42	25.48	.84	794.38
K 14.00	215.00	0.00	0.00	565.60	5900.00	586.71	0.00	586.99	153.23	4.44	.84	419.93
14.00	215.00	0.00	0.00	565.60	8000.00	589.15	0.00	589.48	218.24	4.82	.82	553.55
14.00	215.00	0.00	0.00	565.60	9000.00	590.22	0.00	590.56	240.47	4.89	.83	630.81
14.00	215.00	0.00	0.00	565.60	11000.00	592.33	0.00	592.67	281.82	4.69	.85	804.67
L 16.00	1305.00	0.00	0.00	568.20	5900.00	587.33	0.00	587.57	124.66	4.52	.93	465.02
16.00	1305.00	0.00	0.00	568.20	8000.00	589.83	0.00	590.09	525.24	4.28	.92	619.73
16.00	1305.00	0.00	0.00	568.20	9000.00	590.90	0.00	591.13	576.17	3.83	.92	709.49
16.00	1305.00	0.00	0.00	568.20	11000.00	593.07	0.00	593.22	702.15	3.64	.97	913.35
16.10	170.00	0.00	0.00	567.00	5900.00	587.47	0.00	587.64	98.00	2.01	.94	471.35
16.10	170.00	0.00	0.00	567.00	8000.00	589.89	0.00	590.14	98.00	2.49	.93	628.35
16.10	170.00	0.00	0.00	567.00	9000.00	590.93	0.00	591.21	98.00	2.70	.93	719.47
16.10	170.00	0.00	0.00	567.00	11000.00	593.15	0.00	593.27	481.96	1.15	.99	933.35
16.20	50.00	592.00	585.60	567.00	5900.00	587.64	0.00	587.82	98.00	1.95	.95	473.38
16.20	50.00	592.00	585.60	567.00	8000.00	590.29	0.00	590.53	98.00	2.35	.93	630.66
16.20	50.00	592.00	585.60	567.00	9000.00	591.47	0.00	591.74	98.00	2.50	.94	721.90
16.20	50.00	592.00	585.60	567.00	11000.00	594.07	0.00	594.17	496.15	.96	1.00	940.27
16.30	50.00	0.00	0.00	567.00	5900.00	587.77	0.00	587.85	422.07	.98	.95	476.33
16.30	50.00	0.00	0.00	567.00	8000.00	590.51	0.00	590.59	454.21	.92	.94	634.46
16.30	50.00	0.00	0.00	567.00	9000.00	591.72	0.00	591.80	464.35	.89	.94	726.08
16.30	50.00	0.00	0.00	567.00	11000.00	594.10	0.00	594.18	497.23	.81	1.01	947.47
M 17.00	960.00	0.00	0.00	569.30	5900.00	587.89	0.00	587.95	427.57	1.10	1.09	549.08
17.00	960.00	0.00	0.00	569.30	8000.00	590.61	0.00	590.68	455.10	.92	1.07	733.79
17.00	960.00	0.00	0.00	569.30	9000.00	591.82	0.00	591.89	465.19	.86	1.08	837.72
17.00	960.00	0.00	0.00	569.30	11000.00	594.19	0.00	594.26	500.49	.75	1.14	1084.17

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	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
	19.00	1475.00	0.00	0.00	569.80	5900.00	588.07	0.00	588.14	515.30	1.45	1.30	667.75
N	19.00	1475.00	0.00	0.00	569.80	8000.00	590.76	0.00	590.83	713.15	1.22	1.29	899.57
	19.00	1475.00	0.00	0.00	569.80	9000.00	591.97	0.00	592.03	745.46	1.11	1.30	1026.75
	19.00	1475.00	0.00	0.00	569.80	11000.00	594.33	0.00	594.38	1004.07	.90	1.38	1325.58
O	20.00	535.00	0.00	0.00	567.20	5900.00	588.13	0.00	588.21	408.15	1.60	1.36	701.38
	20.00	535.00	0.00	0.00	567.20	8000.00	590.81	0.00	590.89	553.56	1.40	1.35	945.26
	20.00	535.00	0.00	0.00	567.20	9000.00	592.01	0.00	592.08	826.11	1.29	1.36	1078.83
	20.00	535.00	0.00	0.00	567.20	11000.00	594.36	0.00	594.42	902.25	1.04	1.45	1394.08
	20.10	1315.00	0.00	0.00	571.80	5900.00	588.36	0.00	588.69	97.00	5.58	1.44	772.50
	20.10	1315.00	0.00	0.00	571.80	8000.00	591.00	0.00	591.30	228.00	4.29	1.43	1051.02
	20.10	1315.00	0.00	0.00	571.80	9000.00	592.17	0.00	592.48	228.00	4.14	1.45	1199.03
	20.10	1315.00	0.00	0.00	571.80	11000.00	594.46	0.00	594.79	228.00	3.82	1.53	1552.63
	20.20	65.00	590.00	586.90	571.80	5900.00	588.80	0.00	589.11	97.00	5.02	1.44	774.45
	20.20	65.00	590.00	586.90	571.80	8000.00	591.62	0.00	591.89	228.00	3.70	1.44	1054.62
	20.20	65.00	590.00	586.90	571.80	9000.00	592.45	0.00	592.75	228.00	3.89	1.45	1202.97
	20.20	65.00	590.00	586.90	571.80	11000.00	594.46	0.00	594.79	228.00	3.82	1.53	1557.30
P	22.00	205.00	0.00	0.00	568.60	5900.00	588.98	0.00	589.22	222.52	3.95	1.46	782.26
	22.00	205.00	0.00	0.00	568.60	8000.00	591.70	0.00	591.97	234.46	3.96	1.45	1066.64
	22.00	205.00	0.00	0.00	568.60	9000.00	592.54	0.00	592.83	235.76	4.23	1.46	1215.89
	22.00	205.00	0.00	0.00	568.60	11000.00	594.56	0.00	594.88	238.92	4.30	1.55	1572.43
Q	23.00	850.00	0.00	0.00	569.50	5900.00	589.31	0.00	589.45	373.54	1.80	1.54	828.81
	23.00	850.00	0.00	0.00	569.50	8000.00	592.05	0.00	592.19	533.11	1.65	1.54	1131.83
	23.00	850.00	0.00	0.00	569.50	9000.00	592.92	0.00	593.06	585.07	1.70	1.55	1287.70
	23.00	850.00	0.00	0.00	569.50	11000.00	594.96	0.00	595.10	728.05	1.57	1.63	1662.03
R	24.00	840.00	0.00	0.00	569.10	5900.00	589.48	0.00	589.60	317.92	1.78	1.63	883.42
	24.00	840.00	0.00	0.00	569.10	8000.00	592.20	0.00	592.33	400.33	1.73	1.62	1208.27
	24.60	840.00	0.00	0.00	569.10	9000.00	593.07	0.00	593.21	401.78	1.81	1.63	1372.16
	24.00	840.00	0.00	0.00	569.10	11000.00	595.09	0.00	595.25	430.15	1.78	1.71	1767.60
	24.10	290.00	0.00	0.00	571.50	5900.00	589.51	0.00	589.75	120.00	4.46	1.65	898.05
	24.10	290.00	0.00	0.00	571.50	8000.00	592.34	0.00	592.41	585.57	1.41	1.67	1238.53
	24.10	290.00	0.00	0.00	571.50	9000.00	593.22	0.00	593.29	609.02	1.42	1.67	1405.32
	24.10	290.00	0.00	0.00	571.50	11000.00	595.26	0.00	595.32	669.64	1.28	1.75	1807.90
	24.20	40.00	589.90	588.20	571.50	5900.00	589.51	0.00	589.83	120.00	14.40	1.65	899.34
	24.20	40.00	589.90	588.20	571.50	8000.00	592.28	0.00	592.54	583.83	20.23	1.67	1242.18
	24.20	40.00	589.90	588.20	571.50	9000.00	593.15	0.00	593.42	607.31	19.03	1.67	1409.41
	24.20	40.00	589.90	588.20	571.50	11000.00	595.45	0.00	595.52	675.84	1.22	1.76	1814.42
	24.30	80.00	0.00	0.00	571.50	5900.00	589.87	0.00	589.93	559.86	.96	1.66	904.20
	24.30	80.00	0.00	0.00	571.50	8000.00	592.57	0.00	592.63	649.93	.87	1.68	1249.86
	24.30	80.00	0.00	0.00	571.50	9000.00	593.44	0.00	593.51	686.51	.89	1.69	1418.02
	24.30	60.00	0.00	0.00	571.50	11000.00	595.46	0.00	595.53	723.19	.83	1.77	1828.04

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SECTION CHANNEL MIN EL OF MAX EL OF MIN EL DISCHARGE CWSEL CRIWS EG TOPWID 10K*S TIME VOL

SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
25.00	710.00	0.00	0.00	570.50	5900.00	589.90	0.00	590.08	662.06	3.18	1.72	956.91
25.00	710.00	0.00	0.00	570.50	8000.00	592.61	0.00	592.74	678.47	2.24	1.75	1331.25
25.00	710.00	0.00	0.00	570.50	9000.00	593.49	0.00	593.62	688.17	2.13	1.76	1509.32
25.00	710.00	0.00	0.00	570.50	11000.00	595.51	0.00	595.63	702.91	1.15	1.85	1943.08
25.10	1160.00	0.00	0.00	572.80	5900.00	590.25	0.00	590.32	475.61	1.29	1.87	1025.24
25.10	1160.00	0.00	0.00	572.80	8000.00	592.85	0.00	592.92	768.34	1.02	1.91	1433.48
25.10	1160.00	0.00	0.00	572.80	9000.00	593.72	0.00	593.78	807.39	.98	1.91	1623.78
25.10	1160.00	0.00	0.00	572.80	11000.00	595.70	0.00	595.76	871.01	.80	2.01	2086.65
25.20	50.00	0.00	0.00	572.80	5900.00	590.25	0.00	590.33	477.24	1.93	1.88	1028.75
25.20	50.00	0.00	0.00	572.80	8000.00	592.86	0.00	592.92	768.71	1.39	1.92	1438.93
25.20	50.00	0.00	0.00	572.80	9000.00	593.73	0.00	593.79	807.74	1.30	1.92	1630.01
25.20	50.00	0.00	0.00	572.80	11000.00	595.71	0.00	595.76	871.20	1.02	2.02	2094.80
25.21	1.00	586.00	616.00	572.80	5900.00	590.21	0.00	590.37	470.95	9.09	1.88	1028.80
25.21	1.00	586.00	616.00	572.80	8000.00	592.85	0.00	592.93	768.47	6.66	1.92	1439.02
25.21	1.00	586.00	616.00	572.80	9000.00	593.72	0.00	593.80	807.75	5.66	1.92	1630.12
25.21	1.00	586.00	616.00	572.80	11000.00	595.71	0.00	595.77	871.20	3.30	2.02	2094.95
25.29	10.00	586.00	616.00	572.80	5900.00	590.22	0.00	590.38	471.75	9.07	1.88	1029.28
25.29	10.00	586.00	616.00	572.80	8000.00	592.86	0.00	592.94	768.65	6.65	1.92	1439.85
25.29	10.00	586.00	616.00	572.80	9000.00	593.73	0.00	593.80	807.91	5.65	1.92	1631.10
25.29	10.00	586.00	616.00	572.80	11000.00	595.71	0.00	595.77	871.27	3.30	2.02	2096.30
25.30	1.00	0.00	0.00	572.80	5900.00	590.33	0.00	590.40	487.31	1.88	1.88	1029.34
25.30	1.00	0.00	0.00	572.80	8000.00	592.89	0.00	592.95	769.84	1.38	1.92	1439.94
25.30	1.00	0.00	0.00	572.80	9000.00	593.75	0.00	593.81	808.26	1.29	1.92	1631.21
25.30	1.00	0.00	0.00	572.80	11000.00	595.72	0.00	595.77	871.28	1.01	2.02	2096.45
27.00	320.00	0.00	0.00	571.00	5900.00	590.37	0.00	590.45	429.88	1.42	1.92	1050.93
27.00	320.00	0.00	0.00	571.00	8000.00	592.92	0.00	592.99	633.20	1.21	1.96	1473.30
27.00	320.00	0.00	0.00	571.00	9000.00	593.78	0.00	593.85	638.96	1.18	1.97	1669.05
27.00	320.00	0.00	0.00	571.00	11000.00	595.74	0.00	595.81	659.55	1.02	2.07	2145.03
27.10	135.00	0.00	0.00	574.60	5900.00	590.37	0.00	590.51	149.00	2.23	1.94	1058.40
27.10	135.00	0.00	0.00	574.60	8000.00	592.89	0.00	593.07	149.00	2.28	1.97	1483.72
27.10	135.00	0.00	0.00	574.60	9000.00	593.73	0.00	593.94	149.00	2.43	1.98	1680.51
27.10	135.00	0.00	0.00	574.60	11000.00	595.67	0.00	595.92	149.00	2.51	2.08	2158.90
27.11	5.00	596.30	612.00	574.60	5900.00	590.30	0.00	590.56	149.00	7.80	1.94	1059.59
27.11	5.00	596.30	612.00	574.60	8000.00	592.76	0.00	593.16	149.00	14.47	1.97	1483.94
27.11	5.00	596.30	612.00	574.60	9000.00	593.57	0.00	594.05	149.00	16.94	1.98	1680.74
27.11	5.00	596.30	612.00	574.60	11000.00	595.41	0.00	596.09	149.00	25.64	2.08	2159.15
27.19	60.00	596.30	612.00	574.60	5900.00	590.34	0.00	590.61	149.00	7.74	1.94	1060.57
27.19	60.00	596.30	612.00	574.60	8000.00	592.85	0.00	593.25	149.00	14.34	1.97	1486.12
27.19	60.00	596.30	612.00	574.60	9000.00	593.68	0.00	594.16	149.00	16.78	1.98	1682.96
27.19	60.00	596.30	612.00	574.60	11000.00	595.57	0.00	596.25	149.00	25.46	2.08	2161.44

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	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
	27.20	5.00	0.00	0.00	574.60	5900.00	590.50	0.00	590.64	149.00	2.15	1.94	1060.76
	27.20	5.00	0.00	0.00	574.60	8000.00	593.13	0.00	593.31	149.00	2.17	1.98	1486.34
	27.20	5.00	0.00	0.00	574.60	9000.00	594.04	0.00	594.24	149.00	2.28	1.98	1683.20
	27.20	5.00	0.00	0.00	574.60	11000.00	596.14	0.00	596.34	149.00	2.31	2.08	2161.70
U	29.00	1100.00	0.00	0.00	568.40	5900.00	590.81	0.00	590.92	627.47	2.83	2.07	1129.85
	29.00	1100.00	0.00	0.00	568.40	8000.00	593.48	0.00	593.56	847.33	2.10	2.13	1585.46
	29.00	1100.00	0.00	0.00	568.40	9000.00	594.41	0.00	594.49	856.39	1.98	2.14	1794.06
	29.00	1100.00	0.00	0.00	568.40	11000.00	596.55	0.00	596.61	871.14	1.60	2.25	2299.81
V	31.00	1775.00	0.00	0.00	570.00	5900.00	591.21	0.00	591.26	408.76	1.39	2.34	1281.39
	31.00	1775.00	0.00	0.00	570.00	8000.00	593.78	0.00	593.85	488.37	1.28	2.38	1802.20
	31.00	1775.00	0.00	0.00	570.00	9000.00	594.70	0.00	594.77	497.00	1.30	2.38	2036.21
	31.00	1775.00	0.00	0.00	570.00	11000.00	596.78	0.00	596.86	515.89	1.22	2.49	2601.07
	31.10	490.00	0.00	0.00	573.90	5900.00	591.17	0.00	591.58	83.56	8.24	2.36	1309.95
	31.10	490.00	0.00	0.00	573.90	8000.00	593.68	0.00	594.21	85.00	8.99	2.41	1838.79
	31.10	490.00	0.00	0.00	573.90	9000.00	594.57	0.00	595.17	85.00	9.60	2.40	2075.76
	31.10	490.00	0.00	0.00	573.90	11000.00	596.60	0.00	597.31	313.47	9.52	2.51	2648.53
	31.20	60.00	595.30	595.40	573.90	5900.00	591.22	0.00	591.63	83.61	8.14	2.37	1311.54
	31.20	60.00	595.30	595.40	573.90	8000.00	593.74	0.00	594.27	85.00	8.88	2.41	1840.67
	31.20	60.00	595.30	595.40	573.90	9000.00	594.63	0.00	595.23	85.00	9.49	2.41	2077.75
	31.20	60.00	595.30	595.40	573.90	11000.00	596.64	0.00	597.45	317.10	28.78	2.51	2650.90
	31.30	50.30	0.00	0.00	573.90	5900.00	591.43	0.00	591.71	200.92	4.86	2.37	1313.15
	31.30	50.00	0.00	0.00	573.90	8000.00	594.09	0.00	594.39	219.28	4.50	2.41	1842.71
	31.30	50.00	0.00	0.00	573.90	9000.00	595.06	0.00	595.38	224.71	4.51	2.41	2079.96
	31.30	50.00	0.00	0.00	573.90	11000.00	597.39	0.00	597.70	539.46	3.87	2.51	2653.77
W	33.00	830.00	0.00	0.00	573.50	5900.00	591.96	0.00	592.08	301.46	3.80	2.46	1352.61
	33.00	830.00	0.00	0.00	573.50	8000.00	594.60	0.00	594.72	347.19	3.20	2.50	1895.64
	33.00	830.00	0.00	0.00	573.50	9000.00	595.58	0.00	595.71	364.29	3.12	2.49	2138.25
	33.00	830.00	0.00	0.00	573.50	11000.00	597.85	0.00	597.98	441.19	2.66	2.60	2729.50
X	35.00	1690.00	0.00	0.00	572.10	5900.00	592.46	0.00	592.57	276.41	2.30	2.64	1455.88
	35.00	1690.00	0.00	0.00	572.10	8000.00	595.05	0.00	595.18	298.92	2.28	2.67	2029.86
	35.00	1690.00	0.00	0.00	572.10	9000.00	596.03	0.00	596.16	310.47	2.34	2.66	2285.00
	35.00	1690.00	0.00	0.00	572.10	11000.00	598.25	0.00	598.39	349.44	2.23	2.77	2908.13
Y	37.00	1690.00	0.00	0.00	574.70	5900.00	592.76	0.00	592.90	196.77	1.63	2.82	1557.78
	37.00	1690.00	0.00	0.00	574.70	8000.00	595.37	0.00	595.52	211.42	1.72	2.83	2156.36
	37.00	1690.00	0.00	0.00	574.70	9000.00	596.35	0.00	596.52	218.41	1.80	2.81	2421.36
	37.00	1690.00	0.00	0.00	574.70	11000.00	598.56	0.00	598.75	250.82	1.81	2.90	3068.52
Z	38.00	1100.00	0.00	0.00	573.50	5900.00	592.97	0.00	593.15	383.29	2.94	2.91	1621.03
	38.00	1100.00	0.00	0.00	573.50	8000.00	595.58	0.00	595.76	432.17	2.61	2.93	2239.71
	38.00	1100.00	0.00	0.00	573.50	9000.00	596.57	0.00	596.76	444.33	2.56	2.91	2512.90
	38.00	1100.00	0.00	0.00	573.50	11000.00	598.80	0.00	598.97	476.68	2.26	3.00	3179.15

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	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
	38.10	180.00	0.00	0.00	575.00	5900.00	593.09	0.00	593.24	222.13	4.92	2.93	1630.34
	38.10	180.00	0.00	0.00	575.00	8000.00	595.67	0.00	595.82	224.19	3.89	2.94	2252.40
	38.10	180.00	0.00	0.00	575.00	9000.00	596.65	0.00	596.82	224.98	3.74	2.92	2526.9[illegible]
	38.10	180.00	0.00	0.00	575.00	11000.00	598.84	0.00	599.02	226.73	3.27	3.02	3196.30
	38.20	30.00	623.70	613.90	575.00	5900.00	593.14	0.00	593.28	222.16	4.84	2.93	1631.68
	38.20	30.00	623.70	613.90	575.00	8000.00	595.71	0.00	595.87	224.23	3.84	2.94	2254.13
	38.20	30.00	623.70	613.90	575.00	9000.00	596.70	0.00	596.86	225.02	3.70	2.93	2528.84
	38.20	30.00	623.70	613.90	575.00	11000.00	598.89	0.00	599.07	226.78	3.23	3.02	3198.53
	38.30	100.00	0.00	0.00	575.00	5900.00	593.29	0.00	593.33	430.77	1.23	2.95	1638.81
	38.30	100.00	0.00	0.00	575.00	8000.00	595.87	0.00	595.92	442.01	1.16	2.96	2263.22
	38.30	100.00	0.00	0.00	575.00	9000.00	596.87	0.00	596.92	446.34	1.17	2.94	2538.68
	38.30	100.00	0.00	0.00	575.00	11000.00	599.08	0.00	599.13	456.83	1.11	3.04	3210.08
AA	40.00	1240.00	0.00	0.00	575.10	5900.00	593.46	0.00	593.52	459.83	1.76	3.15	1759.04
	40.00	1240.00	0.00	0.00	575.10	8000.00	596.03	0.00	596.09	473.78	1.56	3.15	2416.59
	40.00	1240.00	0.00	0.00	575.10	9000.00	597.03	0.00	597.09	478.56	1.54	3.13	2705.10
	40.00	1240.00	0.00	0.00	575.10	11000.00	599.22	0.00	599.29	490.13	1.40	3.22	3405.81
AB	42.00	1225.00	0.00	0.00	575.90	5900.00	593.70	0.00	593.78	699.32	2.41	3.32	1877.[illegible]6
	42.00	1225.00	0.00	0.00	575.90	8000.00	596.23	0.00	596.29	719.11	1.75	3.35	2576.98
	42.00	1225.00	0.00	0.00	575.90	9000.00	597.22	0.00	597.28	724.61	1.62	3.33	2882.21
	42.00	1225.00	0.00	0.00	575.90	11000.00	599.40	0.00	599.45	736.68	1.32	3.43	3620.24
AC	44.00	2750.00	0.00	0.00	575.80	5900.00	594.16	0.00	594.19	973.19	1.92	3.75	2058.75
	44.00	2750.00	0.00	0.00	575.80	8000.00	596.54	0.00	596.56	990.02	1.29	3.80	2827.04
	44.00	2750.00	0.00	0.00	575.80	9000.00	597.50	0.00	597.53	996.84	1.16	3.77	3160.08
	44.00	2750.00	0.00	0.00	575.80	11000.00	599.62	0.00	599.64	1011.71	.91	3.88	3959.69
	44.10	860.00	0.00	0.00	575.80	5900.00	594.24	0.00	594.27	973.77	1.42	3.86	2113.96
	44.10	860.00	0.00	0.00	575.80	8000.00	595.59	0.00	596.62	990.36	.98	3.91	2902.52
	44.10	860.00	0.00	0.00	575.80	9000.00	597.55	0.00	597.57	997.10	.89	3.89	3243.91
	44.10	860.00	0.00	0.00	575.80	11000.00	599.66	0.00	599.68	1011.96	.70	3.99	4062.08
	44.20	100.00	0.00	0.00	578.90	5900.00	594.18	0.00	594.43	137.40	7.86	3.87	2122.41
	44.20	100.00	0.00	0.00	578.90	8000.00	596.50	0.00	596.81	137.40	8.05	3.92	2913.99
	44.20	100.00	0.00	0.00	578.90	9000.00	597.44	0.00	597.78	137.40	8.30	3.90	3256.62
	44.20	100.00	0.00	0.00	578.90	11000.00	599.53	0.00	599.91	137.40	8.26	4.00	4077.55
	44.21	5.00	606.30	616.00	578.90	5900.00	594.18	0.00	594.43	137.40	7.86	3.87	2122.58
	44.21	5.00	606.30	616.00	578.90	8000.00	596.51	0.00	596.81	137.40	8.05	3.92	2914.19
	44.21	5.00	606.30	616.00	578.90	9000.00	597.45	0.00	597.79	137.40	8.29	3.90	3256.84
	44.21	5.00	606.30	616.00	578.90	11000.00	599.53	0.00	599.92	137.40	8.26	4.00	4077.80
	44.29	70.00	606.30	616.00	578.90	5900.00	594.24	0.00	594.49	137.40	7.74	3.88	2124.96
	44.29	70.00	606.30	616.00	578.90	8000.00	596.56	0.00	596.87	137.40	7.95	3.92	2917.09
	44.29	70.00	606.30	616.00	578.90	9000.00	597.51	0.00	597.85	137.40	8.19	3.90	3259.95
	44.29	70.00	606.30	616.00	578.90	11000.00	599.60	0.00	599.98	137.40	8.17	4.00	4081.37

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SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL

	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
	44.30	5.00	0.00	0.00	578.90	5900.00	594.25	0.00	594.49	137.40	7.73	3.88	2125.13
	44.30	5.00	0.00	0.00	578.90	8000.00	596.57	0.00	596.87	137.40	7.94	3.92	2917.30
	44.30	5.00	0.00	0.00	578.90	9000.00	597.51	0.00	597.85	137.40	8.19	3.90	3260.17
	44.30	5.00	0.00	0.00	578.90	11000.00	599.60	0.00	599.98	137.40	8.17	4.00	4081.63
AD	46.00	500.00	0.00	0.00	575.90	5900.00	594.63	0.00	594.71	524.03	2.41	3.94	2151.17
	46.00	500.00	0.00	0.00	575.90	8000.00	597.01	0.00	597.09	547.60	1.96	3.99	2951.35
	46.00	500.00	0.00	0.00	575.90	9000.00	597.99	0.00	598.06	554.94	1.85	3.97	3297.57
	46.00	500.00	0.00	0.00	575.90	11000.00	600.12	0.00	600.19	570.50	1.56	4.07	4126.47
AE	48.00	1635.00	0.00	0.00	579.30	5900.00	595.08	0.00	595.27	320.70	6.86	4.06	2234.85
	48.00	1635.00	0.00	0.00	579.30	8000.00	597.36	0.00	597.54	337.26	5.80	4.11	3062.31
	48.00	1635.00	0.00	0.00	579.30	9000.00	598.31	0.00	598.49	344.19	5.53	4.08	3420.16
	48.00	1635.00	0.00	0.00	579.30	11000.00	600.37	0.00	600.55	359.21	4.76	4.19	4274.93
AF	50.00	2010.00	0.00	0.00	581.10	5900.00	595.82	0.00	595.88	779.23	2.05	4.34	2358.52
	50.00	2010.00	0.00	0.00	581.10	8000.00	597.99	0.00	598.05	804.33	1.71	4.40	3224.62
	50.00	2010.00	0.00	0.00	581.10	9000.00	598.91	0.00	598.97	815.40	1.62	4.37	3599.23
	50.00	2010.00	0.00	0.00	581.10	11000.00	600.90	0.00	600.96	852.42	1.39	4.48	4490.93
AG	52.00	1860.00	0.00	0.00	582.90	5900.00	596.43	0.00	596.60	324.62	9.14	4.51	2513.64
	52.00	1860.00	0.00	0.00	582.90	8000.00	598.48	0.00	598.66	382.86	7.60	4.56	3430.22
	52.00	1860.00	0.00	0.00	582.90	9000.00	599.37	0.00	599.55	406.60	7.09	4.53	3827.53
	52.00	1860.00	0.00	0.00	582.90	11000.00	601.28	0.00	601.45	470.39	5.84	4.64	4769.97
AH	54.00	1930.00	0.00	0.00	581.70	5900.00	597.59	0.00	597.74	645.55	5.28	4.68	2604.30
	54.00	1930.00	0.00	0.00	581.70	8000.00	599.44	0.00	599.57	690.21	4.32	4.74	3550.46
	54.00	1930.00	0.00	0.00	581.70	9000.00	600.26	0.00	600.38	703.94	3.97	4.71	3961.43
	54.00	1930.00	0.00	0.00	581.70	11000.00	602.02	0.00	602.12	730.27	3.21	4.83	4934.39
AI	56.00	1030.00	0.00	0.00	583.50	5900.00	597.98	0.00	598.01	1199.91	1.70	4.89	2697.18
	56.00	1030.00	0.00	0.00	583.50	8000.00	599.76	0.00	599.78	1221.98	1.36	4.96	3677.52
	56.00	1030.00	0.00	0.00	583.50	9000.00	600.56	0.00	600.58	1303.05	1.25	4.94	4104.52
	56.00	1030.00	0.00	0.00	583.50	11000.00	602.26	0.00	602.28	1361.97	1.01	5.06	5113.13
AJ	58.00	1160.00	0.00	0.00	581.50	5400.00	597.80	0.00	598.70	158.03	29.94	4.93	2770.56
	58.00	1160.00	0.00	0.00	581.50	7200.00	599.44	0.00	600.41	258.45	29.26	5.03	3775.37
	58.00	1160.00	0.00	0.00	581.50	8100.00	600.22	0.00	601.17	305.98	27.49	4.97	4214.27
	58.00	1160.00	0.00	0.00	581.50	9850.00	601.96	0.00	602.75	394.09	20.94	5.10	5250.19
	58.10	55.00	0.00	0.00	582.30	5400.00	597.95	0.00	598.88	68.00	29.07	4.93	2771.52
	58.10	55.00	0.00	0.00	582.30	7200.00	599.57	0.00	600.59	188.68	27.10	5.00	3776.76
	58.10	55.00	0.00	0.00	582.30	8100.00	600.31	0.00	601.38	218.09	26.77	4.97	4215.90
	58.10	55.00	0.00	0.00	582.30	9850.00	601.97	0.00	602.98	284.68	22.85	5.11	5252.47
	58.20	16.00	598.00	603.20	582.30	5400.00	598.39	0.00	599.17	142.04	22.79	4.94	2771.81
	58.20	16.00	598.00	603.20	582.30	7200.00	599.97	0.00	600.90	204.87	23.66	5.00	3777.16
	58.20	16.00	598.00	603.20	582.30	8100.00	600.63	0.00	601.61	231.03	24.02	4.98	4216.35
	58.20	16.00	598.00	603.20	582.30	9850.00	602.02	0.00	603.02	287.89	22.48	5.11	5253.06

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	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
	58.30	50.00	0.00	0.00	582.30	5400.00	598.52	0.00	599.27	154.81	17.33	4.94	2772.80
	58.30	50.00	0.00	0.00	582.30	7200.00	600.10	0.00	601.01	224.44	18.04	5.00	3778.48
	58.30	50.00	0.00	0.00	582.30	8100.00	600.76	0.00	601.72	253.87	18.34	4.98	4217.84
	58.30	50.00	0.00	0.00	582.30	9850.00	602.14	0.00	603.12	324.68	17.30	5.11	5254.98
AK	59.00	1155.00	0.00	0.00	582.80	5400.00	599.66	0.00	599.70	669.83	1.29	5.18	[illegible]
	59.00	1155.00	0.00	0.00	582.80	7200.00	601.42	0.00	601.46	695.61	1.34	5.22	3866.61
	59.00	1155.00	0.00	0.00	582.80	8100.00	602.15	0.00	602.19	703.60	1.38	5.19	4315.50
	59.00	1155.00	0.00	0.00	582.80	9850.00	603.54	0.00	603.59	718.98	1.41	5.31	5360.36
AL	60.00	1035.00	0.00	0.00	582.20	5400.00	599.80	0.00	599.91	694.24	2.95	5.30	[illegible]
	60.00	1035.00	0.00	0.00	582.20	7200.00	601.56	0.00	601.67	704.50	2.66	5.35	[illegible]
	60.00	1035.00	0.00	0.00	582.20	8100.00	602.29	0.00	602.40	708.35	2.62	5.32	[illegible]
	60.00	1035.00	0.00	0.00	582.20	9850.00	603.69	0.00	603.80	715.71	2.50	5.44	[illegible]
AM	62.00	2080.00	0.00	0.00	584.30	5400.00	600.31	0.00	600.36	819.84	2.71	5.57	3072.99
	62.00	2080.00	0.00	0.00	584.30	7200.00	602.00	0.00	602.05	832.70	2.27	5.61	4160.67
	62.00	2080.00	0.00	0.00	584.30	8100.00	602.71	0.00	602.76	838.15	2.16	5.57	4635.01
	62.00	2080.00	0.00	0.00	584.30	9850.00	604.08	0.00	604.13	848.72	1.97	5.68	5741.00
AN	64.00	1460.00	0.00	0.00	583.90	5400.00	600.69	0.00	600.80	616.87	3.60	5.72	3178.67
	64.00	1460.00	0.00	0.00	583.90	7200.00	602.31	0.00	602.41	633.00	3.25	5.77	[illegible]
	64.00	1460.00	0.00	0.00	583.90	8100.00	603.01	0.00	603.10	640.06	3.09	5.73	[illegible]
	64.00	1460.00	0.00	0.00	583.90	9850.00	604.34	0.00	604.44	652.65	2.79	5.85	5920.77
	64.10	1000.00	0.00	0.00	583.80	5400.00	601.03	0.00	601.25	341.96	5.58	5.79	3228.24
	64.10	1000.00	0.00	0.00	583.80	7200.00	602.59	0.00	602.83	391.42	[illegible]	5.84	4362.71
	64.10	1000.00	0.00	0.00	583.80	8100.00	603.27	0.00	603.53	412.49	6.15	5.80	4857.73
	64.10	1000.00	0.00	0.00	583.80	9850.00	604.57	0.00	604.83	439.70	6.03	5.91	6003.91
	64.20	100.00	0.00	0.00	583.80	5400.00	601.02	0.00	601.41	88.58	7.43	5.80	3231.72
	64.20	100.00	0.00	0.00	583.80	7200.00	602.55	0.00	603.09	89.57	9.31	5.84	4367.00
	64.20	100.00	0.00	0.00	583.80	8100.00	603.20	0.00	603.82	90.00	10.25	5.80	4862.41
	64.20	100.00	0.00	0.00	583.80	9850.00	604.45	0.00	605.22	90.00	11.65	5.91	6009.35
	64.30	38.00	607.50	603.20	583.80	5400.00	601.06	0.00	601.44	88.60	7.38	5.80	3232.67
	64.30	38.00	607.50	603.20	583.80	7200.00	602.59	0.00	[illegible]	89.60	9.22	5.84	4368.07
	64.30	38.00	607.50	603.20	583.80	8100.00	603.26	0.00	603.88	90.00	22.52	5.80	4863.53
	64.30	38.00	607.50	603.20	583.80	9850.00	604.46	0.00	605.38	90.00	33.58	5.91	6010.52
	64.40	50.00	0.00	0.00	583.80	5400.00	601.34	0.00	601.54	354.76	5.03	5.86	3234.47
	64.40	50.00	0.00	0.00	583.80	7200.00	603.08	0.00	603.29	406.50	5.17	5.85	[illegible]
	64.40	50.00	0.00	0.00	583.80	8100.00	603.88	0.00	604.09	430.37	5.06	5.81	4866.01
	64.40	50.00	0.00	0.00	583.80	9850.00	605.50	0.00	605.71	449.33	4.55	5.92	6013.42
AO	66.00	410.00	0.00	0.00	584.30	5120.00	601.66	0.00	601.70	603.90	2.47	5.88	3263.50
	66.00	410.00	0.00	0.00	584.30	6800.00	603.40	0.00	603.44	621.59	2.25	5.93	4407.53
	66.00	410.00	0.00	0.00	584.30	7570.00	604.20	0.00	604.24	625.68	2.10	5.89	4907.12
	66.00	410.00	0.00	0.00	584.30	9170.00	605.80	0.00	605.84	633.93	1.85	6.00	6062.67

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GR	622
GR	608
GR	595.4
GR	615
NC	.05
X1	88.1
X3	1
GR	620
GR	606
GR	594.9
GR	616
GR	626
SB	
X1	88.2
X2	
X3	10
BT	20
BT	190
BT	616
BT	615.7
BT	520
BT	623.5
BT	627.6
NC	.05
X1	88.3
GR	622
GR	608
GR	597.9
GR	624
NC	.05
X1	88.4
X3	10
GR	622
GR	607.5
GR	597.9
GR	620.6
SB	.95
X1	88.5
X2	
X3	10
BT	11
BT	70
BT	620.5
BT	620.6
NC	
X1	88.6
NC	.05
X1	89
GR	620
GR	610
GR	604.6
GR	597.6
EJ	
T1	TY
T2	TO
T3	S
J1	-10
J2	2
T1	TY
T2	TO
T3	S
J1	-10
J2	3
T1	TY
T2	TO

	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
	68.00	535.00	0.00	0.00	585.20	5120.00	601.76	0.00	601.79	838.79	1.85	5.98	3307.81
AP	68.00	535.00	0.00	0.00	585.20	6800.00	603.49	0.00	603.52	847.45	1.53	6.02	4463.70
	68.00	535.00	0.00	0.00	585.20	7570.00	604.28	0.00	604.31	851.41	1.41	5.98	4968.77
	68.00	535.00	0.00	0.00	585.20	9170.00	605.88	0.00	605.91	859.40	1.21	6.09	6135.46
AQ	70.00	1680.00	0.00	0.00	586.80	5120.00	602.01	0.00	602.04	1255.09	1.65	6.27	3461.91
	70.00	1680.00	0.00	0.00	586.80	6800.00	603.68	0.00	603.70	1275.94	1.05	6.36	4675.23
	70.00	1680.00	0.00	0.00	586.80	7570.00	604.45	0.00	604.47	1290.40	.88	6.34	5207.00
	70.00	1680.00	0.00	0.00	586.80	9170.00	606.01	0.00	606.03	1327.23	.64	6.48	6428.51
	70.10	700.00	0.00	0.00	587.10	5120.00	602.12	0.00	602.18	1145.55	2.20	6.38	3529.11
	70.10	700.00	0.00	0.00	587.10	6800.00	603.75	0.00	603.80	1157.16	1.68	6.49	4774.46
	70.10	700.00	0.00	0.00	587.10	7570.00	604.51	0.00	604.55	1162.57	1.47	6.47	5321.24
	70.10	700.00	0.00	0.00	587.10	9170.00	606.06	0.00	606.09	1175.02	1.13	6.62	6573.76
	70.20	100.00	0.00	0.00	587.10	5120.00	601.94	0.00	602.32	96.00	8.20	6.38	3534.75
	70.20	100.00	0.00	0.00	587.10	6800.00	603.46	0.00	603.97	96.00	9.45	6.49	4782.41
	70.20	100.00	0.00	0.00	587.10	7570.00	604.18	0.00	604.74	96.00	9.77	6.48	5330.28
	70.20	100.00	0.00	0.00	587.10	9170.00	606.07	0.00	606.11	1121.37	1.23	6.64	6592.73
	70.21	5.00	602.20	616.50	587.10	5120.00	601.92	0.00	602.34	96.00	4.00	6.38	3534.86
	70.21	5.00	602.20	616.50	587.10	6800.00	603.41	0.00	604.03	96.00	12.01	6.49	4782.54
	70.21	5.00	602.20	616.50	587.10	7570.00	604.08	0.00	604.85	96.00	14.72	6.48	5330.42
	70.21	5.00	602.20	616.50	587.10	9170.00	605.54	0.00	606.64	96.00	21.11	6.64	6593.26
	70.29	82.50	602.20	616.50	587.10	5120.00	601.96	0.00	602.38	96.00	3.95	6.39	3536.72
	70.29	82.50	602.20	616.50	587.10	6800.00	603.51	0.00	604.13	96.00	11.99	6.50	4784.58
	70.29	82.50	602.20	616.50	587.10	7570.00	604.20	0.00	604.97	96.00	14.69	6.48	5332.46
	70.29	82.50	602.20	616.50	587.10	9170.00	605.72	0.00	606.81	96.00	21.06	6.64	6595.33
	70.30	5.00	0.00	0.00	587.10	5120.00	602.03	0.00	602.40	96.00	7.98	6.39	3536.84
	70.30	5.00	0.00	0.00	587.10	6800.00	603.69	0.00	604.18	96.00	8.91	6.50	4784.71
	70.30	5.00	0.00	0.00	587.10	7570.00	604.51	0.00	605.04	96.00	9.02	6.48	5332.60
	70.30	5.00	0.00	0.00	587.10	9170.00	607.12	0.00	607.14	1124.53	.61	6.64	6595.92
	70.40	100.00	0.00	0.00	587.10	5120.00	602.45	0.00	602.49	1147.84	1.48	6.41	3542.90
	70.40	100.00	0.00	0.00	587.10	6800.00	604.26	0.00	604.29	1160.75	1.01	6.52	4793.36
	70.40	100.00	0.00	0.00	587.10	7570.00	605.14	0.00	605.16	1166.99	.84	6.50	5342.50
	70.40	100.00	0.00	0.00	587.10	9170.00	607.12	0.00	607.14	1204.67	.56	6.67	6617.68
AR	72.00	660.00	0.00	0.00	587.20	5120.00	602.56	0.00	602.62	842.98	2.27	6.52	3603.43
	72.00	660.00	0.00	0.00	587.20	6800.00	604.34	0.00	604.38	879.19	1.54	6.64	4881.29
	72.00	660.00	0.00	0.00	587.20	7570.00	605.20	0.00	605.23	893.31	1.29	6.63	5443.95
	72.00	660.00	0.00	0.00	587.20	9170.00	607.17	0.00	607.19	919.63	.88	6.81	6750.41
AS	74.00	2275.00	0.00	0.00	587.70	5120.00	602.98	0.00	603.07	1185.73	3.47	6.73	3726.11
	74.00	2275.00	0.00	0.00	587.70	6800.00	604.61	0.00	604.67	1194.20	2.34	6.90	5060.12
	74.00	2275.00	0.00	0.00	587.70	7570.00	605.43	0.00	605.47	1198.43	1.90	6.92	5650.87
	74.00	2275.00	0.00	0.00	587.70	9170.00	607.32	0.00	607.35	1208.24	1.21	7.14	7022.83

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	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
AT	76.00	1685.00	0.00	0.00	587.50	4500.00	603.37	0.00	603.40	1151.67	1.36	7.07	3860.85
	76.00	1685.00	0.00	0.00	587.50	6250.00	604.88	0.00	604.90	1192.12	1.07	7.26	5254.77
	76.00	1685.00	0.00	0.00	587.50	7[illegible]00.00	605.65	0.00	605.67	1218.59	.94	7.28	5876.38
	76.00	1685.00	0.00	0.00	587.50	9000.00	607.46	0.00	607.48	1272.97	.68	7.53	7321.54
AU	78.00	1710.00	0.00	0.00	591.70	4500.00	603.58	0.00	603.61	1473.72	1.48	7.44	4019.75
	78.00	1710.00	0.00	0.00	591.70	6250.00	605.05	0.00	605.07	1864.02	1.20	7.65	5479.13
	78.00	1710.00	0.00	0.00	591.70	7100.00	605.79	0.00	605.81	1888.20	1.04	7.70	6136.40
	78.00	1710.00	0.00	0.00	591.70	9000.00	607.56	0.00	607.58	1945.79	.73	7.99	7668.17
AV	79.00	1200.00	0.00	0.00	591.50	4500.00	603.62	0.00	604.21	138.86	18.32	7.50	4106.16
	79.00	1200.00	0.00	0.00	591.50	6250.00	604.98	0.00	605.62	632.53	18.32	7.71	5609.41
	79.00	1200.00	0.00	0.00	591.50	7100.00	605.74	0.00	606.28	592.67	15.33	7.76	6292.88
	79.00	1200.00	0.00	0.00	591.50	9000.00	607.59	0.00	607.86	[illegible]222.76	8.47	8.08	7895.93
	79.10	770.00	0.00	0.00	592.00	4500.00	604.72	0.00	604.90	657.17	6.01	7.55	4123.12
	79.10	770.00	0.00	0.00	592.00	6250.00	606.09	0.00	606.26	686.93	5.40	7.77	5636.15
	79.10	770.00	0.00	0.00	592.00	7100.00	606.69	0.00	606.85	793.80	5.15	7.82	6326.17
	79.10	770.00	0.00	0.00	592.00	9090.00	608.11	0.00	608.24	1043.82	4.19	8.14	7952.11
	79.20	5.00	0.00	0.00	596.73	4500.00	604.71	0.00	604.91	657.16	11.44	7.55	4123.34
	79.20	5.00	0.00	0.00	596.73	6250.00	606.10	0.00	606.27	687.99	8.50	7.77	5636.48
	79.20	5.00	0.00	0.00	596.73	7100.00	606.70	0.00	606.85	794.72	7.67	7.82	6326.55
	79.20	5.00	0.00	0.00	596.73	9000.00	608.12	0.00	608.25	1044.93	5.62	8.14	7952.64
	79.30	5.00	0.00	0.00	592.00	4500.00	604.74	0.00	604.92	657.41	5.92	7.55	4123.57
	79.30	5.00	0.00	0.00	592.00	6250.00	606.10	0.00	606.27	688.62	5.37	7.77	5636.81
	79.30	5.00	0.00	0.00	592.00	7100.00	606.70	0.00	606.86	795.30	5.13	7.82	6326.93
	79.30	5.00	0.00	0.00	592.00	9000.00	608.12	0.00	608.25	1045.24	4.17	8.14	7953.17
AW	80.00	705.00	0.00	0.00	592.20	4500.00	605.15	0.00	605.37	443.47	8.33	7.61	4147.55
	80.00	705.00	0.00	0.00	592.20	6250.00	606.46	0.00	606.67	450.14	8.14	7.82	5668.03
	80.00	705.00	0.00	0.00	592.20	7100.00	607.03	0.00	607.25	452.12	8.04	7.86	6361.34
	80.00	705.00	0.00	0.00	592.20	9000.00	608.37	0.00	608.58	599.12	7.25	8.19	7995.22
	80.10	100.00	0.00	0.00	591.80	4500.00	605.23	0.00	605.45	428.80	7.97	7.61	4151.75
	80.10	100.00	0.00	0.00	591.80	6250.00	606.54	0.00	606.76	436.43	8.02	7.82	5673.55
	80.10	100.00	0.00	0.00	591.80	7100.00	607.11	0.00	607.33	439.78	8.01	7.87	6367.44
	80.10	100.00	0.00	0.00	591.80	9000.00	608.44	0.00	608.66	448.22	7.47	8.20	8002.73
	80.20	5.00	602.00	608.30	591.80	4500.00	605.24	0.00	605.45	428.80	7.97	7.61	4151.95
	80.20	5.00	602.00	608.30	591.80	6250.00	606.54	0.00	606.76	436.43	8.02	7.82	5673.82
	80.20	5.00	602.00	608.30	591.80	7100.00	607.11	0.00	607.33	439.78	8.01	7.87	6367.74
	80.20	5.00	602.00	608.30	591.60	9000.00	608.53	0.00	608.68	448.67	10.60	8.20	8003.10
	80.30	50.00	0.00	0.00	591.80	4500.00	605.26	0.00	605.50	429.03	8.47	7.62	4154.04
	80.30	50.00	0.00	0.00	591.80	6250.00	606.57	0.00	606.81	436.64	8.78	7.83	5676.55
	80.30	50.00	0.00	0.00	591.80	7100.00	607.14	0.00	607.39	439.98	8.85	7.88	63[illegible]0.76
	80.30	50.00	0.00	0.00	591.60	9000.00	608.52	0.00	606.76	448.61	8.26	8.20	8006.82

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	SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
AX	82.00	1390.00	0.00	0.00	594.10	4500.00	606.04	0.00	606.16	690.31	3.19	7.76	4213.60
	82.00	1390.00	0.00	0.00	594.10	6250.00	607.35	0.00	607.47	700.10	3.27	7.96	5755.25
	82.00	1390.00	0.00	0.00	594.10	7100.00	607.91	0.00	606.05	704.36	3.28	8.01	6457.92
	82.00	1390.00	0.00	0.00	594.10	9000.00	609.24	0.00	609.37	714.28	3.09	8.33	8114.18
AY	85.00	1590.00	0.00	0.00	593.50	4500.00	606.66	0.00	607.23	203.83	16.76	7.83	4264.31
	85.00	1590.00	0.00	0.00	593.50	6250.00	607.69	0.00	608.65	212.19	20.03	8.02	5821.09
	85.00	1590.00	0.00	0.00	593.50	7100.00	608.42	0.00	609.25	215.78	21.26	8.07	6530.41
	85.00	1590.00	0.00	0.00	593.50	9000.00	609.62	0.00	610.56	223.90	22.52	8.39	8202.26
AZ	87.00	1260.00	0.00	0.00	595.40	4500.00	608.31	0.00	608.46	343.03	5.97	7.95	4305.75
	87.00	1260.00	0.00	0.00	595.40	6250.00	609.79	0.00	609.96	352.63	5.92	8.14	5873.68
	87.00	1260.00	0.00	0.00	595.40	7100.00	610.42	0.00	610.60	358.80	5.94	8.18	6587.87
	87.00	1260.00	0.00	0.00	595.40	9000.00	611.74	0.00	611.94	374.00	5.91	8.49	8270.53
BA	88.00	815.00	0.00	0.00	595.40	4500.00	608.79	0.00	609.03	297.59	7.56	8.01	4337.06
	88.00	815.00	0.00	0.00	595.40	6250.00	610.27	0.00	610.51	316.09	7.28	8.20	5914.01
	88.00	815.00	0.00	0.00	595.40	7100.00	610.89	0.00	611.15	324.72	7.13	8.24	6632.16
	88.00	815.00	0.00	0.00	595.40	9000.00	612.20	0.00	612.47	345.83	6.71	8.55	8323.46
	88.10	200.00	0.00	0.00	594.00	4500.00	608.83	0.00	609.24	61.00	7.84	8.03	4342.26
	88.10	200.00	0.00	0.00	594.00	6250.00	610.16	0.00	610.82	61.00	11.51	8.21	5920.43
	88.10	200.00	0.00	0.00	594.00	7100.00	610.71	0.00	611.50	61.00	3.37	8.24	6639.12
	88.10	200.00	0.00	0.00	594.00	9000.00	611.81	0.00	612.93	61.00	17.55	8.56	8331.58
	88.20	45.00	616.00	615.70	594.00	4500.00	608.87	0.00	609.27	61.00	7.77	8.03	4343.16
	88.20	45.00	616.00	615.70	594.00	6250.00	610.21	0.00	610.87	61.00	11.37	8.21	5921.42
	88.20	45.00	616.00	615.70	594.00	7100.00	610.77	0.00	611.56	61.00	13.19	8.25	6640.15
	88.20	45.00	616.00	615.70	594.00	9000.00	611.90	0.00	613.01	61.00	17.26	8.56	8332.67
	88.30	130.00	0.00	0.00	597.00	4500.00	609.18	0.00	609.39	276.92	6.94	8.04	4346.64
	88.30	130.00	0.00	0.00	597.00	6250.00	610.81	0.00	611.02	289.47	6.45	8.22	5925.71
	88.30	130.00	0.00	0.00	597.00	7100.00	611.51	0.00	611.73	294.90	6.28	8.26	6644.79
	88.30	130.00	0.00	0.00	597.00	9000.00	612.99	0.00	613.22	306.31	5.91	8.57	8338.08
	88.40	210.00	0.00	0.00	597.00	4500.00	609.29	0.00	609.80	117.30	19.70	8.05	4352.02
	88.40	210.00	0.00	0.00	597.00	6250.00	610.86	0.00	611.50	121.53	19.63	8.23	5932.65
	88.40	210.00	0.00	0.00	597.00	7100.00	611.54	0.00	612.24	123.37	19.71	8.26	6652.43
	88.40	210.00	0.00	0.00	597.00	9000.00	612.96	0.00	613.79	127.22	19.68	8.57	8347.23
	88.50	40.00	620.50	617.30	597.00	4500.00	609.32	0.00	609.82	117.37	19.46	8.05	4352.74
	88.50	40.00	620.50	617.30	597.00	6250.00	610.69	0.00	611.53	121.63	19.37	8.23	5933.55
	88.50	40.00	620.50	617.30	597.00	7100.00	611.57	0.00	612.27	123.47	19.45	8.27	6653.40
	88.50	40.00	620.50	617.30	597.00	9000.00	613.01	0.00	613.82	127.34	19.42	8.58	8348.37
	88.60	100.00	0.00	0.00	597.00	4500.00	609.65	0.00	610.03	267.92	6.60	8.06	4355.37
	88.60	100.00	0.00	0.00	597.00	6250.00	611.58	0.00	611.77	285.85	6.23	8.24	5936.95
	88.60	100.00	0.00	0.00	597.00	7100.00	612.34	0.00	612.52	293.65	6.08	8.27	6657.15
	88.60	100.00	0.00	0.00	597.00	9000.00	613.91	0.00	614.11	309.97	5.75	8.58	8352.86

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SECTION NUMBER	CHANNEL LENGTH	MIN EL OF ROADWAY	MAX EL OF LOW CHORD	MIN EL GROUND	DISCHARGE (CFS)	CWSEL	CRIWS	EG	TOPWID	10K*S	TIME	VOL
89.00	420.00	0.00	0.00	596.10	4500.00	610.10	0.00	610.26	266.51	4.53	8.10	4370.29
88 89.00	420.00	0.00	0.00	596.10	6250.00	611.80	0.00	611.98	278.59	4.43	8.27	5956.42
89.00	420.00	0.00	0.00	596.10	7100.00	612.55	0.00	612.74	284.53	4.38	8.31	6678.68
89.00	420.00	0.00	0.00	596.10	9000.00	614.11	0.00	614.32	297.55	4.22	8.62	8378.89

SECTION NUMBER	DISCHARGE CFS	CWSEL	CWSEL DIFF EACH Q	CWSEL DIFF EACH SECTION	CWSEL-WSELK	TOPWID	T.W. DIFF	LENGTH
.100	5900.000	577.170	0.000	0.000	0.000	116.987	0.000	-0.000
.100	8000.000	578.170	[illegible]	0.000	0.000	117.792	-.805	-0.000
.100	9000.000	578.510	.340	0.000	0.000	118.066	-1.078	-0.000
.100	11000.000	579.230	.720	0.000	0.000	118.645	-1.657	-0.000
.200	5900.000	577.081	0.000	-.089	0.000	83.000	0.000	50.000
.200	8000.000	578.020	.939	-.150	0.000	83.000	0.000	50.000
.200	9000.000	578.324	.305	-.186	0.000	83.000	0.000	50.000
.200	11000.000	578.966	.642	-.264	0.000	83.000	0.000	50.000
.300	5900.000	577.137	0.000	.056	0.000	83.000	0.000	43.000
.300	8000.000	578.106	.969	.046	0.000	83.000	0.000	43.000
.300	9000.000	578.429	.323	.105	0.000	83.000	0.000	43.000
.300	11000.000	579.557	1.128	.590	0.000	83.000	0.000	43.000
.400	5900.000	577.510	0.000	.373	0.000	117.261	0.000	50.000
.400	8000.000	578.702	1.193	.597	0.000	118.221	-.960	50.000
.400	9000.000	579.156	.454	.727	0.000	118.588	-1.327	50.000
.400	11000.000	580.488	1.331	.931	0.000	119.660	-2.399	50.000
.500	5900.000	577.776	0.000	.266	0.000	117.475	0.000	425.000
.500	8000.000	579.065	1.289	.363	0.000	118.512	-1.038	425.000
.500	9000.000	579.570	.505	.414	0.000	118.919	-1.444	425.000
.500	11000.000	580.949	1.379	.461	0.000	120.028	-2.553	425.000
.600	5900.000	577.748	0.000	-.028	0.000	82.000	0.000	50.000
.600	8000.000	579.009	1.261	-.056	0.000	82.000	0.000	50.000
.600	9000.000	579.498	.489	-.072	0.000	82.000	0.000	50.000
.600	11000.000	580.841	1.343	-.108	0.000	82.000	0.000	50.000
.700	5900.000	577.782	0.000	.034	0.000	82.000	0.000	42.000
.700	8000.000	579.059	1.277	.049	0.000	82.000	0.000	42.000
.700	9000.000	579.556	.497	.058	0.000	82.000	0.000	42.000
.700	11000.000	580.911	1.355	.070	0.000	82.000	0.000	42.000
.800	5900.000	577.819	0.000	.037	0.000	104.865	0.000	50.000
.800	8000.000	579.146	1.327	.087	0.000	108.435	-3.570	50.000
.800	9000.000	579.674	.528	.116	0.000	109.856	-4.992	50.000
.800	11000.000	581.107	1.433	.196	0.000	113.711	-8.846	50.000
2.000	5900.000	578.377	0.000	.559	0.000	106.360	0.000	750.000
2.000	8000.000	579.888	1.511	.743	0.000	110.459	-4.099	750.000
2.000	9000.000	580.508	.619	[illegible]	0.000	112.100	-5.740	750.000
2.000	11000.000	582.019	1.511	[illegible]	0.000	126.275	-19.914	750.000
2.100	5900.000	578.779	0.000	.402	0.000	107.449	0.000	610.000
2.100	8000.000	580.409	1.630	.521	0.000	111.834	-4.385	610.000
2.100	9000.000	581.087	.678	.579	0.000	113.659	-6.209	610.000
2.100	11000.000	582.649	1.562	.631	0.000	138.279	-30.830	610.000
2.200	5900.000	578.822	0.000	.043	0.000	102.000	0.000	50.000
2.200	8000.000	580.464	1.642	.055	0.000	102.000	0.000	50.000
2.200	9000.000	581.146	.682	.059	0.000	102.000	0.000	50.000

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ATTACHMENT B

HEC-2 Code with Existing Cross-Sections

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T1      Type 19 FIS
T2      Toledo Ohio 1 Year
T3      Swan Creek
J1   -10       2                                                  576.03
J2     1              -1
J3    38      39      42      43       1      67      69      26
NC  0.05    0.05    0.04       1     0.3
QT     7    2905    3811    5900    8000    9000   11000    9000
X1   0.1      11             115
GR   590       0   563.1       0   562.1      10   562.1      57   564.6      67
GR 570.3      86   574.7     115   583.4     122   583.6     150     584     250
GR   604     250
NC  0.05    0.05    0.04     0.3     0.5
X1   0.2      10     272     355      50      50      50
X3    10                                                     583   582.2
GR   590     272     572     272     563     300   562.8     313     563     330
GR 569.3     355     583     400   582.2     425     583     560   584.7     655
SB           1.5     2.8              56       0    1200     0.8     563     563
X1   0.3                              43      43      43
X2                     1   580.3   582.2
X3    10                                                     583   582.2
BT     8     272     590     590     272     583   580.3     355     583   580.3
BT   355   580.3   569.3     400     583     583     425   582.2   582.2     560
BT   583     583     655   584.7   584.7
NC  0.06    0.05    0.04     0.2     0.4
X1   0.4      11       0     115      50      50      50
GR   590       0   563.1       0   562.1      10   562.1      57   564.6      67
GR 570.3      86   574.7     115   583.4     122   583.6     150     584     250
GR   604     250
NC  0.06    0.04    0.04     0.1     0.3
X1   0.5                             425     425     425
NC  0.06    0.04    0.04     0.3     0.5
X1   0.6      11     168     250      50      50      50
X3    10                                                     584   583.6
GR   590     140     585     140     585     168   569.3     168  562.75     179
GR562.75     209  562.75     239   569.2     250     583     250   583.6     280
GR   584     370
SB           1.5     2.8              76       0    1575    0.15     563     563
X1   0.7                              42      42      42
X2                     1     583   583.6
X3    10                                                     584   583.6
BT     9     140     590     590     140     585     585     168     585     585
BT   168     585     583     209   585.1     583     250   585.2     583     250
BT 584.4     583     280   583.6   583.6     370     584     584
NC  0.05    0.04    0.04     0.3     0.5
X1   0.8      11      33     131      50      50      50
GR   610       0   590.4       0   572.4      33   566.4      45   562.9      78
GR 564.4     114   571.4     123   574.4     125   581.4     131   583.9     174
GR   604     174
NC  0.07    0.06    0.04     0.1     0.3
X1     2                             750     750     750
NC  0.07    0.06    0.04     0.1     0.3
X1   2.1                             610     610     610
NC  0.06    0.06    0.04     0.3     0.4
X1   2.2      24     334     436      50      50      50
X3    10                                                     594     600
GR   594             583             583     140     582     210     582     210
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GR	582	245	580.3	273	580.2	317	573.3	334	577.1	354
GR	570.6	354	562.5	370	562.5	410	568.4	436	588.8	436
GR	590	480	591	523	592	560	592.8	580	594	610
GR	596	650	598	670	600	690	606	710		
SB		1.5	2.9		69	0	2480	0.6	563	563
X1	2.3				80	80	80			
X2			1	591.9	594					
*		SHEET 2								
BT	20	0	594	594	0	594	583	140	596	583
BT	210	597.6	582	245	598.2	582	273	598.8	580.3	317
BT	599.5	580.3	334	599.8	573.3	334	599.8	590.2	436	601
BT	591.9	436	601	588.8	480	602	590	523	602.8	591
BT	560	603.5	592	580	604	592.8	610	604.5	594	650
BT	605	596	670	605.3	598	690	605.5	600	710	606
BT	606									
NC	0.06	0.05	0.04	0.2	0.4					
X1	3	28	317	437	125	125	125			
GR	603	0	603	50	583	50	583	90	603	90
GR	603	145	583	145	582	210	602	210	602	245
GR	582	245	580.3	273	580.2	317	572.3	333	565.2	371
GR	561.2	385	568.2	394	572.3	401	588.8	437	591	523
GR	592	560	594	610	596	650	598	670	600	690
GR	602	700	604	720	606	780				
X1	3.05				100	100	100			
NC	0.06	0.05	0.04	0.3	0.5					
X1	3.1	27	125	254	225	225	225			
X3	10							590	594	
GR	590	0	590	30	590	60	590	110	588	120
GR	586.5	125	584	129	565.5	130	561	135	560.7	140
GR	561	155	570.8	183	582.4	183	582.4	196	587.3	196
GR	587.7	218	584.3	218	586.1	251	588.2	251	588.2	254
GR	590.1	254	592	275	593	290	594	300	596	378
GR	598	460	600	510						
NC	0.06	0.06	0.025	0.3	0.5					
X1	3.11				5	5	5			
X3	10							590	594	
BT	14	0	590	590	30	590.5	590	60	591	590
BT	110	590.8	590	120	592	588	125	592	586.5	254
BT	593.6	588.2	254	593.6	590.1	275	593.8	592	290	594
BT	593	300	594	594	370	596	596	460	598	598
BT	510	600	600							
X1	3.19				55	55	55			
X2							1			
X3	10							590	594	
NC	0.07	0.07	0.04	0.3	0.5					
X1	3.2				5	5	5			
X3	10							590	594	
NC	0.07	0.07	0.04	0.2	0.4					
X1	3.3	10	25	125	50	50	50			
GR	586	0	580	25	571.9	35	565	51	561.7	76
GR	564.9	94	572.4	114	580	125	590	142	592	150
NC	0.07	0.06	0.04	0.1	0.3					
X1	5	10	180	315	955	955	955			
GR	585	0	584.4	150	584	180	571.9	219	565	235
GR	561.7	260	564.9	278	574.4	298	603.4	315	603.4	365
NC	0.07	0.06	0.04	0.1	0.3					
X1	5.1	11	85	210	500	500	500			

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GR   594       0     592      60     590      70     586      85   572.4      89
GR 565.6     119   565.9     140   570.1     162     573     179     584     210
GR   590     240
X1  5.15                             425     425     425
NC  0.05    0.06    0.04     0.5     0.7
X1   5.2      13     139     323      50      50      50
X3    10                                                     586     590
GR   586       0     589     139   584.5     139   582.2     139   571.8     164
GR 568.5     195   564.5     230   567.5     265   572.7     300   586.6     323
GR 581.8     323   587.2     410     593     480
SB  1.25     1.5       3              72       8    2590     2.6     565     565
X1   5.3                              66      66      66
X2                     1   586.6     586
X3    10                                                     586     590
BT     7       0     586     586     139     589     589     139     589   584.5
BT   323   591.1   586.6     323   591.1   581.8     410     592   587.2     480
*   ESTIMATED BT
BT   592     587
*       SHEET 3
NC  0.04    0.04    0.04     0.4     0.5
X1     7      13     168     300     200     200     200
GR   586       0     586      85     606      85     606     155   587.8     155
GR 584.8     168   572.4     179   565.6     209   565.9     230   570.1     252
GR   573     269   590.2     300   591.7     580
NC  0.04    0.04    0.04     0.1     0.3
X1   7.1                             600     600     600
NC  0.05    0.05    0.04     0.5     0.7
X1   7.8      36     117     286      50      50      50
X3    10                                                     596   597.5
GR   596      40   596.2      77     594      90     592     100   586.1     117
GR 581.5  129.45   595.6  129.45   595.6  130.55     581  130.55   578.8  142.45
GR 595.7  142.45   595.7  143.55   576.5  143.55   572.3  157.45     596  157.45
GR   596  158.55     572  158.55     571     167   591.4     167   591.4     173
GR 568.3     173   565.3     198   567.6     223   589.9     223   596.3     238
GR 573.6     238   575.3     247     584     247     586     270     593     270
GR   597     270     597     272   589.3     272   592.2     286   598.2     286
GR   599     370
NC  0.03    0.03    0.03     0.1     0.3
X1  7.81                               5       5       5
X3    10                                                     596   597.8
BT    23      40     596     596      77   596.2   596.2      90   596.3     594
BT   100   596.4     592     117   596.7   586.1     117   596.7   595.5  129.45
BT 596.7   595.6  130.55   596.7   595.6  142.45   596.9   595.7  143.55   596.9
BT 595.7  157.45     597     596  158.55     597     596     167     597     596
BT   167     597   591.4     173   597.2   591.4     223   597.5   589.9     238
BT 597.8   590.3     270     598     593     270     598     597     272     598
BT   597     286   598.2   592.2     286   598.2   598.2     370     599     599
X1  7.89                              15      15      15
X2                                                     1
X3    10                                                     596   597.5
NC  0.06    0.05    0.04
X1   7.9                              25      25      25
X3    10                                                     596   597.5
NC  0.06    0.05    0.04     0.2     0.4
X1  7.12      11      45     265      25      25      25
X3    10                                                     594     594
GR   594       0     596      45     588      45   586.8      45   571.5      90
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GR 566.2     103   564.4     150   571.7     195   589.9     265   598.4     265
GR 598.6     290
SB   0.9     1.5     2.9                58       6    3320     3.2     566     566
X1  7.13                                50      50      50
X2                     1   591.1     594                                0.89
X3    10                                                       594     594
BT     6             594     594      45     596     596      45     596     588
BT   265   598.4   591.1     265   598.4   598.4     290   598.6   598.6
NC  0.05    0.05    0.04     0.2     0.4
X1  7.14                                20      20      20
NC  0.05    0.05    0.04     0.2     0.4
X1  7.15       9      50     270      20      20      20
X3    10                                                     597.6   597.6
GR   597       0   597.6      50   590.3      50     571     100   567.1     150
GR 571.3     200   591.1     270   599.6     270     600     340
SB   0.9     1.5     2.9                85       6    3510     2.9     569     567
X1  7.16                                55      55      55
X2                     1   592.4     597                                 .87
X3    10                                                     597.6   597.6
BT     6       0     597     597      50   597.6   597.6      50   597.6   590.3
BT   270   599.6   592.4     270   599.6   599.6     340     600     600
NC   0.1    0.06    0.04     0.2     0.4
X1     8      15      92     232     325     325     325
GR   606       0     606      40     586      40   584.2      92   572.7     103
GR 569.5     126     566     150   568.5     181   572.7     202   586.5     232
GR   594     240     596     250     597     270     596     280     590     300
NC  0.06    0.06    0.04     0.2     0.4
*       SHEET 4         X1 IS IMPROVISED.
X1   8.1      14      84     230     220     220     220
X3    10                                                       590   587.5
GR   594       0   593.8      27   585.1      27     575      72   568.8      84
GR 566.7     117   569.6     153   572.8     184   579.3     214     580     230
GR 587.5     244     590     249     600     254     606     289
NC  0.03    0.03    0.03     0.2     0.4
X1  8.11                                 5       5       5
X3    10                                                       590   587.5
BT    10       0     594     594      27   593.8   593.8      27   593.8   587.2
BT   214   588.3   581.7     214   588.3   579.3     230     588     580     244
BT 587.5   587.5     249     590     590     254     600     600     289     606
BT   606
X1  8.19                                65      65      65
X2                                                     1
X3    10                                                       590   587.5
NC  0.06    0.06    0.04     0.2     0.4
X1   8.2                                 5       5       5
X3    10                                                       590   587.5
X1   8.3                               100     100     100
NC   0.1    0.08    0.05     0.1     0.3
X1     9      20      50     180     605     605     605
GR 589.7       0   588.6      50   575.3      73   573.8      88   572.6      95
GR   569     103   566.4     117   566.6     139   572.9     146   593.9     180
GR   606     250     606     390     608     430     610     440     612     590
GR   612     600     632     600     632     635     612     635     613     770
NC   0.1     0.1    0.05
X1   9.1      50     416     559    1005    1005    1005
X3    10                                                     588.6   591.2
GR 601.4       0   601.4       0   601.2      10     601      20   600.8      30
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GR     600      60     598     100     596     140     594     170     592     210
GR     591     230     590     250   588.6     340     590     375   591.6     413
GR     582     413     580     416   574.4     416   574.6     420   574.3     424
GR     574     431   573.6     438   573.5     442   573.2     446   572.3     452
GR   571.9     456   571.2     460     570     469   569.1     475   568.7     479
GR   567.9     485     568     486   568.1     489   568.3     493     569     497
GR   569.8     504   570.3     512   570.8     516   571.2     520     572     526
GR   572.8     530   572.6     532   573.8     534   574.9     540     577     548
GR   577.1     552   578.2     554     580     556   591.2     559     596     760
NC   0.025   0.025   0.025     0.3     0.5
X1    9.11                               5       5       5
X3      10                                                   588.6   591.2
BT      37     413   591.6     582     413   592.2     582     416   592.2     580
BT     420   592.2   583.4     424   592.2   584.9     431   592.2   586.3     438
BT   592.2   584.9     442   592.2   583.4     446   592.2     580     446   592.2
BT   573.2     452   592.2   572.3     452   592.2     580     456   592.2   583.4
BT     460   592.2   584.9     469   592.2   586.3     475   592.2   584.9     479
BT   592.2   583.4     486   592.2     580     486   592.2     568     489   592.1
BT   568.1     489   592.1     580     493   592.1   583.4     497   592.1   584.9
BT     504   592.1   586.3     512   592.1   584.9     516   592.1   583.4     520
BT     592     580     520     592   571.2     526     592     572     526     592
BT     580     530     592   583.4     536     592   584.9     540     592   586.3
BT     548     592   583.4     552     592   584.9     556     592     580     559
BT   592.1   591.2
X1    9.19                              55      55      55
X2                                                       1
X3      10                                                   588.6   591.2
NC    0.08    0.08   0.045     0.3     0.5
X1     9.2                               5       5       5
X3      10                                                   588.6   591.2
NC    0.08    0.08   0.045     0.2     0.4
X1     9.3      14     400     554     130     130     130
GR     594       0     592      10     590      20     587      30     587     230
GR     587     375   587.1     400   572.8     435   569.8     460     568     480
GR   568.3     508   572.5     517   591.3     554     596     760
NC    0.05     0.1    0.04     0.1     0.3
X1      11                             520     520     520
*        SHEET 5          GRs FOR X1 ABOVE??
X1      12      19      57     260    1365     725    1365
GR   598.9       0   583.4      32   581.8      57   572.6      76   568.9      84
GR   565.9     100   568.9     114   572.9     125   576.5     135   578.3     155
GR     580     260     582     280     584     340     584     450     584     950
GR     584    1220     584    1250     586    1280     590    1320
NC    0.06     0.1    0.04     0.1     0.3
X1      13      11     485     618    1250     660    1250
GR     590       0     588     140   586.3     435   586.3     485     575     509
GR     573     533     567     539   566.4     550   565.9     562   572.3     575
GR   590.8     618
NC    0.05    0.05    0.04     0.4     0.6
X1    13.1      19     219     330     590     590     590
X3      10                                                     600     600
GR   602.2       0   601.9     219   574.2     219   572.9     226   568.5     235
GR   568.4     244   568.5     255   571.6     269   586.6     269   593.7     280
GR   597.6     280  597.96     286   586.6     286   586.6     297   575.3     297
GR   594.1     330   597.3     330   601.7     330     600     820
NC    0.05    0.05    0.04     0.3     0.5
X1   13.11                               5       5       5
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X3    10                                                     600     600
BT     8       0   602.2   602.2     219   601.9   601.9     219   601.9   593.7
BT   280   601.7   593.7     280   601.7   597.6     330   601.7   597.3     330
BT 601.7   601.7     820     600     600
X1 13.19                              32      32      32
X2                                                     1
X3    10                                                     600     600
NC  0.05    0.05    0.04     0.3     0.5
X1  13.2                               5       5       5
X3    10                                                     600     600
NC  0.06    0.07    0.04     0.2     0.4
X1    14      16     200     300     215     215     215
GR 590.9       0     590      50     588      70     586     150   585.1     155
GR 579.9     175   578.5     200   571.9     220   565.6     232   566.8     244
GR   569     259   571.1     274   588.1     275   603.6     300     604     340
GR   624     340
NC  0.06    0.08    0.04     0.1     0.3
X1    16      22     520     722    1305    1305    1305
GR   600       0     590      35     589     100     609     100     609     135
GR   588     135     588     440     590     475   591.7     520   591.6     565
GR 590.9     585   572.2     614   568.7     624   568.2     632   568.4     645
GR 572.2     653   576.7     690   590.2     722     592     740     594     780
GR   596     812     598     825
NC  0.06    0.08    0.04     0.3     0.5
X1  16.1      33     471     569     170     170     170
X3    10                                                     592   592.3
GR   608      30     608      50     608      70     606      80     604      90
GR   600     100   598.5     170     598     250     596     330     594     400
GR   592     420     590     430     585     450     576     471   572.9     477
GR   567     505     567     520     567     535     573     563   573.9     569
GR 578.2     620   583.6     680     584     700   854.5     720   584.9     740
GR 585.8     790     586     800   587.5     850     588     870     590     880
GR   596     900     600     910     604     910
SB           1.5       3              71       0    1525    0.75     567     567
X1  16.2                              50      50      50
X2                     1   585.6     592                                    0.87
X3    10                                                     592   592.3
BT    30      30     608     608      50     608     608      70     608     608
BT    80     606     606      90     604     604     100     600     600     170
BT 598.5   598.5     250     596     596     330     596     596     400     594
BT   594     420     592     592     430   592.3     590     450   592.8     585
BT   471   593.2     576     471   594.5   585.3     569   594.5   585.3     569
BT 593.2   573.9     620   592.3   576.2     680   593.5   583.6     700     594
BT   584     720     595   584.5     740     596   584.9     790     598   585.8
BT   800   598.3     586     850     600   587.5     870   601.2     588     880
BT   602     590     900     603     580     910     600     600     910     604
*        SHEET 6
NC  0.06    0.06    0.46     0.3     0.4
X1  16.3                              50      50      50
NC  0.06    0.06    0.04     0.1     0.3
X1    17      26     450     630     960     960     960
GR   608       0     608      30     608      30     608      70     606      80
GR   604      90     600     100   598.5     170     598     250     596     330
GR   594     400     592     420     590     430   585.1     450   572.1     481
GR 570.3     499   569.3     520   569.3     536   572.1     547   583.6     680
GR 584.5     729     588     800     588     870     590     880     596     900
GR   600     910
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NC   0.1    0.07    0.04     0.1     0.3
X1    19      22      70     122    1475    1385    1475
GR 610.3       0     572      70   570.9      83   569.8      97   570.5     108
GR   572     122   578.3     135     578     250     576     270     580     370
GR   582     390     584     400     586     420   586.7     500     588     550
GR   590     730     592     780     612     780     612     810     592     810
GR   594    1060     596    1080
NC   0.1    0.07    0.04     0.1     0.3
X1    20      36      40     149     535     320     535
GR   600       0     590      30   590.3      40   572.8      75   569.2      86
GR 567.2     100   570.7     116   572.2     129   579.3     149   578.7     278
GR 582.5     300   582.1     360     585     400     588     450     590     490
GR   590     555     610     555     610     585     590     585     592     650
GR   612     655     612     730     592     730     592     850     592     880
GR   612     880     612     910     592     910     592     980     592     990
GR   612     990     612    1040     592    1040     594    1080     596    1240
GR   600    1260
NC   0.1     0.1    0.04     0.3     0.5
X1  20.1      20    1141    1238    1315    1315    1315
X3    10                    1010                             590     597
GR   598       0     596      80     594     160     592     400     590    1010
GR 587.5    1030     586    1040     584    1090     582    1110   582.2    1118
GR 582.7    1130   584.5    1141   575.9    1154   572.5    1167   571.8    1190
GR 572.9    1212     579    1230   586.9    1238   597.2    1262     600    1320
SB           1.5     2.8              43            1040     1.8     572     572
X1  20.2                              65      65      65
X2                     1   586.9     590                            0.88
X3    10                    1010                             590     597
BT    17       0     598     598      80     596     596     160     594     594
BT   400     592     592    1010     590     590    1030     590   587.5    1040
BT 590.4     586    1090   592.8     584    1110   593.8     582    1118     594
BT 582.2    1118   598.3   582.2    1130   598.5   582.7    1141   598.7   584.5
BT  1238   600.2   586.9    1262   600.7   597.2    1262   597.2   597.2    1320
BT   600     600
NC   0.1    0.07    0.04     0.3     0.5
X1    22      36    1162    1262     205     205     205
X3                          1010
GR   600       0     598     120     618     120     618     180     596     180
GR   594     220     614     220     614     270     594     270     594     280
GR   614     280     614     330     594     330     592     490     592     690
GR   612     890     612     930     592     930     592     940     612     940

GR   612     980     592     980     590    1010     586    1040     584    1090
GR   582    1110   582.7    1130   576.6    1152   576.8    1162   572.4    1167
GR 569.8    1176   568.6    1190   570.2    1206   572.9    1215   602.9    1262
GR   604    1280
NC  0.06    0.08    0.04     0.1     0.3
X1    23      38     807     892     850     850     850
GR   594       0     596      70     594     160     594     190     614     190
GR   614     220     594     220     592     330     592     360     612     360
GR   612     400     590     400     590     480     610     480     610     500
GR   590     500     590     520     610     520     610     540     590     540
GR   586     586     586     670     584     730     582     750     580     800
GR   580     807   572.5     822   570.6     832   569.5     850   569.9     871
GR 572.5     885   577.6     892   578.5     898   585.4     912     590     930
GR   594     950     596     960     600     970
*       SHEET 7
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X1    24      53     432     508     840     840     840
GR   618       0     618      10     598      10     598      20     618      20
GR   618      40     598      40     596      60     616      60     616      90
GR   594      90     594     100     614     100     614     130     594     130
GR   594     135     614     135     614     150     594     150     594     160
GR   614     180     614     180     592     180     592     190     612     190
GR   612     210     592     210     592     220     612     220     612     240
GR   592     240     590     260     610     260     610     290     590     290
GR 588.9     356   586.4     397   578.4     410   578.4     432   572.5     442
GR   571     456   569.1     470   569.5     486   572.5     497     580     508
GR 580.9     546     580     570     580     620     584     630     590     640
GR   592     650     598     660     600     670
NC  0.08    0.06    0.04     0.4     0.6
X1  24.1      26     170     290     290     290     290
X3    10                                                 591.1   589.9
GR   600       0     590      17     580      30     578      35     578      50
GR   578      70     578     170   585.2     170   575.1     200   571.5     230
GR 575.8     260   585.5     290     578     290     588     330   588.4     380
GR   588     400   589.4     520     590     575     592     590     594     640
GR   596     700     598     750     600     800     602     860     604     880
GR   606     910
SB           1.5       3              60       0    1350       2     573     573
X1  24.2                              40      40      40
X2                     1   588.2   589.9                                  0.95
X3    10                                                 591.1   589.9
BT    24       0     600     600      17   598.2     590      30   597.3     580
BT    35     597     578      50     596     578      70   594.6     578     170
BT 591.1     578     170   591.1     588     230   591.3   588.2     290   591.1
BT   588     290   591.1     578     330   590.1     588     380   589.9   588.4
BT   400   589.8     588     520     590   589.4     575   591.4     590     590
BT   592     592     640     594     594     700     596     596     750     598
BT   589     800     600     600     860     602     602     880     604     604
BT   910     606     606
NC  0.07    0.08    0.04     0.3     0.5
X1  24.3      19     170     290      80      80      80
GR   600       0     590      17     580      30     578      35     578     170
GR 575.1     200   571.5     230   575.8     260     578     290     588     330
GR   590     575     592     590     594     640   598.7     680     598     750
GR   600     800     602     860     604     880     606     910
NC  0.05    0.08    0.04     0.1     0.3
*   NEW CROSS-SECTIONS FROM CHAMPION TO SOUTH
* THE LAST DIGIT OF X1 FIELD NAME CORRESPONDS TO THE CROSS-SECTION NUMBER FROM
* THE FIELD SURVEY. EXAMPLE - X124.318 = CROSS-SECTION 18, X124.327 = CR-SC 17
X124.318      38     649     715     710     735     710
GR   612       0     610     205     608     269     606     350     596     498
GR   594     525     592     565     590     620     588     630     582     644
GR   573     649  571.76     653  571.13     658  570.83     665  571.29     670
GR570.43     675  570.17     683  570.24     688  570.81     695   570.7     703
GR571.24     710  571.76     715     582     720     584     726     588     736
GR   590     971     592    1031     594    1047     596    1068     598    1099
GR   600    1152     602    1225     604    1302     606    1393     608    1444
GR   610    1483     612    1565     614    1597
X124.327      26     283     342     292     319     300
GR   614       0     612      32     610      50     608     121     606     180
GR   582     222     580     233  571.77     283  570.62     287  569.85     293
GR 568.5     300  568.62     307  569.02     317  568.98     322  571.04     328
GR571.77     333     573     342     580     368     582     380     584     396
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GR   586     643     588     974     590    1080     592    1101     594    1121
GR   610    1227
X124.336      37     304     368     150     151     150
GR   614     0.4     612   113.4     610   146.3     608   202.5     606  210.96
GR   584  243.46     582  247.84     580     256  571.31     304  570.41     309
GR570.44     316     570     322  569.56   326.5  570.29     332  569.91     338
GR570.48     343  571.11     347  571.76   349.5     573     368     580     392
GR   582     405     584     416     586   514.5     588     542     590   556.7
GR   594   573.6     594   624.4     592     647     590   673.8     588   703.5
GR   586     725     588    1104     590    1148     592    1176     594    1207
GR   596    1231     598    1257
X124.345      26     151     200     160     155     159
GR   614       0     612      10     610      19     586      84     584      91
GR   582     100     580     148  571.84     151  569.35     157  568.79     165
GR568.62     166  569.17     173  570.39     179  570.46     187  571.21     195
GR571.84     200     580     202     582     226     584     265     586     290
GR   588     892     590     963     592     997     594    1018     596    1032
GR   598    1050
X124.354      23     106     168     226     202     209
GR   614       0     612      10     584      83     582      89  571.81     106
GR570.85     111  570.21     116  569.84     123  570.34     128  570.32     137
GR 570.8     142  571.07     152  571.81     158     573     168     582     172
GR   584     188     586     248     588     852     590     908     592     953
GR   594    1001     596    1029     598    1044
X124.363      27     166     217     169     153     164
GR   614       0     612      16     610      61     608      88     584     145
GR   582     152     580     160  571.81     166  570.41     171  569.58     178
GR567.74     183  568.06     185  568.24     192  568.52     198  569.71     201
GR571.81     207  572.56     217     580     225     582     239     584     259
GR   586     327     588     954     590    1063     592    1160     594    1197
GR   596    1218     598    1233
X124.372      29     184     230     237     214     231
GR   614       0     612      41     610      63     608     114     606     121
GR   588     153     586     158     584     164     582     179  571.74     184
GR569.82     189  568.43     196  568.86     201  569.13     207   569.4     214
GR569.78     221  571.79     230     582     262     584     276     586     385
GR   588     637     586     822     586     888     588    1040     590    1150
GR   592    1278     594    1296     596    1312     598    1330
X124.381      33     248     300     277     284     279
GR   614       1     612      54     610     103     608     133     606     145
GR   604     151     586     187     584     200     582     211     580     234
GR   574     240     575     242  571.81     248  570.22     252  568.79     255
GR 568.1     262  567.83     265  568.95     271  570.22     276  570.58     280
GR570.72     286   570.6     294  571.81     300     580     311     582     327
GR   584     339     586     375     588     471     590     711     592     756
GR   594     790     596     980     598    1010
X124.390      42     446     498     410     376     388
GR   614       0     612      26     610      58     608      69     606      75
GR   604      82     602      88     600      93     598     100     596     108
GR   594     126     594     226     596     242     596     270     594     288
GR   592     300     590     309     588     323     586     339     584     357
GR   582     381  571.71     446  570.65     453  570.19     463  569.31     471
GR569.21     479  569.31     485  570.09     491  571.71     498     582     527
GR   584     539     586     563     588     608     588     960     586    1231
GR   586    1722     588    1888     590    2053     592    2096     594    2131
GR   596    2232     598    2287
* HIGHLAND PARK FOOTBRIDGE
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SB           1.5     2.8              45     2.5    1077     1.7  570.01  570.01
X1  24.4                             140     152     148
X2                     1   589.7   594.4                    1.33
X3    10                                                   583.2   583.9
BT    28     156     596     596     168   594.4     594     181   594.4     592
BT   199   594.4     590     255   594.4     588     322   594.4     586     449
BT 594.4     584     466   594.4     582     479   594.4     580     527   594.4
BT   580     561   594.4     582     571   594.4   589.7     575   594.4   589.7
BT   580   594.4   589.7     585   594.4   589.7     590   594.4   589.7     595
BT 594.4   589.7     600   594.4   589.7     605   594.4   589.7     610   594.4
BT 589.7     614   594.4   576.7     615   594.4     575     627   594.4     584
BT   642   594.4     586     651   594.4     588     761   594.4     590    1130
BT 594.4     592    1182   594.4     594
X124.409      57     571     614      48      42      46
GR   616       0     614      35     612      55     610      74     608      90
GR   606     102     604     112     602     122     600     131     598     142
GR   596     156     594     168     592     181     590     199     588     255
GR   586     322     584     449     582     466     580     479     580     527
GR   582     561  572.16     571  570.59     575  570.22     580  570.21     585
GR570.01     590  570.18     595   570.4     600  571.06     605  571.21     610
GR571.92     614   576.7     614     575     615     584     627     586     642
GR   588     651     590     761     592    1130     594    1182     596    1229
GR   596    1312     594    1369     592    1408     590    1501     590    1674
GR   592    1728     594    1764     596    1835     598    1862     600    1900
GR   600    2035     598    2070     600    2086     602    2093     604    2100
GR   606    2122     608    2387
X124.418      76     721     776      99     103     102
GR   616       0     614      10     612      18     610      25     608      32
GR   606      42     604      48     602      56     600      62     598      68
GR   596      76     594      83     592      94     590     115     588     348
GR   586     430     584     443     582     453     580     469     579     526
GR   579     617     580     644  575.48     647  572.09     656  571.26     659
GR571.25     664  571.36     669  571.19     674  570.93     679  570.69     684
GR570.44     689  570.11     694  569.93     699  569.87     700  570.04     704
GR570.51     709  571.11     711  576.11     711     582     721     584     727
GR   586     731     588     737     590     748     592     870     594    1035
GR   596    1093     598    1154     600    1190     602    1210     604    1224
GR   606    1238     608    1254     610    1269     612    1286     612    1358
GR   610    1383     608    1398     606    1418     604    1436     602    1448
GR   600    1461     598    1472     596    1485     594    1508     592    1545
GR   592    1721     594    1772     596    1821     598    1873     600    1924
GR   602    1975     604    2211     606    2262     608    2555     610    2797
GR   612    2830
X124.427      55     721     776     105     110     109
GR   614       0     612       6     610      11     608      16     606      28
GR   604      35     602      45     600      57     598      67     596      76
GR   594      84     592      95     590     152     592     425     590     470
GR   588     525     586     547     584     559     582     569     580     595
GR   580     627  576.08     705  572.05     721   571.5     722  570.85     727
GR570.89     732  570.56     737  570.49     742  570.16     747  570.01     752
GR 569.8     757  569.46     762  569.51     762   569.9     767  570.09     772
GR571.05     776  576.25     776  577.05     779     582     790     584     800
GR   586     809     588     816     590     823     592     832     594     845
GR   596     882     598     989     600    1044     602    1096     604    1110
GR   606    1125     608    1284     610    1322     612    1444     614    1471
X124.436      71     714     780     118     117     118
GR   614       0     612      15     610      21     608      26     606      31
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GR   604      37     602      41     600      47     598      53     596      60
GR   594      71     594     105     592     118     590     173     590     218
GR   590     326     591     369     592     385     592     395     592     455
GR   590     467     590     480     588     580     588     581     586     595
GR   586     600     584     605     584     610     582     619     582     620
GR   580     680     579     682     578     688     576     694  572.08     714
GR   571     718     570     723     570     728     569     733  568.93     733
GR   569     738     570     743     570     748     570     753  570.32     758
GR   571     763     571     768     571     773     572     778  572.08     780
GR   577     783     582     817     584     822     586     827     588     830
GR   590     835     594     840     592     840     596     843     594     846
GR   598     851     596     852     598     865     600     902     602     947
GR   604     994     606    1045     608    1098     610    1132     612    1159
GR   614    1177
X124.445      58     914     988      42      39      40
GR   614       0     612       9     611      65     612     171     610     180
GR   608     185     606     190     604     194     602     199     600     203
GR   598     208     596     215     594     277     592     298     590     375
GR   591     512     590     562     589     592     590     636     588     787
GR   586     800     584     809     582     823     580     880  576.03     896
GR 573.5     903  572.14     914  571.56     916     571     921  570.01     927
GR569.21     933  568.77     938  568.82     944  569.18     951  569.81     956
GR570.39     961   569.5     967  568.45     972  569.53     977  571.09     982
GR572.14     988     582    1009     584    1015     586    1019     588    1023
GR   590    1027     592    1032     594    1038     596    1045     598    1057
GR   600    1094     602    1140     604    1187     606    1237     608    1291
GR   610    1324     612    1351     614    1369
X124.454      60     703     789      16      12      14
GR   612       0     610       9     608      15     606      19     604      23
GR   602      28     600      32     598      37     596      45     594     107
GR   592     123     590     190     589     318     590     430     588     603
GR   586     615     584     625     582     661     580     691  577.76     699
GR572.15     703  576.03     703  571.77     707  571.65     712   571.7     717
GR571.44     722  571.28     727   571.3     732  571.02     737     571     740
GR571.02     742  571.39     747  571.64     752  571.73     757  571.66     762
GR571.57     767  571.76     772   571.8     777  571.59     782  571.85     787
GR572.15     789  576.25     796  578.09     803     582     809     584     814
GR   586     818     588     823     590     826     592     830     594     834
GR   596     839     598     844     600     865     602     914     604     937
GR   606     984     608    1023     610    1069     612    1121     614    1174
*  THIS IS THE DAM STRUCTURE
X124.463      56     742     816      17      16      17
GR   614       0     612       9     610      15     608      19     606      25
GR   604      30     602      36     600      45     598      78     596     125
GR   594     140     592     620     590     646     588     668     586     688
GR   584     696     582     713  576.07     731  576.07     741  574.44     742
GR 574.4     742   574.4     745  574.38     750  574.25     755  574.11     760
GR574.14     765  574.24     770  574.26     775   574.2     780  574.21     785
GR574.27     790  574.24     795  574.14     800  574.24     805  574.24     810
GR574.19     814  574.44     816  576.25     817     577     824     582     836
GR   584     843     586     847     588     852     590     855     592     859
GR   594     863     596     867     598     872     600     894     602     942
GR   604     969     606    1002     608    1044     610    1093     612    1143
GR   614    1195
X124.472      62    1126    1225      46      48      47
GR   616       0     614      48     612      88     610     143     608     192
GR   606     234     604     283     602     332     600     370     598     561
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GR   596     739     596     758     595     987     595    1013     596    1032
GR   594    1041     592    1052     590    1058     588    1069     586    1079
GR   584    1089  577.52    1126   576.5    1132  574.54    1136  574.03    1140
GR573.42    1144  573.35    1148  573.25    1152  573.18    1156  572.84    1160
GR572.61    1164  572.64    1168  572.02    1172  572.05    1176  571.99    1180
GR   572    1184  572.08    1188  572.04    1192  572.51    1196  572.74    1200
GR 573.3    1204  573.62    1208  574.05    1212  574.54    1215     576    1216
GR577.52    1225     584    1248     586    1255     588    1262     590    1266
GR   592    1272     594    1275     596    1278     598    1284     600    1292
GR   602    1374     604    1412     606    1441     608    1486     610    1516
GR   612    1548     614    1629
* sOUTH AVENUE BRIDGE
X124.475                                  15      15      15
X3    10
BT    50     283     604     604     332     602     602     370     602     600
BT   561     602     598     739     602     596     758     602     596     987
BT   602     595    1013     602     595    1032     602     596    1041     602
BT   594    1052     602     592    1058     602     590    1069     602     588
BT  1079     602     586    1089     602     584    1126     602     595    1132
BT   602     595    1136     602     595    1140     602     595    1144     602
BT   595    1148     602     595    1152     602     595    1156     602     595
BT  1160     602     595    1164     602     595    1168     602     595    1172
BT   602     595    1176     602     595    1180     602     595    1184     602
BT   595    1188     602     595    1192     602     595    1196     602     595
BT  1200     602     595    1204     602     595    1208     602     595    1212
BT   602     595    1215     602     595    1216     602     595    1225     602
BT   595    1248     602     584    1255     602     586    1262     602     588
BT  1266     602     590    1272     602     592    1275     602     594    1278
BT   602     596    1284     602     598    1292     602     600    1374     602
BT   602
X124.481      63     951    1013      53      56      55
GR   616       1     614      23     612      33     610      45     608     203
GR   606     224     604     232     602     243     600     269     598     325
GR   596     353     596     600     596     712   595.8     801     596     882
GR   594     898     592     906     590     912     588     919     586     923
GR   584     929     582     934     580     948  574.55     951  573.95     953
GR573.68     955  573.55     957  573.29     959  573.63     962  573.45     965
GR573.05     968  573.15     971  572.84     975  572.55     978  572.57     981
GR572.56     984  572.37     987   572.6     990  572.46     993  572.68     997
GR572.55    1001  572.85    1004  573.12    1007  573.75    1011  574.55    1013
GR579.37    1021     582    1028     584    1031     586    1034     590    1043
GR   592    1052     594    1060     596    1066     598    1074     600    1080
GR   602    1086     604    1168     606    1179     608    1184     610    1189
GR   612    1195     614    1231     616    1317
*  END OF NEW XROSS-SECTIONS
*    MISSING SHEET (25.21 TO 29; CROSS-SECTIONS S, T,AND U)
*    INCREASED MANNING'S TO ACCOUNT FOR MISSING CROSS-SECTIONS
NC   0.3     0.3     0.2     0.1     0.3
X1    31      25     184     360    3412    3412    3412
GR   600       0     598      20     598      60     618      60     618      90
GR   598      90     596     100     594     110     592     120   591.2     161
GR 591.6     184   576.9     222   574.7     242     570     260   570.9     284
GR 576.2     302   582.2     314   582.8     360     584     550     586     560
GR   588     580     590     590     594     600     596     610     600     620
*    DECREASED MANNING'S
NC  0.06    0.06    0.03     0.3     0.5
X1  31.1      27     435     520     490     490     490
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X3    10                                                 595.3     598
GR   602       0     600      60     598     110     596     190   595.3     260
GR   596     340     597     395   596.8     410   596.2     420     596     430
GR 592.9     435   576.1     449   574.5     470   573.9     490   576.1     494
GR 581.6     520     585     544     586     550     588     580     590     600
GR   590     630     592     640   593.5     650     596     660     598     680
GR   600     700     606     700
SB           1.5     2.9            66.5       0    1545    0.45     575     575
X1  31.2                              60      60      60
X2                     1   595.4   595.3
X3    10                                                 595.3     598
BT    26             602     602      60     600     600     110     598     598
BT   190     596     596     250   595.3   595.3     340     596     596     395
BT   597     597     410   597.2   596.8     420   597.3   596.2     430     598
BT   596     435   598.5   592.9     435   600.6   595.4     520     601   595.4
BT   520     601   581.6     544   601.2     585     544   599.2     585     550
BT 599.5     586     580     602     588     600   602.5     590     630   603.4
BT   590     640   603.7     592     650     604   593.5     660   604.3     596
BT   680   605.2     598     700     606     600     700     606     606
*     DECREASED MANNING'S
NC  0.05    0.05    0.03     0.4     0.6
X1  31.3                              50      50      50
NC  0.07    0.07   0.045     0.1     0.3
X1    33      21      67     144     830     830     830
GR 619.5           592.5      67     578      91   575.5     100   573.5     106
GR   576     128   583.3     144   585.3     157   581.9     174     582     210
GR   584     250     586     310     588     320     590     330     592     370
GR   594     400     596     430     596     500     600     520     602     530
GR   604     550
NC  0.07     0.1   0.045     0.1     0.3
X1    35      23     294     357    1690    1690    1690
GR   604             602      30     600      40     598      70     596     100
GR   594     120     592     130     590     140     588     150     586     160
GR 582.4     169   581.9     294   576.1     308   572.1     323   572.1     330
GR 572.1     342   576.1     355   581.1     357   587.1     370     590     400
GR   596     410     600     420     604     430
NC  0.06     0.1    0.04     0.1     0.3
X1    37      16     233     337    1690    1690    1690
GR   604             602      60     600      90     598     160     596     170
GR   594     180     584     183     580     233   576.7     255   575.4     280
GR   576     290   574.7     314   576.7     327   584.4     337   589.4     372
GR 620.2     437
NC  0.08     0.1    0.04
X1    38      22     332     403    1100    1100    1100
GR   604             600      10     596      20     592      90     590     180
GR   588     270   585.2     300   582.3     316   583.4     332   577.1     343
GR 574.1     351     574     360   573.5     374   577.1     390   585.3     403
GR 585.3     407   583.5     428   589.4     452     596     460     598     470
GR   600     520     604     530
NC  0.06    0.06   0.045     0.4     0.6
X1  38.1      27     305     555     180     180     180
*        SHEET 9
X3    10                                                   620     620
GR 623.7             604      35     602      45     598      55     592      65
GR   590      75     588      85     586      95     584     115   582.5     145
GR   584     205     586     265     586     305   613.9     305   611.2     306
GR 586.2     355   581.2     385     575     425     575     445   581.9     485
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GR	586.7	525	605.4	540	611.5	562	613.9	565	606.8	565
GR	621.3	622	623.7	630						
SB	1.25	1.5	3		110	22	6012	2	577	577
X1	38.2				30	30	30			
X2			1	613.9	623.7				0.85	
X3	10							620	620	
BT	18		623.7	623.7	35	623.7	604	45	623.7	602
BT	55	623.7	598	65	623.7	592	75	623.7	590	85
BT	623.7	588	95	623.7	586	115	623.7	584	145	623.7
BT	582.5	205	623.7	584	265	623.7	586	305	623.7	586
BT	305	623.7	613.9	565	623.7	613.9	565	623.7	606.8	622
BT	623.7	621.3	630	623.7	623.7					
NC	0.08	0.08	0.045	0.3	0.5					
X1	38.3				100	100	100			
NC	0.08	0.08	0.045	0.1	0.3					
X1	40	26	365	429	1240	1240	1240			
GR	604		602	10	596	20	592	30	590	40
GR	588	50	586	60	584	80	582.5	110	584	170
GR	586	230	586	290	584	310	584	320	584	350
GR	582	360	583.1	365	577.6	383	575.8	393	576	400
GR	575.1	409	577.1	418	583.1	429	594.1	491	609.4	539
GR	621.3	587								
NC	0.08	0.1	0.045	0.1	0.3					
X1	42	25	629	697	1225	1225	1225			
GR	604		600	10	596	20	594	30	592	40
GR	588	60	588	160	590	280	590	410	590	440
GR	590	510	588	520	586	540	584	610	584.9	629
GR	578.2	664	576.6	670	576.8	680	575.9	688	577.9	697
GR	586.2	708	600	750	612	780	620	800	621.7	808
NC	0.08	0.1	0.045	0.1	0.3					
X1	44	23	951	1045	1315	1600	2750			
GR	604		602	10	600	20	596	40	594	50
GR	592	70	590.8	130	590	190	588	520	586.5	600
GR	588	680	588	750	586.9	951	579.7	968	575.8	971
GR	577.8	979	578.3	984	579.3	992	605.2	1045	606.2	1046
GR	610	1056	611.9	1058	613.7	1064				
NC	0.07	0.07	0.04	0.1	0.3					
X1	44.1				340	860	860			
NC	0.07	0.07	0.04	0.4	0.6					
X1	44.2	33	31	175	100	100	100			
X3	10							607	606.3	
GR	607.3		602	5	596.7	14	592.1	31	580.8	73.35
GR	600.8	73.35	600.8	76.65	580	76.65	578.9	103	579.4	129.35
GR	600.8	129.35	600.8	132.65	580	132.65	591	175	586.9	193
GR	587.5	270	588	330	587.1	340	588	350	590	380
GR	590	410	590	450	590	460	590.6	480	592	530
GR	594	570	596	590	598	600	600	610	604	620
GR	610	640	612	650	616	660				
NC	0.07	0.07	0.04	0.3	0.5					
X1	44.21				5	5	5			
X3	10							607	606.3	
BT	31		607.3	607.3	5	607.3	602	14	607.3	596.7
BT	31	607.3	592.1	31	607.3	603.1	73.35	607	600.8	76.65
BT	607	600.8	103	607	603.6	129.35	606.8	600.8	132.65	606.8
BT	600.8	175	606.5	602.5	175	606.5	591	193	606.3	586.9
BT	270	608	587.5	330	608.8	588	340	609	587.1	350
BT	609	588	380	609.5	590	410	610	590	450	610.1

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BT   590     460   610.4     590     480     612   590.6     530     613     592
BT   570     614     594     590   614.4     596     600   614.6     598     610
BT 614.8     600     620     615     605     640   615.4     610     650   615.8
BT   612     660     616     616
*       SHEET 10        X1 IS IMPROVISED.
X1 44.29                                      70      70      70
X2                                                             1
X3    10                                                             607   606.3
NC   0.1    0.07    0.04     0.3     0.5
X1  44.3                                       5       5       5
X3    10                                                             607   606.3
NC   0.1    0.07    0.04     0.2     0.4
X1    46      26       1     140     500     405     500
GR 619.3       1     614      10     610      20     606      30     600      40
GR   596      50     590      60   580.4      85   575.9      93   577.3     103
GR 579.8     113   588.6     128   586.2     140     588     330   587.1     340
GR   588     350     590     350     590     450     590     460     592     530
GR   594     576     596     590     595     600     600     610     604     620
GR   610     640     612     650     616     660
NC  0.08    0.08   0.045     0.1     0.3
X1    48      21     110     171    1075    1075    1635
GR 620.9           618.5      32   609.4      62   588.4     110   581.8     111
GR 579.3     121   579.6     133   579.6     138   581.8     147   589.8     171
GR   588     330     586     350     586     360     590     380     592     400
GR   594     410     596     420     598     430     600     440     602     450
GR   604     460
NC   0.1    0.08    0.04     0.1     0.3
X1    50      26     866     950     980    2010    2010
GR   610             608      20     606      40     604      70     602      90
GR   600     140     598     160     596     180     594     190     592     200
GR   590     210     588     220     588     470     590     570     592     690
GR   592     790     590     860   589.2     866   582.8     894   581.3     906
GR 581.1     920   581.2     928   582.8     945   590.6     950   611.7     991
GR 619.7    1032
NC  0.08    0.08   0.045     0.1     0.3
X1    52      23     267     349    1800    1600    1560
GR   610             604      10     598      20     594      30     590      40
GR   590      90     590     180     590     190     590     280     592     287
GR 584.9     302   583.9     307   582.9     315   583.4     326   585.7     338
GR 596.9     349     598     390     600     440     602     510     604     580
GR   606     720     608     770     610     820
NC  0.08    0.08   0.045     0.1     0.3
X1    54      27     214     276    1600     885    1930
GR   610             608      20     606      40     602      50     600      60
GR   596      70     594      80     592     160   591.6     175   589.8     214
GR 584.6     227   582.4     240   581.7     250   582.8     260   583.6     266
GR 591.6     276     592     350     592     400     594     440     596     640
GR   598     730     600     760     602     780     604     810     606     820
GR   608     850     610     870
NC  0.08    0.08   0.045     0.1     0.3
X1    56      52     660     734     530    1030    1030
GR   610             608      40     606      90     604     150     602     210
GR   600     220     598     240     594     250     592     260   590.5     320
GR   592     380     592     570     594     590     596     600     594     640
GR 597.5     660   584.8     678   583.8     690   583.7     700   583.5     712
GR 584.8     724   592.3     734     592     760     590     770     590     790
GR   592     830     592     860     592     980     594    1010     596    1030
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GR	596	1230	594	1310	592	1370	590	1410	590	1420
GR	594	1430	598	1440	602	1450	608	1460	610	1470
GR	610	1480	608	1490	606	1500	604	1510	602	1520
GR	600	1530	600	1590	602	1630	604	1650	606	1670
GR	608	1680	610	1690						
NC	0.08	0.08	0.045	0.1	0.3					
QT	7	2772	3564	5400	7200	8100	9850	8100		
X1	58	18	779	844	400	1160	1160			
GR	610		608	50	606	140	604	200	602.2	350
GR	602	450	600	550	596	680	596	720	595.5	739
GR	595	779	585.1	785	582.3	794	581.7	800	581.5	808
GR	585.1	813	598.7	844	610	850				
NC	0.08	0.08	0.045	0.3	0.5					
X1	58.1	24	668	736	55	55	55			
*		SHEET 11								
GR	510		608	50	606	120	604	140	604	160
GR	684	230	602	450	600	530	595	610	595.4	661
GR	593	668	589.1	683	585.6	683	582.3	700	584.9	713
GR	596.2	736	597.6	740	600	750	602	760	610	780
GR	616	920	616	990	616	1030	614.9	1080		
SB	0.9	1.5	2.7		41	5	1035	0.7	584	584
X1	58.2				16	16	16			
X2			1	603.2	598					
X3	10							598	604	
BT	22		610	610	50	608	608	120	606	606
BT	149	604	504	160	604	604	230	604	604	450
BT	602	602	530	600	600	610	598	598	661	603.9
BT	595.4	668	603.9	593	668	603.9	602.3	736	604.8	603.2
BT	736	604.8	596.2	740	604.8	597.6	750	606	600	760
BT	607.3	602	780	610	610	920	616	616	990	616
BT	616	1030	616	616	1080	614.9	614.9			
NC	0.08	0.08	0.04	0.3	0.5					
X1	58.3				50	50	50			
NC	0.1	0.08	0.045	0.1	0.3					
X1	59	32	660	740	1000	870	1155			
GR	623		623.2	40	622	210	620	240	618	250
GR	616	260	614	270	610	280	600	290	598	300
GR	596	310	594	320	590	330	590	380	588	450
GR	588	650	593.5	660	586.8	674	585	678	582.8	700
GR	584.6	720	586.5	727	596.5	740	598	830	598	890
GR	598	920	600	970	602	990	604	1010	606	1020
GR	608	1040	610	1060						
NC	0.1	0.1	0.04	0.1	0.3					
X1	60	31	650	715	1035	1035	1035			
GR	610		606	20	604	30	602	40	600	50
GR	598	70	596	180	594	500	592	640	594.2	650
GR	586.8	670	582.8	680	582.2	690	582.9	700	586.8	711
GR	591.4	715	599	746	614	750	616	760	620	780
GR	622	790	622	840	620	850	618	870	616	880
GR	614	890	612	900	610	920	608	940	608	970
GR	610	980								
NC	0.1	0.08	0.045	0.1	0.3					
X1	62	22	496	639	800	1900	2080			
GR	610		608	20	606	70	604	82	594	125
GR	592.1	200	594	330	596	467	596	496	595.6	550
GR	591.9	562	591.9	565	587.2	575	584.8	581	584.3	596
GR	584.3	610	586.8	618	595.8	639	598	640	598	840

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GR   598     910     610     950
NC  0.05    0.08    0.04     0.1     0.3
X1    64      23     222     273     950    1300    1460
GR   610             608      10     606      20     604      30     600      50
GR 598.1     120   598.2     158   598.2     222   587.6     233   584.4     241
GR 583.9     250   584.6     258   587.6     267   593.2     273   594.3     282
GR 594.9     380   594.9     580     596     630     598     650     600     660
GR   604     680     608     690     610     710
NC  0.08    0.08    0.04     0.1     0.3
X1  64.1      35     580     670     750     750    1000
GR   626             624     140     622     170     620     230     618     270
GR   616     320     614     360   612.2     400     610     410     604     441
GR 601.5     490     600     545     598     565     593     580   603.2     580
GR   592     585   587.8     598   583.8     625     588     646     594     664
GR 603.2     670     598     672     596     695     596     755   597.4     800
GR   598     815     600     850     602     855     604     875     606     885
GR   607     920   608.5     955     610    1060     612    1150     614    1220
NC  0.08    0.08    0.04     0.4     0.6
X1  64.2                             100     100     100
X3    10                                                   607.5   607.7
SB           1.5       3              48            1225    1.18   585.5   585.5
X1  64.3                              38      38      38
X2                     1   603.2   607.5
*       SHEET 12        X3 - IS IMPROVISED
X3    10                                                   607.5   607.7
BT    30             626     626     140     624     624     170     622     622
BT   230     620     620     270     618     618     320     616     616     360
BT   614     614     400   612.2   612.2     410   611.5     610     441   611.1
BT   604     490     610   601.5     545   608.4     600     565     608     596
BT   580   607.5     593     580   610.5   603.2     670   610.5   603.2     672
BT 607.7     598     695   607.7     596     755   607.7     596     800   607.7
BT 597.4     815   607.7     598     850   607.8     600     655   607.8     602
BT   875   607.9     604     885   607.9     606     920     608     607     955
BT 608.5   608.5    1060     610     610    1150     612     612    1220     614
BT   614
NC  0.06    0.08    0.04     0.4     0.6
X1  64.4                              50      50      50
NC  0.08    0.08    0.04     0.1     0.3
QT     7    2772    3564    5120    6800    7520    9170    7570
X1    66      19     580     673     410     410     410
GR   610             600      31     590      45     592      85     594     125
GR   596     165     596     280     596     420   594.9     580   590.6     587
GR 587.6     592   584.3     601   587.6     611   590.6     616   601.6     629
GR 602.4     640   607.8     651   606.2     658   605.5     673
NC  0.08    0.08    0.04     0.1     0.3
X1    68      31     620     655     430     240     535
GR   614             612      10     606      25     604      30     600      40
GR   598      50     596      60   595.8     110     596     200   596.8     330
GR   596     420     594     590   595.7     609   592.9     620   588.6     625
GR 587.3     630   585.2     635   585.4     643   588.6     649   595.9     655
GR   594     670     596     690   595.2     720     596     770     596     840
GR   595     850     600     870     604     880     608     890     612     900
GR   614    1000
NC  0.06    0.05    0.04     0.1     0.3
X1    70      48     688     769    1140    1600    1680
GR   614             612      50     612      70     632      70     632     120
GR   612     120     610     130     630     130     630     150     610     150
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GR 608.7     170     608     180     606     270     604     310     602     330
GR   600     440     620     440     620     470     600     470     600     490
GR   598     520     596     560   595.3     640   597.5     688   594.9     701
GR 589.9     709   587.3     718   586.8     730   587.6     738   589.1     752
GR 601.8     769   601.4     860     600    1000     598    1150    5960    1180
GR   598    1240     598    1280   599.4    1330     598    1420     598    1460
GR   596    1560     598    1580     598    1590     598    1600     600    1610
GR   604    1620     610    1640     614    1650
NC  0.06    0.07    0.04     0.1     0.3
X1  70.1      29     712     508     700     700     700
GR   614             612     100     610     240     608     310     606     360
GR 593.3     412   594.1     425   594.1     436   592.9   458.5   592.9   461.5
GR 588.6     473   587.1     490   587.1     508     594     508     596     640
GR   600     660     602     665     602     880     600     890     598     925
GR   598    1010   598.7    1100     600    1260     600    1285   600.8    1370
GR 601.4    1460   601.8    1510     602    1521   616.5    1565
NC  0.07    0.07    0.04     0.1     0.3
X1  70.2                             100     100     100
X3    10                                                     608     606
NC 0.025   0.025   0.025     0.3     0.5
X1 70.29                            82.5    82.5    82.5
X2                                                 1
*       SHEET 13        X3 IS IMPROVISED.
X3    10                                                     608     606
NC  0.07   0.055    0.04     0.3     0.5
X1  70.3                               5       5       5
X3    10                                                     606     606
NC  0.07   0.055    0.04     0.2     0.4
X1  70.4                             100     100     100
NC  0.07   0.055    0.04     0.1     0.3
X1    72      31      43      68     660     660     660
GR 616.9           612.3      15   596.9      36   596.1      43   589.6      54
GR 587.5      61   587.2      67   587.8      72   589.6      80   595.4      88
GR   596     100     596     170     596     190     596     220     600     330
GR   600     430     598     470     595     590     598     600     598     610
GR   598     630     598     640     598     740     600     780     602     860
GR   604     900     606     930     608     950     610     960     612    1010
GR   614    1040
NC  0.07   0.055
X1    74      31    1152    1191    1730     920    2275
GR   616             612      10     608      20     604      30     606      40
GR   598      60     598     130     600     150     602     260   602.2     290
GR   602     350     602     610   602.2     710     602     760     600     830
GR   596     996     596    1000     596    1020     596    1110   598.3    1123
GR 597.4    1152   598.4    1163   588.1    1168   587.7    1180   588.1    1191
GR 590.7    1197   598.8    1207   610.3    1214     612    1350     614    1450
GR   616    1490
NC  0.07   0.055    0.04     0.4     0.3
QT     7    1700    2500    4500    6250    7100    9000    7100
X1    76      39     375     428    1395    1480    1685
GR   616             614      70     612     140     614     220   612.8     250
GR   612     290   610.8     317     598     339   597.1     375     591     384
GR   588     392   587.5     400     589     411     591     418   598.4     420
GR 599.5     590     598     720     598     870     600     920     602     930
GR   604     940     608     950     612     960     612    1030   611.8    1070
GR   610    1340     608    1410     606    1450     604    1500     602    1510
GR 601.8    1730     600    1850     600    2000     602    2040     604    2050
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GR   608    2070     610    2080     614    2090     616    2100
NC  0.07     0.1    0.04     0.1     0.3
X1    78      63    1496    1548    1710    1000    1710
GR   618             616      10     614      30     612      50     610      60
GR   608      80     606     100     604     130     604     140     604     450
GR   604     460     606     480     608     490     608     520     606     550
GR   604     560     600     570     598     580     598     620     600     710
GR   600     740     598     760     595     790     596     830     598     850
GR   598     900     596     920     596     950     593     960     600     980
GR   600    1010     600    1030     600    1040     600    1050     600    1060
GR   600    1070     602    1090     604    1100     604    1110     598    1120
GR   598    1200     600    1210     602    1220   601.4    1456   599.1    1468
GR 594.6    1478   595.1    1496   592.3    1499   591.8    1509   591.7    1520
GR 591.8    1529   592.6    1539   600.7    1548     602    1600     602    1610
GR   602    1620     602    1900     602    1950     602    2000     604    2060
GR   608    2070     612    2080     618    2090
NC  0.07    0.07    0.04     0.1     0.3
X1    79      28    1746    1801    1200    1200    1200
GR   624             622      20     620      60     618     120     616     180
GR   614     240     612     270     610     310     608     370     606     510
GR   606     590     603     670     608     840     606    1160     604    1315
GR   604    1375     604    1575     604    1675     604    1725   602.7    1746
GR 593.5    1758   591.7    1765   591.5    1775   592.2    1783   593.5    1791
GR 597.9    1801   598.7    1864     616    1885
NC  0.07    0.07    0.04     0.2     0.4
X1  79.1      28  1491.1  1491.9     770     100     770
GR   620             618      55     616     110     614     260     612     480
GR   610     520     608     770     606    1125     604    1135     604    1235
GR   604    1275     602    1365     600    1395  598.77  1419.1  598.77    1429
GR   592    1435     592    1475  598.75  1481.4  598.75  1490.9     600    1525
GR   602    1585     604    1615     604    1675     602    1695     600    1735
GR   604    1785     606    1795     610    1805
*       SHEET 14
X1  79.2      28  1419.1  1490.9       5       5       5
GR   620             616      55     616     110     614     260     612     480
GR   610     520     608     770     606    1125     604    1135     604    1235
GR   604    1275     602    1365     600    1395  598.77  1419.1  598.77    1429
GR596.82  1431.1  596.73  1479.9  598.75  1481.4  598.75  1490.9     600    1525
GR   602    1585     604    1615     604    1675     602    1695     600    1735
GR   606    1785     606    1795     610    1805
NC  0.07    0.07    0.04     0.2     0.4
X1  79.3      28  1419.1  1490.9       5       5       5
GR   620             618      55     616     110     614     260     612     480
GR   610     520     608     770     606    1125     604    1135     604    1235
GR   604    1275     602    1365     600    1395  598.77  1419.1  598.77    1429
GR   592    1435     592    1475  598.75  1481.4  598.75  1490.9     600    1525
GR   602    1585     604    1615     604    1675     602    1695     600    1735
GR   604    1785     606    1795     610    1805
NC  0.06    0.07    0.04
X1    80      25     930     991       5     550     705
GR   620             618      55     616     110     614     260     612     480
GR   620     520   607.5     930   597.2     940   593.7     950   593.2     960
GR 592.7     970   592.2     985   601.6     991     602    1010     602    1130
GR   602    1210   602.7    1260     602    1300     600    1330     600    1350
GR   602    1360     604    1370     606    1380     610    1390     616    1410
NC  0.07    0.07    0.04
X1  80.1      24     974    1047      50     100     100
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X3    10                                                     610     602
GR   620     220     618     275     616     330     614     480   612.3     560
GR   614     720     614     830     612     860     610     970   610.6     974
GR 608.3     974     592     995   591.8    1010     592    1025   602.6    1047
GR 608.3    1047     602    1060     602    1385     604    1410     608    1420
GR   610    1430     612    1440     618    1460     620    1470
SB           1.5       3              38             950     1.2   591.8   591.8
X1  80.2                               5       5       5
X2                     1   608.3     602
X3    10                                                     610     602
BT    22     220     620     620     275     618     618     330     616     616
BT   480     614     614     560   612.3   612.3     720     614     614     830
BT   614     614     860     612     612     970     610     610     974   610.6
BT 610.6     974   610.6   608.3    1010   611.8   608.3    1047   610.6   608.3
BT  1047   608.3   608.3    1060     602     602    1385     602     602    1410
BT   604     604    1420     608     608    1430     610     610    1440     612
BT   612    1460     618     618    1470     620     620
NC  0.02    0.08    0.04     0.2     0.4
X1  80.3                              50      50      50
NC  0.08    0.08    0.04     0.1     0.3
X1    82      25     265     396    1225    1035    1390
GR   620             618      10     610      30     608      40     606      50
GR   604     210   603.2     265   597.1     275   594.9     290   595.1     300
GR   595     320   597.1     345   597.1     353   594.1     373   597.1     385
GR 601.6     396     604     630     604     650     606     740     610     750
GR   612     760     614     780     616     910     618    1000     620    1060
NC  0.08    0.06   0.045     0.1     0.3
X1    85      22     520     583    1300     720    1590
GR   620             618      30     617     140     618     240   618.6     270
GR   618     290     616     330     614     350     612     360     610     370
GR   608     380     606     390   604.1     520     597     528   593.5     540
GR 593.5     550     594     564     597     576   602.4     583     612     600
GR   618     630     620     670
NC  0.07    0.07    0.04     0.1     0.3
X1    87      24     421     491    1260    1260    1260
GR   622             620      40     616      60     614     110     612     120
GR   610     140     608     150     606     170     602     210     602     260
GR   604     360     604     400   603.5     421     597     434   595.8     442
GR 595.4     450   595.8     458     597     466     608     491     614     500
GR   620     520     622     530     626     540     630     560
NC  0.05    0.06    0.04     0.1     0.3
*       SHEET 15        X1 IS IMPROVISED.
X1    88      18                     815     815     815
GR   622             618      30     616      70     614      90     612     130
GR   608     170     606     200   605.7     365   597.2     395   595.5     401
GR 595.4     415   596.1     425   597.2     430   610.5     464     614     480
GR   615     490     624     510     626     520
NC  0.05    0.06    0.04     0.1     0.3
X1  88.1      22     410     471     200     200     200
X3    10                                                     616     620
GR   620             618     140     616     150     612     190     610     220
GR   606     260   605.2     310     604     410   594.9     410     594     440
GR 594.9     471     600     471     610     490     612     500     614     510
GR   616     520     618     530     620     540     622     550     624     560
GR   626     650   627.6     790
SB           1.5       3              61            1217             595     595
X1  88.2                              45      45      45
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X2                     1   615.7     616
X3      10                                                   616     620
BT      20           620     620     140     618     618     160   617.8     616
BT     190   617.5     612     220   617.3     610     260   616.7     606     310
BT     616   605.2     410     620     604     410   622.6     614     471   621.4
BT   615.7     490     622     610     500   622.2     612     510   622.3     614
BT     520   622.7     616     530     623     618     540   623.3     620     550
BT   623.5     622     560     624     624     650     626     626     790   627.6
BT   627.6
NC    0.05    0.06    0.04     0.1     0.3
X1    88.3      16     264     367     130     130     130
GR     622             622      10     618      30     614      50     610      70
GR     608      80   607.5     100     606     130     604     264   600.1     274
GR   597.9     279     597     286   597.9     321   600.3     327   615.1     367
GR     624     680
NC    0.05    0.06    0.04     0.4     0.6
X1    88.4      17     234     367     210     210     210
X3      10                                                   620     620
GR     622             618      30     614      50     610      70     608      80
GR   607.5     100     606     130   604.6     234   615.2     234   600.1     274
GR   597.9     279     597     286   597.9     321   600.3     327   615.1     367
GR   620.6     367     624     680
SB    0.95     1.5       3              50     2.6    1763     2.1   597.5   597.5
X1    88.5                              40      40      40
X2                     1   617.3   620.5                                0.91
X3      10                                                   620     620
BT      11             622     622      30   621.7     618      50   621.4     614
BT      70   621.1     610     100     621   607.5     130     621     606     234
BT   620.5   604.6     234   620.5   617.2     367   620.6   617.3     367   620.6
BT   620.6     680     624     624
NC                             0.3     0.5
X1    88.5                             100     100     100
NC    0.05    0.07    0.04     0.1     0.3
X1      89      20     230     315     420     420     420
GR     620             613      10     616      20     614      30     612      40
GR     610      50   608.5      80   606.3     150   602.8     190     603     210
GR   604.6     230   597.6     239   596.6     250   596.6     260   596.1     270
GR   597.6     284   609.6     315     612     320     618     340     622     360
EJ
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    2 YEAR
T3      SWAN CREEK
J1     -10       3                                                    576.39
J2       2              -1
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    10 YEAR
T3      SWAN CREEK
J1     -10       4                                                    577.17
J2       3              -1
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    50 YEAR
T3      SWAN CREEK
J1     -10       5                                                    578.17
J2       4              -1
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    100 YEAR
T3      SWAN CREEK
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J1   -10       6                                                       578.51
J2     5              -1
ER
```

ATTACHMENT C

HEC-2 Code with Proposed Cross-Sections

Proposed Cross-Sections Model

```
T1      Type 19 FIS
T2      Toledo Ohio 1 Year
T3      Swan Creek
J1   -10       2                                                  576.02
J2     1              -1
NC  0.05    0.05    0.04       1     0.3
QT     7    2905    3811    5900    8000    9000   11000    9000
X1   0.1      11             115
GR   590       0   563.1       0   562.1      10   562.1      57   564.6      67
GR 570.3      86   574.7     115   583.4     122   583.6     150     584     250
GR   604     250
NC  0.05    0.05    0.04     0.3     0.5
X1   0.2      10     272     355      50      50      50
X3    10                                                     583   582.2
GR   590     272     572     272     563     300   562.8     313     563     330
GR 569.3     355     583     400   582.2     425     583     560   584.7     655
SB           1.5     2.8              56       0    1200     0.8     563     563
X1   0.3                              43      43      43
X2                     1   580.3   582.2
X3    10                                                     583   582.2
BT     8     272     590     590     272     583   580.3     355     583   580.3
BT   355   580.3   569.3     400     583     583     425   582.2   582.2     560
BT   583     583     655   584.7   584.7
NC  0.06    0.05    0.04     0.2     0.4
X1   0.4      11       0     115      50      50      50
GR   590       0   563.1       0   562.1      10   562.1      57   564.6      67
GR 570.3      86   574.7     115   583.4     122   583.6     150     584     250
GR   604     250
NC  0.06    0.04    0.04     0.1     0.3
X1   0.5                             425     425     425
NC  0.06    0.04    0.04     0.3     0.5
X1   0.6      11     168     250      50      50      50
X3    10                                                     584   583.6
GR   590     140     585     140     585     168   569.3     168  562.75     179
GR562.75     209  562.75     239   569.2     250     583     250   583.6     280
GR   584     370
SB           1.5     2.8              76       0    1575    0.15     563     563
X1   0.7                              42      42      42
X2                     1     583   583.6
X3    10                                                     584   583.6
BT     9     140     590     590     140     585     585     168     585     585
BT   168     585     583     209   585.1     583     250   585.2     583     250
BT 584.4     583     280   583.6   583.6     370     584     584
NC  0.05    0.04    0.04     0.3     0.5
X1   0.8      11      33     131      50      50      50
GR   610       0   590.4       0   572.4      33   566.4      45   562.9      78
GR 564.4     114   571.4     123   574.4     125   581.4     131   583.9     174
GR   604     174
NC  0.07    0.06    0.04     0.1     0.3
X1     2                             750     750     750
NC  0.07    0.06    0.04     0.1     0.3
X1   2.1                             610     610     610
NC  0.06    0.06    0.04     0.3     0.4
X1   2.2      24     334     436      50      50      50
X3    10                                                     594     600
GR   594             583             583     140     582     210     582     210
GR   582     245   580.3     273   580.2     317   573.3     334   577.1     354
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Proposed Cross-Sections Model

GR	570.6	354	562.5	370	562.5	410	568.4	436	588.8	436
GR	590	480	591	523	592	560	592.8	580	594	610
GR	596	650	598	670	600	690	606	710		
SB		1.5	2.9		69	0	2480	0.6	563	563
X1	2.3				80	80	80			
X2			1	591.9	594					
*	SHEET 2									
BT	20	0	594	594	0	594	583	140	596	583
BT	210	597.6	582	245	598.2	582	273	598.8	580.3	317
BT	599.5	580.3	334	599.8	573.3	334	599.8	590.2	436	601
BT	591.9	436	601	588.8	480	602	590	523	602.8	591
BT	560	603.5	592	580	604	592.8	610	604.5	594	650
BT	605	596	670	605.3	598	690	605.5	600	710	606
BT	606									
NC	0.06	0.05	0.04	0.2	0.4					
X1	3	28	317	437	125	125	125			
GR	603	0	603	50	583	50	583	90	603	90
GR	603	145	583	145	582	210	602	210	602	245
GR	582	245	580.3	273	580.2	317	572.3	333	565.2	371
GR	561.2	385	568.2	394	572.3	401	588.8	437	591	523
GR	592	560	594	610	596	650	598	670	600	690
GR	602	700	604	720	606	780				
X1	3.05				100	100	100			
NC	0.06	0.05	0.04	0.3	0.5					
X1	3.1	27	125	254	225	225	225			
X3	10							590	594	
GR	590	0	590	30	590	60	590	110	588	120
GR	586.5	125	584	129	565.5	130	561	135	560.7	140
GR	561	155	570.8	183	582.4	183	582.4	196	587.3	196
GR	587.7	218	584.3	218	586.1	251	588.2	251	588.2	254
GR	590.1	254	592	275	593	290	594	300	596	378
GR	598	460	600	510						
NC	0.06	0.06	0.025	0.3	0.5					
X1	3.11				5	5	5			
X3	10							590	594	
BT	14	0	590	590	30	590.5	590	60	591	590
BT	110	590.8	590	120	592	588	125	592	586.5	254
BT	593.6	588.2	254	593.6	590.1	275	593.8	592	290	594
BT	593	300	594	594	370	596	596	460	598	598
BT	510	600	600							
X1	3.19				55	55	55			
X2							1			
X3	10							590	594	
NC	0.07	0.07	0.04	0.3	0.5					
X1	3.2				5	5	5			
X3	10							590	594	
NC	0.07	0.07	0.04	0.2	0.4					
X1	3.3	10	25	125	50	50	50			
GR	586	0	580	25	571.9	35	565	51	561.7	76
GR	564.9	94	572.4	114	580	125	590	142	592	150
NC	0.07	0.06	0.04	0.1	0.3					
X1	5	10	180	315	955	955	955			
GR	585	0	584.4	150	584	180	571.9	219	565	235
GR	561.7	260	564.9	278	574.4	298	603.4	315	603.4	365
NC	0.07	0.06	0.04	0.1	0.3					
X1	5.1	11	85	210	500	500	500			
GR	594	0	592	60	590	70	586	85	572.4	89

Proposed Cross-Sections Model

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GR 565.6     119   565.9     140   570.1     162     573     179     584     210
GR   590     240
X1  5.15                                 425     425     425
NC  0.05    0.06    0.04     0.5     0.7
X1   5.2      13     139     323      50      50      50
X3    10                                                         586     590
GR   586       0     589     139   584.5     139   582.2     139   571.8     164
GR 568.5     195   564.5     230   567.5     265   572.7     300   586.6     323
GR 581.8     323   587.2     410     593     480
SB  1.25     1.5       3              72       8    2590     2.6     565     565
X1   5.3                                  66      66      66
X2                     1   586.6     586
X3    10                                                         586     590
BT     7       0     586     586     139     589     589     139     589   584.5
BT   323   591.1   586.6     323   591.1   581.8     410     592   587.2     480
*   ESTIMATED BT
BT   592     587
*       SHEET 3
NC  0.04    0.04    0.04     0.4     0.5
X1     7      13     168     300     200     200     200
GR   586       0     586      85     606      85     606     155   587.8     155
GR 584.8     168   572.4     179   565.6     209   565.9     230   570.1     252
GR   573     269   590.2     300   591.7     580
NC  0.04    0.04    0.04     0.1     0.3
X1   7.1                                 600     600     600
NC  0.05    0.05    0.04     0.5     0.7
X1   7.8      36     117     286      50      50      50
X3    10                                                         596   597.5
GR   596      40   596.2      77     594      90     592     100   586.1     117
GR 581.5  129.45   595.6  129.45   595.6  130.55     581  130.55   578.8  142.45
GR 595.7  142.45   595.7  143.55   576.5  143.55   572.3  157.45     596  157.45
GR   596  158.55     572  158.55     571     167   591.4     167   591.4     173
GR 568.3     173   565.3     198   567.6     223   589.9     223   596.3     238
GR 573.6     238   575.3     247     584     247     586     270     593     270
GR   597     270     597     272   589.3     272   592.2     286   598.2     286
GR   599     370
NC  0.03    0.03    0.03     0.1     0.3
X1  7.81                                   5       5       5
X3    10                                                         596   597.8
BT    23      40     596     596      77   596.2   596.2      90   596.3     594
BT   100   596.4     592     117   596.7   586.1     117   596.7   595.5  129.45
BT 596.7   595.6  130.55   596.7   595.6  142.45   596.9   595.7  143.55   596.9
BT 595.7  157.45     597     596  158.55     597     596     167     597     596
BT   167     597   591.4     173   597.2   591.4     223   597.5   589.9     238
BT 597.8   590.3     270     598     593     270     598     597     272     598
BT   597     286   598.2   592.2     286   598.2   598.2     370     599     599
X1  7.89                                  15      15      15
X2                                                         1
X3    10                                                         596   597.5
NC  0.06    0.05    0.04
X1   7.9                                  25      25      25
X3    10                                                         596   597.5
NC  0.06    0.05    0.04     0.2     0.4
X1  7.12      11      45     265      25      25      25
X3    10                                                         594     594
GR   594       0     596      45     588      45   586.8      45   571.5      90
GR 566.2     103   564.4     150   571.7     195   589.9     265   598.4     265
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GR 598.6     290
SB   0.9     1.5     2.9              58       6    3320     3.2     566     566
X1  7.13                              50      50      50
X2                     1   591.1     594                              0.89
X3    10                                                     594     594
BT     6             594     594      45     596     596      45     596     588
BT   265   598.4   591.1     265   598.4   598.4     290   598.6   598.6
NC  0.05    0.05    0.04     0.2     0.4
X1  7.14                              20      20      20
NC  0.05    0.05    0.04     0.2     0.4
X1  7.15       9      50     270      20      20      20
X3    10                                                   597.6   597.6
GR   597       0   597.6      50   590.3      50     571     100   567.1     150
GR 571.3     200   591.1     270   599.6     270     600     340
SB   0.9     1.5     2.9              85       6    3510     2.9     569     567
X1  7.16                              55      55      55
X2                     1   592.4     597                               .87
X3    10                                                   597.6   597.6
BT     6       0     597     597      50   597.6   597.6      50   597.6   590.3
BT   270   599.6   592.4     270   599.6   599.6     340     600     600
NC   0.1    0.06    0.04     0.2     0.4
X1     8      15      92     232     325     325     325
GR   606       0     606      40     586      40   584.2      92   572.7     103
GR 569.5     126     566     150   568.5     181   572.7     202   586.5     232
GR   594     240     596     250     597     270     596     280     590     300
NC  0.06    0.06    0.04     0.2     0.4
*       SHEET 4         X1 IS IMPROVISED.
X1   8.1      14      84     230     220     220     220
X3    10                                                     590   587.5
GR   594       0   593.8      27   585.1      27     575      72   568.8      84
GR 566.7     117   569.6     153   572.8     184   579.3     214     580     230
GR 587.5     244     590     249     600     254     606     289
NC  0.03    0.03    0.03     0.2     0.4
X1  8.11                               5       5       5
X3    10                                                     590   587.5
BT    10       0     594     594      27   593.8   593.8      27   593.8   587.2
BT   214   588.3   581.7     214   588.3   579.3     230     588     580     244
BT 587.5   587.5     249     590     590     254     600     600     289     606
BT   606
X1  8.19                              65      65      65
X2                                                     1
X3    10                                                     590   587.5
NC  0.06    0.06    0.04     0.2     0.4
X1   8.2                               5       5       5
X3    10                                                     590   587.5
X1   8.3                             100     100     100
NC   0.1    0.08    0.05     0.1     0.3
X1     9      20      50     180     605     605     605
GR 589.7       0   588.6      50   575.3      73   573.8      88   572.6      95
GR   569     103   566.4     117   566.6     139   572.9     146   593.9     180
GR   606     250     606     390     608     430     610     440     612     590
GR   612     600     632     600     632     635     612     635     613     770
NC   0.1     0.1    0.05
X1   9.1      50     416     559    1005    1005    1005
X3    10                                                   588.6   591.2
GR 601.4       0   601.4       0   601.2      10     601      20   600.8      30
GR   600      60     598     100     596     140     594     170     592     210
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Proposed Cross-Sections Model

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GR   591     230     590     250   588.6     340     590     375   591.6     413
GR   582     413     580     416   574.4     416   574.6     420   574.3     424
GR   574     431   573.6     438   573.5     442   573.2     446   572.3     452
GR 571.9     456   571.2     460     570     469   569.1     475   568.7     479
GR 567.9     485     568     486   568.1     489   568.3     493     569     497
GR 569.8     504   570.3     512   570.8     516   571.2     520     572     526
GR 572.8     530   572.6     532   573.8     534   574.9     540     577     548
GR 577.1     552   578.2     554     580     556   591.2     559     596     760
NC 0.025   0.025   0.025     0.3     0.5
X1  9.11                               5       5       5
X3    10                                                   588.6   591.2
BT    37     413   591.6     582     413   592.2     582     416   592.2     580
BT   420   592.2   583.4     424   592.2   584.9     431   592.2   586.3     438
BT 592.2   584.9     442   592.2   583.4     446   592.2     580     446   592.2
BT 573.2     452   592.2   572.3     452   592.2     580     456   592.2   583.4
BT   460   592.2   584.9     469   592.2   586.3     475   592.2   584.9     479
BT 592.2   583.4     486   592.2     580     486   592.2     568     489   592.1
BT 568.1     489   592.1     580     493   592.1   583.4     497   592.1   584.9
BT   504   592.1   586.3     512   592.1   584.9     516   592.1   583.4     520
BT   592     580     520     592   571.2     526     592     572     526     592
BT   580     530     592   583.4     536     592   584.9     540     592   586.3
BT   548     592   583.4     552     592   584.9     556     592     580     559
BT 592.1   591.2
X1  9.19                              55      55      55
X2                                                     1
X3    10                                                   588.6   591.2
NC  0.08    0.08   0.045     0.3     0.5
X1   9.2                               5       5       5
X3    10                                                   588.6   591.2
NC  0.08    0.08   0.045     0.2     0.4
X1   9.3      14     400     554     130     130     130
GR   594       0     592      10     590      20     587      30     587     230
GR   587     375   587.1     400   572.8     435   569.8     460     568     480
GR 566.3     508   572.5     517   591.3     554     596     760
NC  0.05     0.1    0.04     0.1     0.3
X1    11                             520     520     520
*       SHEET 5         GRs FOR X1 ABOVE??
X1    12      19      57     260    1365     725    1365
GR 598.9       0   583.4      32   581.8      57   572.6      76   568.9      84
GR 565.9     100   568.9     114   572.9     125   576.5     135   578.3     155
GR   580     260     582     280     584     340     584     450     584     950
GR   584    1220     584    1250     586    1280     590    1320
NC  0.06     0.1    0.04     0.1     0.3
X1    13      11     485     618    1250     660    1250
GR   590       0     588     140   586.3     435   586.3     485     575     509
GR   573     533     567     539   566.4     550   565.9     562   572.3     575
GR 590.8     618
NC  0.05    0.05    0.04     0.4     0.6
X1  13.1      19     219     330     590     590     590
X3    10                                                     600     600
GR 602.2       0   601.9     219   574.2     219   572.9     226   568.5     235
GR 568.4     244   568.5     255   571.6     269   586.6     269   593.7     280
GR 597.6     280  597.96     286   586.6     286   586.6     297   575.3     297
GR 594.1     330   597.3     330   601.7     330     600     820
NC  0.05    0.05    0.04     0.3     0.5
X1 13.11                               5       5       5
X3    10                                                     600     600
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Proposed Cross-Sections Model

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BT     8       0   602.2   602.2     219   601.9   601.9     219   601.9   593.7
BT   280   601.7   593.7     280   601.7   597.6     330   601.7   597.3     330
BT 601.7   601.7     820     600     600
X1 13.19                              32      32      32
X2                                                     1
X3    10                                                     600     600
NC  0.05    0.05    0.04     0.3     0.5
X1  13.2                               5       5       5
X3    10                                                     600     600
NC  0.06    0.07    0.04     0.2     0.4
X1    14      16     200     300     215     215     215
GR 590.9       0     590      50     588      70     586     150   585.1     155
GR 579.9     175   578.5     200   571.9     220   565.6     232   566.8     244
GR   569     259   571.1     274   588.1     275   603.6     300     604     340
GR   624     340
NC  0.06    0.08    0.04     0.1     0.3
X1    16      22     520     722    1305    1305    1305
GR   600       0     590      35     589     100     609     100     609     135
GR   588     135     588     440     590     475   591.7     520   591.6     565
GR 590.9     585   572.2     614   568.7     624   568.2     632   568.4     645
GR 572.2     653   576.7     690   590.2     722     592     740     594     780
GR   596     812     598     825
NC  0.06    0.08    0.04     0.3     0.5
X1  16.1      33     471     569     170     170     170
X3    10                                                     592   592.3
GR   608      30     608      50     608      70     606      80     604      90
GR   600     100   598.5     170     598     250     596     330     594     400
GR   592     420     590     430     585     450     576     471   572.9     477
GR   567     505     567     520     567     535     573     563   573.9     569
GR 578.2     620   583.6     680     584     700   854.5     720   584.9     740
GR 585.8     790     586     800   587.5     850     588     870     590     880
GR   596     900     600     910     604     910
SB           1.5       3              71       0    1525    0.75     567     567
X1  16.2                              50      50      50
X2                     1   585.6     592                                    0.87
X3    10                                                     592   592.3
BT    30      30     608     608      50     608     608      70     608     608
BT    80     606     606      90     604     604     100     600     600     170
BT 598.5   598.5     250     596     596     330     596     596     400     594
BT   594     420     592     592     430   592.3     590     450   592.8     585
BT   471   593.2     576     471   594.5   585.3     569   594.5   585.3     569
BT 593.2   573.9     620   592.3   576.2     680   593.5   583.6     700     594
BT   584     720     595   584.5     740     596   584.9     790     598   585.8
BT   800   598.3     586     850     600   587.5     870   601.2     588     880
BT   602     590     900     603     580     910     600     600     910     604
*       SHEET 6
NC  0.06    0.06    0.46     0.3     0.4
X1  16.3                              50      50      50
NC  0.06    0.06    0.04     0.1     0.3
X1    17      26     450     630     960     960     960
GR   608       0     608      30     608      30     608      70     606      80
GR   604      90     600     100   598.5     170     598     250     596     330
GR   594     400     592     420     590     430   569.1     450   572.1     481
GR 670.3     499   569.3     520   569.3     536   572.1     547   583.6     680
GR 584.5     729     588     800     588     870     590     880     596     900
GR   600     910
NC   0.1    0.07    0.04     0.1     0.3
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Proposed Cross-Sections Model

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X1    19      22      70     122    1475    1385    1475
GR 619.3       0     572      70   570.9      83   569.8      97   570.5     108
GR   572     122   578.3     135     578     250     576     270     580     370
GR   582     390     584     400     586     420   586.7     500     588     550
GR   590     730     592     780     612     780     612     810     592     810
GR   564    1060     596    1080
NC   0.1    0.07    0.04     0.1     0.3
X1    20      36      40     149     535     320     535
GR   600       0     590      30   590.3      40   572.8      75   569.2      86
GR 567.2     100   570.7     116   572.2     129   579.3     149   578.7     278
GR 582.5     300   582.1     360     585     400     588     450     590     490
GR   590     555     610     555     610     585     590     585     592     650
GR   612     655     612     730     592     730     592     850     592     880
GR   612     880     612     910     592     910     592     980     592     990
GR   612     990     612    1040     592    1040     594    1080     596    1240
GR   600    1260
NC   0.1     0.1    0.04     0.3     0.5
X1  20.1      20    1141    1238    1315    1315    1315
X3    10                    1010                             590     597
GR   598       0     596      80     594     160     592     400     590    1010
GR 587.5    1030     586    1040     584    1090     582    1110   582.2    1118
GR 582.7    1130   584.5    1141   575.9    1154   572.5    1167   571.8    1190
GR 572.9    1212     579    1230   586.9    1238   597.2    1262     600    1320
SB           1.5     2.8              43            1040     1.8     572     572
X1  20.2                              65      65      65
X2                     1   586.9     590                            0.88
X3    10                    1010                             590     597
BT    17       0     598     598      80     596     596     160     594     594
BT   400     592     592    1010     590     590    1030     590   587.5    1040
BT 590.4     586    1090   592.8     584    1110   593.8     582    1118     594
BT 582.2    1118   598.3   582.2    1130   598.5   582.7    1141   598.7   584.5
BT  1238   600.2   586.9    1262   600.7   597.2    1262   597.2   597.2    1320
BT   600     600
NC   0.1    0.07    0.04     0.3     0.5
X1    22      36    1162    1262     205     205     205
X3                          1010
GR   600       0     598     120     618     120     618     180     596     180
GR   594     220     614     220     614     270     594     270     594     280
GR   614     280     614     330     594     330     592     490     592     690
GR   612     690     612     930     592     940     612     940     612     940

GR   612     980     592     980     596    1010     586    1040     554    1090
GR   582    1110   582.7    1130   576.6    1152   576.8    1162   572.4    1167
GR 569.2    1176   568.6    1190   570.2    1206   572.9    1215   602.9    1262
GR   604    1280
NC  0.06    0.08    0.04     0.1     0.3
X1    23      38     807     892     850     850     850
GR   594       0     596      70     594     160     594     190     614     190
GR   614     220     594     220     592     330     592     360     612     360
GR   612     400     590     400     590     480     610     480     610     500
GR   590     500     590     520     610     520     610     540     590     540
GR   586     586     586     670     584     730     582     750     580     800
GR   580     807   572.5     822   570.6     832   569.5     850   569.9     871
GR 572.5     885   577.6     892   578.5     898   585.4     912     590     930
GR   594     950     596     960     600     970
*       SHEET 7
X1    24      53     432     508     840     840     840
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GR   618       0     618      10     598      10     598      20     618      20
GR   618      40     598      40     596      60     616      60     616      90
GR   594      90     594     100     614     100     614     130     594     130
GR   594     135     614     135     614     150     594     150     594     160
GR   614     180     614     180     592     180     592     190     612     190
GR   612     210     592     210     592     220     612     220     612     240
GR   592     240     590     260     610     260     610     290     590     290
GR 588.9     356   586.4     397   578.4     410   578.4     432   572.5     442
GR   571     456   569.1     470   569.5     486   572.5     497     580     508
GR 580.9     546     580     570     580     620     584     630     590     640
GR   592     650     598     660     600     670
NC  0.08    0.06    0.04     0.4     0.6
X1  24.1      26     170     290     290     290     290
X3    10                                                 591.1   589.9
GR   600       0     590      17     580      30     578      35     578      50
GR   578      70     578     170   585.2     170   575.1     200   571.5     230
GR 575.8     260   585.5     290     578     290     588     330   588.4     380
GR   588     400   589.4     520     590     575     592     590     594     640
GR   596     700     598     750     600     800     602     860     604     880
GR   606     910
SB           1.5       3              60       0    1350       2     573     573
X1  24.2                              40      40      40
X2                     1   588.2   589.9                                  0.95
X3    10                                                 591.1   589.9
BT    24       0     600     600      17   598.2     590      30   597.3     580
BT    35     597     578      50     596     578      70   594.6     578     170
BT 591.1     578     170   591.1     588     230   591.3   588.2     290   591.1
BT   588     290   591.1     578     330   590.1     588     380   589.9   588.4
BT   400   589.8     588     520     590   589.4     575   591.4     590     590
BT   592     592     640     594     594     700     596     596     750     598
BT   589     800     600     600     860     602     602     880     604     604
BT   910     606     606
NC  0.07    0.08    0.04     0.3     0.5
X1  24.3      19     170     290      80      80      80
GR   600       0     590      17     580      30     578      35     578     170
GR 575.1     200   571.5     230   575.8     260     578     290     588     330
GR   590     575     592     590     594     640   598.7     680     598     750
GR   600     800     602     860     604     880     606     910
NC  0.05    0.08    0.04     0.1     0.3
*   NEW CROSS-SECTIONS FROM CHAMPION TO SOUTH
X124.318      38     649     715     710     735     710
GR   612       0     610     205     608     269     606     350     596     498
GR   594     525     592     565     590     620     588     630     582     644
GR   573     649  571.76     653  571.13     658  570.83     665  571.29     670
GR570.43     675  570.17     683  570.24     688  570.81     695   570.7     703
GR571.24     710  571.76     715     582     720     584     726     588     736
GR   590     971     592    1031     594    1047     596    1068     598    1099
GR   600    1152     602    1225     604    1302     606    1393     608    1444
GR   610    1483     612    1565     614    1597
X124.327      26     283     342     292     319     300
GR   614       0     612      32     610      50     608     121     606     180
GR   582     222     580     233  571.77     283  570.62     287  569.85     293
GR 568.5     300  568.62     307  569.02     317  568.98     322  571.04     328
GR571.77     333     573     342     580     368     582     380     584     396
GR   586     643     588     974     590    1080     592    1101     594    1121
GR   610    1227
X124.336      37     304     368     150     151     150
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GR   614     0.4     612   113.4     610   146.3     608   202.5     606  210.96
GR   584  243.46     582  247.84     580     256  571.31     304  570.41     309
GR570.44     316     570     322  569.56   326.5  570.29     332  569.91     338
GR570.48     343  571.11     347  571.76   349.5     573     368     580     392
GR   582     405     584     416     586   514.5     588     542     590   556.7
GR   594   573.6     594   624.4     592     647     590   673.8     588   703.5
GR   586     725     588    1104     590    1148     592    1176     594    1207
GR   596    1231     598    1257
NC   .05     .08    .055
X124.345      26     151     200     160     155     159
GR   614       0     612      10     610      19     586      84     584      91
GR   582     100     580     148  571.84     151  569.35     157  568.79     165
GR568.62     166  569.17     173  570.39     179  570.46     187  571.21     195
GR571.84     200     580     202     582     226     584     265     586     290
GR   588     892     590     963     592     997     594    1018     596    1032
GR   598    1050
NC  0.05    0.08   0.025
X124.354      23     106     168     226     202     209
GR   614       0     612      10     584      83     582      89  571.81     106
GR570.85     111  570.21     116  569.84     123  570.34     128  570.32     137
GR 570.8     142  571.07     152  571.81     158     573     168     582     172
GR   584     188     586     248     588     852     590     908     592     953
GR   594    1001     596    1029     598    1044
X124.363      27     166     217     169     153     164
GR   614       0     612      16     610      61     608      88     584     145
GR   582     152     580     160  571.81     166  570.41     171  569.58     178
GR567.74     183  568.06     185  568.24     192  568.52     198  569.71     201
GR571.81     207  572.56     217     580     225     582     239     584     259
GR   586     327     588     954     590    1063     592    1160     594    1197
GR   596    1218     598    1233
X124.372      29     184     230     237     214     231
GR   614       0     612      41     610      63     608     114     606     121
GR   588     153     586     158     584     164     582     179  571.74     184
GR569.82     189  568.43     196  568.86     201  569.13     207   569.4     214
GR569.78     221  571.79     230     582     262     584     276     586     385
GR   588     637     586     822     586     888     588    1040     590    1150
GR   592    1278     594    1296     596    1312     598    1330
X124.381      33     248     300     277     284     279
GR   614       1     612      54     610     103     608     133     606     145
GR   604     151     586     187     584     200     582     211     580     234
GR   574     240     575     242  571.81     248  570.22     252  568.79     255
GR 568.1     262  567.83     265  568.95     271  570.22     276  570.58     280
GR570.72     286   570.6     294  571.81     300     580     311     582     327
GR   584     339     586     375     588     471     590     711     592     756
GR   594     790     596     980     598    1010
X124.390      42     446     498     410     376     388
GR   614       0     612      26     610      58     608      69     606      75
GR   604      82     602      88     600      93     598     100     596     108
GR   594     126     594     226     596     242     596     270     594     288
GR   592     300     590     309     588     323     586     339     584     357
GR   582     381  571.71     446  570.65     453  570.19     463  569.31     471
GR569.21     479  569.31     485  570.09     491  571.71     498     582     527
GR   584     539     586     563     588     608     588     960     586    1231
GR   586    1722     588    1888     590    2053     592    2096     594    2131
GR   596    2232     598    2287
* HIGHLAND PARK FOOTBRIDGE
SB           1.5     2.8                45     2.5    1077     1.7  570.01  570.01
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Proposed Cross-Sections Model

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NC  0.05    0.08    0.35
X1  24.4                            140     152     148
X2                     1   589.7   594.4                    1.33
X3    10                                                   583.2   583.9
BT    28     156     596     596     168   594.4     594     181   594.4     592
BT   199   594.4     590     255   594.4     588     322   594.4     586     449
BT 594.4     584     466   594.4     582     479   594.4     580     527   594.4
BT   580     561   594.4     582     571   594.4   589.7     575   594.4   589.7
BT   580   594.4   589.7     585   594.4   589.7     590   594.4   589.7     595
BT 594.4   589.7     600   594.4   589.7     605   594.4   589.7     610   594.4
BT 589.7     614   594.4   576.7     615   594.4     575     627   594.4     584
BT   642   594.4     586     651   594.4     588     761   594.4     590    1130
BT 594.4     592    1182   594.4     594
X124.409      57     571     614      48      42     46
GR   616       0     614      35     612      55     610      74     608      90
GR   606     102     604     112     602     122     600     131     598     142
GR   596     156     594     168     592     181     590     199     588     255
GR   586     322     584     449     582     466     580     479     580     527
GR   582     561  572.16     571  570.59     575  570.22     580  570.21     585
GR570.01     590  570.18     595   570.4     600  571.06     605  571.21     610
GR571.92     614   576.7     614     575     615     584     627     586     642
GR   588     651     590     761     592    1130     594    1182     596    1229
GR   596    1312     594    1369     592    1408     590    1501     590    1674
GR   592    1728     594    1764     596    1835     598    1862     600    1900
GR   600    2035     598    2070     600    2086     602    2093     604    2100
GR   606    2122     608    2387
NC  0.05    0.08    0.04
* CROSS-SECTION 8b - DWNSTRM
X124.418      76     721     776      50      50     50
GR   616       0     614      10     612      18     610      25     608      32
GR   606      42     604      48     602      56     600      62     598      68
GR   596      76     594      83     592      94     590     115     588     348
GR   586     430     584     443     582     453     580     469     579     526
GR   579     617     580     644  575.48     647  572.09     656  571.26     659
GR571.25     664  571.36     669  571.19     674  570.93     679  570.69     684
GR570.44     689  570.11     694  569.93     699  569.87     700  570.04     704
GR570.51     709  571.11     711  576.11     711     582     721     584     727
GR   586     731     588     737     590     748     592     870     594    1035
GR   596    1093     598    1154     600    1190     602    1210     604    1224
GR   606    1238     608    1254     610    1269     612    1286     612    1358
GR   610    1383     608    1398     606    1418     604    1436     602    1448
GR   600    1461     598    1472     596    1485     594    1508     592    1545
GR   592    1721     594    1772     596    1821     598    1873     600    1924
GR   602    1975     604    2211     606    2262     608    2555     610    2797
GR   612    2830
* CROSS-SECTION 8 REVISED  WEIR ELEV 572.6
X124.428      67     721     776      50      50     50
GR   616       0     614      10     612      18     610      25     608      32
GR   606      42     604      48     602      56     600      62     598      68
GR   596      76     594      83     592      94     590     115     588     348
GR   586     430     584     443     582     453     580     469     579     526
GR   579     617     580     644  575.48     647   572.6     654   572.6   696.5

GR571.85     700   572.6   703.5   572.6     711  576.11     711     582     721
GR   584     727     586     731     588     737     590     748     592     870
GR   594    1035     596    1093     598    1154     600    1190     602    1210
GR   604    1224     606    1238     608    1254     610    1269     612    1286
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GR   612    1358     610    1383     608    1398     606    1418     604    1436
GR   602    1448     600    1461     598    1472     596    1485     594    1508
GR   592    1545     592    1721     594    1772     596    1821     598    1873
GR   600    1924     602    1975     604    2211     606    2262     608    2555
GR   610    2797     612    2830
* CROSS-SECTION 8a - UPSTRM
X124.438      76     721     776     9.6     9.6      10
GR   616       0     614      10     612      18     610      25     608      32
GR   606      42     604      48     602      56     600      62     598      68
GR   596      76     594      83     592      94     590     115     588     348
GR   586     430     584     443     582     453     580     469     579     526
GR   579     617     580     644  575.48     647  572.09     656  571.26     659
GR571.25     664  571.36     669  571.19     674  570.93     679  570.69     684
GR570.44     689  570.11     694  569.93     699  569.87     700  570.04     704
GR570.51     709  571.11     711  576.11     711     582     721     584     727
GR   586     731     588     737     590     748     592     870     594    1035
GR   596    1093     598    1154     600    1190     602    1210     604    1224
GR   606    1238     608    1254     610    1269     612    1286     612    1358
GR   610    1383     608    1398     606    1418     604    1436     602    1448
GR   600    1461     598    1472     596    1485     594    1508     592    1545
GR   592    1721     594    1772     596    1821     598    1873     600    1924
GR   602    1975     604    2211     606    2262     608    2555     610    2797
GR   612    2830
*  CROSS-SECTION 7a REVISED  WEIR ELEV 573.1
X124.447      46  718.18     776      92      97      96
GR   614       0     612       6     610      11     608      16     606      28
GR   604      35     602      45     600      57     598      67     596      76
GR   594      84     592      95     590     152     592     425     590     470
GR   588     525     586     547     584     559     582     569     580     595
GR   580     627  576.08     705   573.1  718.18   573.1     758  572.35   761.5

GR 573.1     765   573.1     776  576.25     776  577.05     779     582     790
GR   584     800     586     809     588     816     590     823     592     832
GR   594     845     596     882     598     989     600    1044     602    1096
GR   604    1110     606    1125     608    1284     610    1322     612    1444
GR   614    1471
*  CROSS-SECTION 7
X124.457      55     721     776      13      13    13.5
GR   614       0     612       6     610      11     608      16     606      28
GR   604      35     602      45     600      57     598      67     596      76
GR   594      84     592      95     590     152     592     425     590     470
GR   588     525     586     547     584     559     582     569     580     595
GR   580     627  576.08     705  572.05     721   571.5     722  570.85     727
GR570.89     732  570.56     737  570.49     742  570.16     747  570.01     752
GR 569.8     757  569.46     762  569.51     762   569.9     767  570.09     772
GR571.05     776  576.25     776  577.05     779     582     790     584     800
GR   586     809     588     816     590     823     592     832     594     845
GR   596     882     598     989     600    1044     602    1096     604    1110
GR   606    1125     608    1284     610    1322     612    1444     614    1471
*  CROSS-SECTION 6a REVISED  WEIR ELEV 573.6
X124.466      60     709     780     100      99     100
GR   614       0     612      15     610      21     608      26     606      31
GR   604      37     602      41     600      47     598      53     596      60
GR   594      71     594     105     592     118     590     173     590     218
GR   590     326     591     369     592     385     592     395     592     455
GR   590     467     590     480     588     580     588     581     586     595
GR   586     600     584     605     584     610     582     619     582     620
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GR   580     680     579     682     578     688     576     694   573.6     707
GR 573.6     729  572.85   732.5   573.6     736   573.6     779     577     783
GR   582     817     584     822     586     827     588     830     590     835
GR   594     840     592     840     596     843     594     846     598     851
GR   596     852     598     865     600     902     602     947     604     994
GR   606    1045     608    1098     610    1132     612    1159     614    1177
*  CROSS-SECTION 6
X124.486      71     714     780      18      18    18.5
GR   614       0     612      15     610      21     608      26     606      31
GR   604      37     602      41     600      47     598      53     596      60
GR   594      71     594     105     592     118     590     173     590     218
GR   590     326     591     369     592     385     592     395     592     455
GR   590     467     590     480     588     580     588     581     586     595
GR   586     600     584     605     584     610     582     619     582     620
GR   580     680     579     682     578     688     576     694  572.08     714
GR   571     718     570     723     570     728     569     733  568.93     733
GR   569     738     570     743     570     748     570     753  570.32     758
GR   571     763     571     768     571     773     572     778  572.08     780
GR   577     783     582     817     584     822     586     827     588     830
GR   590     835     594     840     592     840     596     843     594     846
GR   598     851     596     852     598     865     600     902     602     947
GR   604     994     606    1045     608    1098     610    1132     612    1159
GR   614    1177
* CROSS-SECTION 5 - ELEVATION 571.2 DAM ROCK STR
X124.495      58     914     988      42      39      40
GR   614       0     612       9     611      65     612     171     610     180
GR   608     185     606     190     604     194     602     199     600     203
GR   598     208     596     215     594     277     592     298     590     375
GR   591     512     590     562     589     592     590     636     588     787
GR   586     800     584     809     582     823     580     880  576.03     896
GR 573.5     903  572.14     914  571.56     916   571.2     921   571.2     927
GR 571.2     933   571.2     938   571.2     944   571.2     951   571.2     956
GR 571.2     961   571.2   968.5  570.45     972   571.2   975.5   571.2     982
GR572.14     988     582    1009     584    1015     586    1019     588    1023
GR   590    1027     592    1032     594    1038     596    1045     598    1057
GR   600    1094     602    1140     604    1187     606    1237     608    1291
GR   610    1324     612    1351     614    1369
* CROSS-SECTION 4 - ELEVATION 572.7 DAM ROCK STR
X124.504      60     703     789      16      12      14
GR   612       0     610       9     608      15     606      19     604      23
GR   602      28     600      32     598      37     596      45     594     107
GR   592     123     590     190     589     318     590     430     588     603
GR   586     615     584     625     582     661     580     691  577.76     699
GR576.03     703   572.7     703   572.7     707   572.7     712   572.7     717
GR 572.7     722   572.7     727   572.7     732   572.7   736.5  571.95     740
GR 572.7   743.5   572.7     747   572.7     752   572.7     757   572.7     762
GR 572.7     767   572.7     772   572.7     777   572.7     782   572.7     787
GR 572.7     789  576.25     796  578.09     803     582     809     584     814
GR   586     818     588     823     590     826     592     830     594     834
GR   596     839     598     844     600     865     602     914     604     937
GR   606     984     608    1023     610    1069     612    1121     614    1174
*  THIS IS THE DAM STRUCTURE - REVISED
X124.513      58     742     816      17      16      17
GR   614       0     612       9     610      15     608      19     606      25
GR   604      30     602      36     600      45     598      78     596     125
GR   594     140     592     620     590     646     588     668     586     688
GR   584     696     582     713  576.07     731  576.07     741  575.98   741.8
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GR575.96     742   575.7     745   575.4     750   575.0     755   574.6     760
GR574.24     765  574.17   766.5  574.24     770  574.26     775   574.2     780
GR574.21     785  574.27     790  574.26   791.5  574.53     795  574.92     800
GR575.31     805  575.70     810  576.02     814  576.17     816  576.25     817
GR   577     824     582     836     584     843     586     847     588     852
GR   590     855     592     859     594     863     596     867     598     872
GR   600     894     602     942     604     969     606    1002     608    1044
GR   610    1093     612    1143     614    1195
* CROSS-SECTION 2B
X124.522      64    1126    1225    17.5    17.5    17.5
GR   616       0     614      48     612      88     610     143     608     192
GR   606     234     604     283     602     332     600     370     598     561
GR   596     739     596     758     595     987     595    1013     596    1032
GR   594    1041     592    1052     590    1058     588    1069     586    1079
GR   584    1089  577.52    1126     576    1132  575.09    1136  574.25  1138.7
GR574.03    1140  573.42    1144  573.35    1148  573.25    1152  573.18    1156
GR572.84    1160  572.61    1164  572.64    1168  572.02    1172  572.05    1176
GR571.99    1180     572    1184  572.08    1188  572.04    1192  572.51    1196
GR572.74    1200   573.3    1204  573.62    1208  574.05    1212  574.25  1212.5
GR574.75    1215  575.14    1216  577.52    1225     584    1248     586    1255
GR   588    1262     590    1266     592    1272     594    1275     596    1278
GR   598    1284     600    1292     602    1374     604    1412     606    1441
GR   608    1486     610    1516     612    1548     614    1629
* CROSS-SECTION 2A
X124.532      62    1126    1225    17.5    17.5    17.5
GR   616       0     614      48     612      88     610     143     608     192
GR   606     234     604     283     602     332     600     370     598     561
GR   596     739     596     758     595     987     595    1013     596    1032
GR   594    1041     592    1052     590    1058     588    1069     586    1079
GR   584    1089  577.52    1126   576.5    1132  574.54    1136  574.03    1140
GR573.42    1144  573.35    1148  573.25    1152  573.18    1156  572.84    1160
GR572.61    1164  572.64    1168  572.02    1172  572.05    1176  571.99    1180
GR   572    1184  572.08    1188  572.04    1192  572.51    1196  572.74    1200
GR 573.3    1204  573.62    1208  574.05    1212  574.54    1215     576    1216
GR577.52    1225     584    1248     586    1255     588    1262     590    1266
GR   592    1272     594    1275     596    1278     598    1284     600    1292
GR   602    1374     604    1412     606    1441     608    1486     610    1516
GR   612    1548     614    1629
*  CROSS-SECTION 2
X124.542      62    1126    1225      11      13      12
GR   616       0     614      48     612      88     610     143     608     192
GR   606     234     604     283     602     332     600     370     598     561
GR   596     739     596     758     595     987     595    1013     596    1032
GR   594    1041     592    1052     590    1058     588    1069     586    1079
GR   584    1089  577.52    1126   576.5    1132  574.54    1136  574.03    1140
GR573.42    1144  573.35    1148  573.25    1152  573.18    1156  572.84    1160
GR572.61    1164  572.64    1168  572.02    1172  572.05    1176  571.99    1180
GR   572    1184  572.08    1188  572.04    1192  572.51    1196  572.74    1200
GR 573.3    1204  573.62    1208  574.05    1212  574.54    1215     576    1216
GR577.52    1225     584    1248     586    1255     588    1262     590    1266
GR   592    1272     594    1275     596    1278     598    1284     600    1292
GR   602    1374     604    1412     606    1441     608    1486     610    1516
GR   612    1548     614    1629
* sOUTH AVENUE BRIDGE
X124.550                                    15      15      15
X3    10
BT    50     283     604     604     332     602     602     370     602     600
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BT   561     602     598     739     602     596     758     602     596     987
BT   602     595    1013     602     595    1032     602     596    1041     602
BT   594    1052     602     592    1058     602     590    1069     602     588
BT  1079     602     586    1089     602     584    1126     602     595    1132
BT   602     595    1136     602     595    1140     602     595    1144     602
BT   595    1148     602     595    1152     602     595    1156     602     595
BT  1160     602     595    1164     602     595    1168     602     595    1172
BT   602     595    1176     602     595    1180     602     595    1184     602
BT   595    1188     602     595    1192     602     595    1196     602     595
BT  1200     602     595    1204     602     595    1208     602     595    1212
BT   602     595    1215     602     595    1216     602     595    1225     602
BT   595    1248     602     584    1255     602     586    1262     602     588
BT  1266     602     590    1272     602     592    1275     602     594    1278
BT   602     596    1284     602     598    1292     602     600    1374     602
BT   602
X124.551      63     951    1013      53      56      55
GR   616       1     614      23     612      33     610      45     608     203
GR   606     224     604     232     602     243     600     269     598     325
GR   596     353     596     600     596     712   595.8     801     596     882
GR   594     898     592     906     590     912     588     919     586     923
GR   584     929     582     934     580     948  574.55     951  573.95     953
GR573.68     955  573.55     957  573.29     959  573.63     962  573.45     965
GR573.05     968  573.15     971  572.84     975  572.55     978  572.57     981
GR572.56     984  572.37     987   572.6     990  572.46     993  572.68     997
GR572.55    1001  572.85    1004  573.12    1007  573.75    1011  574.55    1013
GR579.37    1021     582    1028     584    1031     586    1034     590    1043
GR   592    1052     594    1060     596    1066     598    1074     600    1080
GR   602    1086     604    1168     606    1179     608    1184     610    1189
GR   612    1195     614    1231     616    1317
*  END OF NEW XROSS-SECTIONS
*    MISSING SHEET (25.21 TO 29; CROSS-SECTIONS S, T,AND U)
*    INCREASED MANNING'S TO ACCOUNT FOR MISSING CROSS-SECTIONS
NC   0.3     0.3     0.2     0.1     0.3
X1    31      25     184     360    3412    3412    3412
GR   600       0     598      20     598      60     618      60     618      90
GR   598      90     596     100     594     110     592     120   591.2     161
GR 591.6     184   576.9     222   574.7     242     570     260   570.9     284
GR 576.2     302   582.2     314   582.8     360     584     550     586     560
GR   588     580     590     590     594     600     596     610     600     620
*    DECREASED MANNING'S
NC  0.06    0.06    0.03     0.3     0.5
X1  31.1      27     435     520     490     490     490
X3    10                                                 595.3     598
GR   602       0     600      60     598     110     596     190   595.3     260
GR   596     340     597     395   596.8     410   596.2     420     596     430
GR 592.9     435   576.1     449   574.5     470   573.9     490   576.1     494
GR 581.6     520     585     544     586     550     588     580     590     600
GR   590     630     592     640   593.5     650     596     660     598     680
GR   600     700     606     700
SB           1.5     2.9            66.5       0    1545    0.45     575     575
X1  31.2                              60      60      60
X2                     1   595.4   595.3
X3    10                                                 595.3     598
BT    26             602     602      60     600     600     110     598     598
BT   190     596     596     250   595.3   595.3     340     596     596     395
BT   597     597     410   597.2   596.8     420   597.3   596.2     430     598
BT   596     435   598.5   592.9     435   600.6   595.4     520     601   595.4
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Proposed Cross-Sections Model

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BT   520     601   581.6     544   601.2     585     544   599.2     585     550
BT 599.5     586     580     602     588     600   602.5     590     630   603.4
BT   590     640   603.7     592     650     604   593.5     660   604.3     596
BT   680   605.2     598     700     606     600     700     606     606
*    DECREASED MANNING'S
NC  0.05    0.05    0.03     0.4     0.6
X1  31.3                                50      50      50
NC  0.07    0.07   0.045     0.1     0.3
X1    33      21      67     144     830     830     830
GR 619.5           592.5      67     578      91   575.5     100   573.5     106
GR   576     128   583.3     144   585.3     157   581.9     174     582     210
GR   584     250     586     310     588     320     590     330     592     370
GR   594     400     596     430     596     500     600     520     602     530
GR   604     550
NC  0.07     0.1   0.045     0.1     0.3
X1    35      23     294     357    1690    1690    1690
GR   604             602      30     600      40     598      70     596     100
GR   594     120     592     130     590     140     588     150     586     160
GR 582.4     169   581.9     294   576.1     308   572.1     323   572.1     330
GR 572.1     342   576.1     355   581.1     357   587.1     370     590     400
GR   596     410     600     420     604     430
NC  0.06     0.1    0.04     0.1     0.3
X1    37      16     233     337    1690    1690    1690
GR   604             602      60     600      90     598     160     596     170
GR   594     180     584     183     580     233   576.7     255   575.4     280
GR   576     290   574.7     314   576.7     327   584.4     337   589.4     372
GR 620.2     437
NC  0.08     0.1    0.04
X1    38      22     332     403    1100    1100    1100
GR   604             600      10     596      20     592      90     590     180
GR   588     270   585.2     300   582.3     316   583.4     332   577.1     343
GR 574.1     351     574     360   573.5     374   577.1     390   585.3     403
GR 585.3     407   563.5     428   589.4     452     596     460     598     470
GR   600     520     604     530
NC  0.06    0.06   0.045     0.4     0.6
X1  38.1      27     305     555     180     180     180
*       SHEET 9
X3    10                                                        620     620
GR 623.7             604      35     602      45     598      55     592      65
GR   590      75     588      85     586      95     584     115   582.5     145
GR   584     205     586     265     586     305   613.9     305   611.2     306
GR 586.2     355   581.2     385     575     425     575     445   581.9     485
GR 586.7     525   605.4     540   611.5     562   613.9     565   606.8     565
GR 621.3     622   623.7     630
SB  1.25     1.5       3             110      22    6012       2     577     577
X1  38.2                                30      30      30
X2                     1   613.9   623.7                                   0.85
X3    10                                                        620     620
BT    18           623.7   623.7      35   623.7     604      45   623.7     602
BT    55   623.7     598      65   623.7     592      75   623.7     590      85
BT 623.7     588      95   623.7     586     115   623.7     584     145   623.7
BT 582.5     205   623.7     584     265   623.7     586     305   623.7     586
BT   305   623.7   613.9     565   623.7   613.9     565   623.7   606.8     622
BT 623.7   621.3     630   623.7   623.7
NC  0.08    0.08   0.045     0.3     0.5
X1  38.3                               100     100     100
NC  0.08    0.08   0.045     0.1     0.3
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Proposed Cross-Sections Model

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X1    40      26     365     429    1240    1240    1240
GR   604             602      10     596      20     592      30     590      40
GR   588      50     586      60     584      80   582.5     110     584     170
GR   586     230     586     290     584     310     584     320     584     350
GR   582     360   583.1     365   577.6     383   575.8     393     576     400
GR 575.1     409   577.1     418   583.1     429   594.1     491   609.4     539
GR 621.3     587
NC  0.08     0.1   0.045     0.1     0.3
X1    42      25     629     697    1225    1225    1225
GR   604             600      10     596      20     594      30     592      40
GR   588      60     588     160     590     280     590     410     590     440
GR   590     510     588     520     586     540     584     610   584.9     629
GR 578.2     664   576.6     670   576.8     680   575.9     688   577.9     697
GR 586.2     708     600     750     612     780     620     800   621.7     808
NC  0.08     0.1   0.045     0.1     0.3
X1    44      23     951    1045    1315    1600    2750
GR   604             602      10     600      20     596      40     594      50
GR   592      70   590.8     130     590     190     588     520   586.5     600
GR   588     680     588     750   586.9     951   579.7     968   575.8     971
GR 577.8     979   578.3     984   579.3     992   605.2    1045   606.2    1046
GR   610    1056   611.9    1058   613.7    1064
NC  0.07    0.07    0.04     0.1     0.3
X1  44.1                             340     860     860
NC  0.07    0.07    0.04     0.4     0.6
X1  44.2      33      31     175     100     100     100
X3    10                                                     607   606.3
GR 607.3             602       5   596.7      14   592.1      31   580.8   73.35
GR 600.8   73.35   600.8   76.65     580   76.65   578.9     103   579.4  129.35
GR 600.8  129.35   600.8  132.65     580  132.65     591     175   586.9     193
GR 587.5     270     588     330   587.1     340     588     350     590     380
GR   590     410     590     450     590     460   590.6     480     592     530
GR   594     570     596     590     598     600     600     610     604     620
GR   610     640     612     650     616     660
NC  0.07    0.07    0.04     0.3     0.5
X1 44.21                               5       5       5
X3    10                                                     607   606.3
BT    31           607.3   607.3       5   607.3     602      14   607.3   596.7
BT    31   607.3   592.1      31   607.3   603.1   73.35     607   600.8   76.65
BT   607   600.8     103     607   603.6  129.35   606.8   600.8  132.65   606.8
BT 600.8     175   606.5   602.5     175   606.5     591     193   606.3   586.9
BT   270     608   587.5     330   608.8     588     340     609   587.1     350
BT   609     588     380   609.5     590     410     610     590     450   610.1
BT   590     460   610.4     590     480     612   590.6     530     613     592
BT   570     614     594     590   614.4     596     600   614.6     598     610
BT 614.8     600     620     615     605     640   615.4     610     650   615.8
BT   612     660     616     616
*       SHEET 10        X1 IS IMPROVISED.
X1 44.29                              70      70      70
X2                                                     1
X3    10                                                     607   606.3
NC   0.1    0.07    0.04     0.3     0.5
X1  44.3                               5       5       5
X3    10                                                     607   606.3
NC   0.1    0.07    0.04     0.2     0.4
X1    46      26       1     140     500     405     500
GR 619.3       1     614      10     610      20     606      30     600      40
GR   596      50     590      60   580.4      85   575.9      93   577.3     103
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GR	579.8	113	588.6	128	586.2	140	588	330	587.1	340
GR	588	350	590	350	590	450	590	460	592	530
GR	594	576	596	590	595	600	600	610	604	620
GR	610	640	612	650	616	660				
NC	0.08	0.08	0.045	0.1	0.3					
X1	48	21	110	171	1075	1075	1635			
GR	620.9		618.5	32	609.4	62	588.4	110	581.8	111
GR	579.3	121	579.6	133	579.6	138	581.8	147	589.8	171
GR	588	330	586	350	586	360	590	380	592	400
GR	594	410	596	420	598	430	600	440	602	450
GR	604	460								
NC	0.1	0.08	0.04	0.1	0.3					
X1	50	26	866	950	980	2010	2010			
GR	610		608	20	606	40	604	70	602	90
GR	600	140	598	160	596	180	594	190	592	200
GR	590	210	588	220	588	470	590	570	592	690
GR	592	790	590	860	589.2	866	582.8	894	581.3	906
GR	581.1	920	581.2	928	582.8	945	590.6	950	611.7	991
GR	619.7	1032								
NC	0.08	0.08	0.045	0.1	0.3					
X1	52	23	267	349	1800	1600	1560			
GR	610		604	10	598	20	594	30	590	40
GR	590	90	590	180	590	190	590	280	592	287
GR	584.9	302	583.9	307	582.9	315	583.4	326	585.7	338
GR	596.9	349	598	390	600	440	602	510	604	580
GR	606	720	608	770	610	820				
NC	0.08	0.08	0.045	0.1	0.3					
X1	54	27	214	276	1600	885	1930			
GR	610		608	20	606	40	602	50	600	60
GR	596	70	594	80	592	160	591.6	175	589.8	214
GR	584.6	227	582.4	240	581.7	250	582.8	260	583.6	266
GR	591.6	276	592	350	592	400	594	440	596	640
GR	598	730	600	760	602	780	604	810	606	820
GR	608	850	610	870						
NC	0.08	0.08	0.045	0.1	0.3					
X1	56	52	660	734	530	1030	1030			
GR	610		608	40	606	90	604	150	602	210
GR	600	220	598	240	594	250	592	260	590.5	320
GR	592	380	592	570	594	590	596	600	594	640
GR	597.5	660	584.8	678	583.8	690	583.7	700	583.5	712
GR	584.8	724	592.3	734	592	760	590	770	590	790
GR	592	830	592	860	592	980	594	1010	596	1030
GR	596	1230	594	1310	592	1370	590	1410	590	1420
GR	594	1430	598	1440	602	1450	608	1460	610	1470
GR	610	1480	608	1490	606	1500	604	1510	602	1520
GR	600	1530	600	1590	602	1630	604	1650	606	1670
GR	608	1680	610	1690						
NC	0.08	0.08	0.045	0.1	0.3					
QT	7	2772	3564	5400	7200	8100	9850	8100		
X1	58	18	779	844	400	1160	1160			
GR	610		608	50	606	140	604	200	602.2	350
GR	602	450	600	550	596	680	596	720	595.5	739
GR	595	779	585.1	785	582.3	794	581.7	800	581.5	808
GR	585.1	813	598.7	844	610	850				
NC	0.08	0.08	0.045	0.3	0.5					
X1	58.1	24	668	736	55	55	55			
*		SHEET 11								

Proposed Cross-Sections Model

GR	510		608	50	606	120	604	140	604	160
GR	684	230	602	450	600	530	595	610	595.4	661
GR	593	668	589.1	683	585.6	683	582.3	700	564.9	713
GR	596.2	736	597.6	740	600	750	602	760	610	780
GR	616	920	616	990	616	1030	614.9	1080		
SB	0.9	1.5	2.7		41	5	1035	0.7	584	584
X1	58.2				16	16	16			
X2			1	603.2	598					
X3	10							598	604	
BT	22		610	610	50	608	608	120	606	606
BT	149	604	504	160	604	604	230	604	604	450
BT	602	602	530	600	600	610	598	598	661	603.9
BT	595.4	668	603.9	593	668	603.9	602.3	736	604.8	603.2
BT	736	604.8	596.2	740	604.8	597.6	750	606	600	760
BT	607.3	602	780	610	610	920	616	616	990	616
BT	616	1030	616	616	1080	614.9	614.9			
NC	0.08	0.08	0.04	0.3	0.5					
X1	58.3				50	50	50			
NC	0.1	0.08	0.045	0.1	0.3					
X1	59	32	660	740	1000	870	1155			
GR	623		623.2	40	622	210	620	240	618	250
GR	616	260	614	270	610	280	600	290	598	300
GR	596	310	594	320	590	330	590	380	588	450
GR	588	650	593.5	660	586.8	674	585	678	582.8	700
GR	584.6	720	586.5	727	596.5	740	598	830	598	890
GR	598	920	600	970	602	990	604	1010	606	1020
GR	605	1040	510	1060						
NC	0.1	0.1	0.04	0.1	0.3					
X1	60	31	650	715	1035	1035	1035			
GR	610		606	20	604	30	602	40	600	50
GR	598	70	596	180	594	500	592	640	594.2	650
GR	586.8	670	582.8	680	582.2	690	582.9	700	586.8	711
GR	591.4	715	599	746	614	750	616	760	620	780
GR	622	790	622	840	620	850	618	870	616	880
GR	614	890	612	900	610	920	608	940	608	970
GR	610	980								
NC	0.1	0.08	0.045	0.1	0.3					
X1	62	22	496	639	800	1900	2080			
GR	610		608	20	606	70	604	82	594	125
GR	592.1	200	594	330	596	467	596	496	595.6	550
GR	591.9	562	591.9	565	587.2	575	584.8	581	584.3	596
GR	584.3	610	586.8	618	595.8	639	598	640	598	840
GR	598	910	610	950						
NC	0.05	0.08	0.04	0.1	0.3					
X1	64	23	222	273	950	1300	1460			
GR	610		608	10	606	20	604	30	600	50
GR	598.1	120	598.2	158	598.2	222	587.6	233	584.4	241
GR	583.9	250	584.6	258	587.6	267	593.2	273	594.3	282
GR	594.9	380	594.9	580	596	630	598	650	600	660
GR	604	680	608	690	610	710				
NC	0.08	0.08	0.04	0.1	0.3					
X1	64.1	35	580	670	750	750	1000			
GR	626		624	140	622	170	620	230	618	270
GR	616	320	614	360	612.2	400	610	410	604	441
GR	601.5	490	600	545	598	565	593	580	603.2	580
GR	592	585	587.8	598	583.8	625	588	646	594	664
GR	603.2	670	598	672	596	695	596	755	597.4	800

Proposed Cross-Sections Model

GR	598	815	600	850	602	855	604	875	606	885
GR	607	920	608.5	955	610	1060	612	1150	614	1220
NC	0.08	0.08	0.04	0.4	0.6					
X1	64.2				100	100	100			
X3	10							607.5	607.7	
SB		1.5	3		48		1225	1.18	585.5	585.5
X1	64.3				38	38	38			
X2			1	603.2	607.5					
*		SHEET 12		X3 - IS IMPROVISED						
X3	10							607.5	607.7	
BT	30		626	626	140	624	624	170	622	622
BT	230	620	620	270	618	618	320	616	616	360
BT	614	614	400	612.2	612.2	410	611.5	610	441	611.1
BT	604	490	610	601.5	545	608.4	600	565	608	596
BT	580	607.5	593	580	610.5	603.2	670	610.5	603.2	672
BT	607.7	598	695	607.7	596	755	607.7	596	800	607.7
BT	597.4	815	607.7	598	850	607.8	600	655	607.8	602
BT	875	607.9	604	885	607.9	606	920	608	607	955
BT	608.5	608.5	1060	610	610	1150	612	612	1220	614
BT	614									
NC	0.06	0.08	0.04	0.4	0.6					
X1	64.4				50	50	50			
NC	0.08	0.08	0.04	0.1	0.3					
QT	7	2772	3564	5120	6800	7570	9170	7570		
X1	66	19	580	673	410	410	410			
GR	610		600	31	590	45	592	85	594	125
GR	596	165	596	280	596	420	594.9	580	590.6	587
GR	587.6	592	584.3	601	587.6	611	590.6	616	601.6	629
GR	602.4	640	607.8	651	606.2	658	605.5	673		
NC	0.08	0.08	0.04	0.1	0.3					
X1	68	31	620	655	430	240	535			
GR	614		612	10	606	25	604	30	600	40
GR	598	50	596	60	595.8	110	596	200	596.8	330
GR	596	420	594	590	595.7	609	592.9	620	588.6	625
GR	587.3	630	585.2	635	585.4	643	588.6	649	595.9	655
GR	594	670	596	690	595.2	720	596	770	596	840
GR	595	850	600	870	604	880	608	890	612	900
GR	614	1000								
NC	0.06	0.05	0.04	0.1	0.3					
X1	70	48	688	769	1140	1600	1680			
GR	614		612	50	612	70	632	70	632	120
GR	612	120	610	130	630	130	630	150	610	150
GR	608.7	170	608	180	606	270	604	310	602	330
GR	600	440	620	440	620	470	600	470	600	490
GR	598	520	596	560	595.3	640	597.5	688	594.9	701
GR	589.9	709	587.3	718	586.8	730	587.6	738	589.1	752
GR	601.8	769	601.4	860	600	1000	598	1150	5960	1180
GR	598	1240	598	1280	599.4	1330	598	1420	598	1460
GR	596	1560	598	1580	598	1590	598	1600	600	1610
GR	604	1620	610	1640	614	1650				
NC	0.06	0.07	0.04	0.1	0.3					
X1	70.1	29	712	508	700	700	700			
GR	614		612	100	610	240	608	310	606	360
GR	593.3	412	591.1	425	594.1	436	592.9	458.5	592.9	461.5
GR	588.6	473	587.1	490	587.1	508	594	508	596	640
GR	60	660	602	665	602	880	600	890	598	925
GR	598	1010	598.7	1100	600	1260	600	1285	600.8	1370

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GR 601.4    1460   601.8    1510     602    1521   616.5    1565
NC  0.07    0.07    0.04     0.1     0.3
X1  70.2                             100     100     100
X3    10                                                     608     606
NC 0.025   0.025   0.025     0.3     0.5
X1 70.29                            82.5    82.5    82.5
X2                                                     1
*       SHEET 13        X3 IS IMPROVISED.
X3    10                                                     608     606
NC  0.07   0.055    0.04     0.3     0.5
X1  70.3                               5       5       5
X3    10                                                     606     606
NC  0.07   0.055    0.04     0.2     0.4
X1  70.4                             100     100     100
NC  0.07   0.055    0.04     0.1     0.3
X1    72      31      43      68     660     660     660
GR 612.9           612.3      15   596.9      36   596.1      43   589.6      54
GR 587.5      61     587      67   587.8      72   589.6      80   595.4      88
GR   596     100     596     170     596     190     596     220     600     330
GR   600     430     598     470     595     590     590     600     590     610
GR   598     630     598     640     598     740     690     780     602     860
GR   604     900     606     930     608     950     640     960     612    1010
GR   614    1040
NC  0.07   0.055
X1    74      31    1152    1191    1730     920    2275
GR   616             612      10     608      20     604      30     606      40
GR   598      60     598     130     600     150     602     260   602.2     290
GR   602     350     602     610   602.2     710     602     760     600     830
GR   596     996     596    1000     596    1020     596    1110   589.3    1123
GR 597.4    1152   598.4    1163   588.1    1168   587.7    1180   588.1    1191
GR 590.7    1197   598.8    1207   610.3    1214     612    1350     514    1450
GR   616    1490
NC  0.07   0.055    0.04     0.4     0.3
QT     7    1700    2500    4500    6250    7100    9000    7100
X1    76      39     375     428    1395    1480    1685
GR   616             614      70     612     140     614     220   612.8     250
GR   612     290   610.8     317     598     339   597.1     375     591     384
GR   588     392   587.5     400     589     411     591     418   598.4     420
GR 599.5     590     598     720     598     870     600     920     602     930
GR   604     940     608     950     612     960     612    1030   611.8    1070
GR   610    1340     608    1410     606    1450     604    1500     602    1510
GR 601.8    1730     600    1850     600    2000     602    2040     604    2050
GR   608    2070     610    2080     614    2090     616    2100
NC  0.07     0.1    0.04     0.1     0.3
X1    78      63    1496    1548    1710    1000    1710
GR   618             616      10     614      30     612      50     610      60
GR   608      80     606     100     604     130     604     140     604     450
GR   604     460     606     480     608     490     608     520     606     550
GR   604     560     600     570     598     580     598     620     600     710
GR   600     740     598     760     595     790     596     830     598     850
GR   598     900     596     920     596     950     593     960     600     980
GR   600    1010     600    1030     600    1040     600    1050     600    1060
GR   600    1070     602    1090     604    1100     604    1110     598    1120
GR   598    1200     600    1210     602    1220   601.4    1456   599.1    1468
GR 594.6    1478   595.1    1496   592.3    1499   591.8    1509   591.7    1520
GR 591.8    1529   592.6    1539   600.7    1548     602    1600     602    1610
GR   602    1620     602    1900     602    1950     602    2000     604    2060
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Proposed Cross-Sections Model

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GR   608    2070     612    2080     618    2090
NC  0.07    0.07    0.04     0.1     0.3
X1    79      28    1746    1801    1200    1200    1200
GR   624             622      20     620      60     618     120     616     180
GR   614     240     612     270     610     310     608     370     606     510
GR   606     590     603     670     608     840     606    1160     604    1315
GR   604    1375     604    1575     604    1675     604    1725   602.7    1746
GR 593.5    1758   591.7    1765   591.5    1775   592.2    1783   593.5    1791
GR 597.9    1801   589.7    1864     616    1885
NC  0.07    0.07    0.04     0.2     0.4
X1  79.1      28  1491.1  1491.9     770     100     770
GR   620             618      55     616     110     614     260     612     480
GR   610     520     608     770     606    1125     604    1135     604    1235
GR   604    1275     602    1365     300    1395  598.77  1419.1  598.77    1429
GR   592    1435     592    1475  598.75  1481.4  598.75  1490.9     600    1525
GR   602    1585     604    1615     604    1675     602    1695     600    1735
GR   606    1785     606    1795     610    1805
*       SHEET 14
X1  79.2      28  1419.1  1490.9       5       5       5
GR   620             616      55     616     110     614     260     612     480
GR   610     520     608     770     606    1125     604    1135     604    1235
GR   604    1275     602    1365     600    1395  598.77  1419.1  598.77    1429
GR596.82  1431.1  596.73  1479.9  598.75  1481.4  598.75  1490.9     600    1525
GR   602    1585     604    1615     604    1675     602    1695     600    1735
GR   606    1785     606    1795     610    1805
NC  0.07    0.07    0.04     0.2     0.4
X1  79.3      28  1419.1  1490.9       5       5       5
GR   620             618      55     616     110     614     260     612     480
GR   610     520     608     770     606    1125     604    1135     604    1235
GR   604    1275     602    1365     600    1395  598.77  1419.1  598.77    1429
GR   592    1435     592    1475  598.75  1481.4  598.75  1490.9     600    1525
GR   602    1585     604    1615     604    1675     602    1695     600    1735
GR   604    1785     606    1795     610    1805
NC  0.06    0.07    0.04
X1    80      25     930     991       5     550     705
GR   620             618      55     616     110     614     260     612     480
GR   620     520   607.5     930   597.2     940   593.7     950   593.2     960
GR 592.7     970   592.2     985   601.6     991     602    1010     602    1130
GR   602    1210   602.7    1260     602    1300     600    1330     600    1350
GR   602    1360     604    1370     606    1380     610    1390     616    1410
NC  0.07    0.07    0.04
X1  80.1      24     974    1047      50     100     100
X3    10                                                     610     602
GR   620     220     618     275     616     330     614     480   612.3     560
GR   614     720     614     830     612     860     610     970   610.6     974
GR 608.3     974     592     995   592.8    1010     592    1025   602.6    1047
GR 608.3    1047     602    1060     602    1385     604    1410     608    1420
GR   610    1430     612    1440     618    1460     620    1470
SB           1.5       3              38             950     1.2   591.8   591.8
X1  80.2                               5       5       5
X2                     1   608.3     602
X3    10                                                     610     602
BT    22     220     620     620     275     618     618     330     616     616
BT   480     614     614     560   612.3   612.3     720     614     614     830
BT   614     614     860     612     612     970     610     610     974   610.6
BT 610.6     974   610.6   608.3    1010   611.8   608.3    1047   610.6   608.3
BT  1047   608.3   608.3    1060     602     602    1385     602     602    1410
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Proposed Cross-Sections Model

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BT   604     604    1420     608     608    1430     610     610    1440     612
BT   612    1460     618     618    1470     620     620
NC  0.02    0.08    0.04     0.2     0.4
X1  80.3                              50      50      50
NC  0.08    0.08    0.04     0.1     0.3
X1    82      25     265     396    1225    1035    1390
GR   620             618      10     610      30     608      40     606      50
GR   604     210   603.2     265   597.1     275   594.9     290   595.1     300
GR   595     320   597.1     345   597.1     353   594.1     373   597.1     385
GR 601.6     396     604     630     604     650     606     740     610     750
GR   612     760     614     780     616     910     618    1000     620    1060
NC  0.08    0.06   0.045     0.1     0.3
X1    85      22     520     583    1300     720    1590
GR   620             618      30     617     140     618     240   618.6     270
GR   618     290     616     330     614     350     612     360     610     370
GR   608     380     606     390   604.1     520     597     528   593.5     540
GR 593.5     550     594     564     597     576   602.4     583     612     600
GR   618     630     620     670
NC  0.07    0.07    0.04     0.1     0.3
X1    87      24     421     491    1260    1260    1260
GR   622             620      40     616      60     614     110     612     120
GR   610     140     608     150     606     170     602     210     602     260
GR   604     360     604     400   603.5     421     597     434   595.8     442
GR 595.4     450   595.8     458     597     466     608     491     614     500
GR   620     520     622     530     626     540     630     560
NC  0.05    0.06    0.04     0.1     0.3
*       SHEET 15        X1 IS IMPROVISED.
X1    88      18                     815     815     815
GR   622             618      30     616      70     614      90     612     130
GR   608     170     606     200   605.7     365   597.2     395   595.5     401
GR 595.4     415   596.1     425   597.2     430   610.5     464     614     480
GR   615     490     624     510     626     520
NC  0.05    0.06    0.04     0.1     0.3
X1  88.1      22     410     471     200     200     200
X3    10                                                     616     620
GR   620             618     140     616     150     612     190     610     220
GR   606     260   605.2     310     604     410   594.9     410     594     440
GR 594.9     471     600     471     610     490     612     500     614     510
GR   616     520     618     530     620     540     622     550     624     560
GR   626     650   627.6     790
SB           1.5       3              61            1217             595     595
X1  88.2                              45      45      45
X2                     1   615.7     616
X3    10                                                     616     620
BT    20             620     620     140     618     618     160   617.8     616
BT   190   617.5     612     220   617.3     610     260   616.7     606     310
BT   616   605.2     410     620     604     410   622.6     614     471   621.4
BT 615.7     490     622     610     500   622.2     612     510   622.3     614
BT   520   622.7     616     530     623     618     540   623.3     620     550
BT 623.5     622     560     624     624     650     626     626     790   627.6
BT 627.6
NC  0.05    0.06    0.04     0.1     0.3
X1  88.3      16     264     367     130     130     130
GR   622             622      10     618      30     614      50     610      70
GR   608      80   607.5     100     606     130     604     264   600.1     274
GR 597.9     279     597     286   597.9     321   600.3     327   615.1     367
GR   624     680
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Proposed Cross-Sections Model

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NC  0.05    0.06    0.04     0.4     0.6
X1  88.4      17     234     367     210     210     210
X3    10                                                     620     620
GR   622             618      30     614      50     610      70     608      80
GR 607.5     100     606     130   604.6     234   615.2     234   600.1     274
GR 597.9     279     597     286   597.9     321   600.3     327   615.1     367
GR 620.6     367     624     680
SB  0.95     1.5       3              50     2.6    1763     2.1   597.5   597.5
X1  88.5                              40      40      40
X2                     1   617.3   620.5                                    0.91
X3    10                                                     620     620
BT    11             622     622      30   621.7     618      50   621.4     614
BT    70   621.1     610     100     621   607.5     130     621     606     234
BT 620.5   604.6     234   620.5   617.2     367   620.6   617.3     367   620.6
BT 620.6     680     624     624
NC                             0.3     0.5
X1  88.5                             100     100     100
NC  0.05    0.07    0.04     0.1     0.3
X1    89      20     230     315     420     420     420
GR   620             613      10     616      20     614      30     612      40
GR   610      50   608.5      80   606.3     150   602.8     190     603     210
GR 604.6     230   597.6     239   596.6     250   596.6     260   596.1     270
GR 597.6     284   609.6     315     612     320     618     340     622     360
EJ
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    2 YEAR
T3      SWAN CREEK
J1   -10       3                                                  576.38
J2     2              -1
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    10 YEAR
T3      SWAN CREEK
J1   -10       4                                                  577.17
J2     3              -1
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    50 YEAR
T3      SWAN CREEK
J1   -10       5                                                  578.17
J2     4              -1
T1      TYPE 19 FIS
T2      TOLEDO, OHIO    100 YEAR
T3      SWAN CREEK
J1   -10       6                                                  578.51
J2     5              -1
ER
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DEPARTMENT OF THE ARMY
BUFFALO DISTRICT, CORPS OF ENGINEERS
1776 NIAGARA STREET
BUFFALO, NEW YORK 14207-3199

August 20, 2008

REPLY TO

Regulatory Branch

SUBJECT: Application No. 2008-888, Nationwide Permit No. (27) as Published in the Federal Register, Volume 72, No. 47, on Monday, March 12, 2007

Mr. Matt Horvat
Maumee River Coordinator
Toledo Metropolitan Area Council of Governments
300 Dr. Martin Luther King Jr. Drive
Toledo, Ohio 43604

Dear Mr. Horvat:

This pertains to your preconstruction notification for Nationwide Permit 27 on behalf of the Partners for Clean Streams and the City of Toledo. The proposed project involves constructing three rock ramps downstream of the existing low head dam in Swan Creek. The purpose of the project is to allow for fish passage beyond the existing low head dam. The project is located in Highland Park on South Avenue in the city of Toledo Lucas County, Ohio.

I have evaluated the impacts associated with your proposal, and have concluded that they are authorized by the enclosed Nationwide Permit 27 provided that the attached conditions are satisfied.

Verification of the applicability of this Nationwide Permit is valid for two years from the date of this correspondence unless the Nationwide Permit is modified, suspended or revoked, or your activity complies with any subsequent permit modification. Absent any changes to the current Nationwide Permits, reverification of the applicability of your project under the Nationwide Permit is not required if work is completed prior to March 19, 2012.

It is your responsibility to remain informed of changes to the Nationwide Permit program. A public notice announcing any changes will be issued when they occur. Finally, note that if your activity is not undertaken within the defined period or the project specifications have changed, you must immediately notify this office to determine the need for further approval or reverification.

This affirmation is limited to the attached Nationwide Permit and associated Water Quality Certification, and does not obviate the need to obtain any other project specific Federal, state, or local authorization.

Finally, this letter contains an approved jurisdictional determination for the subject parcel. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and Request for Appeal (RFA) form. If you request to appeal the above determination, you must submit a completed RFA form within 60 days of the date on this letter to the Great Lakes/Ohio River Division Office at the following address:

Mr. Mike Montone, Regulatory Review Officer
Great Lakes and Ohio River Division
CELRD-PDS-O
550 Main Street, Room 10032
Cincinnati, OH 45202-3222
Phone: 513-684-6212

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete; that it meets the criteria for appeal under 33 C.F.R. part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address within 60 days of the date of this letter.

In addition to the general conditions attached to the Nationwide Permit, your attention is directed to the following Special Conditions which are also appended at the end of the Nationwide Permit General Conditions:

1. The proposed project lies within the range of the rayed bean mussel (*Villlosa fabalis*) and the Indiana bat (*Myotis sodalis*). The U.S. Fish and Wildlife Service and the Corps of Engineers conducted an affects determination for the above referenced project and have concluded that although three trees will be removed during the summer months, none of these trees exhibited Indiana bat roosting characteristics and is not likely to adversely affect the Indiana bat. In addition, no impacts are anticipated on the rayed bean mussel. Should additional information on listed or proposed species or their critical habitat become available or if new information reveals effects of the action that were not previously considered, this determination may be reconsidered. If project plans change or if portions of the proposed project were not evaluated, you shall contact this office for further review and work shall not commence until you receive written authorization from the Corps.
2. That the fill material shall consist of clean non- erodible stone obtained from an upland source, shall be free of fines, oil and grease, debris, wood, general refuse, plaster, and other pollutants, and shall contain no broken asphalt.
3. All erosion and sediment control practices shall be in place prior to any grading or filling operations and installation of proposed structures or utilities. They shall remain in place until construction is completed and the area is stabilized.
4. Prior to the discharge of any dredged or fill material into wetlands or other waters of the U.S. authorized by this permit, the permittee shall install and maintain erosion and sedimentation controls in and/or adjacent to wetlands or other waters

of the United States which are not immediately scheduled to be filled and/or authorized to be filled. Plans for erosion and sedimentation controls in and/or adjacent to wetlands or other waters of the U.S. shall comply with the Ohio Environmental Protection Agency (OEPA) Construction Storm Water Program. OEPA administers a permitting program designed to document construction activity in the state and requires practices that keep pollutants out of the streams. The point of contact for OEPA is Ms. Lynette Hablitzel and she may be reached at 419-373-3009 or by email at lynette.hablitzel@epa.state.oh.us .

Questions pertaining to this matter should be directed to me at (419) 898-3491, by writing to the following address: U.S. Army Corps of Engineers, Buffalo District, Oak Harbor Field Office, 240 Lake Street, Unit D, Oak Harbor, Ohio 43449, or by email at mailto:paul.f.wetzel@usace.army.mil.

Sincerely,

Paul Wetzel
Biologist

Enclosures

COMPLIANCE CERTIFICATION

General Condition 14 of the Nationwide Permit you were affirmed requires that:

"Every permittee who has received a Nationwide permit verification from the Corps will submit a signed certification regarding the completed work and any required mitigation. The certification will be forwarded by the Corps with the authorization letter and will include: a) A statement that the authorized work was done in accordance with the Corps authorization, including any general or specific conditions; b) A statement that any required mitigation was completed in accordance with the permit conditions; c) The signature of the permittee certifying the completion of the work and mitigation."

APPLICANT:
City of Toledo
Div. of Recreation
2201 Ottawa Parkway
Toledo, Ohio 43606

POINT of CONTACT:
Matt Horvat
300 Dr. Martin Luther King Jr.
Dr., Toledo, Ohio 43604

File Number: 2008-888
File Closed: 08/20/08

Upon completion of the activity authorized by this permit sign this certification and return it to the address listed below within 30-days of project completion.

Please note that your permitted activity is subject to a compliance inspection by a U.S. Army Corps of Engineers representative. If you fail to comply with this permit you are subject to permit suspension, modification, or revocation.

______________________________ Applicant

______________________________ Date

Permittee Telephone Number: ____________________

Project Location: Highland Park, City of Toledo, Lucas County, Ohio.

Project Description: constructing three stone rock ramps downstream of the existing low head dam

Authorized Impacts (Waters of U.S. Impacted by Project): 0.41 acres

Waterway and/or Project Setting: Swan Creek

Return Completed form to:

Regulatory Branch
U.S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL

Applicant: City of Toledo		File Number: 2008-888	Date: 08/20/08
Attached is:			See Section below
	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)		A
	PROFFERED PERMIT (Standard Permit or Letter of permission)		B
	PERMIT DENIAL		C
X	APPROVED JURISDICTIONAL DETERMINATION		D
	PRELIMINARY JURISDICTIONAL DETERMINATION		E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at http://usace.army.mil/inet/functions/cw/cecwo/reg or Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- **OBJECT:** If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- **ACCEPT:** If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.

- **APPEAL:** If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- **ACCEPT:** You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.

- **APPEAL:** If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT
REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)
ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:	
If you have questions regarding this decision and/or the appeal process you may contact: Mr. Paul Wetzel U.S. Army Corps of Engineers, Buffalo District Oak Harbor Field Office 240 Lake Street, Unit D Oak Harbor, Ohio 43449, or by mailto:paul.f.wetzel@usace.army.mil.	If you only have questions regarding the appeal process you may also contact: Mr. Michael Montone U.S. Army Corps of Engineers Great Lakes and Ohio River Division 550 Main Street, Room 10032 Cincinnati, OH 45202-3222 (513) 684-6212;FAX(513) 684-2460 michael.g.montone@lrdor.usace.army.mil

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15 day notice of any site investigation, and will have the opportunity to participate in all site investigations.

	Date:	Telephone number:
Signature of appellant or agent.		

NWP 27: "*Aquatic Habitat Restoration, Establishment and Enhancement"* Application and Pre-Construction Notification

Highland Park Dam Mitigation

City of Toledo (Owner)
Partners for Clean Streams (Project Initiator)

Prepared for:

U. S. Army Corps of Engineers
Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199

Prepared by:

JFNew

605 South Main Street, Suite 1
Ann Arbor, MI 48104
(734) 222-9690 (phone)
(734) 222-9655 (fax)

APPLICATION FOR DEPARTMENT OF THE ARMY PERMIT *(33 CFR 325)*	**OMB APPROVAL NO. 0710-0003** **Expires December 31, 2004**

(ITEMS 1 THRU 4 TO BE FILLED BY THE CORPS)

1. APPLICATION NO.	2. FIELD OFFICE CODE	3. DATE RECEIVED	4. DATE APPLICATION COMPLETED

(ITEMS BELOW TO BE FILLED BY APPLICANT)

5. APPLICANT'S NAME see attached sheet	8. AUTHORIZED AGENT'S NAME AND TITLE *(an agent is not required)* JFNew, Erin Switala, Ecological Resource Specialist
6. APPLICANT'S ADDRESS see attached sheet	9. AGENT'S ADDRESS 605 S. Main St., Suite 1 Ann Arbor, MI 48104
7. APPLICANT'S PHONE NOS. W/AREA CODE a. Residence b. Business see attached sheet	10. AGENT'S PHONE NOS. W/AREA CODE a. Residence b. Business 734-222-9690

11. STATEMENT OF AUTHORIZATION

I hereby authorize, JFNew to act in my behalf as my agent in the processing of this application and to furnish, upon request, supplemental information in support of this permit application.

William H Franklin — 5-19-08

APPLICANT'S SIGNATURE — DATE

NAME, LOCATION AND DESCRIPTION OF PROJECT OR ACTIVITY

12. PROJECT NAME OR TITLE (see instructions)

Highland Park Dam Mitigation and Riparian Enhancement

13. NAME OF WATERBODY, IF KNOWN ***(if applicable)*** Swan Creek	**14. PROJECT STREET ADDRESS** ***(if applicable)*** Highland Park South Avenue between Champion St. and Shasta Dr. Toledo, OH
15. LOCATION OF PROJECT Lucas (**COUNTY**) Ohio (**STATE**)	

16. OTHER LOCATION DESCRIPTIONS, IF KNOWN, ***(see instructions)***

Sections 9 and 10, Township 3, Range 7 East, second principal meridian. Swan Creek River Mile 4.3. Project area is downstream of South Avenue Bridge and upstream of pedestrian bridge in Highland Park.

17. DIRECTIONS TO THE SITE

From I-75 S, take Exit 201A, OH-25 towards Maumee. Follow OH-25 approximately 1.5 miles, and turn Right onto South Avenue. Continue on South Avenue approximately 0.8 miles. Highland Park will be on the Right. Swan Creek flows through Highland Park.

18. Nature of Activity (*Description of project, include all features*)

Partners for Clean Streams proposes to construct three rock ramps (55-105 ft long and 56-86 ft wide) downstream of an existing low head dam on Swan Creek. The proposed work includes over-excavation in the channel to anchor the rock and minor excavation into the banks to key in the rock. Rock will be placed in the channel to build the ramps. In addition to the ramps, rock will also be placed upstream of the dam to concentrate low flows towards the low flow notch. The rock will be placed with an excavator stationed on the West streambank. The excavator may drive out on top of the rock if necessary to reach the opposite bank. All disturbed areas will be restored with native plantings.

19. Project Purpose (*Describe the reason or purpose of the project, see instructions*)

This project is part of a Joyce Foundation grant spearheaded by Partners for Clean Streams. An existing low head dam has created a blockage for fish passage. The dam encases a sewer main and thus, cannot be removed. Therefore, the applicant is proposing to construct three rock ramps with low flow notches to allow fish passage. Optimal construction period is during low flow, July 2008 through September 2008, and we are planning to construct in August 2008.

USE BLOCKS 20-22 IF DREDGED AND/OR FILL MATERIAL IS TO BE DISCHARGED

20. Reason(s) for Discharge

Rock will be placed in the channel to raise the low-flow water surface elevation and allow fish passage over an existing low head dam. The low head dam cannot be removed because it encases a large sewer main.

21. Type(s) of Material Being Discharged and the Amount of Each Type in Cubic Yards

Total Rock - 1340 CY, includes D50 = 24 inches and stone filter layer of D50 = 2.5 inches

22. Surface Area in Acres of Wetlands or Other Waters Filled (*see instructions*)

A total of 0.41 acres of Swan Creek will have rock fill placed to build the rock ramps and concentrate flow. Rock will be placed using an excavator. Any material dredged will be taken off-site for disposal. No wetlands will be impacted by the proposed construction.

23. Is Any Portion of the Work Already Complete? Yes ____ No _X_ IF YES, DESCRIBE THE COMPLETED WORK

24. Addresses of Adjoining Property Owners, Lessees, Etc., Whose Property Adjoins the Waterbody (If more than can be entered here, please attach a supplemental list).

The project area is bordered on both sides by Highland Park, owned by the City of Toledo.

City of Toledo
Division of Recreation
2201 Ottawa Parkway
Toledo, OH 43606

25. List of Other Certifications or Approvals/Denials Received from other Federal, State or Local Agencies for Work Described in This Application.

AGENCY	TYPE APPROVAL*	IDENTIFICATION NUMBER	DATE APPLIED	DATE APPROVED	DATE DENIED
Ohio EPA	401 Water Quality Certification		concurrent		
City of Toledo	Special Flood Hazard Development Permit		concurrent		

***Would include but is not restricted to zoning, building and flood plain permits**

26. Application is hereby made for a permit or permits to authorize the work described in this application. I certify that the information in this application is complete and accurate. I further certify that I possess the authority to undertake the work described herein or am acting as the duly authorized agent of the applicant.

SIGNATURE OF APPLICANT	DATE	SIGNATURE OF AGENT	DATE

The application must be signed by the person who desires to undertake the proposed activity (applicant) or it may be signed by a duly authorized agent if the statement in block 11 has been filled out and signed.

18 U.S.C. Section 1001 provides that: Whoever, in any manner within the jurisdiction of any department or agency of the United States knowingly and willfully falsifies, conceals, or covers up any trick, scheme, or disguises a material fact or makes any false, fictitious or fraudulent statements or representations or makes or uses any false writing or document knowing same to contain any false, fictitious or fraudulent statements or entry, shall be fined not more than $10,000 or imprisoned not more than five years or both.

Additional Information for 404 Permit Application:

BLOCK 5 –

Partners for Clean Streams (grant recipient)
Contact person: Matt Horvat

City of Toledo (owner)
Contact person: Dennis Garvin

BLOCK 6 –

Partners for Clean Streams (grant recipient)
Contact person: Matt Horvat
300 Dr. Martin Luther King Jr. Drive
Toledo, OH 43604
(419)241-9155 ext. 123

City of Toledo (owner)
Contact person: Dennis Garvin
2201 Ottawa Parkway
Toledo, OH 43606
(419)936-2326

BLOCK 7 –

Partners for Clean Streams (grant recipient)
Contact person: Matt Horvat
(419)241-9155 ext. 123

City of Toledo (owner)
Contact person: Dennis Garvin
(419)936-2326

605 S. Main Street, Suite 1
Ann Arbor, MI 48104
Phone: 734-222-9690
Fax: 734-222-9655

Erin Switala
Ecological Resource Specialist
eswitala@jfnew.com

Corporate Office:
Walkerton, Indiana

Chicago, Illinois

Indianapolis, Indiana

Grand Haven, Michigan

Cincinnati, Ohio

Madison, Wisconsin

Native Plant Nursery:
Walkerton, Indiana

www.jfnew.com

May 20, 2008

Mr. Alan Sisselman
Regulatory Branch
U.S. Army Corps of Engineers, Buffalo District
1776 Niagara Street
Buffalo, NY 14207-3199

Re: NWP 27 Application and Pre-Construction Notification
Highland Park Dam Mitigation
Fish Passage Improvement,
City of Toledo and Partners for Clean Streams,
Toledo, Lucas County, Ohio

Dear Mr. Sisselman:

JFNew is contacting the U.S. Army Corps of Engineers on behalf of the City of Toledo (owner) and Partners for Clean Streams (grant recipient), who seek authorization under NWP 27: "*Aquatic Habitat Restoration, Establishment and Enhancement"* to construct 3 rock ramps downstream of a low-head dam to improve fish passage over the dam in Swan Creek. We are requesting authorization that the project, as proposed below, meets the conditions of Nationwide Permit (NWP) program and that the necessary work in non-tidal waters of the U.S. can be completed under NWP 27: "*Aquatic Habitat Restoration, Establishment and Enhancement*" This letter serves as our preconstruction notification (PCN) and request for Nationwide Permit authorization.

PROJECT LOCATION

The project is located in the City of Toledo's Highland Park between the South Avenue bridge and Champion Street bridge, Toledo, Lucas County, Ohio (**Drawing 1**). The work will be conducted in Swan Creek, a perennial tributary to the Maumee River. Specifically, it is located in Sections 9 and 10 of Township 3 and Range 7 East, of the second principal meridian, on the Toledo (OH, MI) USGS quadrangle (**Drawing 1**). Below, I have provided a brief description of the project, existing site conditions and the proposed site conditions.

PROJECT DESCRIPTION AND NEED

This project is part of a Joyce Foundation grant spearheaded by the non-profit organization Partners for Clean Streams. An existing low head dam has created a blockage for fish passage. The dam encases a sewer main and thus, cannot be removed. Therefore, the applicants are proposing to construct three rock ramps with low flow notches to allow fish passage. This minimal activity within waters of the U.S. appears to be authorized under Section B.27(a)(3) of the 2007 NWP Program and the Ohio State 401 Certification for NWP 27.

Although a main entrance road exists, temporary access paths will be needed to access the streamside project area. The primary access for this project will be from the existing Shasta Drive. The parking lot near the swimming pool complex will be used as a staging area for equipment. An access path from the parking lot will extend to the south along the existing and proposed portions of the walking path (**Drawing 6**). The wetland area will not be impacted. Three construction paths will be utilized, one at the upstream end of each rock ramp, to get equipment to the edge of the stream for rock placement.

In order to access the edge of the stream, a few trees and some brush in the riparian area will be removed. The trees are labeled on the proposed plan view (**Drawing 6**). None of the trees in the construction area are potential Indiana Bat habitat. The temporary access paths will be restored through re-seeding. In order to key the rock ramp structures into the bed and banks, approximately 40 cubic yards (CY) will be removed. All dredged material is proposed to be taken off site for disposal. All disturbed areas will be restored through native plantings and installation of live stakes, which will not only stabilize the banks, but also will provide wildlife habitat (**Drawing 9**).

Thus, the City of Toledo and Partners for Clean Streams wish to perform this work under Nationwide Permit 27: Aquatic Habitat Restoration, Establishment and Enhancement.

EXISITING CONDITIONS

To determine if concerns for impacts to waters of the U.S. would limit the enhancement potential of the project, JFNew completed a “Waters of the U.S.” delineation in the project area at Highland Park (**Attachment 1**) on April 4, 2008. The site consists predominantly of old-field/manicured lawn with a forested area in the northwest portion of the site. The forest is dominated by sassafras, box elder, cockspur thorn, and sycamore. We identified one 0.20 acre emergent floodplain wetland and one perennial stream, Swan Creek (±500 linear feet).

Approximately 500 linear feet (lf) of streams and 0.20 acre of emergent floodplain wetland exist in the project area (2.1 acres) of the approximately fifty-eight (58) acre Highland Park property (**Exhibit 1 in Attachment 1**). There were no other jurisdictional or isolated waters identified within the study area. **Table 1** summarizes the identified waters and their jurisdictional measurements.

Table 1: Approximate Lengths and Acreage of Identified Waters of the US

ID	*Type*	*Length (LF) or Area (ac)*	*QHEI / ORAM*	*"Waters of the U.S."*	*QHEI / ORAM Classification*
Swan Creek	***Perennial***	***500***	***31***	***Yes***	***Modified warm water habitat***
Wetland A	***PEM***	***0.20***	***27***	***Yes***	***Class 1***

PROPOSED PROJECT

The applicants propose to construct three rock ramps downstream of an existing low head dam on Swan Creek in order to allow fish passage over the dam. The proposed work includes over-excavation in the channel to anchor the rock and minor excavation into the banks to key in the rock. Rock will be placed in the channel to build the ramps. In addition to the ramps, rock will also be placed upstream of the dam to concentrate low flows toward the low flow notch, allowing adequate water depth for fish passage.

The rock structures were designed using the Rock Ramp Design Guidelines (Mooney et. al., 2007) published by the U.S. Department of the Interior's Bureau of Reclamation. The guidelines include several equations used to design the ramps and to size the stone, the stone filter layer, and the low flow channel. The stone sizing calculations are based on the 100-year event flow (9000 cfs), while the low-flow channel sizing is based on a low flow of 40 cfs. The low-flow channel calculations incorporate interstitial flow, depth-based roughness, and velocity to ensure that flow conditions are suitable for fish passage. We are confident that the rock ramp design will be stable up to the 100-year event, and that we will have sufficient flow in the low flow channel to allow passage of fish with body length greater than 4 inches. The design process also included consultation with Dave Derrick, a research hydraulic engineer with the U.S Army Corps of Engineers' Coastal and Hydraulics Laboratory in Vicksburg, Mississippi.

To ensure that the rock structures would not adversely affect flood elevations, we modeled the preliminary design using HEC-2. The existing HEC-2 model was obtained from FEMA and field surveyed cross-sections were added upstream and downstream of the proposed project location. The existing conditions HEC model was validated to low-flow conditions (flow, velocity, and water surface elevations) observed during field work. The proposed rock ramps were then added to the model to effectively "lift" the streambed elevations. The proposed structures resulted in no significant changes in the flood elevations. Our HEC model is conservative because the preliminary design had included a series of four rock ramps, while the current design only includes three rock ramps.

PROPOSED IMPACTS ASSOCIATED WITH HABITAT ENHANCEMENT

Due to the elevational change from the encased sewer pipe (low head dam), a blockage to fish passage has existed for several decades. The applicants are proposing to restore fish passage by constructing a series of three rock ramps downstream of the dam. The rock will consist of stone with a D_{50} of 24 inches and the ramps will be underlain by a stone filter (D_{50}= 2.5 inches). The rock ramps will be keyed into the banks and into the streambed to provide stability during high flows. Each rock ramp will drop the pool water surface elevation by 0.75 feet (**Drawing 7**). One low flow sinuous notch channel will be constructed on each rock ramp to be 0.75 feet deep and 10 to 20 feet wide (notch top width is different for each rock ramp). These low flow notches are designed to allow warm-water fish with a body length of 4 inches or less to pass during low flow (approximately 40 cubic feet per second).

The fill will consist of 1275 cubic yards of stone for the three rock ramps and an additional 65 cubic yards upstream of the dam to concentrate the flow. The rock size will be the same for the upstream discharge as for the rock ramps.

The total acreage of waters to be impacted as a result of discharge activities is 0.41 acre. The total volume of material to be discharged into the river will be approximately 1340 CY.

The following table (**Table 2**) summarizes the narrative text description and discusses the proposed impacts under Nationwide Permit 27: Aquatic Habitat Restoration, Establishment and Enhancement in accordance with **Drawing 6**.

Table 2: Proposed Impact Lengths and Acreages to Identified Waters of the US

	Impact Acreage	Perennial Impacts (LF)	Cubic Yards Dredged / Fill
Nationwide 27 Impacts			
Swan Creek – Rock Ramp Construction	0.39	278 LF	1275 CY
Swan Creek- upstream rock to concentrate flow	0.02	35 LF	65 CY
TOTAL for NWP 27	**0.41**	**313 LF**	**1340 CY**
TOTAL FOR PROJECT	**0.41 ACRE**		

Request for a Letter from the Corps

It is our understanding that this project is within the limitations of Nationwide Permit 27 and does not cause more than minimal impact to jurisdictional natural resources. Because impacts to waters of the U.S. for this project are minimal, we are requesting nationwide general permit coverage. Partners for Clean Streams is requesting a letter from the Corps indicating that the project as represented in this letter and on the attached site plan is authorized by Nationwide Permit 27 and can be completed upon receipt of authorization.

Enclosed with this PCN are copies of the site impact plan (**Drawing 6**) and relevant natural resource maps (USGS Topographic Map, NWI Map, and Soil Survey of Lucas County) (**Drawings 2-4**), as well as appendices highlighting the original site assessment (Waters of the U.S. Delineation) report with necessary maps and photos describing current site conditions. Detailed draft construction drawings for the project are also included.

We are concurrently requesting consultation regarding rare, threatened and endangered (RTE) species from Ohio Dept. of Natural Resources (ODNR) and the U.S. Fish and Wildlife Services (USFWS). Partners for Clean Streams initiated discussions with Mr. John Navarro and Ms. Becky Jenkins at ODNR regarding potential mussel populations in the project area. Initially, it does not appear that any federally-listed species are in the project area; however state-listed species may be present. Partners for Clean Streams has received permission from ODNR to have a local malacologist perform a mussel survey in the project area, however this survey has not yet been conducted. Partners for Clean Streams has agreed to relocate existing mussel populations if necessary.

Due to the scale and scope of the proposed project, JFNew feels that it is unlikely that there will be impact to any present cultural resources. However, if further cultural resource investigations are required, the applicant will complete them.

If you have any questions concerning this PCN and NWP 27 authorization request, please do not hesitate to call me at 734.222.9690 or contact me by email at *eswitala@jfnew.com.*

Sincerely,

Erin N. Switala

Erin Switala
Project Manager

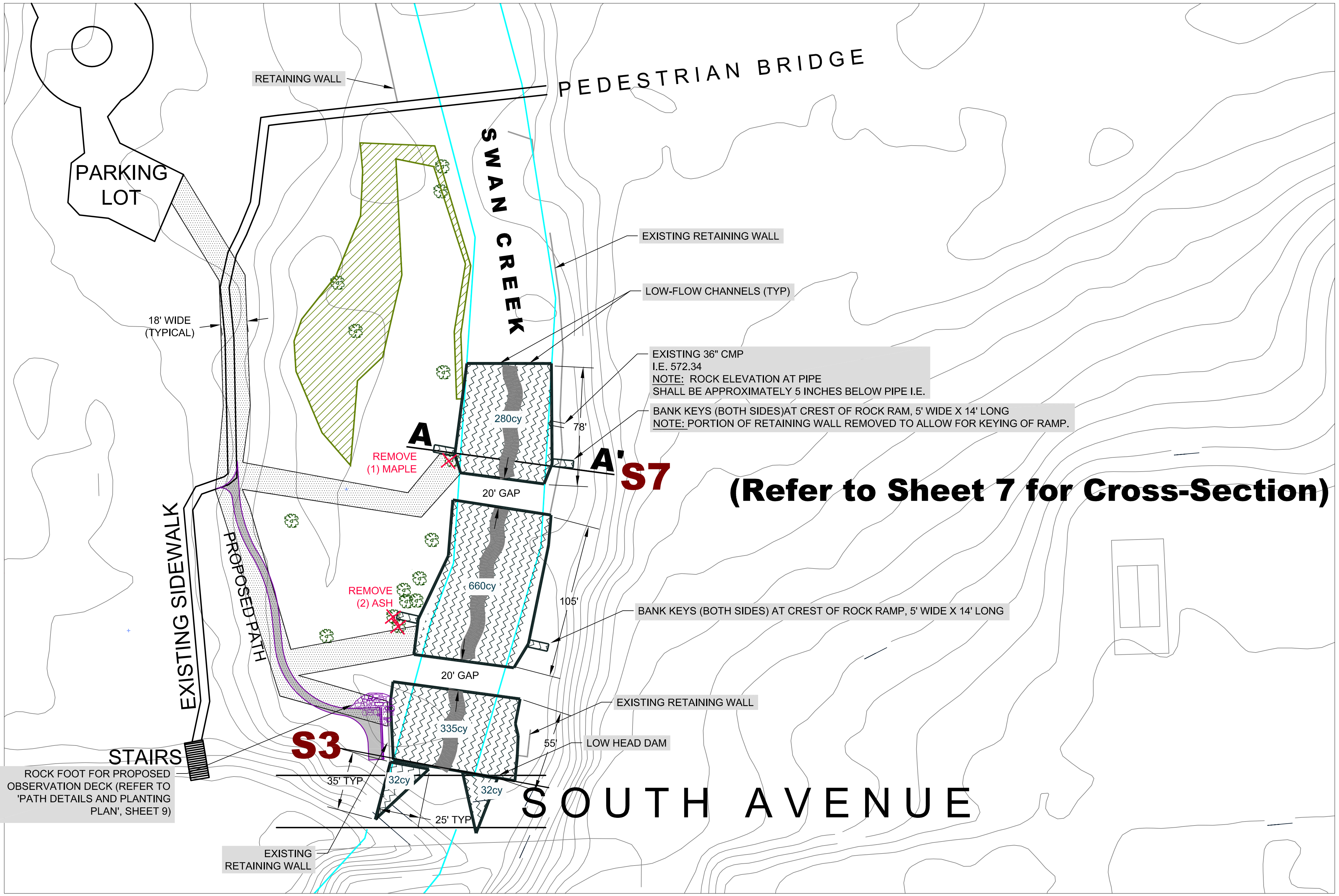
Attachments

cc:
Matt Horvat, Partners for Clean Streams
Dennis Garvin, City of Toledo
Cherie Blaire, OEPA
Dr. Mary Knapp, USFWS
ODNR

Mooney, DM, CL Holmquist-Johnson, and S Broderick. 2007. Rock Ramp Design Guidelines. Reclamation: Managing Water in the West. U.S. Department of the Interior, Bureau of Reclamation, Technical Services Center.

SITE IMPACT PLAN

DRAWING 6 – PROPOSED CONDITIONS PLAN VIEW



SITE PLAN

LEGEND

- Existing Grade
- S# Cross-Section Designation / Location
- Existing Trees
- Trees to be removed as specified
- Rock Ramp (Refer to Details, Sheet 8)
- Construction Access (Refer to Details, Sheet 8)
- Wetland

NOTE

1.) Contours on this document are derived from available public domain DEM data. This data does not constitute professional topographic survey, and may not accurately represent actual field elevations. This data is not intended to support engineering plans or detailed site design.

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N

0 40'

SCALE IN FEET

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

JFNew
Corporate/Northern Indiana
708 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400

Eastern Michigan
605 S. Main Street, Suite 1,
Ann Arbor, MI 48104
734-222-9690

REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
PROPOSED PLAN

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

DRAFT

DRAWING NO.

6

DRAWINGS

DRAWING 1 - SITE LOCATION MAP
DRAWING 2 - NATIONAL WETLAND INVENTORY (NWI) MAP
DRAWING 3 - SOIL SURVEY OF LUCAS COUNTY, OH
DRAWING 4 - AERIAL MAP OF SITE
DRAWING 5 - EXISTING CONDITIONS PLAN VIEW
DRAWING 6 - PROPOSED CONDITIONS PLAN VIEW
DRAWING 7 - PROFILE AND CROSS-SECTIONS
DRAWING 8 – DETAILS
DRAWING 9 – PATH DETAILS AND PLANTING PLAN

ATTACHMENT 1.

WATERS OF THE U.S. DELINEATION REPORT

APPENDIX A - SITE PHOTOGRAPHS
APPENDIX B – ORAM, QHEI DATA SHEETS

ATTACHMENT 2.

COORDINATION LETTERS

RARE, THREATENED, AND ENDANGERED SPECIES CONSULTATION

JFNew

605 S. Main Street, Suite 1
Ann Arbor, MI 48104
phone: 734-222-9690
fax: 734-222-9655

Erin Switala
Ecological Resource
Specialist
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Ann Arbor, Michigan

Grand Haven, Michigan

Cincinnati, Ohio

Madison, Wisconsin

Native Plant Nursery:
Walkerton, Indiana

www.jfnew.com

May 16, 2008

Dr. Mary Knapp
United States Fish and Wildlife Service
Ecological Services
6950 Americana Parkway, Suite H
Reynoldsburg, Ohio 43068-4132

Re: Request for Endangered, Threatened and Rare Species Review for City of Toledo and Partners for Clean Streams, Toledo, Lucas County, Ohio

Dear Dr. Knapp:

JFNew is contacting the United States Fish and Wildlife Resources (USFWS) on behalf of the City of Toledo (owner) and Partners for Clean Streams (grant recipient), who are planning to construct 3 rock ramps downstream of a low-head dam to improve fish passage over the dam in Swan Creek.

The project is located in Highland Park between the South Avenue bridge and Champion Street bridges, Toledo, Lucas County, Ohio (**Drawing 1**). The work will be conducted in Swan Creek, a perennial tributary to the Maumee River. The site is located on the Toledo (OH, MI) USGS quadrangle at 41°37'56"N latitude and -83°35'05"W longitude.

This project is part of a Joyce Foundation grant spearheaded by Partners for Clean Streams. An existing low head dam has created a blockage for fish passage. The dam encases a sewer main and thus, cannot be removed. Therefore, the agency is proposing to construct three rock ramps with low flow notches to allow fish passage. The work includes discharge of approximately 1340 cubic yards of rock to create the ramps. There will be a few trees and brush cleared in the process in order to gain access to the work area.

We have included a copy of the Nationwide Permit application, which contains photographs, and a Waters of the U.S. delineation report.

We are soliciting information from USFWS on the presence of any Federally listed (or proposed for listing) endangered or threatened species or critical habitat in the project area that may be affected by the proposed development. Please also inform us of known locations of species. This information is being requested as part of the U.S. Army Corps of Engineers Section 404 permitting process.

Thank you for your assistance in this matter. If you have any questions regarding our request, please contact me at your convenience at 734-222-9690, or by email at *eswitala@jfnew.com*.

Sincerely,

Erin N. Switala

Erin Switala
Ecological Resource Specialist

Enclosure
PN: 070812

JFNew

605 S. Main Street, Suite 1
Ann Arbor, MI 48104
phone: 734-222-9690
fax: 734-222-9655

Erin Switala
Ecological Resource Specialist
eswitala@jfnew.com

May16, 2008

Ohio Department of Natural Resources
Division of Natural Areas and Preserves
Ohio Natural Heritage Program
2045 Morse Road, Building F-1
Columbus, Ohio 43229

Re: Request for Endangered, Threatened and Rare Species Review for Highland Park Dam Mitigation, Toledo, Lucas County, Ohio

Dear Project Manager:

JFNew is contacting the Ohio Department of Natural Resources (ODNR) on behalf of Partners for Clean Streams, who is planning to construct 3 rock ramps downstream of a low-head dam to improve fish passage over the dam in Swan Creek.

The project is located in Highland Park between the South Avenue bridge and Champion Street bridges, Toledo, Lucas County, Ohio (**Figure 1**). The work will be conducted in Swan Creek, a perennial tributary to the Maumee River. Specifically, it is located in Sections 9 and 10, Township 3, and Range 7 East of the second principal meridian. The site is located on the Toledo (OH, MI) USGS quadrangle.

This project is part of a Joyce Foundation grant spearheaded by Partners for Clean Streams. An existing low head dam has created a blockage for fish passage. The dam encases a sewer main and thus, cannot be removed. Therefore, the agency is proposing to construct three rock ramps with low flow notches to allow fish passage. The work includes discharge of approximately 1340 cubic yards of rock to create the ramps. There will be a few trees and brush cleared in the process in order to gain access to the work area.

We are soliciting information from ODNR on the presence of any State listed (or proposed for listing) endangered or threatened species or critical habitat in the project area that may be affected by the proposed construction. This information is being requested as part of the Section 404 permitting process.

Mr. Matthew Horvat from Partners for Clean Streams (PCS) has been in contact with Mr. John Navaro and Ms. Becky Jenkins of ODNR and has discussed the potential for existence of state-listed mussel populations on the project site. Mr. Horvat has received permission for PCS to have a local malacologist perform a mussel survey of the project site. PCS has also agreed to relocate mussel populations if necessary.

JFNew has contacted USFWS, for site-specific information on Federal listed plants and animals. Thank you for your assistance in this matter. If you have any questions regarding our request, please contact me at your convenience at 734-222-9690, or by email at *eswitala@jfnew.com*.

Sincerely,

Erin Switala
Project Manager

Enclosure
JFNew Project No. 070812

DATA REQUEST FORM

OHIO DEPARTMENT OF NATURAL RESOURCES
DIVISION OF NATURAL AREAS AND PRESERVES
OHIO NATURAL HERITAGE PROGRAM
2045 MORSE RD., BLDG. F-1
COLUMBUS, OHIO 43229-6693
PHONE: 614-265-6453; FAX: 614-267-3096

INSTRUCTIONS:
Please complete both sides of this form, sign and return it to the address or fax number given above along with: **(1)** a brief letter describing your project, and **(2)** a map detailing the boundaries of your project site. A copy of the pertinent portion of a USGS 7.5 minute topographic map is preferred but other maps are acceptable. Our turnaround time is two weeks, although we can often respond more quickly. If you fax in your request you do not need to mail the original unless otherwise requested.

FEES:
Fees are determined by the amount of time it takes to complete your project. The charge is $50.00 per half hour with a one hour minimum. A cost estimate can be provided upon request. An invoice will be included with our response.

WHAT WE PROVIDE: The Natural Heritage Database is the most comprehensive source of information on the location of Ohio's rare species and significant natural features. Our inventory program has not completely surveyed Ohio and relies on information supplied by many individuals and organizations. Therefore, a lack of records for any particular area is not a statement that rare species or unique features are absent from that area. Records for the following will be provided from the Natural Heritage Database: plants and animals (state and federal listed species), high quality examples of natural plant communities, geologic features, breeding animal concentrations, and unprotected natural areas. In addition, we report locations for managed areas including federal, state, county, local and non-profit areas, as well as state and national scenic rivers. Natural Heritage Data can be provided in many formats, including GIS shapefiles, spreadsheets, printed reports or maps. A minimum one mile radius around the project site will automatically be searched. Because Natural Heritage data is sensitive information, it is our policy to provide only the data needed to complete your project.

****

Date: May 16, 2008

Company name: JFNew

Your name: Erin Switala

Address: 605 S. Main St, Suite 1

City/State/Zip: Ann Arbor, MI 48104

Phone: (734)222-9690 Fax: (734)222-9655

E-mail address: eswitala@jfnew.com

Project Name: Highland Park Dam Mitigation

Project Number: JFN 070812

Project Site Address: South Avenue and Shasta Drive

Project County: Lucas

Project Township: in City of Toledo

Project site is located on the following USGS 7.5 minute topographic quad(s): Toledo (OH, MI)

Description of project: Three rock ramps are proposed to be constructed downstream of an existing low-head dam that encases a sewer main.

How do you want your data reported? Printed list and map X GIS shapefile ______

Other format (please specify): ______

Additional information required: ______

How will the information be used? Clean Water Act permitting

I certify that data supplied by the Ohio Natural Heritage Program will not be published without crediting the ODNR Division of Natural Areas and Preserves as the source of the material. In addition, I certify that electronic datasets will not be distributed to others without the consent of the Division of Natural Areas and Preserves, Ohio Natural Heritage Program.

Signature ______

Date: ______

DNR 5203
REV 2/2008

605 S. Main Street, Suite 1
Ann Arbor, MI 48104
Phone: 734-222-9690
Fax: 734-222-9655

Erin Switala
Ecological Resource Specialist
eswitala@jfnew.com

Corporate Office:
Walkerton, Indiana

Chicago, Illinois

Indianapolis, Indiana

Grand Haven, Michigan

Cincinnati, Ohio

Madison, Wisconsin

Native Plant Nursery:
Walkerton, Indiana

www.jfnew.com

June 16, 2008

Mr. David Golles
City of Toledo
Division of Building Inspection
One Government Center, Suite 1600
Toledo, OH 43604

**Re: Flood Hazard Development Permit Application
Highland Park Dam Mitigation
Fish Passage Improvement,
City of Toledo and Partners for Clean Streams,
Toledo, Lucas County, Ohio**

Dear Mr. Golles:

JFNew is contacting the City of Toledo Division of Building Inspection on behalf of the City of Toledo Parks Department (owner) and Partners for Clean Streams (grant recipient), who seek approval to construct 3 rock ramps downstream of a low-head dam to improve fish passage over the dam in Swan Creek.

The project is located in the City of Toledo's Highland Park between the South Avenue Bridge and Champion Street Bridge, Toledo, Lucas County, Ohio (**Drawing 1**). The work will be conducted in Swan Creek, a perennial tributary to the Maumee River. Specifically, it is located in Sections 9 and 10 of Township 3 and Range 7 East, of the second principal meridian, on the Toledo (OH, MI) USGS quadrangle (**Drawing 1**). Below, I have provided a brief description of the project and items included with this application.

This project is part of a Joyce Foundation grant spearheaded by the non-profit organization Partners for Clean Streams. An existing low head dam has created a blockage for fish passage. The dam encases a sewer main and thus, cannot be removed. Therefore, the applicants are proposing to construct three rock ramps with sinuous, low flow channels to allow fish passage.

The rock structures were designed using the Rock Ramp Design Guidelines (Mooney et. al., 2007) published by the U.S. Department of the Interior's Bureau of Reclamation. The guidelines include several equations used to design the ramps and to size the stone, the stone filter layer, and the low flow channel. The stone sizing calculations are based on the 100-year event flow (9,000 cfs), while the low-flow channel sizing is based on a low flow of 30-40 cfs. The low-flow channel calculations incorporate interstitial flow, depth-based roughness, and velocity to ensure that flow conditions are suitable for fish passage. We are confident that the rock ramp design will be stable up to the 100-year event, and that we will have sufficient flow in the low flow channel to allow passage of fish with body length greater than 4 to 6 inches. The design process also included consultation with Dave Derrick, a research hydraulic engineer with the U.S Army Corps of Engineers' Coastal and Hydraulics Laboratory in Vicksburg, Mississippi. Construction drawings are included with this permit application for your reference.

The proposed work includes over-excavation in the channel to anchor the rock and minor excavation into the banks to key in the rock. Rock will be placed in the channel to build the ramps. In addition to the ramps, rock will also be placed upstream of the dam to concentrate low flows toward the low flow notch, allowing adequate water depth for fish passage. A total of approximately 1,340 CY of stone will be added to the channel. The rock will consist of stone with a D_{50} of 24 inches and the ramps will be underlain by a stone filter (D_{50}= 2.5 inches). The rock ramps will be keyed into the banks and into the streambed to provide stability during high flows. Each rock ramp will drop the pool water surface elevation by 0.75 feet (**Drawing 7**). One low flow notch channel will be constructed on each rock ramp to be 0.75 feet deep and 10 to 20 feet wide (notch top width is different for each rock ramp). These low flow notches are designed to allow warm-water fish with a body length of 4 to 6 inches or greater to pass during low flow (approximately 40 cubic feet per second).

To ensure that the rock structures would not adversely affect flood elevations, we modeled the preliminary design using HEC-2. The existing HEC-2 model was obtained from FEMA and field surveyed cross-sections were shot upstream and downstream of the proposed project location. The existing conditions HEC model was validated to low-flow conditions (flow, velocity, and water surface elevations) observed during field work. The proposed rock ramps were then added to the model to effectively "lift" the streambed elevations. The proposed structures resulted in no significant changes in the 100-year flood elevations upstream of the dam (see **Table 7** in attached memo). Our HEC model is conservative because the preliminary design had included a series of four rock ramps, while the current design only includes three rock ramps. The technical memorandum included with this application shows the results of the hydrologic/hydraulic analysis.

If you have any questions concerning this permit application, please do not hesitate to call me at 734.222.9690 or contact me by email at *eswitala@jfnew.com.*

Sincerely,

Erin Switala
Project Manager

Attachments

cc:
Matt Horvat, Partners for Clean Streams
Dennis Garvin, City of Toledo

Mooney, DM, CL Holmquist-Johnson, and S Broderick. 2007. Rock Ramp Design Guidelines. Reclamation: Managing Water in the West. U.S. Department of the Interior, Bureau of Reclamation, Technical Services Center.

CITY OF TOLEDO

Division of Building Inspection

National Flood Insurance Program

NOTICE: Lending Institutions, Real Estate Agencies, and Insurance Agencies

SUBJECT: Flood Insurance Information – City of Toledo

AS A PUBLIC SERVICE, THE City of Toledo WILL PROVIDE YOU WITH THE FOLLOWING IFORMATION UPON REQUEST:

- Whether the property is located in a Special Flood Hazard Area (SFHA) based on the Flood Insurance Rate Maps (FIRM) within the City of Toledo.
- Provide additional information such as FIRM Zones, Base Flood Elevation (BFE) data elevation and depth.
- Provide informational handouts regarding flood insurance within SFHA's.

The Division of Building Inspection is located on the 16th Floor at One Government Center. The Office hours are Mon. thru Friday from 7:30AM to 4:30PM. The Phone number is 419-245-1220. There is no charge for this service and the information requested may take a couple of days. The Office can also provide Elevation Certificates for buildings constructed in the Flood Plain since 2000 and also provide Elevation Certificate Applications for new construction.

One Government Center, Suite 1600, Toledo, Ohio 43604, USA Telephone 419-245-1220 FAX: 419-245-1329 www.toledo.oh.gov

CITY OF TOLEDO

Division of Building Inspection

FLOOD INSURANCE

NFIP: The City of Toledo participates in the National Flood Insurance Program (NFIP). The NFIP makes federally backed flood insurance available for all buildings, whether they are in a floodplain or not. Flood insurance covers direct loss caused by surface flooding.

The NFIP insures buildings for structure and contents, which have to be purchased separately. The content coverage is for the contents actually located within the insured building and include HVAC equipment.

MANDATORY PURCHASE REQUIREMENT: The mandatory purchase requirement applies to all forms of federal or federally related financial assistance for buildings located in a special flood hazard area (SFHA). This requirement affects loans and grants for the purchase, construction, repair, or improvement of any publicly or privately owned building within the SFHA, including machinery, equipment, fixtures, and furnishings contained in such buildings.

Financial assistance programs affected include loans and grants from agencies such as the Dept. of Veterans Affairs, Farmers Home Administration, Federal Housing Administration, Small Business Administration, and Federal Emergency Management Agency. The requirement also applies to secured mortgage loans from financial institutions and mortgage loans purchased by Fannie Mae or Freddie Mac in secondary mortgage market.

HOW IT WORKS: Before a person can receive a loan or other financial assistance from one of the affected agencies or lenders, there must be a check to see if the building is in a SFHA. The SFHA is the base (100-year) floodplain mapped on a Flood Insurance Rate Map (FIRM). It is shown as one or more zones that begin with the letter “A” or “V.”

Copies of the FIRM are available for review at the Division of Building Inspection located at One Government Center, Suite 1600 in Toledo, OH 43604. It is the agency’s or the lender’s responsibility to verify the FIRM data to determine if the building is in an SFHA. If the building is located within an SFHA, the agency or lender is required by law to require the recipient to purchase a flood insurance policy on the building. The requirement is for structural coverage equal to the amount of the loan or the maximum amount available, whichever is less. The maximum amount available for a single-family house is $250,000.

The mandatory purchase requirement does not affect loans or financial assistance for items that are not covered by a flood insurance policy, such as vehicles, business expenses, landscaping, and vacant lots. It does not affect loans for buildings that are not in the SFHA, even though a portion of the lot may be flood prone. While not mandatory by law, a lender may require a flood insurance policy for a property in any zone on a Flood Insurance Rate Map.

PT08-01481

Special Flood Hazard Area Development Permit Application

Application is hereby made for a DEVELOPMENT PERMIT as required by the Flood Damage Prevention Ordinance No. (908-00) of (Toledo, Ohio) for development in an identified flood hazard area. All activities shall be completed in accordance with the requirement of said Ordinance. The development to be performed is described below and in attachments hereto. The applicant understands and agrees that:

- ❑ This permit is issued on the conditions and facts described;
- ❑ Any permit may be repealed if conditions or facts change;
- ❑ Permit void if the activity has not begun within 180 days of the issuance date;
- ❑ The permit will remain valid for one year from date of issuance.

Grant Recipient:
Partners for Clean Streams
300 Dr. Martin Luther King Jr. Dr.
Toledo, OH 43604
Contact: Matt Horvat
(419)241-9155 ext. 123

Grant Recipient:
Partners for Clean Streams
300 Dr. Martin Luther King Jr. Dr.
Toledo, OH 43604
Contact: Matt Horvat
(419)241-9155 ext. 123

Owner's Name: City of Toledo (Dennis Garvin) Builder: JFNew (Erin Switala)

City of Toledo (Dennis Garvin) JFNew (Erin Switala)

Address: 2201 Ottawa Parkway, Toledo,OH, 43606 Address 605 S. Main St., Suite 1, Ann Arbor, MI, 48104

2201 Ottawa Parkway, Toledo,OH, 43606 605 S. Main St., Suite 1, Ann Arbor, MI, 48104

Phone: 419-936-2326 Phone: 734-222-9690

419-936-2326 734-222-9690

NOTE: In addition to completion of this form the applicant agrees to submit any additional information required by the administrator in order to determine that the proposed development is compliant with the local and federal flood damage prevention criteria of the National Flood Insurance Program. Additional information may include but is not limited to: site specific plans to scale showing the nature, location, dimensions and elevations of the area and structure(s) in question.

DESCRIPTION OF WORK

1865 Finch

1. Location of proposed development site-address: Swan Creek at Highland Park, (South Avenue at Woodsdale Ave)

Swan Creek at Highland Park, (South Avenue at Woodsdale Ave)

2. Kind of development proposed:

new building ___	existing structure ___	filling/grading ___
residential ___	alteration ___	mining/dredging ___
nonresidential ___	addition ___	watercourse alteration ___
manufactured ___	materials storage ___	other* X

*Describe activity: Improve fish passage in Swan Creek over low-head dam at South Avenue, by constructing a series of rock ramps/weirs in the channel downstream of the dam

Improve fish passage in Swan Creek over low-head dam at South Avenue, by constructing a series of rock ramps/weirs in the channel downstream of the dam.

3. If the proposed construction is an alteration, addition or improvement to an existing structure, indicate the cost of proposed construction $______. What is the estimated market value of the existing structure $______?

NOTE: An existing structure must comply with the flood protection standards if it is substantially improved (an improvement equal to or greater than 50% of the market value of the structure). FEMA maintains that the "substantial improvement" definition applies to existing structures only and that once a structure meets the definition of "new construction" any further improvements to that structure must meet "new construction" requirements. For floodplain management purposes "new construction" means structures for which "start of construction" began on or after the effective date of the Initial Flood Insurance Rate Map issued by FEMA for the community.

4. Does propose development involve a subdivision or other development containing at least 50 lots or 5 acres (whichever is less) Yes__ No X ?

NOTE: If yes, base flood elevation data is required from applicant if it has not been provided by FEMA.

I AGREE THAT ALL STATEMENTS IN AND ATTACHMENTS TO THIS APPLICATION ARE A TRUE DESCRIPTION OF THE EXISTING PROPERTY AND THE PROPOSED DEVELOPMENT ACTIVITY. I UNDERSTAND THE DEVELOPMENT REQUIREMENTS FOR SPECIAL FLOOD HAZARD AREA ACTIVITIES PER THE APPROPRIATE ORDINANCE (RESOLUTION) AND AGREE TO ABIDE THERETO. I UNDERSTAND IT IS MY RESPONSILITY TO OBTAIN ALL APPLICABLE FEDERAL, STATE AND LOCAL PERMITS.

Applicant's Signature William H Franklin

Date: 6/11/08 **FEE: $35.00**

ADMINISTRATIVE

NOTE: The following is to be completed by the local floodplain administrator. All references to elevations are in feet mean sea level (m.s.l.). The term base flood elevation means the same as the 100-year elevation.

5. Is the proposed development located in:
_____ An identified floodway
_____ A flood hazard area where base flood elevations exist with no identified floodway
_____ An area within the floodplain fringe
_____ An approximate flood hazard area (Zone A). If yes, complete only 6a in the following question. See No. 9

NOTE: Floodway development must demonstrate through hydrologic and hydraulic analysis, performed in accordance with standard engineering practice, that no increase in base flood elevation would result during occurrence of the base flood discharge. If base flood elevations exist with no floodway delineation, hydrologic and hydraulic analysis is required to demonstrate no more than one foot increase at any point to the water surface elevation of the base flood.

6a. Does proposed development meet NFIP and local Specific Standards at Section TMC 1110 of your regulations?
_____ Construction materials and methods resistant to flood damage
_____ Anchored property
_____ Subdivision designed to minimize flood damage
_____ Utilities safe from flooding

6b. Does proposed development meet NFIP and local Specific Standards at Section TMC 1169.0 of your regulations?

_______ Encroachments-proposed action will not obstruct floodwaters
_______ Proposed site grade elevations if fill or topographic alteration is planned
_______ Proposed lowest floor elevation expressed in feet mean sea level
_______ Proposed flood proofed elevation expressed in feet mean sea level (nonresidential only)

7. Base flood elevation (100-year) at proposed site____________ feet m.s.l.
Date source____________________________
Map effective date________________ Community-Panel No._______________

8. Does the structure contain:
_____ basement ______ enclosed area other than basement below lowest floor?

9. For structure located in approximate A zones (no BFE available) the structure's lowest floor is ________feet above the highest grade adjacent to the structure.

10. The proposed development is in compliance with applicable floodplain standards.
PERMIT ISSUED ON________________________

11. The proposed development is not in compliance with applicable floodplain standards.
PERMIT DENIED ON________________________
Reason: ____.

NOTE: All structures must be built with the lowest floor, including the basement, elevated or flood proofed to or above the base flood elevation (100-year) unless a variance has been granted. Only nonresidential structure may be flood proofed.

12. The proposed development is exempt from the floodplain standards per Section TMC 1110.0 of the Flood Damage Prevention Ordinance No. 908-00

Administrator's Signature_____________________________________Date_______________________________

13. The certified as-built elevation of the structure's lowest floor is __________ feet above m.s.l.*

14. The certified as-built flood proofed elevation of the structure is__________ feet above m.s.l.*

Note: Certification by registered engineer or land surveyor documenting these elevations is necessary if applicant provides elevations.

DRAWINGS

ATTACHMENT 1.

Technical Memorandum – Hydrologic/Hydraulic Analysis

Storm Water Pollution Prevention Plan

Highland Park Dam Mitigation and Restoration Project

LUCAS COUNTY, TOLEDO, OHIO

AUGUST 2008

Prepared For:

Highland Park Dam Mitigation and Restoration Project

City of Toledo (owner)

In partnership with:
Partners for Clean Streams (grant recipient)

Prepared By:

JFNew

Eastern Michigan Office
605 South Main Street, Suite 1
Ann Arbor, MI 48104
(734) 222-9690

Storm Water Pollution Prevention Plan

Table of Contents

Storm Water Pollution Prevention Plan
Highland Park Dam Mitigation and Restoration Project, Toledo, OH

1.0 Owner and Agent Contact Information

The proposed project will take place at the City of Toledo's Highland Park. The park is located on South Avenue between Champion Street and Shasta Drive. The landowner is the City of Toledo. The project is in partnership with the Partners for Clean Streams, the recipient of a Joyce Foundation Grant. The City of Toledo has designated JFNew as their permitting agent, and Ecological Restoration, Inc is acting as the construction contractor.

Landowner: City of Toledo
2201 Ottawa Parkway
Toledo, OH 43606
Attn: Dennis Garvin
Phone: (419)936-2326

Grant Recipient: Partners for Clean Streams
300 Dr. Martin Luther King Jr. Drive
Toledo, OH 43604
Attn: Matt Horvat
Phone: (419)241-9155 ext. 123

Agent : JFNew
605 S. Main Street
Suite 1
Ann Arbor, MI 48104
Phone (734)222-9690

Construction Contractor: Ecological Restoration, Inc.
194 Goodview Dr.
Apollo, PA 15613
Attn: Dave Hails
Phone (724)727-3771

2.0 Site Location and Overview

This project is part of a Joyce Foundation grant spearheaded by the non-profit organization Partners for Clean Streams. An existing low head dam has created a blockage for fish passage.

The dam encases a sewer main and thus, cannot be removed. Therefore, we are proposing to construct three rock ramps with low flow notches to allow fish passage.

The project is located in the City of Toledo's Highland Park between the South Avenue bridge and Champion Street bridge, Toledo, Lucas County, Ohio (**Drawing 1**). The work will be conducted in Swan Creek, a perennial tributary to the Maumee River. Specifically, it is located in Sections 9 and 10 of Township 3 and Range 7 East, of the second principal meridian, on the Toledo (OH, MI) USGS quadrangle (**Drawing 1**). A vicinity map is included in the attached Engineering Drawings for your reference (**Appendix A**).

The applicants propose to construct three rock ramps downstream of an existing low head dam on Swan Creek in order to allow fish passage over the dam. The proposed work includes trenching in the channel to anchor the rock and minor excavation into the banks to key in the rock. Rock will be placed in the channel to build the ramps. In addition to the ramps, rock will also be placed upstream of the dam to concentrate low flows toward the low flow notch, allowing adequate water depth for fish passage. In-stream work will involve approximately 315 ft of stream. The project will also include construction of a new walking path and a native plant demonstration garden (**Sheet 9**).

The total area to be disturbed is 0.85 acres (**Appendix B**). Because the disturbance area is less than 1 acre, a storm water permit is not required by the State of Ohio or the City of Toledo.

3.0 Soils and Wetlands

The soils at the project site in Highland Park are loams. The soils on both streambanks in the project area are classified as Udorthents, while the soils downstream of the project area are classified Sisson Loams. See the attached Soils Map and Reports (**Sheet 3**).

The site consists predominantly of old-field/manicured lawn with a thin strip of forested riparian area along the streambanks. JFNew completed a "Waters of the U.S." delineation in the project area at Highland Park on April 4, 2008, and identified one 0.20 acre emergent floodplain wetland in the project area (**Sheet 5**).

4.0 Proposed Work

Proposed earth changes will occur to build temporary stone access paths, to create the new walking path and garden, and within the stream and streambanks to create the rock ramps and key them into the banks.

Although a main entrance road exists, temporary stone access paths will be needed to access the streamside project area. The primary access for this project will be from the existing Shasta Drive. The parking lot near the swimming pool complex will be used as a staging area for equipment and materials. An access path from the parking lot will extend to the south along the existing and proposed portions of the walking path (**Drawing 6**) on the west bank. The construction access will be from the western stream bank, where the native plant garden and proposed walking path will also be built. The only disturbance on the east bank will be the removal of a portion of retaining wall and re-grading, as well as excavation to key in the rock ramp structures.

Three construction paths will be utilized, one at the upstream end of each rock ramp, to get equipment to the edge of the stream for rock placement. In order to access the edge of the stream, a few trees and some brush in the riparian area will be removed. The trees are labeled on the proposed plan view (**Drawing 6**). The wetland area will not be impacted. The temporary access paths will be restored through re-seeding and will be covered with erosion control blanket.

The proposed in-stream work will extend 35 feet upstream of the low-head dam and approximately 280 ft downstream of the dam. **Sheet 6** of the Plans (attached) shows the site plan with proposed rock ramps. The rock will consist of stone with a D50 of 24 inches and the ramps will be underlain by a stone filter (D50= 2.5 inches). The rock ramps will be keyed into the banks and into the streambed to provide stability during high flows. Each rock ramp will drop the pool water surface elevation by 0.75 feet (**Drawing 7**). One low flow sinuous notch channel will be constructed on each rock ramp to be 0.75 feet deep and 10 to 20 feet wide (notch top width is different for each rock ramp). These low flow notches are designed to allow warm-water fish with a body length of 4 inches or less to pass during low flow (approximately 40 cubic feet per second).

The fill will consist of 1,275 cubic yards of stone for the three rock ramps and an additional 65 cubic yards upstream of the dam to concentrate the flow. The rock size will be the same for the upstream discharge as for the rock ramps. In order to key the rock ramp structures into the bed and banks, approximately 40 cubic yards (CY) will be removed. All dredged material is proposed to be taken off site for disposal.

The total acreage of in-stream impact as a result of building the rock ramps is 0.41 acres (**Appendix B**). The total volume of material to be permanent placed into the river will be approximately 1,340 CY. All disturbed riparian areas will be restored through native plantings and installation of live stakes, which will not only stabilize the banks, but also will provide wildlife habitat (**Drawing 9**).

5.0 Construction Sequence

Construction will take place the last two weeks of August and the first week in September, if necessary. The swimming pool complex parking lot (off of Shasta Drive) will be used to stockpile erosion control blankets, gravel, stone, and planting materials.

Construction will begin with creation of the access paths in order to reach the streamside construction areas. Access paths will be created by laying gravel over the existing grass. Because no removal of turf grass or grading will take place to construct the access paths, little or no soil will be disturbed in these areas. Tree removal and grubbing of brush will be done and stone laid for the access paths as needed. Swamp mats may be used in some riparian areas to decrease the amount of stone needed and minimize impacts to riparian vegetation.

The in-stream work will begin with the construction of the rock ramp immediately downstream of the low-head dam. The excavator will work from west streambank to east streambank, first excavating a small amount of bed material to key the ramps into the streambed. Then the stone filter will be laid, and then the large anchor rock lain on top. Each ramp will be built with the stone in compression, so as you move upstream, the stone is laid on top of the downstream stone. The excavator will build the portion of the ramp closest to the west bank, and then move out onto the stone in the stream as necessary to continue across the stream width.

The second and third ramps downstream of the dam will be built in sequence, in the same manner as the first rock ramp. Bank keying will be done for the two further downstream ramps, at the crests of the ramps. The bank keys will be excavated and rock laid in place. Non-woven geotextile will be placed between the back and sides of the keys to prevent loss of virgin soil by seepage piping through the key. The rock will be covered with a thin layer of topsoil, and seeded and blanketed at the conclusion of construction on each rock ramp. After construction of rock ramps is completed, volunteer crew will be utilized to plant bare-root shrubs and small trees in the bank key areas. Prior to keying in the third ramp on the east bank, a portion of the crumbling concrete retaining wall will be removed. The last rock placed in the stream will be the flow-narrowing rock on the upstream side of the dam.

Because excavation equipment will be readily available on-site during construction, the turf grass where native vegetation will be planted will be scraped off the surface rather than using an herbicide to kill the grass. The grass will be removed and the area re-graded as necessary within a day of planting the native plant demonstration garden. In the native garden area, a three inch thick layer of hardwood mulch will be spread and native plugs will be planted into the mulch and covered with erosion control blanket.

6.0 Soil Erosion and Sedimentation Control Measures

Temporary Measures During Construction

Because the work will be occurring on the streambank and in the channel, it will be important to follow Best Management Practices (BMPs) to minimize soil erosion and minimize the amount of sediment entering Swan Creek. Silt fences will be employed on much of the site (**Appendix C**), including on the downstream side of all floodplain soil disturbances (i.e. native planting area, re-graded areas, etc). Sediment discharges into the river during construction will be minimized as much as possible through careful excavation of as little material as possible by skilled operators. The large stone will be underlain by gravel in order to minimize disturbance of the stream sediments.

Any stockpiles of dirt or fill material left on-site (in parking lot) will be covered with a tarp during rain events. Silt fence will also be used on the downstream sides of the parking lot pavement. Inlet protection, such as the GSI Dandy® Bag will be used around any stormwater inlet drains in the parking lot. Temporary erosion control measures in and around the parking lot will be installed prior to stockpiling, and be removed after all stockpiled material is removed.

Permanent Measures

Disturbed areas immediately along the streambank (bank keys and re-graded area where retaining wall removed) will be seeded with a native plant buffer and covered with a coir fabric erosion control blanket. The native plant seed mix will include annual oat and rye species to take hold and provide protection within weeks of construction and perennial species that will come up the following spring. All seeding will be done immediately following final grading. In addition to seeding, live stakes and bare-root trees and shrubs will also be planted in these areas.

Much of the area disturbed to create the access paths will be converted into the proposed walking path. After construction has been completed, gravel will be removed from the remaining access path areas and turf re-seeding will be done as necessary.

7.0 Inspection and Maintenance

During construction, all stormwater pollution prevention BMPs should be inspected once a week and after major storm events. An inspection form is included in **Appendix D**.
For the first year following the project, monitoring will be done to assess plant growth, survival, and invasive species presence in the riparian area and native plant garden areas. Hand pulling and spot herbicide treatment may be used to remove invasive plants that compete with the natives. As a general rule of thumb, prairies should be mowed 1-3 times during the first year. The mower blade should be sharp (to avoid ripping seedlings out of the ground) and should be set at a height of 6”. Exact mowing schedules are dictated by the growth of the vegetation, and should be performed when the weeds reach a height of 1-2 feet, or begin to flower. In the second year, an early summer mow may be all that is needed to give the natives the jump they need.

Monitoring of the rock ramps will also be done, looking for signs of shifting rock, piping, wash out, and blockage of the meandering notch channels within the rock ramps. Any obstructions (debris that has come into the reach from upstream, or trees that have fallen into the reach) will be evaluated to determine if it is blocking fish passage or adversely affecting the stability of the rock ramps. If so, the obstruction will be removed.

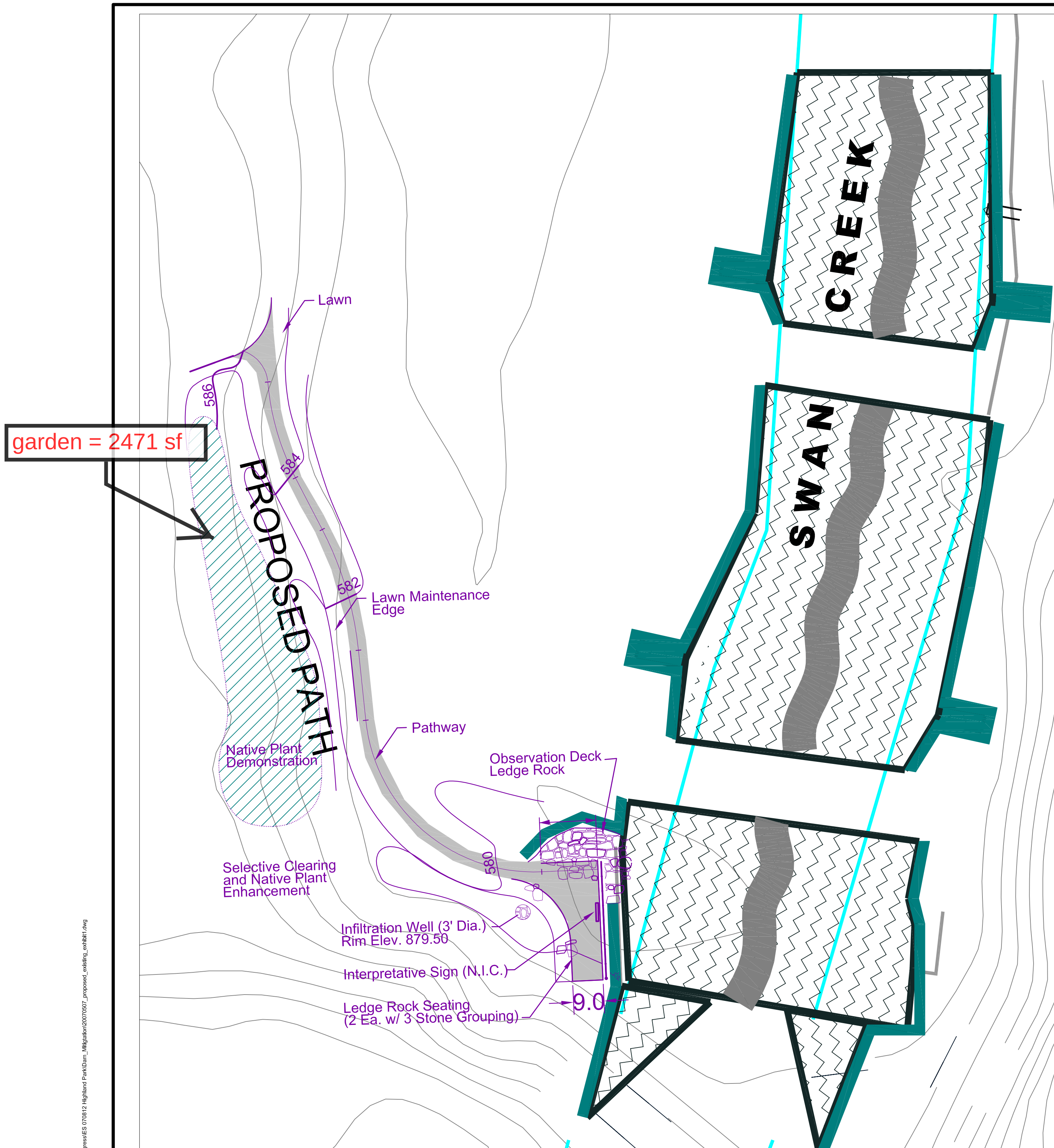
Long-term maintenance required for the native plant buffer is very minimal. Ideal maintenance for the native plant buffer is by prescribed burning, approximately every three years. If prescribed burning is not done, mowing may be a suitable alternative. Maintenance responsibility lies with the City of Toledo Department of Parks and Forestry.

APPENDIX A

Engineering Drawings

APPENDIX B

Construction Disturbance Areas



SITE PLAN

NOTE

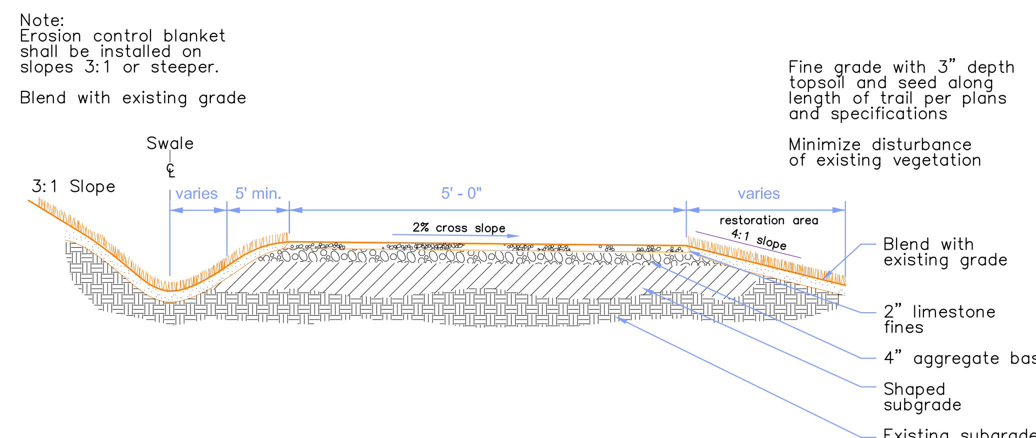
1.) Contours on this document are derived from available public domain DEM data. This data does not constitute professional topographic survey, and may not accurately represent actual field elevations. This data is not intended to support engineering plans or detailed site design.

LEGEND

- Existing Grade
- Rock Ramp

PLANTING LEGEND

- Native Seed Mix and Live Stakes
- Native Plant Plugs



Limestone Fines Trail with Cross Slope

Scale: Not To Scale

Native Plant Plugs (1'-3' on center)

Botanical Name	Common Name	# Plugs
Grass:		
Elymus canadensis	Canada Wild Rye	114
Panicum virgatum	Switchgrass	114
Schizachyrum scoparium	Little Bluestem	114
Sorghastrum nutans	Indian Grass	114
Forbs:		
Aquilegia canadensis	Columbine	76
Asclepias tuberosa	Butterfly Milkweed	76
Aster azureus	Sky-blue Aster	114
Aster laevis	Smooth Blue Aster	76
Coreopsis lanceolata	Lance-leafed Coreopsis	76
Coreopsis tripteris	Tall Coreopsis	114
Echinacea purpurea	Purple Coneflower	76
Eupatorium rugosum	Snakeroot	76
Euphorbia corollata	Flowering Spurge	76
Helianthus occidentalis	Western Sunflower	38
Helianthus strumosus	Pale-Leaved Sunflower	76
Monarda fistulosa	Bergamot	76
Penstemon hirsutus	Hairy Beard's Tongue	76
Ratibida pinnata	Gray-headed Coneflower	76
Rudbeckia hirta	Black-eyed Susan	76
Solidago nemoralis	Gray Goldenrod	76
Solidago rigida	Stiff Goldenrod	76
Verbena stricta	Hoary Vervain	114
Veronicastrum virginicum	Culver's Root	76
	Total Plugs	1976

Native Seed Mix

Botanical Name	Common Name	PLS Oz Per Acre
Avena sativa	Seed Oats	128
Carex crinita	Fringed sedge	1
Carex emoryi	Riverbank sedge	1
Carex frankii	Bristly cattail sedge	2
Carex grayi	Common bur sedge	0.5
Carex lupulina	Common hop sedge	1
Carex muskingumensis	Swamp oval sedge	1
Carex vulpinoidea	Brown fox sedge	2
Cinna arundinacea	Common wood reed	1
Coreopsis tripteris	Tall coreopsis	1
Elymus riparius	Riverbank wild rye	4
Elymus virginicus	Virginia wild rye	32
Eupatorium maculatum	Spotted joe-pye weed	1
Eupatorium perfoliatum	Common boneset	0.5
Eupatorium purpureum	Purple joe-pye weed	1
Hibiscus moscheutos	Swamp rose mallow	1
Juncus effusus	Common rush	0.25
Juncus tenuis v. dudleyi	Dudley's rush	0.1
Liatris spicata	Marsh blazing star	0.25
Lobelia cardinalis	Cardinal flower	0.25
Lobelia siphilitica	Great blue lobelia	0.25
Lolium multiflorum	Annual rye	40
Monarda fistulosa	Wild bergamot	0.5
Panicum virgatum	Switch grass	2
Rudbeckia laciniata	Wild golden glow	2
Spartina pectinata	Prairie cord grass	2
Verbesina alternifolia	Wingstem	2
Zizia aurea	Golden Alexanders	0.25
	Total PLS Ounces	227.85

Live Stakes (1' on center)

		# Stakes
Cornus stolonifera	Red-osier dogwood	337
Salix exigua	Sandbar willow	337
	Total Stakes	674

PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N

0 20'

SCALE IN FEET

GRAPHIC SCALE VERIFICATION
This bar measures 1" on 22"x34" or 1/2" on 11"x17" original. Adjust scale accordingly.

JFNew
Corporate/Northern Indiana
708 Roosevelt Road
Walkerton, Indiana 46574
574-586-3400

Eastern Michigan
605 S. Main Street, Suite 1,
Ann Arbor, MI 48104
734-222-9690

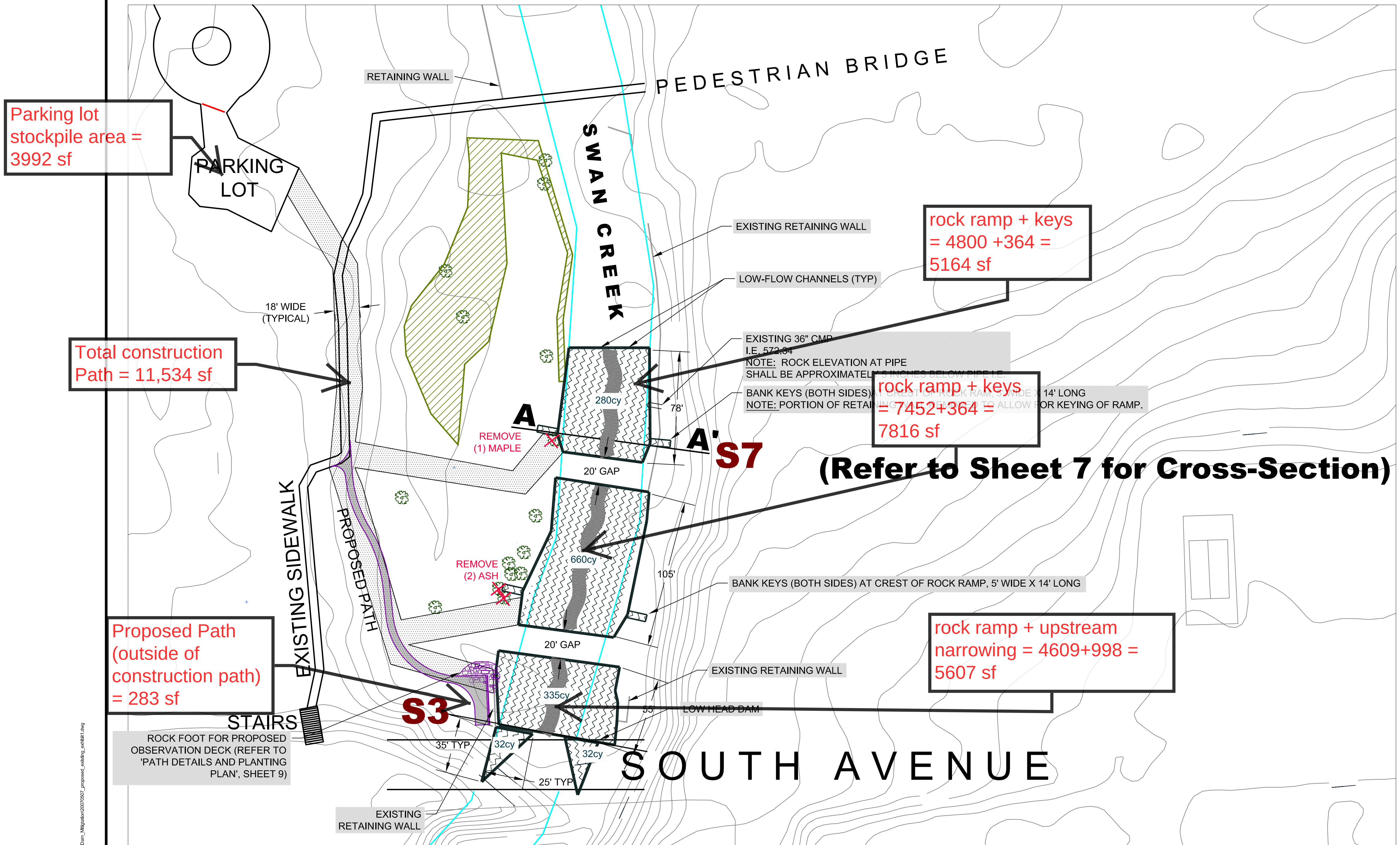
REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
PATH DETAILS AND PLANTING PLAN

DRAWN BY: COD
DESIGNED BY: ES
DATE: MAY 2008
JOB NO: 070812.00

DRAFT

DRAWING NO.
9



SITE PLAN

LEGEND

- Existing Grade
- S# Cross-Section Designation / Location
- Existing Trees
- Trees to be removed as specified
- Rock Ramp (Refer to Details, Sheet 8)
- Construction Access (Refer to Details, Sheet 8)
- Wetland

Total Areas	
Garden	2471
Construction Paths	11,534
Proposed Path	283
Rock Ramps	5164
	7816
	5607
Stockpile	3992
SUM	36,867 SF

36,867 SF = 0.846 acres

NOTE

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PRELIMINARY DRAWING:
NOT APPROVED FOR CONSTRUCTION.

N

0 40'

SCALE IN FEET

GRAPHIC SCALE VERIFICATION

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REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
PROPOSED PLAN

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

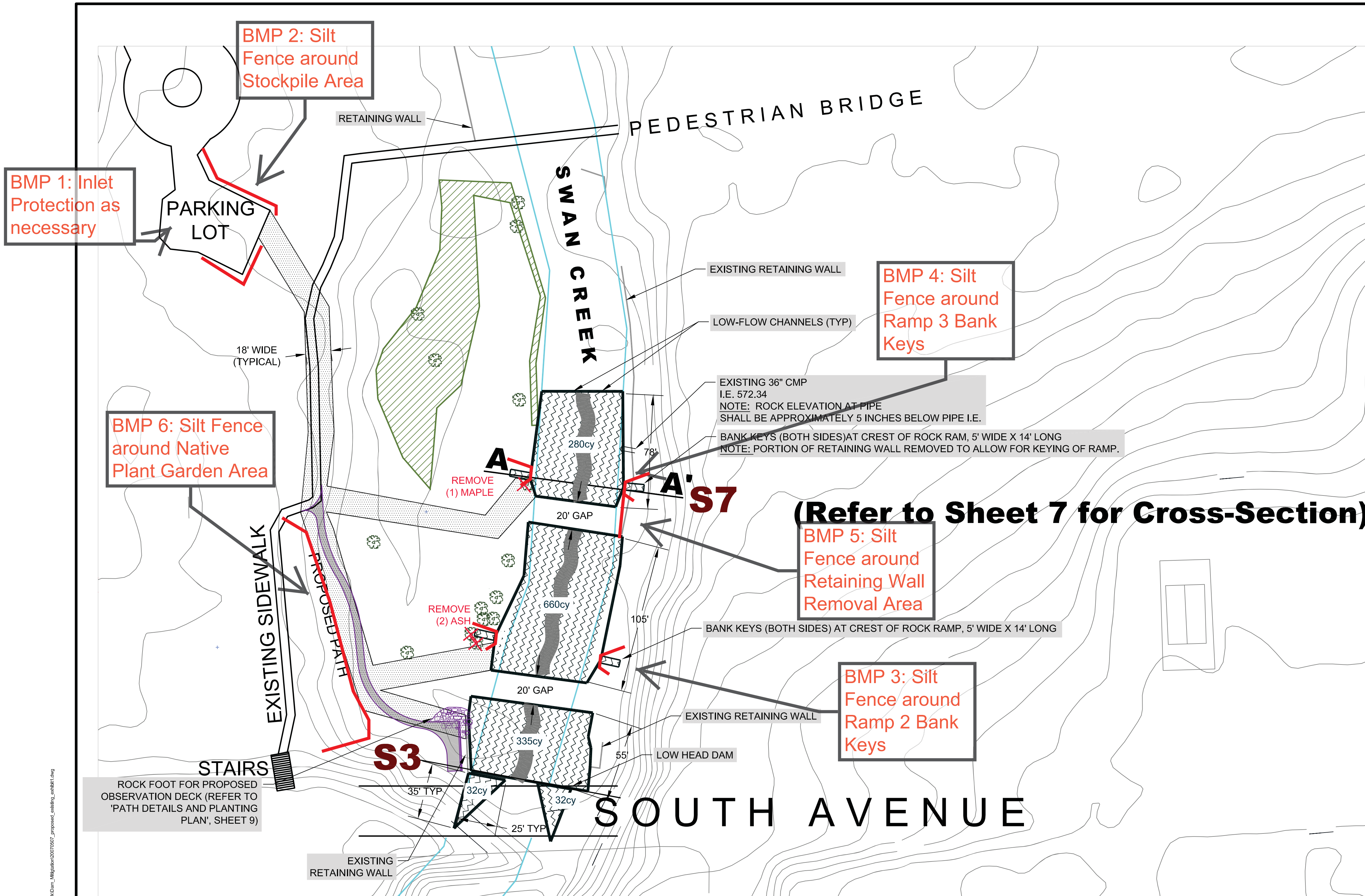
DRAFT

DRAWING NO.

6

APPENDIX C

BMP Locations



SITE PLAN

LEGEND

- Existing Grade
- S# Cross-Section Designation / Location
- Existing Trees
- Trees to be removed as specified
- Rock Ramp (Refer to Details, Sheet 8)
- Construction Access (Refer to Details, Sheet 8)
- Wetland
- Silt Fence for Stormwater BMP

NOTE

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PRELIMINARY DRAWING: NOT APPROVED FOR CONSTRUCTION.

N

0 40'

SCALE IN FEET

GRAPHIC SCALE VERIFICATION
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REVISION

Highland Park Dam Mitigation and Riparian Enhancement
Partners for Clean Streams
Lucas County, Toledo, Ohio
PROPOSED PLAN

DRAWN BY:	COD
DESIGNED BY:	ES
DATE:	MAY 2008
JOB NO:	070812.00

DRAFT

DRAWING NO.

6

APPENDIX D

BMP Inspection Form

Stormwater Construction Site Inspection Report – Highland Park

General Information			
Project Name	Highland Park Dam Mitigation and Restoration		
NPDES Tracking No.		**Location**	Highland Park, Toledo, OH
Date of Inspection		**Start/End Time**	
Inspector's Name(s)			
Inspector's Title(s)			
Inspector's Contact Information			
Inspector's Qualifications			
Describe present phase of construction			
Type of Inspection: ❑ Regular ❑ Pre-storm event ❑ During storm event ❑ Post-storm event			
Weather Information			
Has there been a storm event since the last inspection? ❑Yes ❑No **If yes, provide:** Storm Start Date & Time: Storm Duration (hrs): Approximate Amount of Precipitation (in):			
Weather at time of this inspection? ❑ Clear ❑Cloudy ❑ Rain ❑ Sleet ❑ Fog ❑ Snowing ❑ High Winds ❑ Other: Temperature:			
Have any discharges occurred since the last inspection? ❑Yes ❑No **If yes, describe:**			
Are there any discharges at the time of inspection? ❑Yes ❑No **If yes, describe:**			

Site-specific BMPs

- *Describe corrective actions initiated, date completed, and note the person that completed the work in the Corrective Action Log.*

	BMP	BMP Installed?	BMP Maintenance Required?	Corrective Action Needed and Notes
1	Inlet Protection in Parking Lot Stockpile Area	❑Yes ❑No	❑Yes ❑No	
2	Silt Fence along Parking Lot Stockpile Area	❑Yes ❑No	❑Yes ❑No	
3	Silt Fence along bank keys on Rock Ramp 2	❑Yes ❑No	❑Yes ❑No	
4	Silt Fence along bank keys on Rock Ramp 3	❑Yes ❑No	❑Yes ❑No	
5	Silt Fence along Retaining Wall Removal Area (Ramp 3)	❑Yes ❑No	❑Yes ❑No	
6	Silt Fence along Native Plant Demo Garden	❑Yes ❑No	❑Yes ❑No	
7	Other:	❑Yes ❑No	❑Yes ❑No	
8	Other:	❑Yes ❑No	❑Yes ❑No	

Overall Site Issues

Below are some general site issues that should be assessed during inspections.

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
1	Are all slopes and disturbed areas not actively being worked properly stabilized?	❑Yes ❑No	❑Yes ❑No	
2	Are natural resource areas (e.g., streams, wetlands, mature trees, etc.) protected with barriers or similar BMPs?	❑Yes ❑No	❑Yes ❑No	
3	Are perimeter controls and sediment barriers adequately installed (keyed into substrate) and maintained?	❑Yes ❑No	❑Yes ❑No	
4	Are discharge points and receiving waters free of any sediment deposits?	❑Yes ❑No	❑Yes ❑No	
5	Are storm drain inlets properly protected?	❑Yes ❑No	❑Yes ❑No	
6	Is the construction exit preventing sediment from being tracked into the street?	❑Yes ❑No	❑Yes ❑No	
7	Is trash/litter from work areas collected and placed in covered dumpsters?	❑Yes ❑No	❑Yes ❑No	
8	Are washout facilities (e.g., paint, stucco, concrete) available, clearly marked, and maintained?	❑Yes ❑No	❑Yes ❑No	
9	Are vehicle and equipment fueling, cleaning, and maintenance areas free of spills, leaks, or any other deleterious material?	❑Yes ❑No	❑Yes ❑No	
10	Are materials that are potential stormwater contaminants stored inside or under cover?	❑Yes ❑No	❑Yes ❑No	
11	Are non-stormwater discharges (e.g., wash water, dewatering)	❑Yes ❑No	❑Yes ❑No	

	BMP/activity	Implemented?	Maintenance Required?	Corrective Action Needed and Notes
	properly controlled?			
12	(Other)	❑Yes ❑No	❑Yes ❑No	

Non-Compliance

Describe any incidents of non-compliance not described above:

CERTIFICATION STATEMENT

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

Print name and title: ____

Signature:____ Date:_____________________

Freshwater Mussel Translocation at Highland Park Dam

Swan Creek - Toledo - Ohio


Final Report to Partners for Clean Streams

Prepared by:

Jeffrey D. Grabarkiewicz
18 Oct 2008

Introduction

Swan Creek is a small tributary of the lower Maumee River, draining 204 mi^2 at the mouth in downtown Toledo, OH. The creek rises in the rural landscape of Fulton County and meanders southeast through Oak Openings Metropark before turning northeast towards the City of Toledo.

In the first half of the 20th century, unionid collections were made on Swan Creek by Calvin Goodrich and Clarence Clark. Records at the University of Michigan Museum of Zoology (UMMZ) indicate that a total of 13 species were recovered by these two malacologists. Museum records at the Ohio State Museum of Biological Diversity document the presence of just 6 species. More recently, studies by Grabarkiewicz (2007; 2008) reported 24 species, with 17 species found live. These surveys also documented new and viable populations of the Ohio state endangered and federal candidate rayed bean (*Villosa fabalis*).

Dams have long been implicated in the decline of freshwater mussels throughout the United States (Ellis 1942; Bates 1962; Coon et al. 1977; USFWS 1985; Bogan 1993; Neves et al. 1993; Yeager 1993; Neves et al. 1997; Hughes and Parmalee 1999). In fact, of the habitat alterations initiated by humans, the systematic impoundment of large rivers has likely contributed more to the decline of freshwater mussels than any other perturbation (USFWS 1985; USFWS 2004). Impoundment not only reworks the depth and hydraulics of a river reach, but also prevents the migration of host fishes and may severely alter downstream water quality (e.g. hypolimnetic releases altering stream temperature and oxygen) (Watters 1996; Vaughn and Taylor 1999; Watters 2000). As a result, mussel species adapted to shallow, flowing rivers are now some of the most imperiled animals in the United States. The destruction of the *Epioblasma* (riffleshells), for example, has been attributed largely to the impoundment of small and large rivers (USFWS 1983; USFWS 1985; USFWS 2004).

In the short-term, dam removal or modification may have deleterious consequences for resident freshwater mussel communities (Doyle et al. 2004; Sethi et al. 2004). Localized changes in bed stability, water levels, channel morphology, and sediment transport may initially displace, smother, or create habitat conditions unsuitable for unionids. For this reason, mussels are typically relocated (termed "translocation") when channel disturbance or dam work is planned. This report details the translocation of the freshwater mussel community found below Highland Park dam in Swan Creek, Toledo, OH (Photo 1).

Methodology

A full coverage, qualitative survey (see Strayer and Smith 2003) was performed across the area of impact, downstream of the area of impact (to just before the park footbridge), as well as upstream of the dam. In total, qualitative sampling was conducted in a cell that extended 129 m downstream (dam to footbridge) and 52 m upstream of the dam (Figure 1). One pass was made by Phil Mathias and two passes were made by Jeff Grabarkiewicz starting near the footbridge working upstream. Underwater viewers were used to assist in the visual detection of freshwater mussels (Photo 2).

In addition to qualitative searches, quantitative samples were taken every meter along two transects laid parallel to flow (Figure 2). A total of 20 quadrats (0.25 m^2) were excavated with a small steel scoop. Sediments were deposited and sieved with a mesh (mesh = 2.5 mm) bag. All quadrat samples were excavated within the heaviest populated area in an effort to detect burrowing unionids, small individuals, and overlooked mussels (Photo 3).

Live mussels were identified, measured, and tagged with a unique tracking number (Table 1; Table 2). Shellfish tags were adhered to both valves using instant KRAZY glue gel (Photos 4-6). After allowing a short time for the glue to dry, tagged unionids were deposited in mesh bags and placed in Swan Creek until translocation. When survey and tagging activities were complete, all mussels were transported via an aerated cooler to the Anderson Property.

Unionids were hand placed at the Anderson Property using a view-bucket and wetsuit (Photo 7). Photos were taken to document the exact area of translocation and a reference measurement from the dam was recorded (Photo 8).

Survey Results

A total of 69 live unionids were collected during qualitative sampling, with six species found live and an additional six species represented by shell only (12 total species). The unionid species found live included fatmucket (*Lampsilis siliquoidea*), white heelsplitter (*Lasmigona complanata complanata*), fragile papershell (*Leptodea fragilis*), pink heelsplitter (*Potamilus alatus*), giant floater (*Pyganodon grandis*), and creeper (*Strophitus undulatus*) The species represented by shell only included spike (*Elliptio dilatata*), Wabash pigtoe (*Fusconaia flava*), plain pocketbook (*Lampsilis cardium*), creek heelsplitter (*Lasmigona compressa*), rayed bean (*Villosa fabalis*), and rainbow (*Villosa iris*). No live state or federally listed mussels were found. Evidence of recent reproductive success was found for fatmucket (*L. siliquoidea*) [(2) < 46 mm], white heelsplitter (*L. c. complanata*) [(3) < 51 mm], and fragile papershell (*L. fragilis*) [(1) 48 mm). Quantitative sampling yielded a total of just two live mussels, both *L. c. complanata*.

All sampled unionids were translocated to the Anderson Property, which is approximately 7.3 river miles upstream of Highland Park (Figure 3). The majority of the mussels found on the Anderson Property occur in a pool just below the Anderson Dam (41.60286, -83.67748). All tagged unionids were hand placed in this pool near the left downstream bank

Remarks and Conclusions

The species found during survey and translocation activities typically do not burrow deeply into substrates and are often associated with lentic habitats. Most of the collected species also tolerate fine substrates. A single subfossil rayed bean (*V. fabalis*) valve was recovered from the study area. In my opinion, live *V. fabalis* does not occur at the Highland Park site.

While dam turbulence does likely increase D.O. levels downstream, the excavated substrates exhibited signs of hypoxia/anoxia (gray material, sulfide/methane odor, etc.). For this reason, I believe that unionid species often found burrowed in the substrate (e.g. *F. flava*, *E. dilatata*, *V. fabalis*, etc.) have likely been extirpated from the area. In fact, our surveys over 2006 - 2008 show that these species occur chiefly in stream reaches where substrates are comprised of stable, clean sand and gravel (Grabarkiewicz 2007; 2008).

One unusual result of this project was the translocation of mussels to a point 7.3 river miles upstream of the project site. Typically, translocated mussels are placed just a short distance (usually 100 m to 500 m) upstream of a proposed disturbance if suitable habitat exists. This was ultimately due to the lack of a nearby (and known) unionid bed. To the best of my knowledge, the Anderson Property was the closest protected location with a unionid community in lower Swan Creek (see Grabarkiewicz 2008). In addition, the resident mussel community and habitat features of the Anderson Property closely matched the Highland Park site (see Grabarkiewicz 2008). For these reasons, it seemed appropriate to move the tagged unionids to this location.

Future Monitoring

The mussels translocated to the Anderson Property from Highland Park will require monitoring to evaluate survivorship and health. Generally, an exhaustive sampling effort is performed to locate translocated mussels. All recovered individuals are measured with a metric caliper to the nearest tenth of a millimeter. Recovery rates are then calculated and an analysis of overall health is assessed by comparing shell lengths at the time of translocation and the time of sampling. Positive growth is generally used as an indicator of health. It is recommend that monitoring take place two years after translocation.

Table 1. Summary table of unionids surveyed during Highland Park qualitative and quantitative sampling activities.

COMMON NAME	SCIENTIFIC NAME	NOTATION	TOTAL	MIN LENGTH	MAX LENGTH	OH LIST
fatmucket	*Lampsilis siliquoidea*	LASI	4	45.6	70.3	-
white heelsplitter	*Lasmigona c. complanata*	LACL	46	38.9	105.3	-
fragile papershell	*Leptodea fragilis*	LEFR	2	47.7	78.3	-
pink heelsplitter	*Potamilus alatus*	POAL	12	81.0	122.9	-
giant floater	*Pyganodon grandis*	PYGR	2	68.6	69.4	-
creeper	*Strophitus undulatus*	STUN	3	53.6	61.9	-
spike	*Elliptio dilatata*	ELDI	S	-	-	-
Wabash pigtoe	*Fusconaia flava*	FUFL	S	-	-	-
plain pocketbook	*Lampsilis cardium*	LACA	S	-	-	-
creek heelsplitter	*Lasmigona compressa*	LACR	S	-	-	-
rayed bean	*Villosa fabalis*	VIFA	S	-	-	-
rainbow	*Villosa iris*	VIIR	S	-	-	-

Table 2. Raw survey data with unique tracking numbers for each individual.

DATE	SITE	SPECIES	LENGTH (mm)	TRACK1	TRACK2
8/10/2008	HIGH	LEFR	47.7	2500	2501
8/10/2008	HIGH	LACL	83.9	502	503
8/10/2008	HIGH	LACL	97.1	504	505
8/10/2008	HIGH	LACL	105.3	506	507
8/10/2008	HIGH	LACL	103.1	508	509
8/10/2008	HIGH	LACL	64.6	510	511
8/10/2008	HIGH	LACL	94.2	512	513
8/10/2008	HIGH	POAL	122.9	514	515
8/10/2008	HIGH	LACL	87.0	516	517
8/10/2008	HIGH	LACL	74.8	518	519
8/10/2008	HIGH	POAL	118.9	520	521
8/10/2008	HIGH	LACL	85.7	522	523
8/10/2008	HIGH	POAL	106.5	524	525
8/10/2008	HIGH	POAL	107.7	526	527
8/10/2008	HIGH	POAL	110.5	528	529
8/10/2008	HIGH	LACL	103.9	535	534
8/10/2008	HIGH	LACL	74.2	531	530
8/10/2008	HIGH	POAL	90.9	532	533
8/10/2008	HIGH	POAL	111.9	537	536
8/10/2008	HIGH	POAL	91.5	543	542
8/10/2008	HIGH	LACL	73.9	540	541
8/10/2008	HIGH	LACL	98.1	538	539
8/10/2008	HIGH	POAL	108.7	545	544
8/10/2008	HIGH	PYGR	68.6	546	547
8/10/2008	HIGH	LACL	70.1	548	549
8/10/2008	HIGH	LACL	79.7	552	553
8/10/2008	HIGH	LACL	84.5	550	551

8/10/2008	HIGH	LACL	71.1	556	557
8/10/2008	HIGH	LACL	63.0	558	559
8/10/2008	HIGH	LASI	52.6	563	562
8/10/2008	HIGH	LASI	45.6	560	561
8/10/2008	HIGH	LACL	77.0	555	554
8/10/2008	HIGH	LACL	73.4	568	569
8/10/2008	HIGH	LACL	53.9	566	567
8/10/2008	HIGH	PYGR	69.4	564	565
8/10/2008	HIGH	LACL	70.5	570	571
8/10/2008	HIGH	LACL	74.7	572	573
8/10/2008	HIGH	LACL	82.1	574	575
8/10/2008	HIGH	LACL	66.8	576	577
8/10/2008	HIGH	POAL	109.5	578	579
8/10/2008	HIGH	LACL	60.6	580	581
8/10/2008	HIGH	LACL	50.9	582	583
8/10/2008	HIGH	POAL	92.6	584	585
8/10/2008	HIGH	LACL	89.5	599	598
8/10/2008	HIGH	LACL	86.1	592	593
8/10/2008	HIGH	LACL	90.8	596	597
8/10/2008	HIGH	LACL	103.8	594	595
8/10/2008	HIGH	LACL	92.7	588	589
8/10/2008	HIGH	LACL	85.5	590	591
8/10/2008	HIGH	LACL	101.5	586	587
8/10/2008	HIGH	LACL	85.7	600	601
8/10/2008	HIGH	LACL	99.2	602	603
8/10/2008	HIGH	LACL	79.5	604	605
8/10/2008	HIGH	LACL	75.8	608	609
8/10/2008	HIGH	LACL	77.8	606	607
8/10/2008	HIGH	LASI	70.3	610	611
8/10/2008	HIGH	LACL	105.6	612	613
8/10/2008	HIGH	LACL	105.6	612	613
8/10/2008	HIGH	LACL	66.4	616	617
8/10/2008	HIGH	LACL	83.2	614	615
8/10/2008	HIGH	STUN	61.9	618	619
8/10/2008	HIGH	STUN	53.6	620	621
8/10/2008	HIGH	LACL	38.9	626	627
8/10/2008	HIGH	STUN	61.1	628	629
8/10/2008	HIGH	LEFR	78.3	622	623
8/10/2008	HIGH	POAL	81.0	630	631
8/10/2008	HIGH	LACL	79.8	632	633
8/10/2008	HIGH	LACL	75.1	634	635
8/10/2008	HIGH	LACL	80.9	636	637
8/10/2008	HIGH	LASI	46.0	638	639

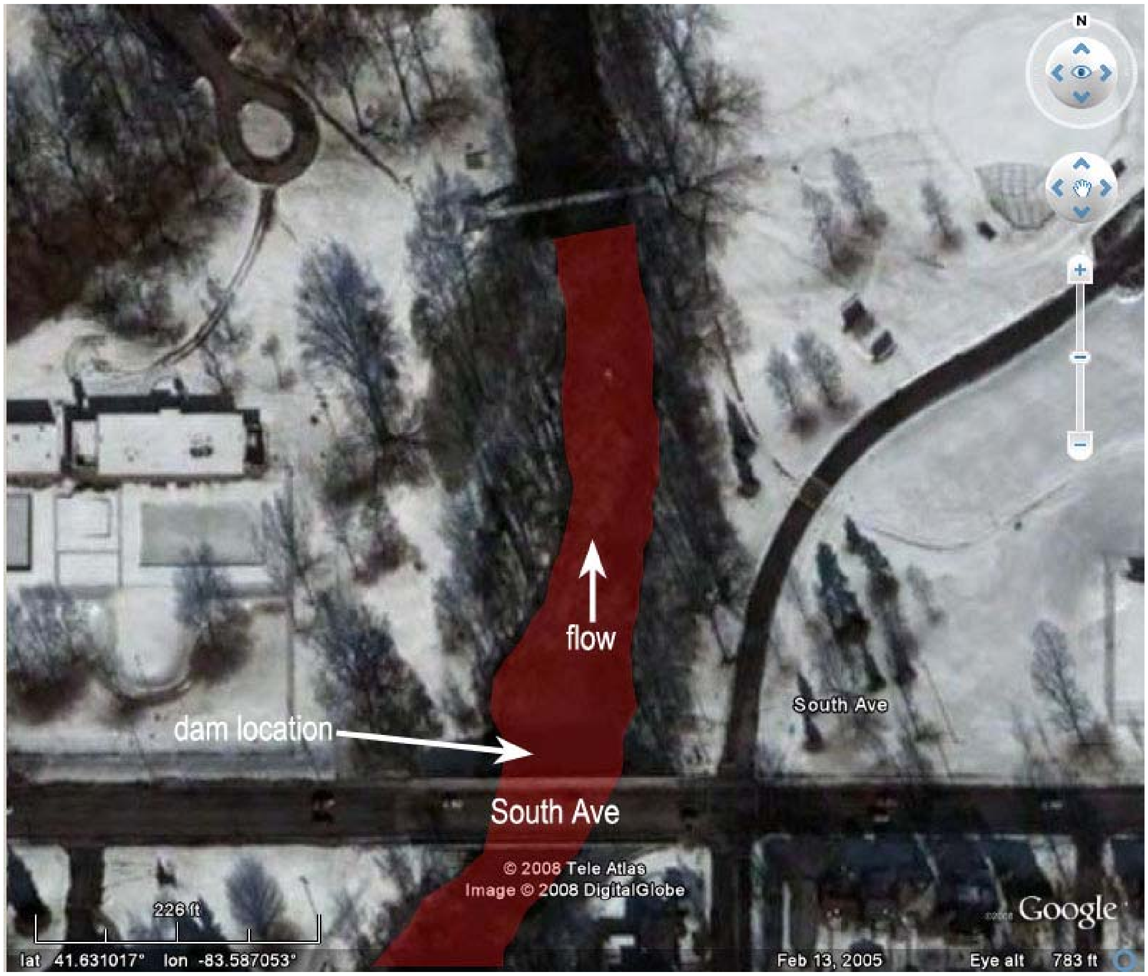

Figure 1. Plan view of Highland Park. Shaded in dark red is the extent of the qualitative sampling area.

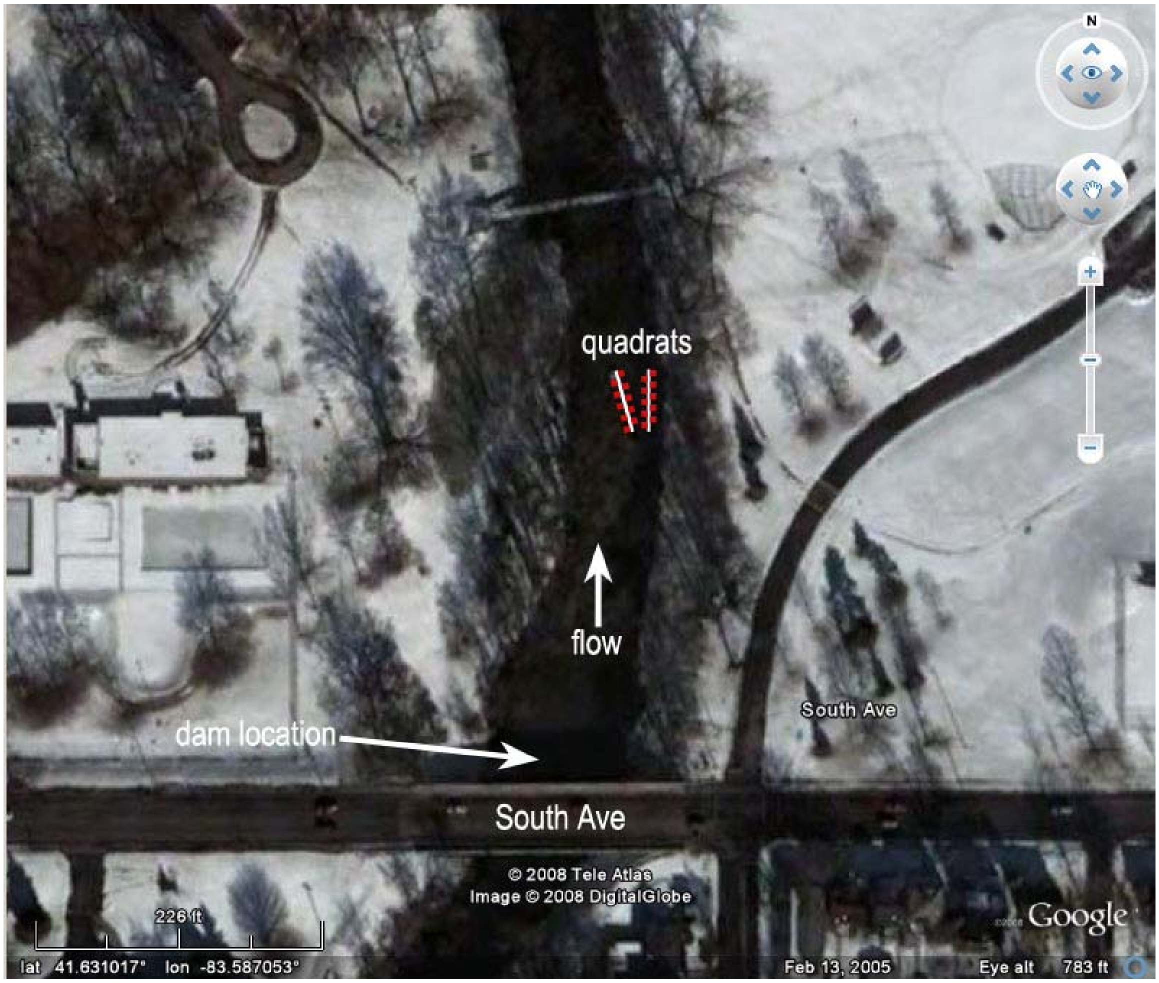

Figure 2. Plan view of Highland Park. The two transects laid parallel to flow are in white, with individual 0.25 m^2 quadrats in red. Note: the quadrats and transects are not to scale.

Figure 3. Location of the dam site and upstream translocation site.

Photo 1: Highland Park dam and South Ave. bridge.

Photo 2: Jeff Grabarkiewicz (left) and Phil Mathias (right) surveying for mussels using view-buckets.

Photo 3: Jeff placing a quadrat along a marked transect.

Photo 4: Matt Horvat applying super glue to a white heelsplitter.

Photo 5: Matt adhering a unique tag to a white heelsplitter.

Photo 6: Mussels with drying tags on the workbench.

Photo 7: Jeff searching for spots to hand place unionids at the Anderson Property.

Photo 8: Jeff (right) standing near the point of translocation. Matt (far left) holding tape to measure the distance from the dam to the translocation point.

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