Wayne Road Dam Removal and Habitat Restoration Project
Lower Rouge River, Michigan
NOAA/GLRI Final Report

NOAA Grant Number: NA11NMF4630146

September, 2013

Project Partners:

Alliance of Rouge Communities
OURS TO PROTECT
Working together, restoring the river

NOAA

Great Lakes RESTORATION

Rouge River Advisory Council
Restore & Protect

Wayne - Michigan
People - Pride and Progress

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Seal of the Charter County of Wayne, Michigan
1796

Friends of the ROUGE

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National Oceanic Atmospheric Administration (NOAA)/Great Lakes Restoration Initiative
Grant Final Report
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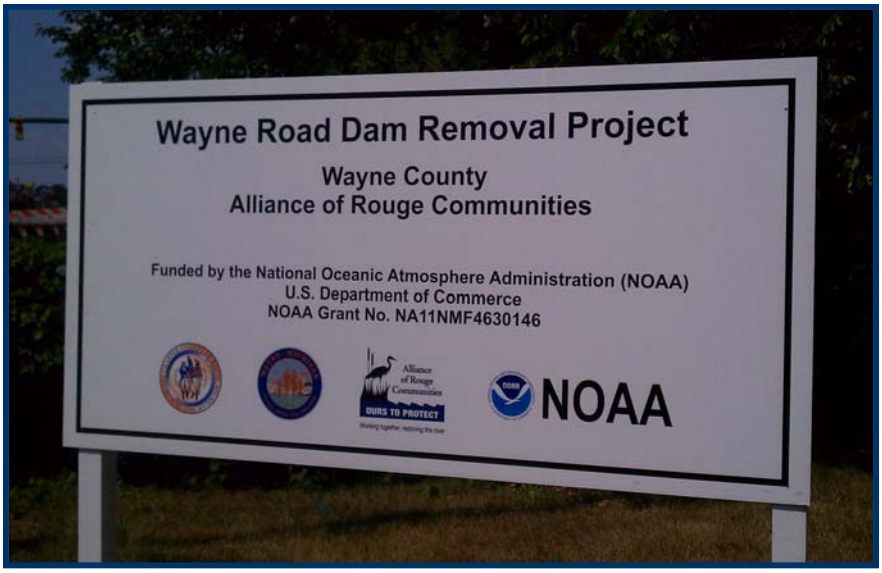

NOAA Grant Number:	NA11NMF4630146
Grantee:	Alliance of Rouge Communities
Award Amount:	$1,033,536
Project Location:	Adjacent to the City of Wayne Municipal Building 3355 South Wayne Road, Wayne, Michigan 48184 Latitude: 42 17 06 00 Longitude: 83 23 01 00
Stream:	Rouge River
Property Owner:	Wayne County

Report prepared by:

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1.0 INTRODUCTION

The Wayne Dam Removal and Habitat Restoration Project is located within the City of Wayne on the Lower Branch of the Rouge River. The project was funded by a NOAA GLRI Grant to the Alliance of Rouge Communities (ARC), in partnership with Wayne County. This project consisted of the construction of the Wayne Dam removal, and stream and habitat restoration.

Located in Southeast Michigan, the Rouge River Watershed shown in Figure 1-1 is a heavily urbanized and industrialized area that includes portions of three counties and encompasses 48 communities and a population of over 1.5 million. The watershed is a designated Area of Concern (AOC) under the Great Lakes Water Quality Agreement (GLWQA), and is characterized by nine Beneficial Use Impairments (BUIs), including three associated with fish and wildlife habitat (i.e., Degraded Fish and Wildlife Populations, Degradation of Benthos, Loss of Fish and Wildlife Habitat).

Figure 1-1: Rouge River Watershed Location

Prior to implementation of the project, the dam acted as a barrier to fish passage as well as promoted the accumulation of sediment and debris behind the dam, which contributed to the degradation of the reach of river. The ARC proposed the project to aid in the advancement of the Rouge River AOC delisting efforts.

The project outputs included:

1) Wayne Road Dam was removed and fish passage for multiple species were restored by reconnecting 11 miles of the Rouge River and over 110 miles of tributaries with the Great Lakes system;
2) Rock structures and bank stabilization improved fish and wildlife habitat, benefiting key aquatic species and natural communities;
3) Great Lakes aquatic and terrestrial habitats were restored and protecting by re-connecting the river to the Great Lakes system.

The implementation of the project has improved the riparian corridor and hydrologically reconnected approximately 123 miles of river and tributaries to the Great Lakes system for the first time in over a century. The river hosts a variety of fish species in the vicinity of the dam, including variety of warm water species (e.g., smallmouth bass, northern pike, walleye, suckers, darters, minnow, sunfishes). All of these species have been benefitted as a result of the implementation of this project.

Wayne Road Dam prior to project implementation

Restored reach

2.0 PROJECT BACKGROUND

The project is located in the City of Wayne, Michigan, underneath, and within the vicinity of the Wayne Road Bridge, over the Lower Rouge River (see Figure 2-1). The structural height of the dam was approximately three feet, with a hydraulic height of approximately 2.5 feet. The dam spanned the entire 80-foot width of the stream, effectively creating a hydrologic barrier for the movement of fish between the Great Lakes system via the Detroit River and the upstream reaches of the river. Removal of the Wayne Road Dam reconnected this reach of the river to the Great Lakes system for the first time in over a century.

Historically, in 1910, the Village of Wayne government began on a water supply system to provide fire protection. The construction included building a dam on the Rouge River just west of Washington Street (now Wayne Road) along with an open reservoir to pump water into a pump house and water main to supply water to 80 fire hydrants in the downtown area. The water supply system was a great improvement in fire fighting as the fire department could now connect fire hoses to the hydrants, an improvement over the hand pump engine. The system was complete and in operation by 1914. By 1939, the City of Detroit Water Board took over the Wayne water system, and all water was then purchased from Detroit. Detroit made improvements to the system and the pump house and the dam was no longer used.

Construction of this dam over a century ago, as well as a legacy of subsequent activities (i.e., land use, shoreline development, point and non-point source pollution, storm water runoff) have contributed to compromised water quality; loss of fish; benthos and wildlife health; habitat and populations, and loss of a natural flow regime.

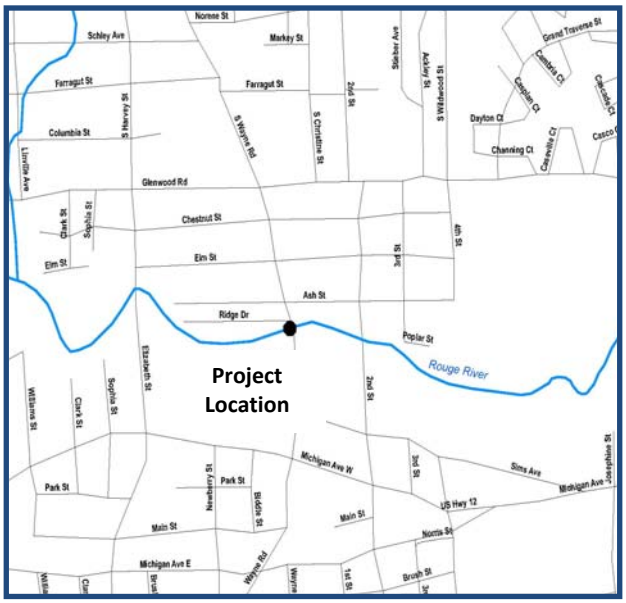
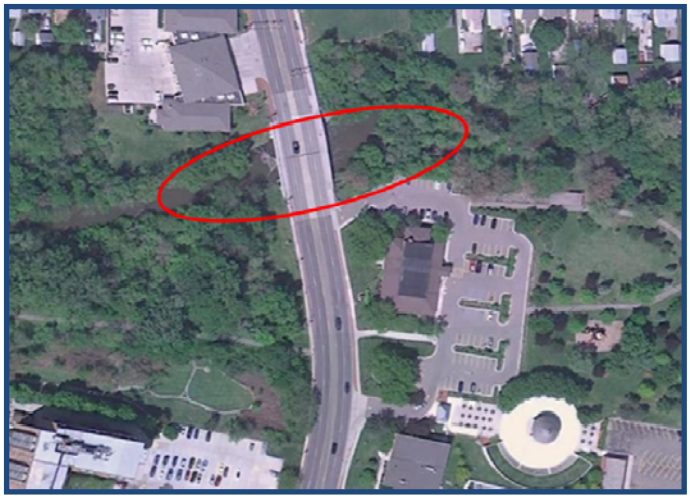


Figure 2-1: Project Location Map



2.1 DESIGN

The design phase of the project was completed in the summer of 2011 within funding from the Rouge River National Wet Weather Demonstration Project (Rouge Project) grant. This included data collection, design, permit application assembly and contract document preparation.

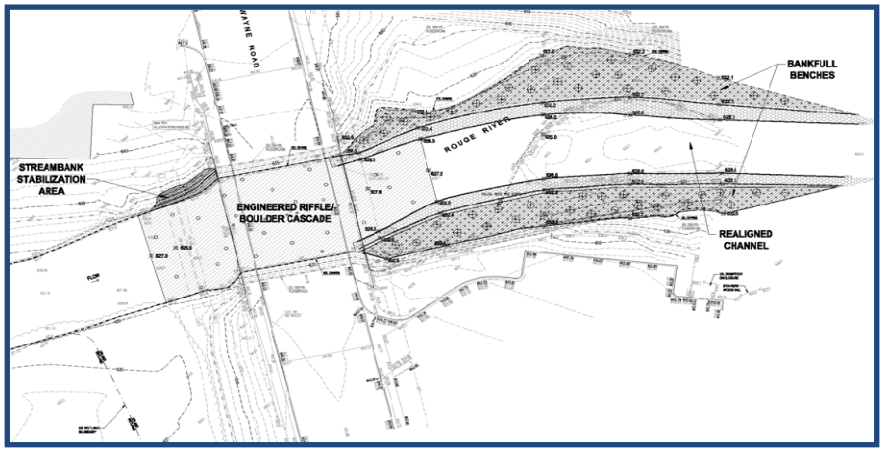
Data collection began in the winter, 2010/2011. A survey of the dam, its vicinity as well as 25 cross sections along the river reach was conducted. The survey data was used in the design permit, and construction documents. The cross-sectional data was used in the design to help make informed design decisions of in-channel changes and to create a hydraulic model.

Using the survey data and hydraulic model, the design was conducted based on analytical, empirical and natural channel design concepts that reflect proven modern urban stream restoration practices. The objective was to restore the natural flow patterns of the Lower Rouge River as a result of the dam removal without the need for operational and maintenance activities to maintain this natural flow. The design included the removal of the majority of the concrete weir structure, leaving a small width of concrete on either edge to protect the integrity of the Wayne Road Bridge and avoid creating an over-wide channel in the vicinity of the existing dam. In addition to the removal of the dam, the design included the removal of the in-stream island downstream of the dam and reconstruction of a more stable single flow channel with bankfull benches, installation of an engineered riffle/ boulder cascade to protect existing infrastructure and facilitate fish passage and bank stabilization.

Grade control structures, other than the riffle/ boulder cascade were considered. The riffle/ boulder cascade was chosen based on modeling and evaluation of the expected sediment transport due to a predicted increase in the energy grade line slope and shear stress. It was suspected that the existing bridge and sanitary sewer infrastructure immediately upstream of the dam would be impacted in the very short term by a headcut migrating upstream from the scour hole located downstream of the dam. Therefore, the engineered riffle/ boulder cascade was proposed to extend from upstream of the sanitary sewer lines, under the Wayne Road bridge and past the existing water main. The structures were designed and intended to be permanent and do not require maintenance or operation after proper installation. The grade control structures were designed for fish passage, using the swim speed for walleye.

The bankfull bench and removal of the island together were proposed to alleviate the erosive velocities on the adjacent banks and restore natural flow to this reach of the river. Both the bed and banks of the engineered riffle, along with the constructed bankfull benches were proposed to be armored to prevent erosion. The rock proposed was sized using industry accepted equations. In addition to protection of the banks and bed, the rock provides attachment sites for macro invertebrates and feeding and spawning habitat for fish.

The resulting design (see Appendix A) was completed and the Joint MDEQ/ USACE permit application was submitted and permits received.



Proposed design

3.0 PROJECT IMPLEMENTATION

In the fall of 2011, a NOAA GLRI grant was awarded to the Alliance of Rouge Communities (ARC) for pre- and post- construction monitoring, contract documents, contractor selection, construction, grant administration, and public involvement for the dam removal and habitat restoration. The following provides a summary of the grant activities, by task:

3.1 CONTRACT DOCUMENTS AND CONTRACTOR SELECTION

The ARC entered into an Inter-Agency Agreement (IAA) with Wayne County (one of its members) to contract for the construction activities associated with the implementation. After receipt of the State of Michigan permit, ARC Staff worked with Wayne County to finalize the contract documents for bidding.

The project was released for bidding on March 28, 2012, with a mandatory pre-bid conference on April 11, 2012. Bids were due on April 24, 2012. After bids were received, a bid tab was developed and reviewed and the lowest bidder's references were checked. ECT (as ARC Staff) then issued a contractor recommendation letter to the County. In June, 2012 Wayne County approved to award the construction contract to Inland Lakes Landscaping Corporation.

3.2 CONSTRUCTION AND CONSTRUCTION OVERSIGHT

The construction activities for the project were initiated with a pre-construction meeting on July 16, 2012. Following the meeting the contractor began mobilization on July 23, 2012 and construction continued through November. Construction of the project went generally as planned and on schedule. Two noteworthy unexpected items were encountered and addressed: While removing debris upstream of the bridge a sanitary siphon was discovered. It was determined that, in order to complete the riffle as planned, the sanitary siphon had to be relocated. A design for the siphon relocation was completed and the siphon was relocated prior to riffle placement. The other unexpected item was two stormwater outfalls at the north bank downstream of the bridge. When work began, the two outfalls were discovered and determined to be below the top of the proposed bankfull bench elevation. Therefore, the outfalls were extended to outlet at the face of the rock toe of the bankfull bench. Neither of these items caused a delay in the construction schedule. A detailed summary of the monthly activities is presented below:

July, 2012- The contractor completed the audio-visual recording of the project site to establish a record of existing conditions. Wayne County permits were acquired. Installation of the construction staking and soil erosion and sediment control measures began. Also during July the project sign was installed and removal of the log jam began.

Project Sign

August , 2012- Throughout the month of August, the contractor cleared the island downstream of the dam as well as the proposed access route west of Wayne Road, south of the river.

Clearing operations on the island downstream of the dam

Clearing operations for west access route

Log Jam Removal (Upstream Side of Wayne Road Bridge, view looking south)

The water level behind the dam was lowered by notching the dam incrementally. When the water level was lowered the rest of the spillway was then removed.

Notched spillway

Notching of spillway

Spillway removal

Spillway removal

View of downstream side of dam during removal

Also during August removal of the log jam and debris upstream of the dam and the bridge continued.

On August 8, 2012, A 6-inch sanitary siphon was found at or just below the bed of the river. It was determined that this siphon and another 6-inch sanitary relief siphon would need to be lowered in order to accomdate the removal of the dam, installation of the riffle and provide adaquate cover to protect the utilities.

September- With the dam removed, work continued on the Wayne Road Dam Removal Project as follows:

- The rock for the riffle was placed under the bridge. A 6" thick layer of smaller stone was placed first and overtopped by larger rock.

North half of riffle under the bridge, view looking east. Note smaller stone near the bridge abutment and larger rock in the stream channel. The smaller stone will eventually be covered with larger rock that will slope up against the abutments

South half of riffle under the bridge, view looking northeast

- The rock for the riffle was also placed downstream of the bridge.

Riffle, view looking down from bridge deck

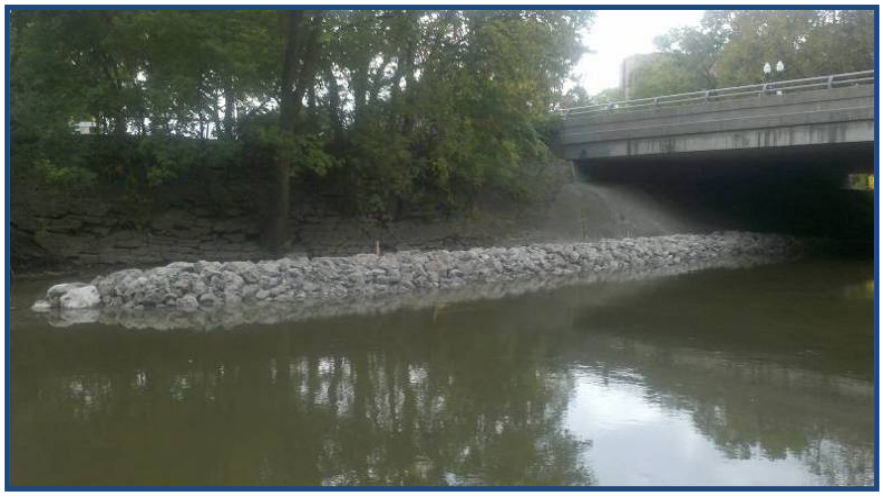
- Construction of the stone toe began under the bridge and extended downstream.

09.19.12- View of north abutment, looking northwest

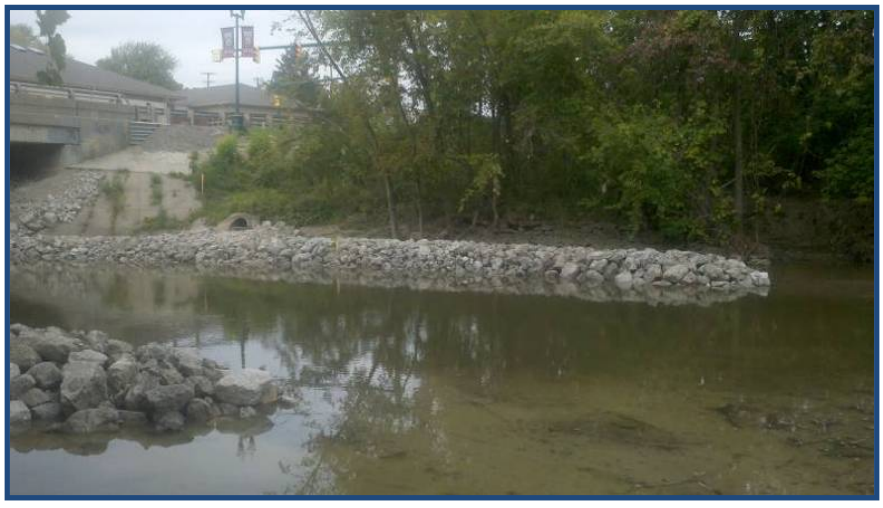
09.19.12- View looking west

09.21.12- View looking northwest

09.21.12- View looking west



09.25.12- South rock toe downstream of bridge



09.25.12- North rock toe downstream of bridge

- Sand bankfill was placed behind the stone toe. Geotextile fabric was used between the stone toe and the sand backfill.

South bench, just downstream of the bridge, view looking west

View looking west, note sand backfill behind a portion of the stone toe

- Proposed storm pipe was installed at an existing outfall to extend the pipe through the proposed bankfull bench to the stream channel.

Storm sewer outfall at north bank downstream of the bridge

- A portion of the existing island was excavated. It will eventually be completely removed.

Island, view looking east

October- Throughout the month of October, work continued on the bankfull benches downstream of the bridge:

October 5, 2012: View from bridge looking downstream (east). Note: portion of rock placed and sand backfill.

October 11, 2012: View from bridge looking downstream (east). Note: topsoil placed overtop of sand backfill.

October 24, 2012: View from bridge looking downstream (east). Note: rock at north bench complete

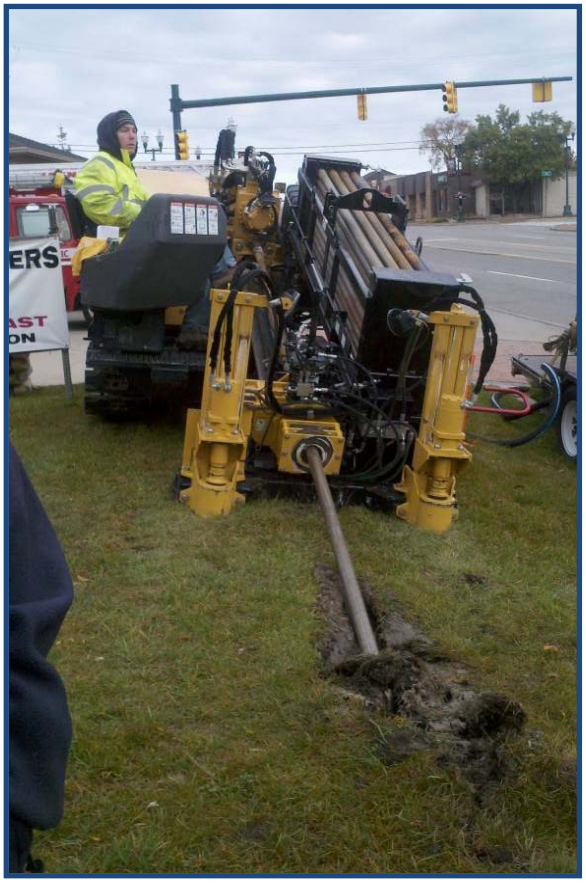
With the construction of the north bankfull bench, two storm sewer extensions and outlets were installed.

North bankfull bench, downstream of bridge, view looking northwest. Note: two newly installed stormwater outfalls

On October 5, 2012 the directional driller mobilized to conduct the replacement of the sanitary sewer siphon.

Directional drill equipment mobilized on the north bank, upstream of the bridge

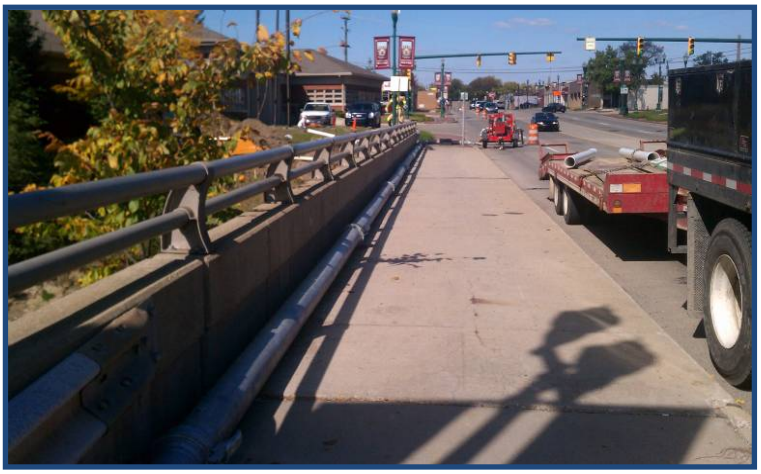
On October 6, 2012, the new sanitary sewer siphon was installed.



Directional drilling

Following the drilling, new structures were installed and old structures were removed and the pipes were connected.

New structure on the south bank



Diversion pipe used during sewer connection work

Sanitary sewer connection work at north bank

With the sanitary sewer siphon and structure in place, the old pipes were flushed and removed. Excavation for the riffle and sediment removal upstream of the bridge was completed.

Excavating upstream of the bridge. Note old sanitary sewer pipe in staging area

Beginning in November, the final elements were completed at the bankfull benches. Trees were installed at the bankfull benches; the benches were seeded and erosion control blanket was placed; and live stakes were installed.

Concurrent with bank full bench completion, other final elements were completed, including in-stream boulder placement, and general site restoration Damaged curbs and sidewalks were replaced, and access areas were restored.

A preliminary site walk through was held on November 26, 2012, with a follow up walk through on December 17, 2012. Final restoration will occur in the spring along with parking lot replacement. Site visits continued in March, 2013 to observe effects of the winter season on the site conditions.

Tree installation: The tree locations were flagged prior to installation.

November 5, 2012: View from bridge looking downstream (east). Most of rock toe complete, topsoil placed, tree locations flagged

November 8, 2012: trees onsite

November 14, 2012: View from bridge looking downstream (east)

November 16, 2012: View from bridge looking downstream (east), tree planting complete

Bankfull bench restoration: With tree planting complete, seed was placed and erosion control blanket was installed on the bankfull benches. Then, live stakes were installed.

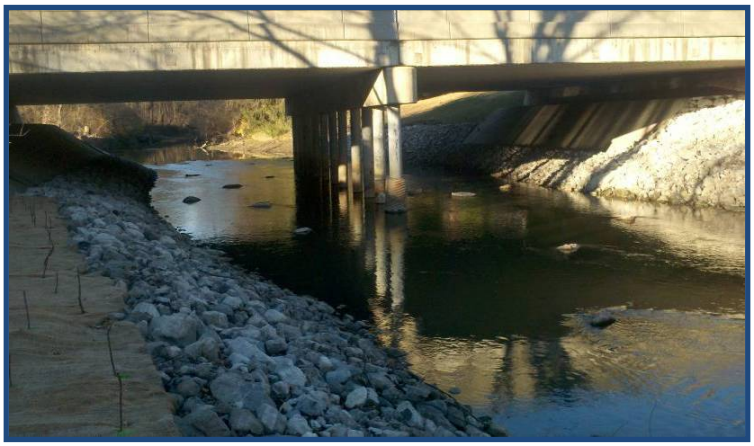
November 19, 2012: View from downstream end of constructed south bench looking upstream (west) and erosion control blanket installation

November 21, 2012: View from downstream end of constructed south bench looking upstream (west) and live stakes installation

November 26, 2012: View from downstream end of constructed south bench looking northwest with erosion control blanket and live stakes installed

In-stream boulders: Concurrently with the tree, erosion control blanket and live stake installation, the in-stream boulders were placed.

November 21, 2012: View from under bridge looking upstream (west) Note: in-stream boulders



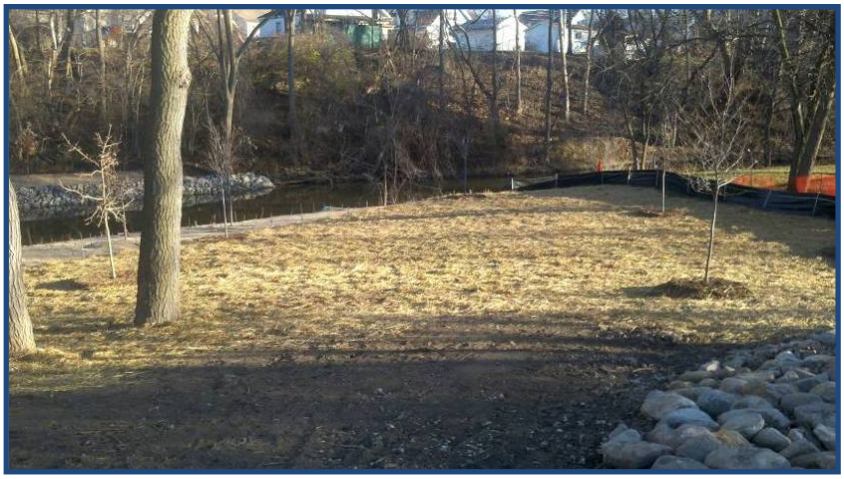
December 5, 2012: East face of bridge, looking west Note: in-stream boulders

December 17, 2012: West face of bridge, view looking northeast, note in-stream boulders

Site restoration: Final restoration activities were completed.

November 14, 2012: View from bridge looking upstream at south bank. (southwest). Rock toe and shaping of top of bank

December 5, 2012: South bank upstream (west) of the bridge. Note: rock toe, graded top of bank, erosion control blanket, trees, straw mulch



December 5, 2012: Area south of downstream (west) end of south bench. Restored: Graded, trees planted, area seeded and straw mulch placed

December 5, 2012: Access area west of Wayne Road, note trees and straw mulch

December 17, 2012: Area south of downstream (east) end of south bench, view looking southwest toward City of Wayne City Hall. Note: restored area and constructed stairs

December 17, 2012: North bank upstream (west) of bridge, note rock stabilization, erosion control blanket, straw mulch

December 17, 2012: View from bridge looking downstream (east)

March 5, 2013: View from bridge looking downstream (east)

March 22, 2013: View from downstream end of constructed south bench looking northwest

April 11, 2013: View from bridge looking downstream (east) after sequence of rain events, note, bankfull benches overtopped

3.3 GRANT ADMINISTRATION

Throughout the project, the ARC completed status and financial reports and other documentation required by the agency. This document is the final report and was completed under this task.

3.4 PUBLIC EDUCATION AND INVOLVEMENT

The Alliance of Rouge Communities began public education activities for this grant as soon as the notice of the award was announced and are summarized below.

3.4.1 CITIZEN CONCERNS

Concerns were raised by a resident of the City of Wayne regarding the project in December, 2011. With the assistance of the ARC contractor, Wayne County prepared a letter response responding to all questions and concerns raised by the resident. All concerns were addressed and the resident had no further issues with the project.

In August, 2012, concerns were raised by the City of Wayne during the start of construction because citizens were seen crossing the construction barriers. The ARC contractor prepared a statement that was posted on the City of Wayne's website warning the public against these actions and advising them to watch the construction from the Wayne Road bridge over the dam.

3.4.2 PRESENTATIONS

Presentations were given to various groups to educate them on the project including:

- 8/24/11 – GLRI Grant projects presentation including the Wayne Rd. Dam Removal and Restoration Project given to the Alliance of Rouge Communities.
- 10/4/11 – Project presentation given to the City of Wayne City Council.
- 4/26/12 – Public meeting held at the City of Wayne Public Library with presentations by Wayne County, Friends of the Rouge (FOTR) and the Alliance of Rouge Communities. The public meeting was attended by 25 people. The presentation, which is included in Appendix B, was also posted on the ARC's website.
- 12/2012- A presentation, which is included in Appendix B, was given to the ARC members explaining the restoration project and updating members on the progress to date.
- 7/2013 – A poster presentation at the National Conference on Ecosystem Restoration conference in Chicago highlighted the Wayne Rd. Dam removal and restoration project.

3.4.3 PRESS RELEASES

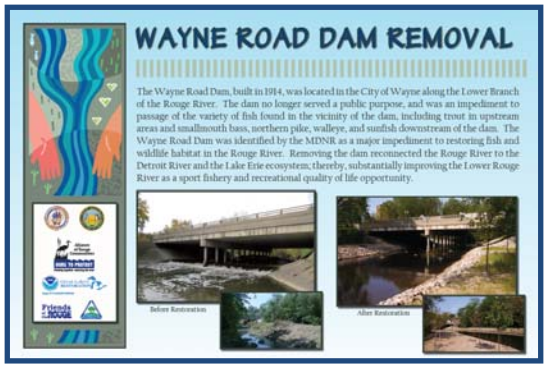
The following press releases were written in response to the project:

- 9/20/11 – ARC press release announcing the funding award which is included in Appendix B.
- 10/5/11 – FOTR press release announcing the canoe trip on the Rouge River that was inspired by the project and announcing a public trip on October 29, 2011.
- 11/21/11 – FOTR press release announcing the Rouge canoe expedition as a success.
- 5/31/13 – Wayne County press release announcing the public opening event on June 7, 2013.

3.4.4 EDUCATION MATERIALS

Once the award was announced a fact sheet was created to explain the project to ARC members and other interested parties and was also on the ARC website at www.allianceofrougecommunities.com. The fact sheet is included in Appendix B.

Additionally, a fact sheet describing various federal grant activities, conducted by the ARC, including this NOAA/GLRI project, was created as part of a public education fact sheet about the ARC. The fact sheet was distributed in a variety of ways and at a variety of ARC public education events, which included ARC rain barrel sales (2011-13), seedling distribution events (2011-13) and public education workshops conducted by the ARC, such as homeowner native gardening workshops, green infrastructure workshops and various community meetings. To date, approximately 6,000 fact sheets have been distributed to the general public from 2011-13.



In July, 2013 a permanent sign was designed and installed at the bridge overlooking where the dam once was. It explains the project and benefits to the river.

3.4.5 FOTR WORKSHOPS AND CANOE TRIPS

A class was planned for May 9, 2012 when the weather would be warm enough to offer a hands-on component and it was scheduled for the Wayne City Hall located next to the Wayne Road Dam. The purpose for the workshop was to teach municipal employees and other interested residents how to open the river for canoeing without damaging the river with heavy machinery or removing too much wood that provides habitat. Evaluations were very positive for the class and the group exercise showed us how most people understood the concept of minimal treatment of logjams.

There were two "official" work days held following the workshop – one on May 19, 2012 with nine attendees and one on August 25, 2012 with 20 attendees. Logjam Opening Class attendees were all invited to the work days. This work and some additional days that were inspired by the project resulted in 4.17 miles of river being opened, from Commerce Court to Venoy Road.

Two public canoe trips were held; one on October 29, 2011 and one on October 13, 2012. Heavner Canoe Rental provided rental canoes for both trips. The 2011 trip had 18 participants and the group paddled from Wayne Road to Inkster Road. Al Heavner, the owner of Heavner Canoe Rental announced to the group that they were working with Wayne County Parks to open canoe rentals on Newburgh Lake in 2012.

Canoeists were given an option to canoe to Venoy Road or go all the way to Inkster Road. All chose to do the whole route. There were many logjams that had not been opened and the trip took about four hours.

The Saturday Oct. 13, 2012 trip was publicized through Friends of the Rouge networks and a press release distributed. The Detroit Free Press contacted Friends of the Rouge and asked if a preview tour could be arranged as they were unable to attend on Saturday. Bill, Kurt and Sally took a reporter and photographer on a shortened version of the trip on the Wednesday prior. This resulted in an article in the Friday paper that led to more interest and registrations.

Past trips had all started at Wayne Road but this was not possible due to the continued dam deconstruction. Commerce Court was the most easily accessible upstream access point. This launch is somewhat problematic because it is on private property but we were able to obtain permission from the owners through Wayne County and Wayne County offered to open the building so we could use the restrooms. The take-out was to be at Venoy Road. In past years we had canoed all the way to Inkster Road but this would take too long if we started at Commerce Court.

The day of the trip was cool (40s) and threatened rain but 49 people still showed up. This was by far the largest number of canoes and kayaks on the Rouge River in recent history. The route was completely open but challenging due to the twists and turns.

3.4.6 MEDIA COVERAGE

The following newspaper articles were published:

- 9/28/11 – Detroit News article announcing the grant award
- 5/15/12 – Detroit Free Press article titled "$1M project to open lower Rouge to Great Lakes"
- 6/9/13 – Observer Eccentric article titled "Happy day: Wayne celebrates dam removal" regarding the public opening event that was held on June 7, 2013 which is included in Appendix B.

3.4.7 PUBLIC OPENING EVENT

On June 7, 2013 the ARC held a public opening event at the project site on the grounds of the City of Wayne City Hall. The event celebrated the removal of the Wayne Rd. Dam and restoration of the Lower Rouge fishery. The event was attended by 45 citizens and elected officials. A press release was sent announcing the event through Wayne County. Speakers included Mayor Haidous, City of Wayne, Wayne County Executive Robert Ficano, Congressman John Conyers, ARC Chair Kevin Buford and John Bratton from NOAA. Handouts included the NOAA/GLRI fact sheet, information on canoe rental availability now that canoeing is possible with the dam removed and a map showing the waterways affected by the removal of the dam. Informational boards showing photos of the dam removal and stream restoration at different stages of construction (included in Appendix B) were prepared and were given to the City of Wayne to display in their City Hall at the end of

the public opening event. There were table-top displays by Friends of the Rouge and Wayne County. In addition, there was a live macroinvertebrate sampling demonstration which is used to gage the health of the river. Heavner Canoe Rental was also on-site and gave free canoe rides to those attending the event.

Photos from the June 7, 2013 public opening celebration

3.5 PRE AND POST- CONSTRUCTION MONITORING

Pre- and post construction monitoring occurred as part of the project. The details of these activities are provided in the Wayne Road Dam Removal Monitoring Report (included as Appendix C). However, a summary is also provided here for reference.

3.5.1 FISH MONITORING

Fish community results were inconclusive, but suggested that the fish community diversity upstream of the dam increased between 2012 pre-removal sampling and 2013 post-removal sampling. This increase could be due to greater connectivity to downstream reaches. The inconclusive results are due primarily to high variability between pre- and post-construction sampling results that is most likely caused by different habitat conditions and environmental conditions linked to weather patterns. Although sampling was conducted at the same time of year in 2012 and 2013, weather patterns were much different between the two years during and prior to the sampling periods. Therefore, the timing of spawning runs was different. In 2013, sampling was conducted during the peak of white sucker spawning activity, as indicated by the higher numbers of white sucker captured (Appendix C: Table 1 and 2), particularly in Reach 6. The variability in sampling reaches, and from pre- to post-removal, was evident by the inconsistent similarities in fish community diversity: adjoining reaches were significantly different, but were not significantly different to one or more of the other reaches sampled (Appendix C: Table 5). These differences are not due to the dam removal, but due to differences and similarities in habitat and fish distribution at the time of sampling.

Fish Monitoring

Nonetheless, fish community sampling revealed some important facts about fish abundance and distribution that do suggest the dam removal affected fish distribution. Most notably, the number of white sucker captured in Reach 1 (upstream reference reach) increased from 19 prior to dam removal to 68 after dam removal. Habitat in Reach 6 did not change after dam removal. Therefore, this result suggests that upstream white sucker movement was formerly restricted by the Wayne Road Dam. Following dam removal, white sucker preferentially moved upstream of the dam seeking habitat required for various life stages. Interestingly enough, the number of white sucker captured in Reach 6 (downstream reference) decreased from 36 prior to dam removal to 16 after dam removal. Again, those contrasting results suggest preferential upstream movement by white sucker.

While the fish community assemblages of Reaches 2 and 4 were not strongly similar based on Sorenson's similarity index, there were several species common to both reaches and the diversity index for the two Reaches were not significantly different during post-removal sampling. This result indicates that the channel realignment and restoration immediately downstream of the former dam location produced habitat preferred by fish and that fish were able to move freely between the two reaches.

The constructed riffle is an important component of the channel restoration following dam removal because it protects utilities and infrastructure, but also because it has the potential to provide an important type of habitat that is not abundant in the Lower Rouge River. Therefore, the riffle was sampled during post-removal monitoring. Sampling results demonstrate the high value of the created

riffle habitat to fish of the Lower Rouge River. The Shannon-Wiener diversity index was higher than any other reach sampled; with a species richness of 20 and effective number of species of 10.39. In addition, two species with high affinity for riffle habitat, Johnny darter and central stoneroller, were captured in the riffle. More stonerollers were captured in the constructed riffle than any other reach. In addition, 32 white sucker were captured in the riffle, a significant finding given white sucker were actively spawning in the river during the post-removal sampling. Monitoring results clearly show that the constructed riffle is providing important and valuable habitat for fishes.

Clipped White Sucker captured upstream of the former dam site

Use of a mark-recapture technique successfully demonstrated that target fish species could freely move between downstream reaches and upstream reaches. A white sucker marked in 2012 downstream of the Wayne Road Dam in Reach 6 (downstream reference) was recaptured in 2013 after dam removal in Reach 2. Furthermore, the fish community diversity upstream of the dam in Reach 2 was similar to the diversity downstream of the dam in Reaches 4 and 5, although the assemblage was slightly different. This indicates that the improved habitat and access to Reach 2 (former impounded reach has improved and the number of species using habitat located immediately upstream of the dam has increased due to greater connectivity.

3.5.2 MORPHOLOGY MONITORING

Channel cross-section surveys pre- and post-removal shows that headcutting and sedimentation have not occurred upstream or downstream of the former dam location. Dam removal can lead to deposition of sediment on the bed downstream of dams and erosion of the bed upstream of dams that results in formation of a headcut that propagates upstream. Appreciable decrease or increase in bed elevations were not observed at any of the cross-sections surveyed prior to and after dam removal. Observed changes were minor and due to natural variability in sediment transport processes.

3.5.3 BENTHIC MONITORING

Post- construction macroinvertebrate monitoring was completed in the spring of 2012 at the constructed riffle. A total of five different families of macroinvertebrates and two different mollusk families were collected from the constructed riffle. The most abundant were midges (Chironomidae) (77%) and net-spinning caddisfly (Hydropsychidae) (20%). The other three families collected were found in low abundances, comprising of 1% or less of the total sample collection.

In the spring of 2013, a Michigan Clean Water Corps (MiCorps) stream quality index (SQI) was conducted at two sites within the project area, one directly upstream and one directly downstream of the constructed riffle at the former dam site. The SQI scores are rated as : >48 is Excellent, 34-48 is Good, 19-33 is Fair, and <19 is Poor. The upstream site went from a “poor” rating to a “fair” rating following removal of the dam (16 to 28), and the downstream site remained at a “fair” rating following removal. The SQI rating, as quantified using macroinvertebrate data from this project, resulted in a score of 16 (Poor). While this number is lower than the previously mentioned scores, it falls within the long-term trend seen at either MiCorps station. Full results from the long-term SQI studies can be found in Appendix C.

4.0 PROJECT RESULTS

4.1 PRIMARY GOAL

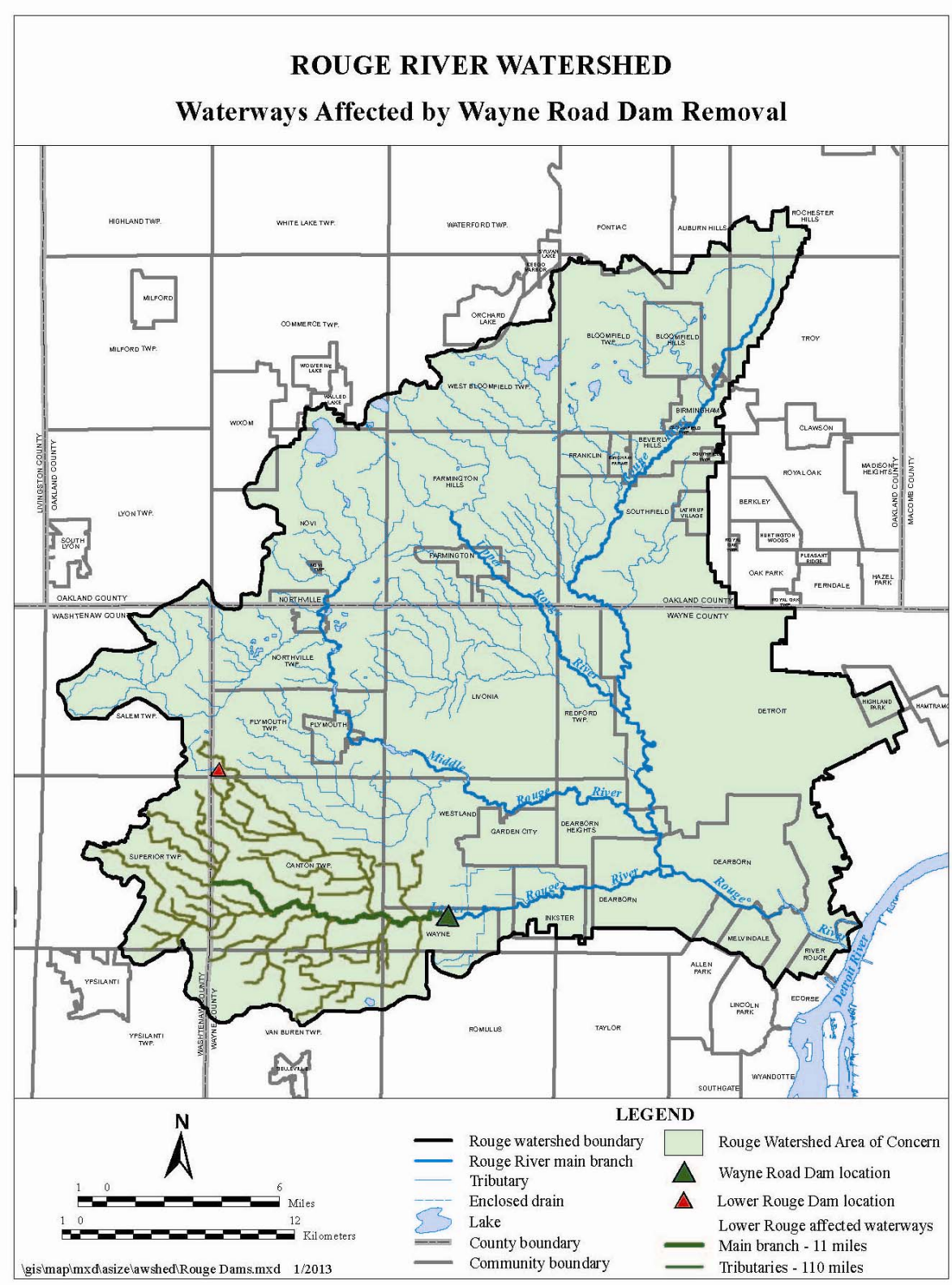
The primary goal of this project was to remove the Wayne Road Dam and improve the habitat and water quality of the Rouge River and support the delisting of the AOC's Benthos and Fish and Wildlife Habitat BUIs as shown in Figure 4-1. This was accomplished by, removing the existing dam, removing the existing in-stream island, and restoring a stable channel with grade control structure and bankfull benches. The projected goals were:

1) Wayne Road Dam was removed and fish passage for multiple valued species was restored by reconnecting 11 miles and over 110 tributary miles of the Lower Rouge River with the Great Lakes system as shown in Figure 4-2;
2) Rock structures and bank stabilization improved fish and wildlife habitat, benefiting key aquatic species and natural communities; and
3) Great Lakes aquatic and terrestrial habitats were restored and protecting by re-connecting the river to the Great Lakes system.

Figure 4-1: Performance Measures

Objective/ Goal Description	Measure	Baseline	Project Target	Actual To Date	Explanation
Stream miles made accessible upstream of project site	Miles	0	>12	>12	Removal of dam opened the upstream to 11 miles of the main stem and over 110 miles of tributaries (See Figure 4-2)
Channel width	Feet	64	54	55-60	Channel width was measured after construction and was determined to vary from 55 to 60 feet.
Overall channel slope	%	0.12	0.12	0.12	Post construction measurements determined an overall slope of 0.12
Maximum channel slope	%	0.07	0.3	0.3	Post construction measurements determined a maximum channel slope of 0.3 through the riffle profile.
Maximum jump height	Feet	2.2	0	0	With the dam removed, the jump is height is 0.
Target fish species upstream of project site	Present/ absent	Sunfish wh. Sucker dace minnow sp.	Present	Present	Based on post construction monitoring, removal of the dam has retained target fish species.
Fish diversity increases upstream of project site	# of species present	5	>15	21	Based on post construction monitoring, it was determined that at the constructed riffle and upstream of project site 21 species were found.
Macroinvertibrate species upstream of project site	Present/ absent	Present	Present	Present	Based on post construction monitoring, midges and net-spinning caddis fly were present.

Figure 4-2: Waterways Affected by Wayne Road Dam Removal



With the implementation of this project, these outputs were achieved. The dam has been removed and fish passage has been restored. Fish and wildlife habitat has improved as shown in the pre and post construction monitoring.

Aside from the project outputs, the implementation of the Wayne Road Dam and Habitat Restoration Project provided an outcome of making progress toward eliminating the Benthos and Fish and Wildlife BUI s for the AOC.

Bank before restoration

Bank stabilization after restoration

Before removal and restoration

After removal and restoration

APPENDIX A

AS-BUILT DRAWINGS

WAYNE ROAD DAM REMOVAL

NOAA GRANT AWARD NO. NA11NMF4630146

DECEMBER 2011

WAYNE COUNTY - CONTROL NO. 37-12-084

IN PARTNERSHIP WITH:

PREPARED BY:

ECT

Environmental Consulting & Technology, Inc.
2200 Commonwealth Boulevard, Suite 300
Ann Arbor, Michigan 48105
Phone: 734.769.3004
Fax: 734.769.31664

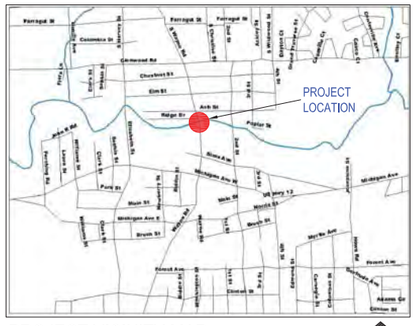
STATE OF MICHIGAN
JOHN R. MICHALSKI
ENGINEER
No. 42640
LICENSED PROFESSIONAL ENGINEER

AS-BUILT NOTE

THESE DRAWINGS WERE ORIGINALLY DESIGNED AND PRODUCED BY ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC. FOR WAYNE COUNTY. THE DRAWINGS HAVE BEEN REVISED TO REFLECT AS-BUILT CONDITIONS AS OF DECEMBER 2012 FOR WORK PERFORMED BY INLAND LAKES LANDSCAPING CO. UNDER THE WAYNE ROAD DAM REMOVAL PROJECT. ALL OTHER PRE-EXISTING UTILITIES, ITEMS, AND FEATURES SHOWN DO NOT NECESSARILY REFLECT AS-BUILT CONDITIONS.

THESE DRAWINGS ARE SEALED FOR THE CONTENT OF AS-BUILT INFORMATION ONLY.

WAYNE COUNTY, MI
NOT TO SCALE



PROJECT VICINITY MAP
NOT TO SCALE

NORTH

AS-BUILT DRAWINGS

AS-BUILT
DRAWING INDEX *

* REFERENCE ORIGINAL CONSTRUCTION BID SET FOR COMPLETE DESIGN DRAWING SET.

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Ann Arbor, Michigan 48105
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734.769.3164 fax
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WAYNE ROAD DAM REMOVAL PROJECT

WAYNE COUNTY, MICHIGAN
CONTROL NO. 37-12-084

IN PARTNERSHIP WITH:

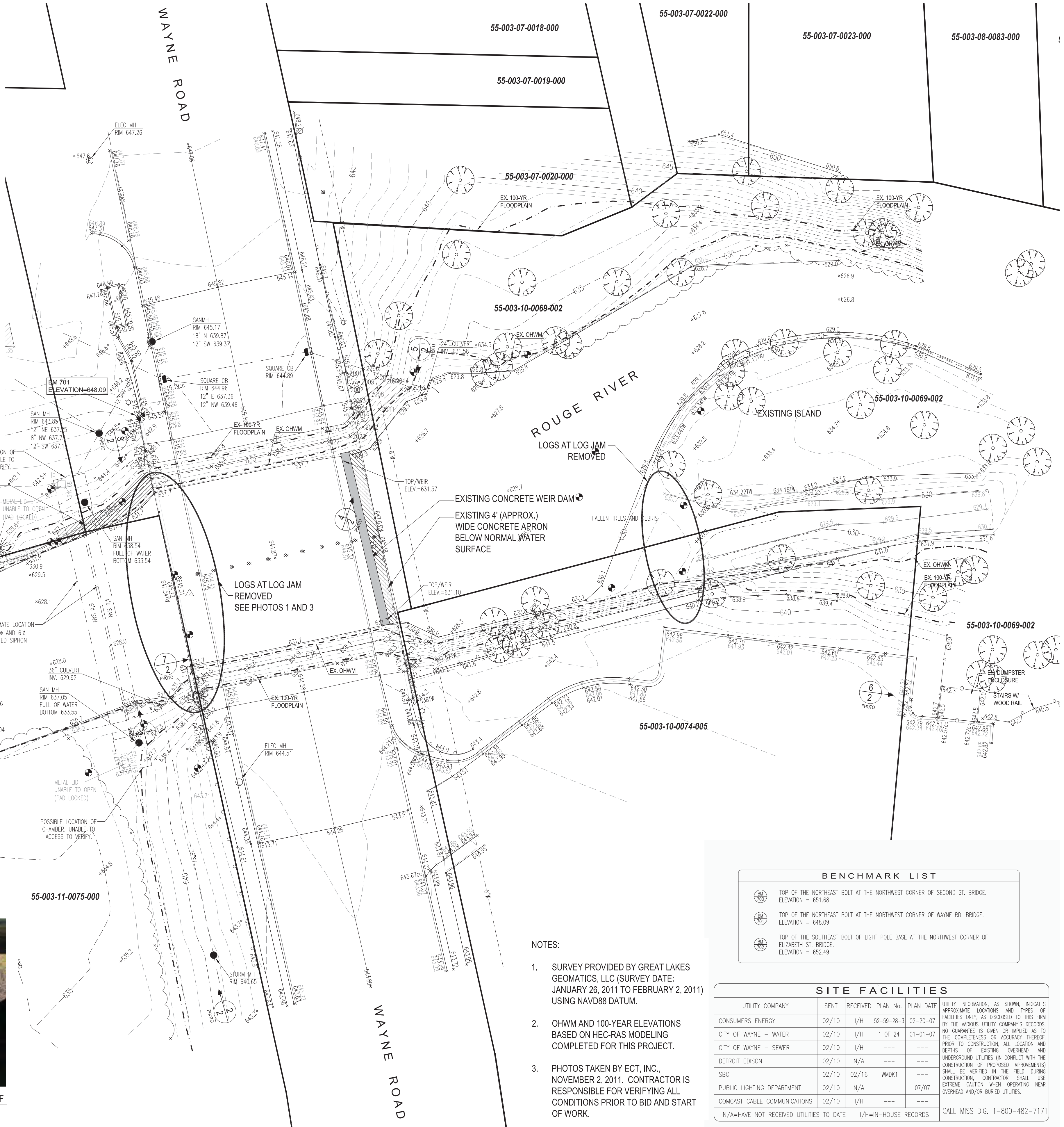
Alliance of Rouge Communities — OURS TO PROTECT — Working together, restoring the river

1/2 PHOTO 1
LOOKING N. @ EXISTING EROSION AREA AND LOG JAM. PHOTO TAKEN 11/2/2011, ECT.

2/2 PHOTO 2
LOOKING N. ALONG THE WAYNE COUNTY PROPERTY SITE ACCESS. PHOTO TAKEN 11/2/2011, ECT.

3/2 PHOTO 3
LOOKING S. @ UPSTREAM SIDE OF WAYNE ROAD BRIDGE AND LOG JAM. PHOTO TAKEN 11/2/2011, ECT.

4/2 PHOTO 4
LOOKING N. ALONG W. SIDE OF WAYNE ROAD BRIDGE @ EXISTING 24" CULVERT END SECTION. PHOTO TAKEN 11/2/2011, ECT.



5/2 PHOTO 5
LOOKING SW. @ DOWNSTREAM SIDE OF WAYNE RD. BRIDGE & DAM. PHOTO TAKEN 11/2/2011, ECT.

6/2 PHOTO 6
LOOKING E. @ EXISTING CITY HALL ACCESS LOCATION (EXISTING DUMPSTER AND STAIRS. PHOTO TAKEN 11/2/2011, ECT.

7/2 PHOTO 7 LOOKING E. @ LOG JAM DOWNSTREAM OF DAM. PHOTO TAKEN 11/2/2011, ECT.

LEGEND

- BENCHMARK
- TRAVERSE POINT
- SEWER MH (STORM/SAN)
- SQUARE CATCH BASIN
- ROUND CATCH BASIN
- BEEHIVE CATCH BASIN
- CLEAN OUT
- STEAM MANHOLE
- UNKNOWN MANHOLE
- HYDRANT
- GATE VALVE AND WELL
- WATER VALVE
- WATER SHUT OFF
- VALVE BOX
- POST INDICATOR VALVE
- WATER METER
- ELECTRIC MANHOLE
- ELECTRIC PEDESTAL
- ELECTRIC HANDHOLE
- PUBLIC LIGHTING MH
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- TELEPHONE PEDESTAL
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- BOLLARD
- PARKING METER
- SIGN
- RR CONTROL BOX
- RR CROSSING
- DECIDUOUS TREE
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- TELEPHONE LINES
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- F.M. FOUND MONUMENT
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- F.M.N. FOUND MAG NAIL
- S.I.R. SET IRON ROD
- S.M. SET MONUMENT
- S.P.K. SET P.K. NAIL
- S.M.N. SET MAG NAIL
- 000.00 SPOT ELEVATION
- TW TOP OF WALL ELEVATION
- cc CURB CUT ELEVATION
- UG UNDERGROUND
- Fin.Flr. FINISHED FLOOR ELEVATION
- M MEASURED
- R RECORD
- C CALCULATED
- PHOTO LOCATION

NOTES:

1. SURVEY PROVIDED BY GREAT LAKES GEOMATICS, LLC (SURVEY DATE: JANUARY 26, 2011 TO FEBRUARY 2, 2011) USING NAVD88 DATUM.
2. OHWM AND 100-YEAR ELEVATIONS BASED ON HEC-RAS MODELING COMPLETED FOR THIS PROJECT.
3. PHOTOS TAKEN BY ECT, INC., NOVEMBER 2, 2011. CONTRACTOR IS RESPONSIBLE FOR VERIFYING ALL CONDITIONS PRIOR TO BID AND START OF WORK.

BENCHMARK LIST

- BM 700 — TOP OF THE NORTHEAST BOLT AT THE NORTHWEST CORNER OF SECOND ST. BRIDGE. ELEVATION = 651.68
- BM 701 — TOP OF THE NORTHEAST BOLT AT THE NORTHWEST CORNER OF WAYNE RD. BRIDGE. ELEVATION = 648.09
- BM 702 — TOP OF THE SOUTHEAST BOLT OF LIGHT POLE BASE AT THE NORTHWEST CORNER OF ELIZABETH ST. BRIDGE. ELEVATION = 652.49

SITE FACILITIES

UTILITY COMPANY	SENT	RECEIVED	PLAN No.	PLAN DATE
CONSUMERS ENERGY	02/10	I/H	52-59-28-3	02-20-07
CITY OF WAYNE – WATER	02/10	I/H	1 OF 24	01-01-07
CITY OF WAYNE – SEWER	02/10	I/H	---	---
DETROIT EDISON	02/10	N/A	---	---
SBC	02/10	02/16	WMDK1	---
PUBLIC LIGHTING DEPARTMENT	02/10	N/A	---	07/07
COMCAST CABLE COMMUNICATIONS	02/10	I/H	---	---

N/A=HAVE NOT RECEIVED UTILITIES TO DATE I/H=IN-HOUSE RECORDS

UTILITY INFORMATION, AS SHOWN, INDICATES APPROXIMATE LOCATIONS AND TYPES OF FACILITIES ONLY, AS DISCLOSED TO THIS FIRM BY THE VARIOUS UTILITY COMPANY'S RECORDS. NO GUARANTEE IS GIVEN OR IMPLIED AS TO THE COMPLETENESS OR ACCURACY THEREOF. PRIOR TO CONSTRUCTION, ALL LOCATION AND DEPTHS OF EXISTING OVERHEAD AND UNDERGROUND UTILITIES (IN CONFLICT WITH THE CONSTRUCTION OF PROPOSED IMPROVEMENTS) SHALL BE VERIFIED IN THE FIELD. DURING CONSTRUCTION, CONTRACTOR SHALL USE EXTREME CAUTION WHEN OPERATING NEAR OVERHEAD AND/OR BURIED UTILITIES.

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1-800-482-7171

ISSUED FOR BIDS	3.27.12
FOR CONSTRUCTION	DEC. 2011
FOR PERMITTING	8-9-11

101066
ECT PROJECT NUMBER

LH/ MB/ AB	LH
DESIGNED BY	CHECKED BY
AB/ AM/ TH/ PH	JO
DRAWN BY	APPROVED BY

SHEET TITLE

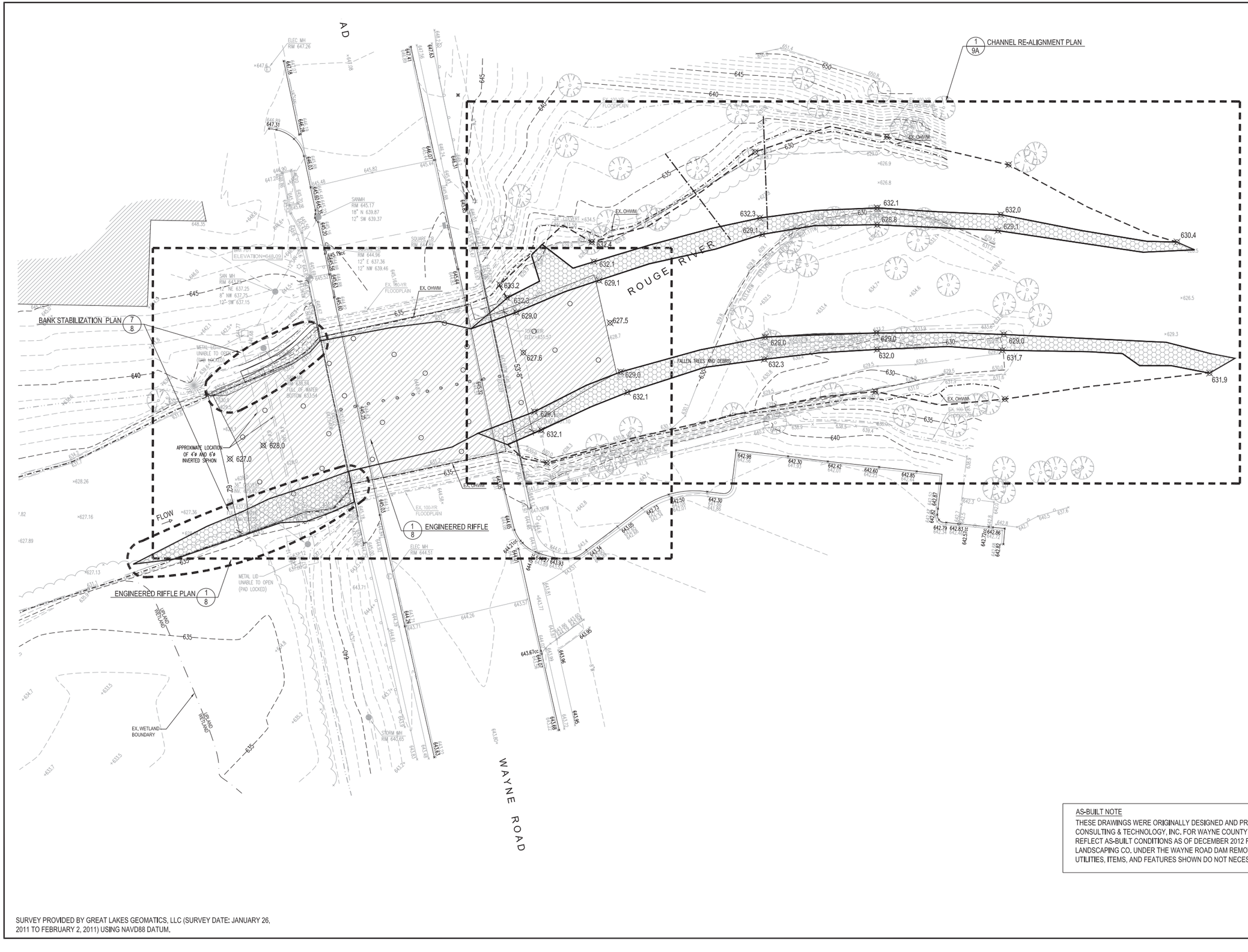
EXISTING CONDITIONS - DAM VICINITY

SCALE: 1" = 20' @ 22x34

0 10' 20' 40'

NORTH

SHEET NUMBER



LEGEND

- BENCHMARK
- TRAVERSE POINT
- SEWER MH (STORM/SAN)
- SQUARE CATCH BASIN
- ROUND CATCH BASIN
- BEEHIVE CATCH BASIN
- CLEAN OUT
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- UG UNDERGROUND
- Fin.Flr. FINISHED FLOOR ELEVATION
- M MEASURED
- R RECORD
- C CALCULATED
- LIMITS OF GRADING
- RIPRAP STONE TOE
- PROPOSED RIFFLE

AS-BUILT NOTE

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FOR PERMITTING	8-9-11

101066
ECT PROJECT NUMBER

LH/ MB/ AB — DESIGNED BY
LH — CHECKED BY
AB/ AM/ TH/ PH — DRAWN BY
JO — APPROVED BY

SHEET TITLE

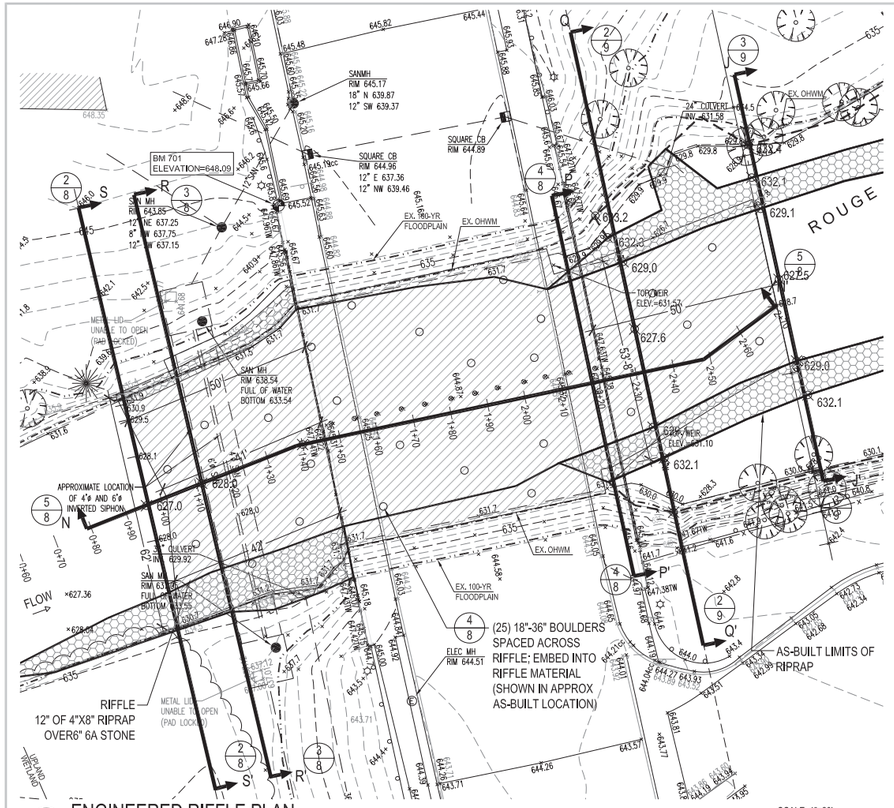
SITE IMPROVEMENTS PLAN

SCALE: 1" = 20' @ 22x34
0 10' 20' 40'

NORTH

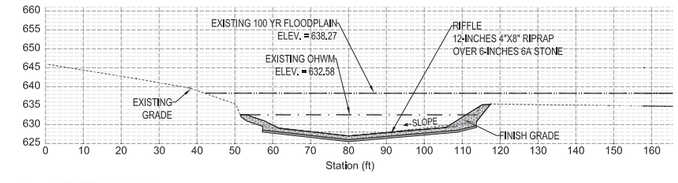
SHEET NUMBER 7

P:\Alliance of Rouge Communities /ARC\2011 Alliance of Rouge Communities\Wayne Road Dam\CAD\ECT\Permit Drawings\Construction.dwg



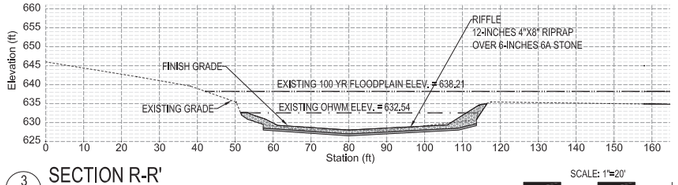
1 8 ENGINEERED RIFFLE PLAN

SCALE: 1"=20'



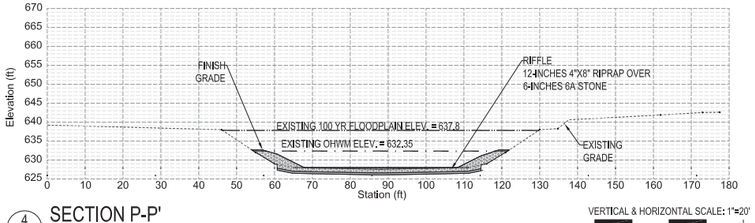
2 8 SECTION S-S'

SCALE: 1"=20'



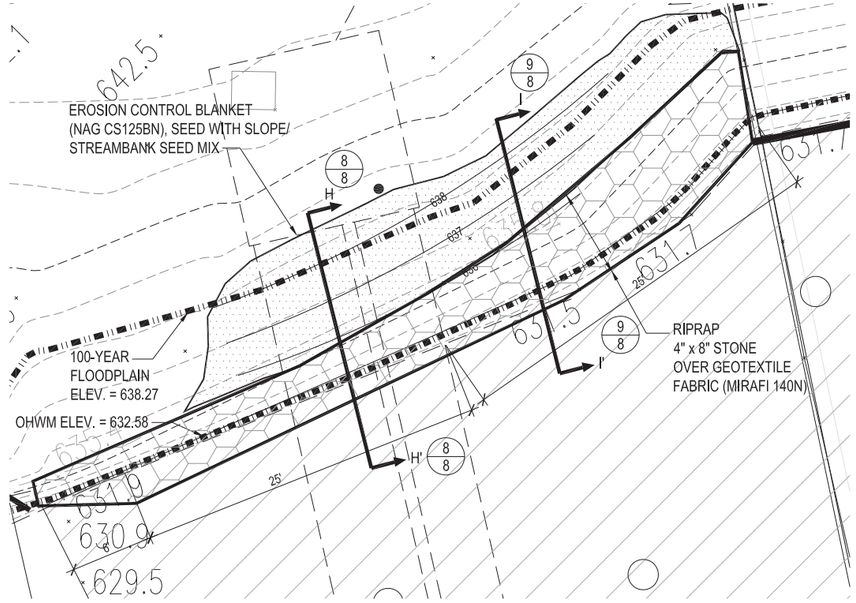
3 8 SECTION R-R'

SCALE: 1"=20'



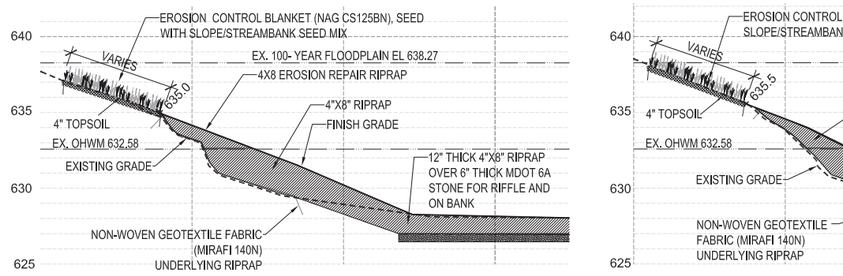
4 8 SECTION P-P'

VERTICAL & HORIZONTAL SCALE: 1"=20'



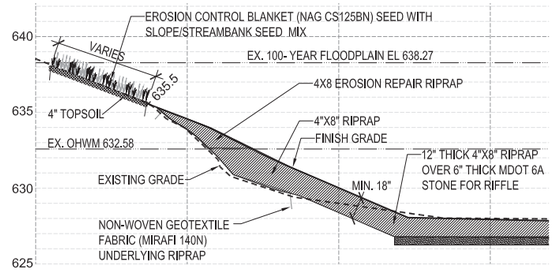
7 8 BANK STABILIZATION PLAN

SCALE: 1"=5'



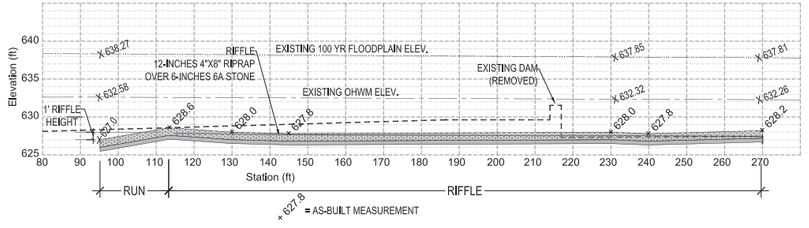
8 8 CROSS SECTION H - H'

SCALE: 1" = 20' (HORIZ. & VERT.)



9 8 CROSS SECTION I - I'

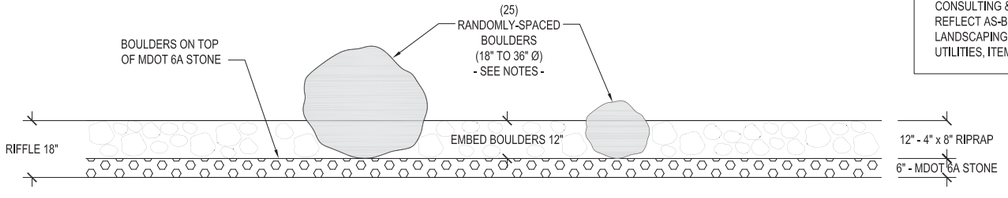
SCALE: 1" = 20' (HORIZ. & VERT.)



5 8 SECTION N-N'

VERTICAL SCALE: 1"=10' @ 22" x 34"

HORIZONTAL SCALE: 1"=20' @ 22" x 34"



6 8 BOULDER EMBEDDING DETAIL

VERTICAL SCALE: 1"=2' @ 22" x 34"

LEGEND

- BENCHMARK
- TRAVERSE POINT
- SEWER MH (STORM/SAN)
- SQUARE CATCH BASIN
- ROUND CATCH BASIN
- BEEHIVE CATCH BASIN
- CLEAN OUT
- STEAM MANHOLE
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- Fin.Flr. FINISHED FLOOR ELEVATION
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- R RECORD
- C CALCULATED

NOTES:

1. 4" x 8" RIPRAP SHALL HAVE D_{50} = 6", D_{84} = 7", AND D_{100} = 8".
2. 4" X 8" RIPRAP SHALL EXTEND UP BANKS TO THE OHWM ALONG BOTH SIDES OF THE RIFFLE AT A MINIMUM THICKNESS OF 18".
3. 50% OF RIFFLE BOULDERS SHALL BE GREATER THAN 24" AND 50% SHALL BE LESS THAN 24".

AS-BUILT NOTE

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101066
ECT PROJECT NUMBER

LH/ MB/ AB	LH
DESIGNED BY	CHECKED BY
AB/ AM/ TH/ PH	JO
DRAWN BY	APPROVED BY

SHEET TITLE

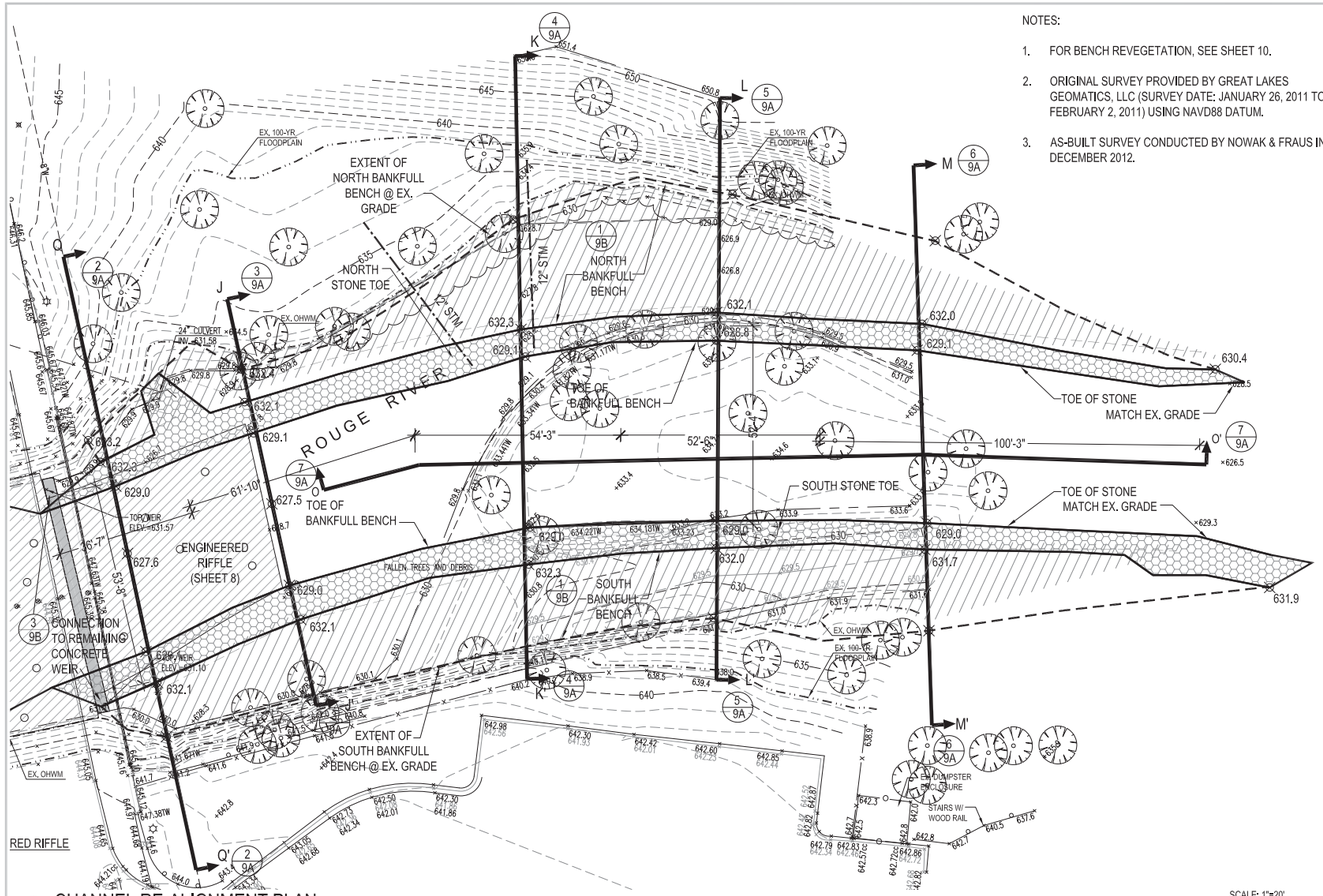
RIFFLE & BANK STABILIZATION PLAN

SCALE: AS SHOWN

NORTH

SHEET NUMBER 8

P:\Alliance of Rouge Communities (ARC)\2011 Alliance of Rouge Communities\Wayne Road Dam\CAD\ECI Permit Drawings\Construction.dwg

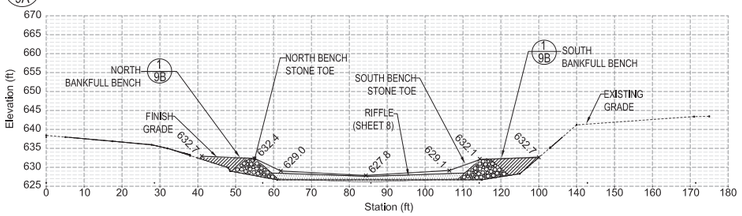


NOTES:

1. FOR BENCH REVEGETATION, SEE SHEET 10.
2. ORIGINAL SURVEY PROVIDED BY GREAT LAKES GEOMATICS, LLC (SURVEY DATE: JANUARY 26, 2011 TO FEBRUARY 2, 2011) USING NAVD88 DATUM.
3. AS-BUILT SURVEY CONDUCTED BY NOWAK & FRAUS IN DECEMBER 2012.

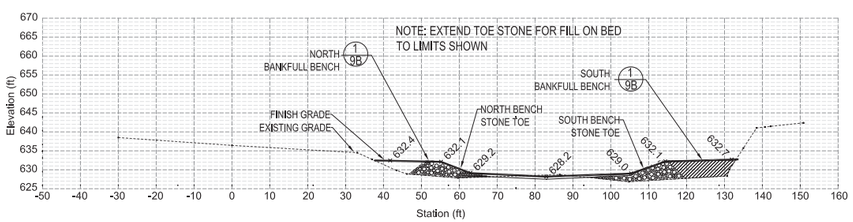
1 9A CHANNEL RE-ALIGNMENT PLAN

SCALE: 1"=20'



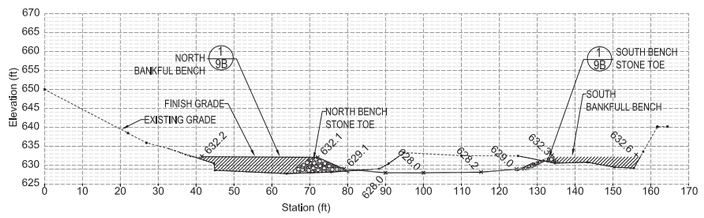
2 9A CROSS SECTION Q-Q'

SCALE: 1"=20'



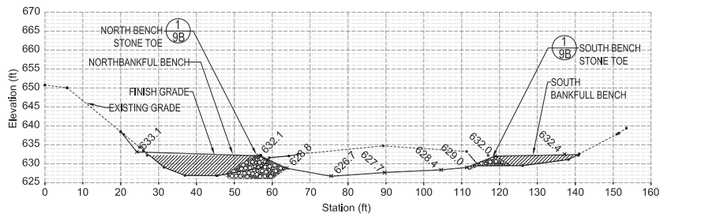
3 9A CROSS SECTION J-J'

SCALE: 1"=20'



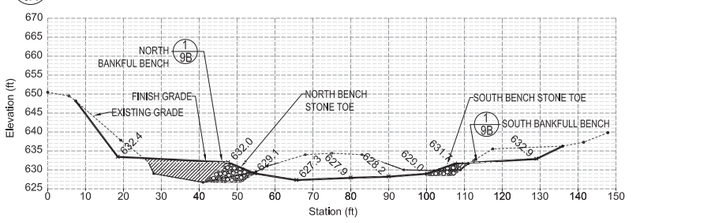
4 9A CROSS SECTION K-K'

SCALE: 1"=20'



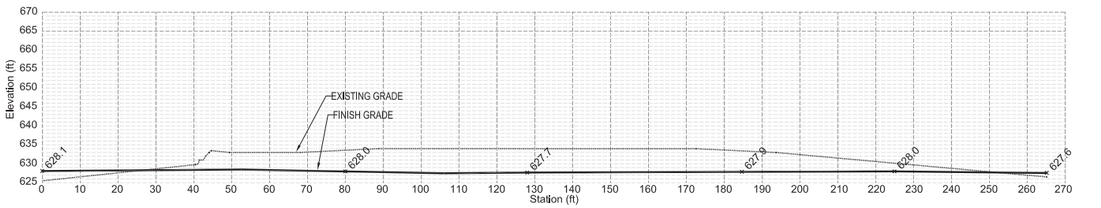
5 9A CROSS SECTION L-L'

SCALE: 1"=20'



6 9A CROSS SECTION M-M'

SCALE: 1"=20'



7 9A CROSS SECTION O-O'

SCALE: 1"=20'

NOTE: FINISH GRADE = SURVEY ELEVATIONS FROM DECEMBER 2012

AS-BUILT NOTE

THESE DRAWINGS WERE ORIGINALLY DESIGNED AND PRODUCED BY ENVIRONMENTAL CONSULTING & TECHNOLOGY, INC. FOR WAYNE COUNTY. THE DRAWINGS HAVE BEEN REVISED TO REFLECT AS-BUILT CONDITIONS AS OF DECEMBER 2012 FOR WORK PERFORMED BY INLAND LAKES LANDSCAPING CO. UNDER THE WAYNE ROAD DAM REMOVAL PROJECT. ALL OTHER PRE-EXISTING UTILITIES, ITEMS, AND FEATURES SHOWN DO NOT NECESSARILY REFLECT AS-BUILT CONDITIONS.

3 WORKING DAYS BEFORE YOU DIG CALL MISS DIG 1-800-482-7171

LEGEND

- BENCHMARK
- TRAVERSE POINT
- SEWER MH (STORM/SAN)
- SQUARE CATCH BASIN
- ROUND CATCH BASIN
- BEEHIVE CATCH BASIN
- CLEAN OUT
- STEAM MANHOLE
- UNKNOWN MANHOLE
- HYDRANT
- GATE VALVE AND WELL
- WATER VALVE
- WATER SHUT OFF
- VALVE BOX
- POST INDICATOR VALVE
- WATER METER
- ELECTRIC MANHOLE
- ELECTRIC PEDESTAL
- ELECTRIC HANDHOLE
- PUBLIC LIGHTING MH
- TELEPHONE MANHOLE
- TELEPHONE PEDESTAL
- CABLE PEDESTAL
- GAS VALVE
- UTILITY POLE
- GUY ANCHOR
- LIGHT POLE
- BOLLARD
- PARKING METER
- SIGN
- RR CONTROL BOX
- RR CROSSING
- DECIDUOUS TREE
- CONIFEROUS TREE
- CHAINLINK FENCE
- WROUGHT IRON FENCE
- OVERHEAD UTILITIES
- STORM SEWER
- SANITARY SEWER
- COMBINATION SEWER
- STEAM LINES
- WATERMAIN
- GAS LINES
- ELECTRIC LINES
- PUBLIC LIGHTING DEPT.
- TELEPHONE LINES
- CABLE LINES
- F.I.R. FOUND IRON ROD
- F.M. FOUND MONUMENT
- F.P.K. FOUND P.K. NAIL
- F.M.N. FOUND MAG NAIL
- S.I.R. SET IRON ROD
- S.M. SET MONUMENT
- S.P.K. SET P.K. NAIL
- S.M.N. SET MAG NAIL
- 000.00 SPOT ELEVATION
- TW TOP OF WALL ELEVATION
- cc CURB CUT ELEVATION
- UG UNDERGROUND
- Fin.Flr. FINISHED FLOOR ELEVATION
- M MEASURED
- R RECORD
- C CALCULATED
- PROPOSED DREDGE/EXCAVATION
- PROPOSED BANKFULL BENCH/FILL
- PROPOSED STONE TOE

ECT
Environmental Consulting & Technology, Inc.
2200 Commonwealth Blvd, Suite 300
Ann Arbor, Michigan 48105
734.769.3004
734.769.3164 fax
www.ectinc.com

WAYNE ROAD DAM REMOVAL PROJECT

WAYNE COUNTY, MICHIGAN
CONTROL NO. 37-12-084

IN PARTNERSHIP WITH:

Alliance of Rouge Communities
OURS TO PROTECT
Working together, restoring the river

AS-BUILT	1-29-13
ISSUED FOR BIDS	1-27-12
FOR CONSTRUCTION	DEC, 2011
FOR PERMITTING	8-9-11

101066
ECT PROJECT NUMBER

LH/ MB/ AB	LH
DESIGNED BY	CHECKED BY
AB/ AM/ TH/ PH	JO
DRAWN BY	APPROVED BY

SHEET TITLE

CHANNEL REALIGNMENT PLAN

SCALE: 1" = 20' @ 22x34

NORTH

SHEET NUMBER **9A**

APPENDIX B

PUBLIC EDUCATION MATERIALS

Public Meeting on
April 26, 2012

ROUGE RIVER REPORT CARD

Noel Mullett, Wayne County

Rouge River Report Card

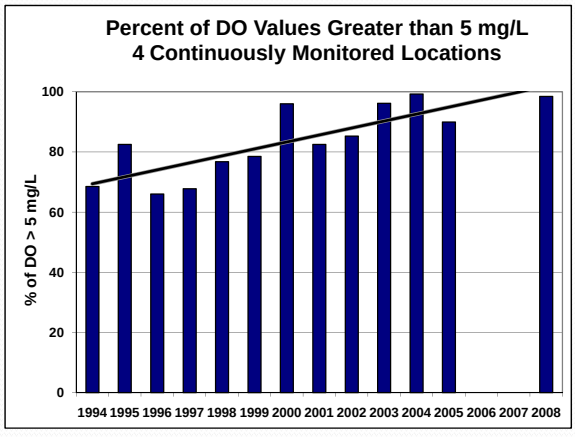
- The Rouge River communities, residents and partners continue to address watershed issues
- Water quality and ecosystem health continues to improve
- Community projects are beginning to establishing a healthier balance between green and gray infrastructure.

Alliance of Rouge Communities

- The ARC is comprised of 35 communities, three counties, including Wayne County, 2 education institutions and partners, such as Friends of the Rouge.
- The ARC supports activities such as water quality monitoring, public education activities and special projects including green infrastructure, such as native plant grow zones, tree plantings, rain barrel sales, habitat (green infrastructure) restoration.

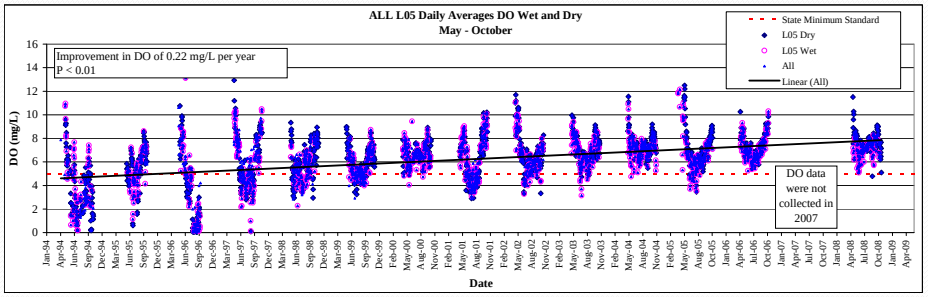
Water Quality and Ecosystem Health

- Dissolved Oxygen concentrations are improving across the watershed.



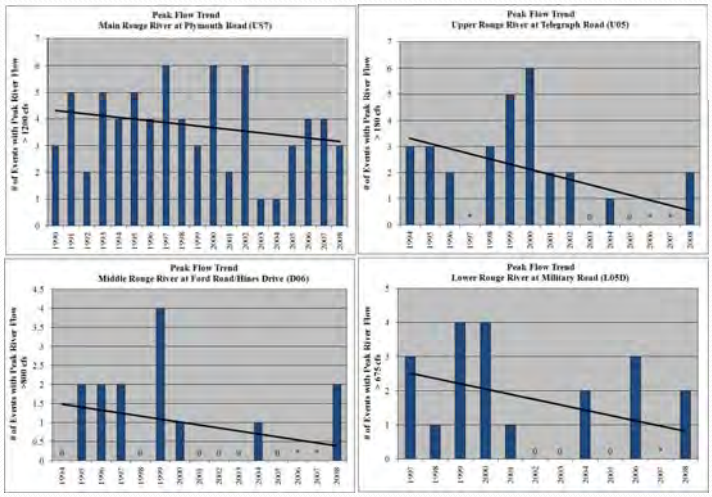
Water Quality and Ecosystem Health

- **The Lower Rouge Branch has improved the most since 1994 with an average improvement of 0.22mg/L/year.**



Water Quality and Ecosystem Health

- **Flow is stabilizing and/or improving across the watershed.**



Water Quality and Ecosystem Health

- **Rouge Macroinvertebrate data is showing signs of improvement**

Spring Data 2001-2011			
Subwatershed	slope	*p*-value	Significant Trend
Main 1-2	0.7404	0.0056	**yes, improving**
Upper	0.3945	0.2346	no
Johnson Creek	0.8523	0.1093	no
Middle 1	1.5981	0.0002	**yes, improving**
Middle 3*	1.6287	0.0428	**yes, improving**
Lower 1	0.5064	0.2189	no
Lower 2	1.1860	0.0679	no
Main3-4	NA	NA	NA
Fall Data 2001-2011			
Subwatershed	slope	*p*-value	Significant Trend
Main 1-2	-0.4321	0.2242	No trend
Upper	-0.7679	0.0185	**yes, declining**
Johnson Creek	1.4091	0.0013	**yes, improving**
Middle 1	0.8406	0.0222	**yes, improving**
Middle 3	0.8141	0.0323	**yes, improving**
Lower 1	0.4931	0.2606	No trend
Lower 2	-0.2741	0.5865	No trend
Main3-4	NA	NA	NA

Community Projects (Local Funding)

- **Through funding from Wayne County, ARC members are implementing a variety of projects to improve the Lower Branch of the Rouge River.**
- **Along the Lower Rouge River, these projects include:**
  - **Inkster:**
    - CSO Outfall L49 Sewer Separation and Relief Sewer Separation and Relief Sewer to Andover Pump Station
    - Construction of CSO Retention treatment basin at Middlebelt Road
  - **Canton:**
    - Lower Rouge River Recreational Trail and Bridges
  - **Wayne County Parks:**
    - Lower Rouge Parkway: Five (5) acres of native plantings in Inkster and Westland

Community Projects (Local Funding)

- Thanks to funding from a variety of federal sources, Wayne County and ARC members are implementing projects to restore beneficial uses to the river, such as improved habitat. They are:
- Danvers Dam Removal in Farmington Hills;
- Creation of 25 acres of natural areas in Wayne County Parks and Detroit and restoration of a wetland in Southfield;
- The installation of 2,350 trees in 12 communities and Wayne County to replace trees lost to the Emerald Ash Borer, and
- Removal of the Wayne Road Dam.

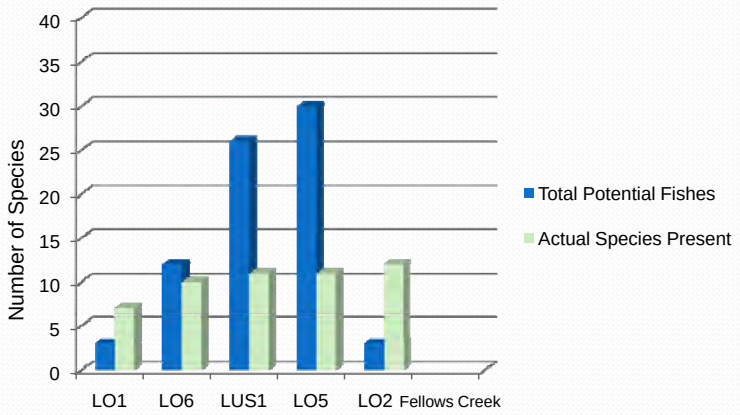
Wayne Road Dam

- The MDNR 1998 Fisheries Assessment identified the Wayne Road Dam as a major impediment to restoring fish and wildlife habitat in the Rouge River.
- The river hosts a variety of fish in the vicinity of the dam, including trout in upstream areas and warm water species, such as smallmouth bass, northern pike and walleye downstream of the dam.
- Removing the dam would reconnect approximately 17 miles of the Rouge River to the Detroit River and the Lake Erie ecosystem.

Wayne Road Dam – NOAA Grant

- In 2011, the ARC received a $1 Million grant from NOAA to remove the Wayne Road Dam.
- Project Partners - ARC, Wayne County, City of Wayne and Friends of the Rouge.
- Project Components - monitoring before and after, public outreach, dam removal and stream restoration
- Construction to begin this June.

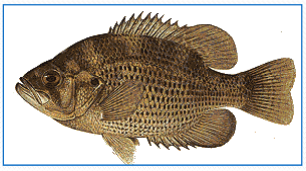
Comparison of Potential Target Species vs. Actual Species Present in the Lower Rouge River



Ecological Targets: Northern Pike

Northern Pike

Ecological Targets: Rock Bass



Northern Rock Bass

Ecological Targets: Smallmouth Bass

Northern Smallmouth Bass

Ecological Targets: Channel Catfish & Walleye

Channel Catfish

Walleye

Friends of the Rouge
2011 Lower Canoe Expedition

October 7-9, 2011

Canton to Dearborn: Beck Road to Fairlane Estate

Sally Petrella, Friends of the Rouge

This is funded in part by a GLRI/NOAA grant to the Alliance of Rouge Communities (Wayne Road Dam Removal and Habitat Restoration Project, NA11NMF4630146).

Canoe Expedition Purpose

To examine and document the potential for a recreational canoe route on the Lower Rouge as it flows through

Canton, Wayne, Westland, Dearborn Heights and Dearborn

The Route

The Expeditioners

Kurt Kuban

Bill Craig

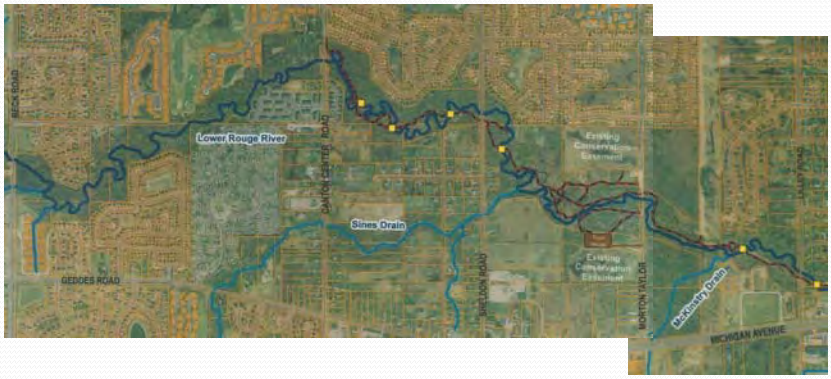
Jeff Vallender

Matt Mullholland

Sally Petrella

Sue Thompson

Day One: Beck Road to Lilley Rd



Day One: Friday October 7, 2011

Expeditioners: Kurt Kuban, Bill Craig, Jeff Vallender, Sue Thompson, Sally Petrella, Matthew Mulholland plus Bob Belair, Joe Mantey and Joe the walker

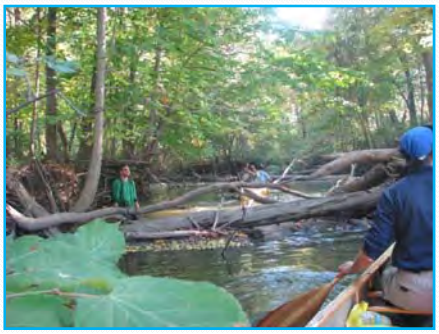
We're out to prove canoeing the Rouge no pipe dream

Did you ever wonder what Lewis and Clark must have been thinking as they embarked from St. Louis on their way into the great unknown and, ultimately, into the history books on one of the most ambitious explorations in this nation's history? Against major odds they, along with their crew, mapped out most of the West as we know it — all the way to the Pacific Coast.

I've been pondering that question a lot lately. I'm also getting ready, along with a small group of people, to embark on what I think is an ambitious — though some might say crazy — journey to map out a largely forgotten water course. Unlike Lewis and Clark, though, I'm not talking about in some far away place. Our goal is to paddle and document a potential canoe route through the heart of Wayne County.

10:19 am – Launch

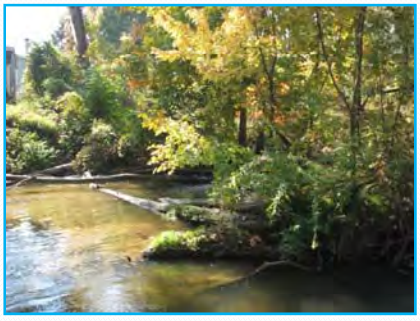
Day One: Friday October 7, 2011



10:37 am: First logjam & Joe the walker

11:39 am – Limbo time

Day One: Friday October 7, 2011



12:16 am - Gorgeous scenery

1:17 pm Lunch stop at Lilley Road

Day One: Friday October 7, 2011

2:08 pm - Dryad's saddle mushroom

2:09 pm Back to the logjams

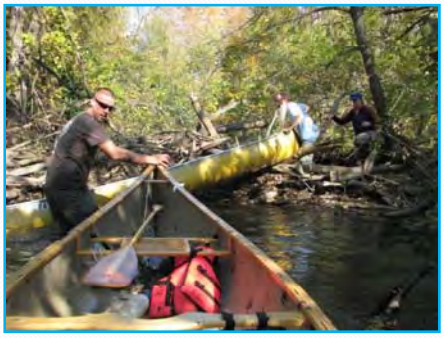
Day One: Friday October 7, 2011

Day One: Friday October 7, 2011

3:05 pm - Canton's Lower Rouge Trails

3:06 pm Kurt and Matt determined it is easier to walk the trails

Day One: Friday October 7, 2011



3:33 pm

4:49 pm Almost to Lilley Rd and our pull out for the night

Day One: Beck Rd to Lilley Rd

Day One Accomplishments:

- 2.4 miles/ 6:45 hours of canoeing = 0.36 mph
- 60 large logjams

Beck Rd to Canton Center
- 1 mile/3 hours = 0.33 mph

Canton Center to Lilley Rd
- 1.5 mile/4 hours = 0.375 mph

Friends of the Rouge

Day Two: Lilley Rd to Wayne Rd

Lilley Rd to Commerce Court

Friends of the Rouge

Day Two: Saturday Oct. 8, 2011

Expeditioners: Kurt Kuban, Bill Craig, Jeff Vallender, Sue Thompson, Sally Petrella, Matthew Mulholland plus Dan Wright

10:00 am – Lilley Rd launch

10:34 am – An old sunken boat rumored to once have been used to open logjams

Friends of the Rouge

Day Two: Saturday Oct. 8, 2011

10:39 am – Walkers in Canton

10:41 am Awesome scenery near Haggerty

Friends of the Rouge

Day Two: Saturday Oct. 8, 2011

10:56 am – I-275

11:00 am I-275 walking trail bridge

Day Two: Saturday Oct. 8, 2011

11:39 am

11:54 am Kurt, Matt and Dan catch up

Day Two: Saturday Oct. 8, 2011

12:30 pm Fellows Creek confluence

12:41 pm American toad

Friends of the ROUGE

Day Two: Saturday Oct. 8, 2011

2:48 pm Lunch back of Wayne County office

3:34 pm Large logjam

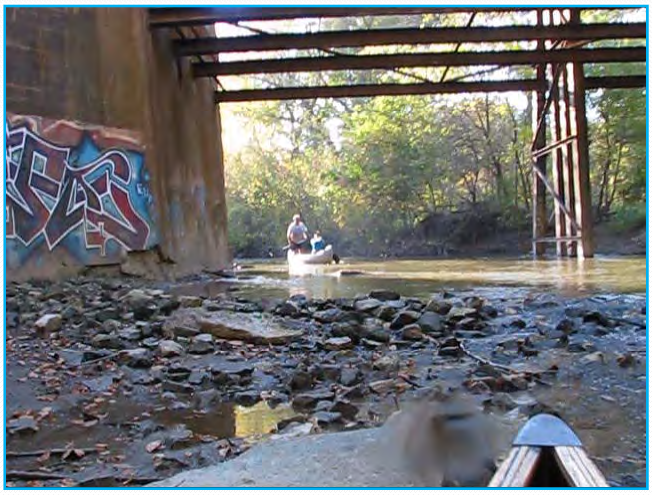
Friends of the ROUGE

Day Two: Lilley Rd to Wayne Rd

Commerce Court to Wayne Road

Day Two: Saturday Oct. 8, 2011

Day Two: Saturday Oct. 8, 2011



Day Two: Saturday Oct. 8, 2011

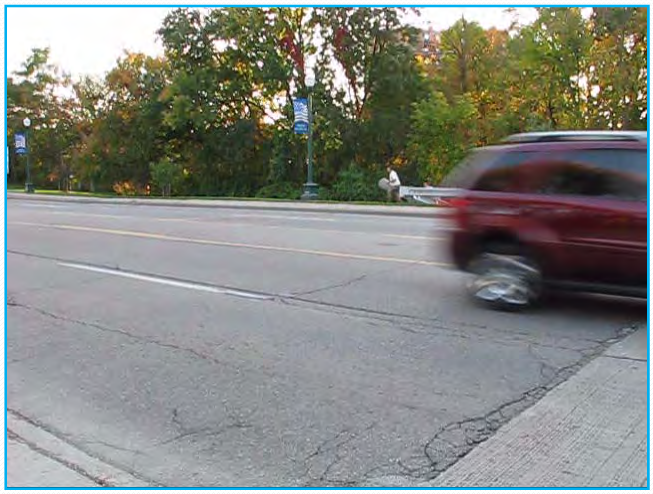
Day Two: Saturday Oct. 8, 2011

Day Two: Saturday Oct. 8, 2011

5:49 pm

5:49 pm

Day Two: Saturday Oct. 8, 2011



Day Two: Lilley Rd to Wayne Rd

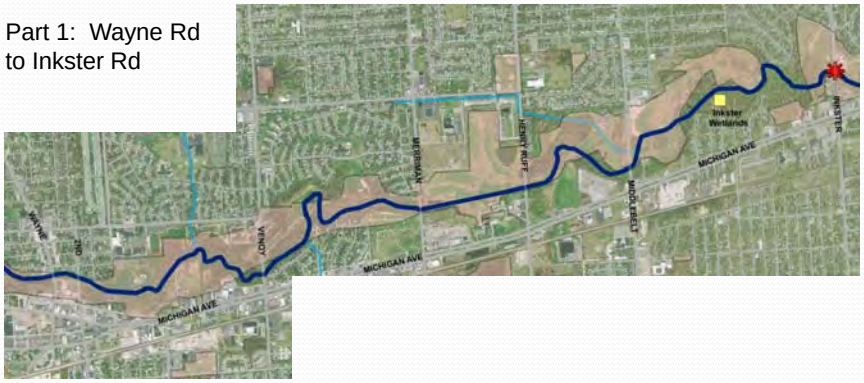
Day Two Accomplishments:

- 2 miles/ 5:25 hours of canoeing = 0.38 mph
- 33 large logjams/33 small = 66 total

Wildlife Seen:
- 1 American toad
- 1 Cooper's hawk
- many wood ducks
- 1 mink

Day Three: Wayne Rd to Fairlane Estate

Part 1: Wayne Rd to Inkster Rd



Day Three: Sunday Oct. 9, 2011

Expeditioners: Kurt Kuban, Bill Craig, Jeff Vallender, Sue Thompson, Sally Petrella, Matthew Mulholland

10:04 am – high school student Chelsea

10:22 am – Wayne Road Dam

Day Three: Sunday Oct. 9, 2011

10:34 am Female wood duck

10:52 am Sleeping raccoon

Day Three: Sunday Oct. 9, 2011

11:16 am Mushrooms after giant logjam

11:19 am Virginia creeper

Day Three: Sunday Oct. 9, 2011

11:24 am Hillside

11:31 am Outfall

Day Three: Sunday Oct. 9, 2011

11:55 am Bridge in Eloise property

11:57 am Golf course bridge

Day Three: Sunday Oct. 9, 2011

1:26 pm Inkster Wetlands

4:01 pm Giant snapping turtle

Day Three: Wayne Rd to Fairlane Estate

Part 2: Inkster to Fairlane Estate

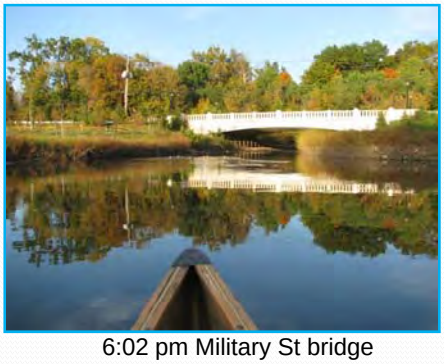
Day Three: Sunday Oct. 9, 2011

5:10 pm Dearborn Hills Golf Course

5:51 pm Just past Outer drive bridge

Friends of the Rouge

Day Three: Sunday Oct. 9, 2011



6:02 pm Military St bridge

7:09 pm The confluence with the Main Rouge and the end of the trip

Friends of the Rouge

Day Three: Wayne Rd to Fairlane Estate

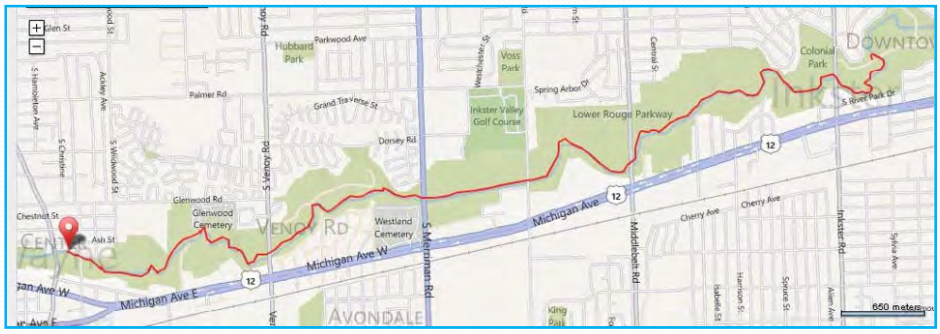
Day Three Accomplishments:

- 8 miles/ 7:45 hours of canoeing = 1.03 mph
- 25 large logjams/20 small = 45

Wildlife Seen:
- Many Wood ducks
- 2 Raccoon
- 1 Snapping turtle
- 4 White-tailed deer
- Old beaver sign

Total Trip: 21.69 miles of river/19:45 hours/ 8 people
171 logjams

Public Canoe Trip: Oct. 29, 2011



Opening the route prior

Public Canoe Trip: Oct. 29, 2011

Alan Heavner, owner of Heavner Canoe Rental, announces his intent to work out an agreement with Wayne County to provide canoe rentals and programming in the Rouge River watershed.

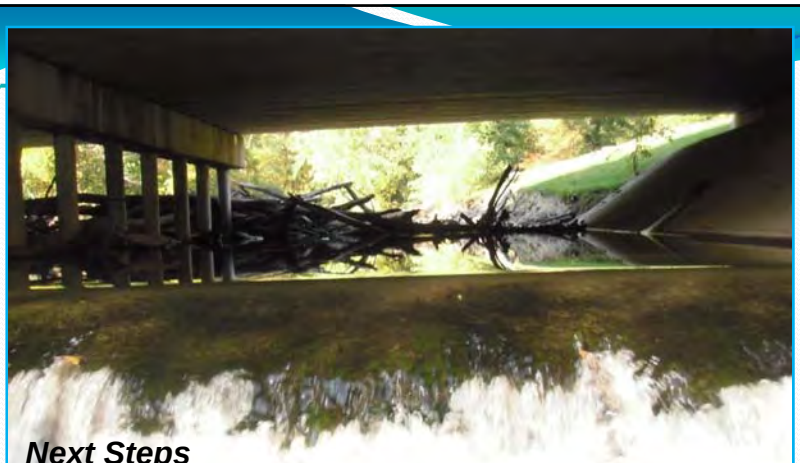
Conclusion & Challenges

Conclusion: The Lower Rouge has excellent potential for recreational canoeing

- Water levels are high enough for canoeing year round due to YCUA discharge
- Most of the route is public land (parkland and forested)
- Route is accessible to a large metropolitan area

Challenges

- Fallen trees prevent passage for much of the route
- Water quality, though improving, can be a concern
- Rouge River carries stigma due to years of pollution



Next Steps

- *FOTR to hold a hands-on logjam opening class for municipal workers and volunteers on May 9*
- *Dam removal this year will provide passage for fish and canoes*
- *Heavner Canoe Rental is planning trips for the Lower Rouge*

WAYNE ROAD DAM PROJECT

John O'Meara, P.E.

Alliance of Rouge Communities

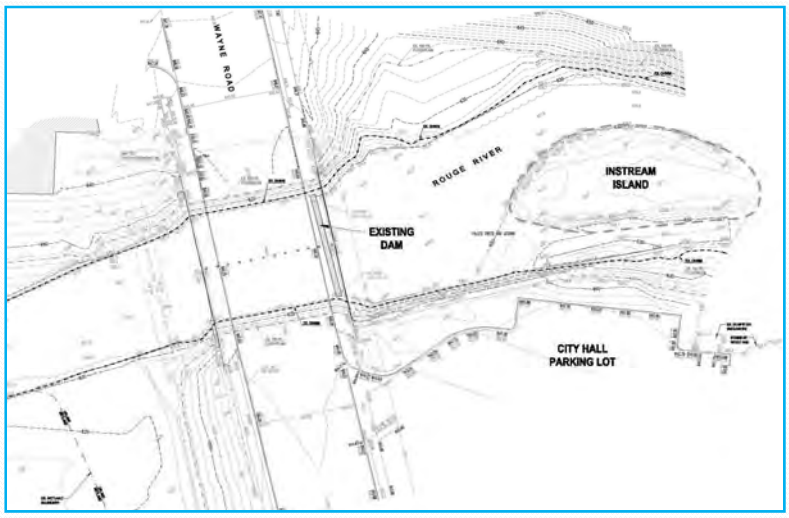
Wayne Road Dam - Project Background

- Dam installed in late 1800's (anecdotal evidence)
- Project identified by Rouge River AOC PAC as a priority project for restoring fish & wildlife habitat to the Rouge River watershed
- Design completed by ARC through partial funds from a Rouge Grant in 2010-2011
- Construction funding secured from NOAA 2011 Great Lakes Restoration Initiative Grant

The Project Will:

- Reconnect 17 miles of the Lower Rouge River (125 miles of its tributaries) back to the Great Lakes and restore fish passage by removing the Wayne Road dam
- Insure that the streambed remains stable and protect integrity of the bridge and utilities
- Stabilize the streambank immediately upstream of the dam (north bank) and downstream of the dam (north bank)

Existing Conditions



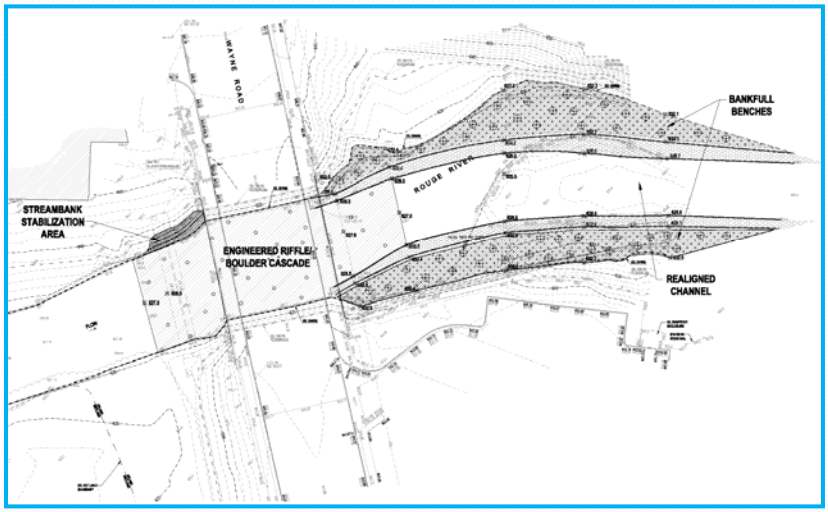
Existing Conditions



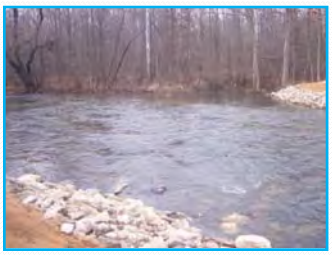

Project Improvements

- **Removal and disposal of upstream impounded sediment**
- **Dam removal**
- **Engineered riffle/boulder cascade construction**
- **Realignment of downstream channel**
  - Removal of instream island
  - Construction of bankfull benches on both sides of channel to protect banks from erosive forces
- **Bank erosion repair upstream of dam**
- **Woody debris removal**

Proposed Conditions



Riffle and Bankfull Bench Examples

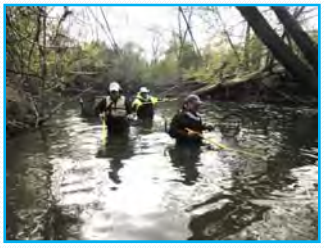



Project Timeline

- Site Investigation & Design - COMPLETED
- MDEQ Permitting – COMPLETED
- Construction Documents – COMPLETED
- Pre-construction Monitoring - COMPLETED
- Bidding – On-going
- Construction – July –October 2012
- Post Construction Monitoring - Spring 2013

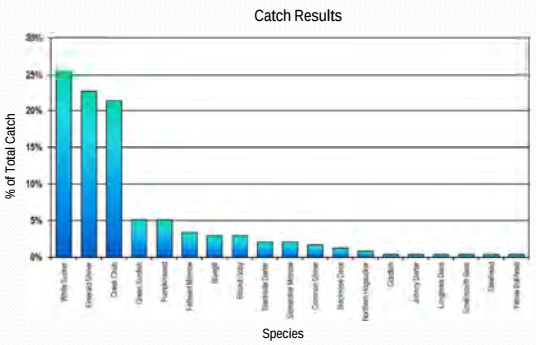
Pre-Construction Monitoring

- Fish monitoring conducted at three transects, 2 upstream of the dam, 1 downstream
- Fish collection was conducted by electro-shocking and netting
- Specimens were identified, counted and released



Pre-Construction Monitoring Results

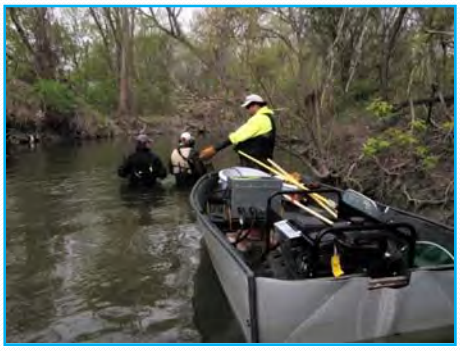
- 19 total fish species, 234 specimens captured
- Dominant species were Creek Chub, White Sucker, and Emerald Shiner
- Found 1 Great Lakes Steelhead downstream of the dam




White Sucker


Creek Chub


Emerald Shiner

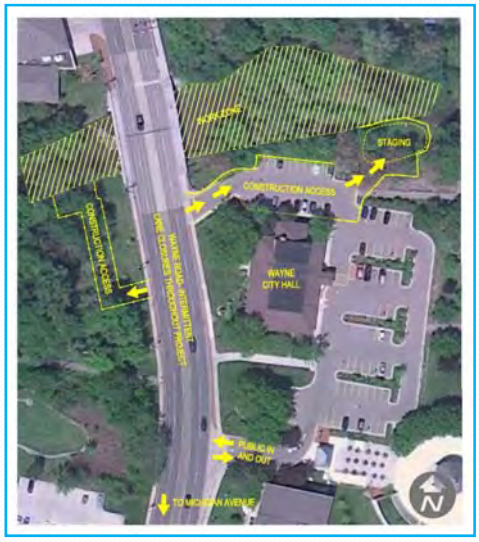


Electro-shocking crew

Steelhead captured downstream of the dam

Construction Impacts

- Intermittent Lane Closures
- Construction Access Areas
- Public Access to City Hall
- City Hall Parking
- Park Access Limited



Presentation to the ARC
in December 2012

WAYNE DAM REMOVAL PROJECT

Alliance of Rouge Communities OURS TO PROTECT | NOAA | Friends of the Rouge | ECT

Project Location

Alliance of Rouge Communities
OURS TO PROTECT
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Project Overview

Issue

- Impeding fish passage
- Sediment accumulation
- Island disrupting natural sediment transport
- Island causing flow impingement
- Erosion

Solution

- Sediment Removal
- Dam Removal
- Island Removal
- Channel Restoration/ Stabilization

Project cost - $1.12 million

- ARC: $57,550
- RPO grant: $57,550
- NOAA (GLRI) grant: $1 million

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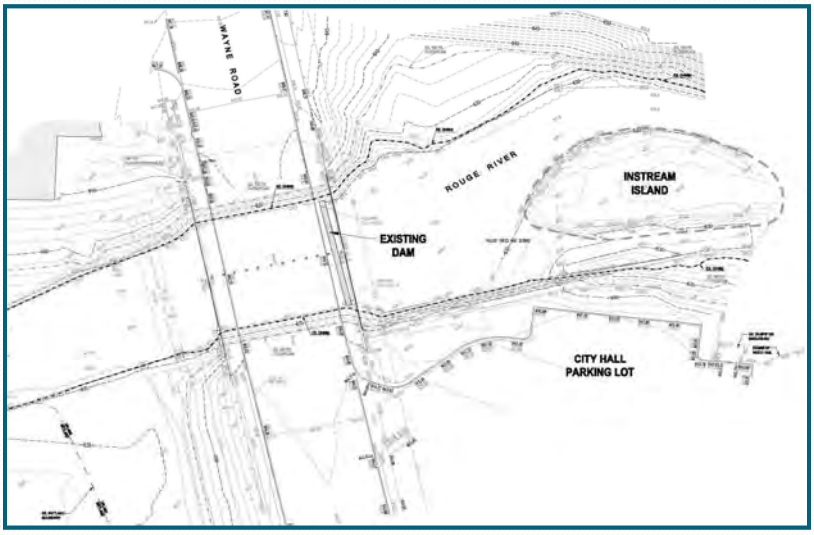
Design- Existing Conditions



Existing Conditions

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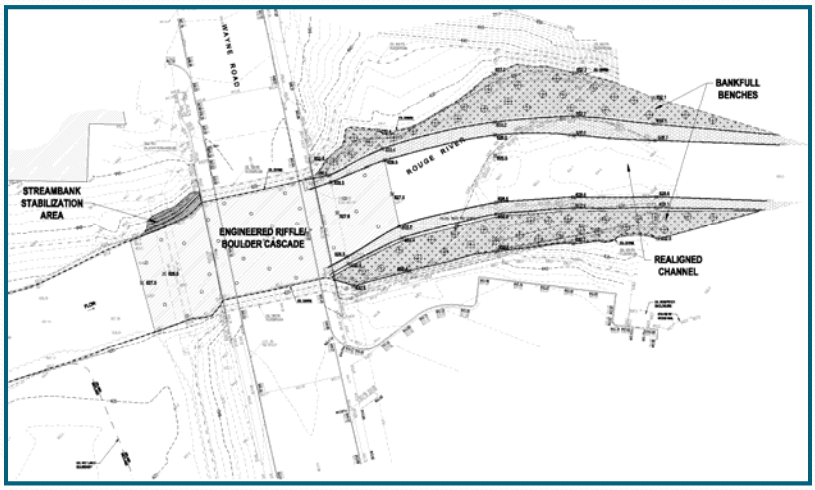
Design- Proposed Conditions



Proposed Conditions

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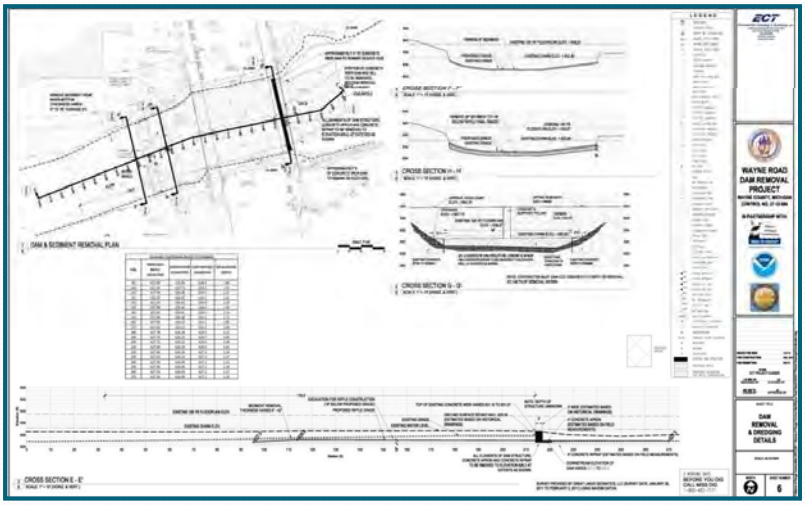
Design- Sediment Removal and Dam Removal



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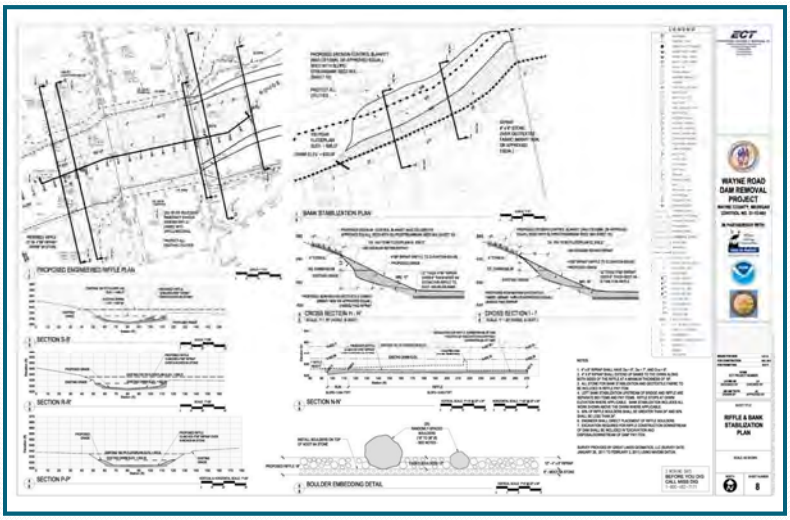
Design- Riffle and Bank Stabilization



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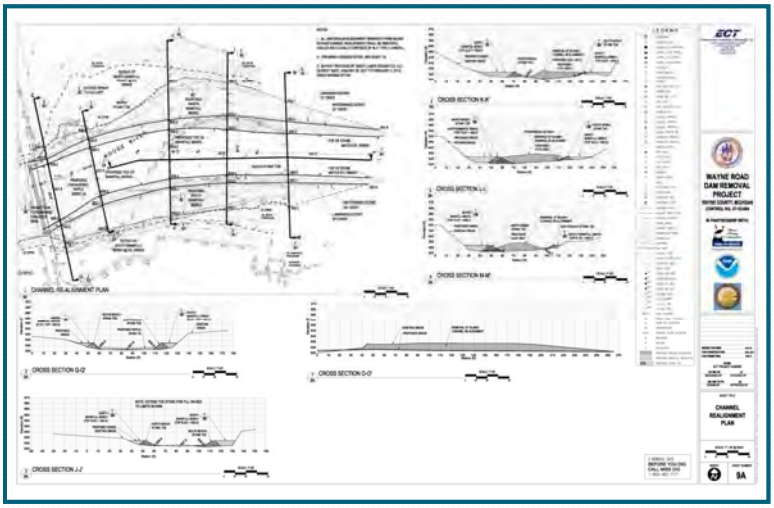
Design- Island Removal and Channel Realignment



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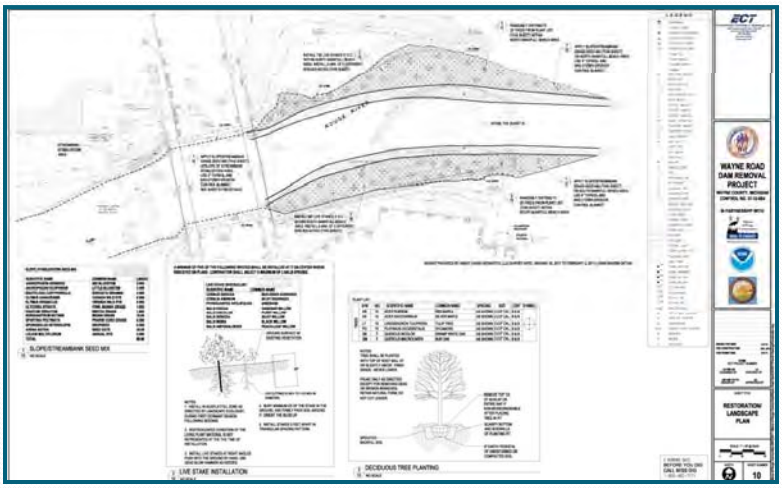
Design- Revegetation Plan



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Implementation

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Implementation- Site Prep

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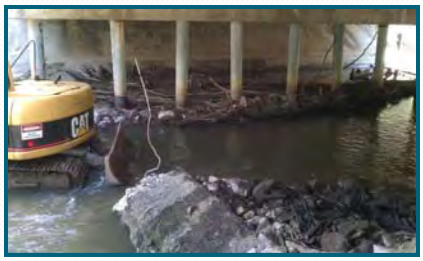
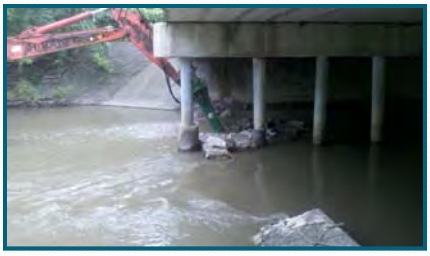
Implementation- Dam Demolition





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Implementation- Sanitary Siphon

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Implementation- Riffle

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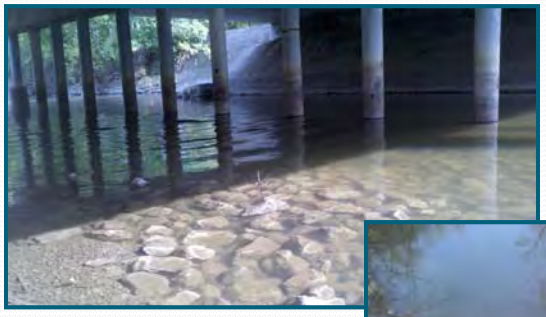
Implementation- Riffle



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Implementation- Rock Toe

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Implementation- Rock Toe and Bankfull Benches




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Implementation- Rock Toe and Bankfull Benches



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Implementation- Island Removal

Island removal occurred concurrent with bankfull bench construction.

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Implementation

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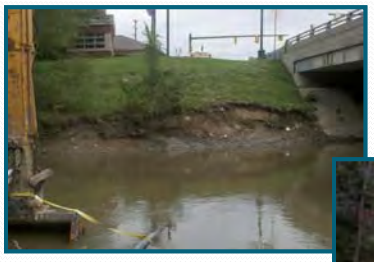
Implementation- Bank Stabilization



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Implementation- Bank Stabilization

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Implementation- Planting

Alliance of Rouge Communities
OURS TO PROTECT
Working together, restoring the river

September 20, 2011

PRESS RELEASE

Contact:
James W. Ridgway
Executive Director, Alliance of Rouge Communities
313-410-6504

Alliance of Rouge Communities receives $1 million to restore fish passage in the Lower Rouge River

A major environmental project in the City of Wayne is another step toward the full restoration of the Rouge River.

The Alliance of Rouge Communities (ARC) has received a $1 million federal grant to remove the Wayne Road Dam in the City of Wayne and restore the fishery in the Lower Rouge River. The two-year grant was awarded to the ARC by the National Oceanic and Atmospheric Administration (NOAA), which provides financial and technical assistance to remove dams and barriers, construct fish passage, clean up marine debris, restore coastal wetlands, and remove invasive species in the region.

The Wayne Road Dam Removal and Habitat Improvement Project will restore fish passage for migratory species such as salmon, walleye, northern pike and small mouth bass, while stabilizing and improving shoreline habitat. The project will also reconnect 22 miles of the Lower Rouge River with the Great Lakes. The Wayne Road Dam was identified by the Michigan Department of Natural Resources as a major impediment to restoring fish and wildlife habitat in the Rouge River's Lower Branch. The Lower Branch of the Rouge River begins in Superior Township and flows through such communities as Canton Township, Wayne, Westland, Inkster, Dearborn Heights and Dearborn.

"Over the past twenty years, the restoration of the Rouge River is simply unbelievable," said James Ridgway, ARC Executive Director. "This project is yet another example of how the Rouge Communities can work miracles when they work together for the betterment of our river. The people of the City of Wayne and all of the residents of the Rouge Watershed are lucky to have the type of leadership willing to take the long view and continue to improve our quality of life, one project at a time."

Partners working with the ARC on this project are Wayne County, the City of Wayne, Friends of the Rouge and the Rouge RAP Advisory Council. The Wayne Road Dam project is the latest in a series of projects conducted by local communities and Wayne County to improve water quality and restore habitat and recreational uses in the Rouge River's Lower Branch. Those projects include the Rouge Recreational Trail in Canton Township, five acres of native prairie being installed in Wayne County's Lower Rouge Parkway, and the City of Dearborn's habitat

restoration in Ford Field and sewer separation projects to reduce the amount of untreated sewage going to the Rouge River.

The Alliance of Rouge Communities (ARC), a 501(c)(3) voluntary public watershed entity currently comprised of 35 municipal governments, Wayne, Oakland and Washtenaw counties and Henry Ford Community College. The purpose of the ARC is to provide an institutional mechanism to encourage watershed-wide cooperation and mutual support to meet water quality permit requirements and more importantly, to restore beneficial uses of the Rouge River to the area residents.

The ARC grant is one of eight projects funded with $5 million in NOAA grants to support habitat restoration throughout the Great Lakes Areas of Concern. NOAA's Restoration Center is funding three shovel-ready projects and five engineering and design projects. This allows NOAA to support both current efforts to restore the Great Lakes as well as future projects that, once implemented, will have significant benefits to Great Lakes restoration.

WAYNE ROAD DAM REMOVAL AND RIVER RESTORATION

November 2010 – July 2013

Rouge Program Office (RPO) Round X Grant:	**$ 57,500**
RPO Round X Required Match:	**$ 57,500**
National Oceanic and Atmospheric Administration (NOAA) Grant:	*$1,033,536*
Total Project Cost:	**$1,148,536**

Removing the Wayne Road Dam is one of the most important dam removal projects in the Rouge River Watershed.

- The MDNR 1998 Fisheries Assessment identified the Wayne Road Dam as a major impediment to restoring fish and wildlife habitat in the Rouge River. Removing the dam would reconnect the Rouge River to the Detroit River and the Lake Erie ecosystem.
- Removal of the Wayne Road Dam was also a priority project for the Rouge RAP Advisory Council in order to implement the 2008 Delisting Targets for Fish and Wildlife Habitat and Population Beneficial Use Impairments for the Rouge River Area of Concern.

Wayne Road Dam (City of Wayne, Wayne County)

The Wayne Road Dam is located in the City of Wayne and on the Lower Branch of the Rouge River which flows through Superior, Salem, Canton, Van Buren and Plymouth townships and the cities of Wayne, Westland, Romulus, Garden City, Inkster, Dearborn Heights and Dearborn before joining the Main Branch of the Rouge River. The river hosts a variety of fish in the vicinity of the dam, including trout in upstream areas and a variety of warm water species. (e.g., smallmouth bass, northern pike, walleye, sunfish) downstream of the dam.

The MDNR 1998 Fisheries Assessment suggested that removing or providing fish passage at this site would be extremely helpful in enhancing fish communities in the Lower Rouge River by reconnecting the Rouge to the Detroit River and Lake Erie ecosystem. Removal of the Wayne Road Dam would reconnect approximately 17 miles of river to the Great Lakes system for the first time in over a century.

The draft Rouge River Watershed Management Plan (2008) was more direct. A discussion of impairments in the Lower 2 Subwatershed section stated that the size and diversity of the fish community in the Lower 2 Subwatershed is constrained by the dam at Wayne Road which prevents fish passage within the subwatershed and from Lake Erie.

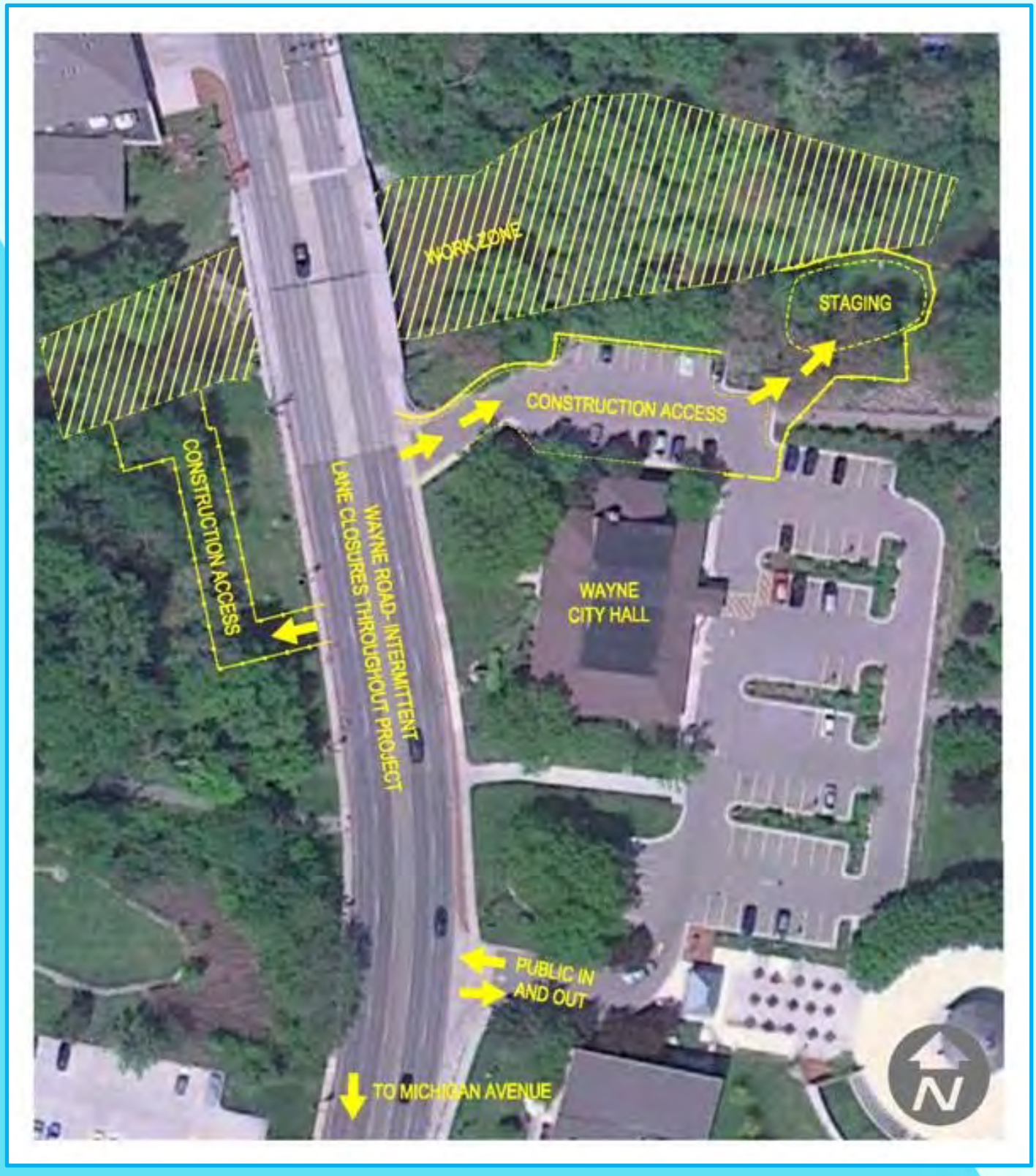
Under the RPO Round X Grant an Engineering Design and State MDEQ Permit was completed. Construction and monitoring of the project will be completed under the NOAA Grant. The project will remove the dam and restore fish passage. In addition to the removal of the dam the project removes an instream island downstream of the dam and reconstructs a more stable single flow channel with bankfull benches, installs an engineered riffle/boulder cascade to protect existing infrastructure and facilitate fish passage, and provides for bank stabilization.

For More Information Contact:

Alliance of Rouge Communities
James Ridgway, P.E., Executive Director
719 Griswold St., Suite 820, Detroit, Michigan 48226

Phone: 313-963-6600
Email: info@allianceofrougecommunities.com
Website: www.allianceofrougecommunities.com

Construction Plan for Wayne Road Dam Removal



Alliance of Rouge Communities
OURS TO PROTECT

Happy day: Wayne celebrates dam removal

By LeAnne Rogers
Staff Writer

A ribbon-cutting ceremony to officially celebrate removal of the Wayne Road dam and habitat restoration in that section of the Rouge River was held Friday morning.

To highlight the new navigability of the Rouge River in Wayne, Mayor Al Haidous ceremonially arrived by canoe.

"This is the first time I've introduced someone who has arrived by canoe," said James Ridgway, executive director of the Alliance of Rouge Communities.

Canoeing, kayaking and fishing are activities Wayne officials are hoping to see a lot of as restoration of the river and wildlife habitat continues.

"This is a happy day in the City of Wayne. It's the beginning of new hope to make the city a destination for recreation," said Haidous. "We've been dreaming of this day for so long."

The multi-year $1.14 million project reconnects 11 miles of the Lower Rouge River and 110 miles of tributary streams to the Detroit River and the Lake Erie ecosystem. It had been approximately 100 years since the Lower Rouge had been connected barrier-free with the Great Lakes system.

BILL BRESLER | STAFF PHOTOGRAPHER

The ceremonial ribbon is cut by Wayne City Council member Jim Hawley, County Executive Robert Ficano, Wayne City Manager Robert English, Wayne Mayor Al Haidous, Executive Director of the Alliance of Rouge Communities Jim Ridgway, Westland DPS Director Kevin Buford, U.S. Rep. John Conyers, City Council members John Rhaesa and Pam Dobrowolski, Westland Mayor Bill Wild and John Bratton of NOAA.

NOAA grant

Largely funded by a National Oceanic and Atmospheric Administration grant, the project removed a 1917 dam underneath Wayne Road as well as a 40-foot man-made island located in the river a short distance downstream.

Once the island and the dam, used to help pump the city's water, were removed, the river bed and banks were restored. Fish tagged and released downstream are already being seen in the Wayne section of the Rouge River.

Friends of the Rouge Board member Adam Cloutier with daughters Ellleana, 5, and Graycee, 3, take the new stairs that lead down to the river.

It's a project that involved county and local officials, as well as regional and community groups. Elected officials and staff who worked on the dam removal project were presented with commemorative pieces of the dam.

Efforts are underway by the Friends of the Rouge, the local communities and Wayne County to establish the Lower Rouge Water Trail which will connect with the Rouge Water Trail and the Detroit River Heritage Water Trail.

The Lower Branch of the Rouge River flows through Superior and Canton townships and the cities of Wayne, Westland, Inkster, Dearborn and Dearborn Heights.

The idea about removing the dam had been around for about a decade before coming to fruition. Haidous brought the concept to Wayne County Executive Robert Ficano a number of times.

"Bob Ficano may have wondered what this guy was talking about," said Haidous. "The river was blocked and polluted."

'Mr. Rouge'

Haidous cited the efforts of local Rouge Rescue coordinator Kurt Kuban - Hadious calls him Mr. Rouge - with getting people involved locally with cleaning up the river.

On the day that U.S. Rep. John Dingell, D-Trenton, officially became the country's longest serving congressman, Haidous said he especially wanted to thank him for helping get the city $14 million to pay for most of the unfunded federal mandate to get sewage out of the river.

"Without him, this project would not be reality," said Haidous.

Removal of the dam and restoration of the wildlife habitat on the Rouge River was definitely the vision of a number of partners, said Ficano.

"I didn't think you (Haidous) were completely crazy when you kept saying you wanted canoeing on the river," said Ficano. "Who thought 20 years ago that we would be talking about fishing and canoeing on the Rouge River? It's something of a small miracle."

Not too many years ago the only goal relating to the Rouge River was removing sewage, said Kevin Buford, Westland Department of Public Services director and chairman of the Alliance of Rouge Communities.

"Now we are opening the Lower Rouge to Great Lakes fish with the dam removal. It had been a barrier for years," said Buford. "In 1992, no one was thinking of recreation on the river - it was a distant hope for canoeing, fishing and recreation."

For Wayne, the hope is that the river will attract not only visitors but new residents and help spur a revitalization of the community.

WAYNE ROAD DAM REMOVAL

Alliance of Rouge Communities
OURS TO PROTECT
Working together, restoring the river

Great Lakes RESTORATION
Grant #: NAIINMF4630146

Friends of the ROUGE

July - August 2012

Removal of log jams.

Clearing operations.

Lowering of water level at the dam by notching the dam.

Removal of the dam sill.

September 2012

The rock for the riffle was placed under the bridge. A 6" thick layer of smaller stone was placed first and overtopped by larger rock.

Sand bankfill was placed behind the stone toe. Geotextile fabric was used between the stone toe and the sand backfill.

Storm pipe was installed at existing outfall to extend the pipe through the proposed bankfull bench to the stream channel.

A portion of the existing island was excavated. It was eventually completely removed.

October 2012

Bankfull bench construction view looking upstream towards bridge

Work continued on the bankfull benches downstream of the bridge

With the construction of the north bankfull bench, two storm sewer extensions and outlets were installed.

Directional drill equipment mobilized on the north bank, upstream of the bridge.

November 2012 - May 2013

Tree planting locations were flagged prior to installation

With tree planting complete, seed was placed and erosion control blanket was installed on the bankfull benches. Then, live stakes were installed.

Concurrently with the tree, erosion control blanket and live stake installation, the in-stream boulders were placed.

Replacing parking lot.

APPENDIX C

WAYNE ROAD DAM REMOVAL MONITORING REPORT

Wayne Road Dam Removal Monitoring Report

NOAA Grant Number: NA11NMF4630146

September, 2013

Project Partners:

Alliance of Rouge Communities
OURS TO PROTECT
Working together, restoring the river

NOAA

Great Lakes RESTORATION

Rouge River Advisory Council
Restore & Protect

Wayne Michigan

Charter County of Wayne, Michigan

Friends of the Rouge

719 Griswold, Suite 820
Detroit, MI 48226
www.allianceofrougecommunities.com

TABLE OF CONTENTS

1. INTRODUCTION

1.1 PROJECT BACKGROUND

The Wayne Road Dam was identified as an impediment to free fish movement in the Lower Rouge River by the Michigan Department of Natural Resources in a 1998 Fisheries Assessment and the 2008 Rouge River Watershed Management Plan (2008). Removal of the dam was also identified as a priority project by the Rouge Remedial Action Plan Advisory Council for delisting beneficial use impairments (the dam is located in the Rouge River Area of Concern). Dams are known to restrict Great Lakes potadromouos fish species migrations upstream to natal spawning habitat and restrict resident fish access to important habitat types located upstream or downstream of a dam. The Alliance of Rouge Communities was awarded a grant by the National Oceanic and Atmospheric Administration (NOAA) under the Great Lakes Restoration Initiative funding in to remove the dam. Engineering, design, and permitting were completed under a grant from the Rouge River Program Office under the Rouge River Wet Weather Demonstration Project.

Removal of the dam and restoration of the Lower Rouge River began in July 2012 and was completed in November 2012. The dam was completely removed to grade after sediment was excavated from the upstream side of the dam. Due to the presence of utilities under the riverbed upstream and downstream of the dam, a rock riffle was constructed over the bed using 18 inches of gravel and cobble. A large sediment island located downstream of the dam was removed and the channel was reconstructed to bankfull dimensions as a single channel, including bankfull floodplain benches on both sides of the channel. The restored reach was located in a gentle meander, so the channel cross-section was designed as a scour pool.

1.2 MONITORING OVERVIEW

1.2.1 NOAA FUNDED PRE- AND POST-CONSTRUCTION MONITORING.

River morphology was surveyed at multiple cross-sections, macroinvertebrates were collected, and fish were collected before and after dam removal. The purpose of monitoring was to verify fish passage and study fish and maroinvertebrate community response to dam removal and channel restoration. This report presents the methods and results used during monitoring.

2. METHODS

2.1 FISH COMMUNITY

Fish were collected from the Lower Rouge River at six river reaches, three of which were sampled prior to and after dam removal in 2012. An additional three reaches were sampled in 2013 after dam removal to better understand project effects on the Lower Rouge River. Fish were collected at all stations and during all sampling events using a Smith-Root GPP5.0 and shore fishing equipment mounted on a tote barge with one exception: electrofishing was not possible upstream of the dam prior to removal due to the lack of boat access and water depth that prevented wading. Two mini-fyke nets and two large fyke nets were deployed upstream of the dam prior to removal in an attempt to assess the fish community within that river reach. The nets were set in the middle of the river with leads perpendicular to flow and the shoreline, facing opposite directions, and approximately 200 to 250 feet between nets. Collected fish were placed in holding tanks located on the tote barge, counted, identified to species, and released. Due to the length of river sampled and number of fish captured, fish were processed two or more times within a sampling reach depending on the number of fish captured.

2.1.1 SAMPLING REACH DESCRIPTIONS

Prior to removal of the Wayne Road Dam, fish were collected at three reaches to establish baseline conditions. An upstream (Reach 1) and downstream reach (Reach 6) were selected as reference stations because they contained representative lotic habitat are located beyond the influence of the dam. The middle location, Reach 2, was within the impounded reach of Lower Rouge River upstream of the Wayne Road Dam; it represented ecological responses to immediate impact from the project activities. Three additional sampling reaches were chosen to assess changes in fish community structure following the removal of the Wayne Road Dam. Two of the reaches were sampled because the habitat was directly altered by the restoration work. A third station was sampled immediately downstream of the project reach for comparison. The locations of all six sampling reaches are shown in Figure 1 and described below.

Reach 1: Located upstream of the project site (upstream site from pre-monitoring). Transect length was approximately 600 ft due to an impassible log jam at the upstream end up the reach.

Reach 2: This site was located upstream of the constructed riffle where the previous dam was located. The sampling reach began at the upstream end of the start of the riffle and ended approximately 600ft upstream due to the presence of an impassible log jam.

Reach 3: This reach was located within the riffle constructed under Wayne Road following removal of the Wayne Road Dam from its downstream to upstream limits and from embankment to embankment.

Reach 4: This sampling reach began at the downstream end of the constructed riffle and ended at the downstream end of the project site where stream channel realignment and restoration ended.

Reach 5: This reach began at the downstream end of the project site and ended at the 2nd Street Bridge.

Reach 6: This reach is located downstream of the project site (downstream site from pre-monitoring). Transect length was between 800-900 ft, due to an impassible log jam located at the upstream end of the reach.

2.1.2 SAMPLING DATES

Prior to dam removal fish were collected at Stations 1 (upstream reference station), 2 (impounded reach immediately upstream of the dam), and 6 (downstream reference station) on April 5, 2012 , and April 19, 2012, and April 4, 2012 respectively. After dam removal fish were collected at all six stations on April 23, May 2, and May 10, 2013.

2.1.3 DATA ANALYSIS AND STATISTICS

The following data analyses and statistics will be used to evaluate changes and differences in fish community structure pre- and post-removal and between sampling reaches. Fish community diversity (Shannon-Weiner index), species richness (number

of species), catch-per-effort, and species composition will be determined to compare the fish community of the historic channel before and after dam removal. Similarity between the pre- and post-construction historic channel fish communities will be evaluated using Sørensen's similarity index. The equations that will be used to calculate each of these community indices or metrics provided below.

Shannon-Wiener index of Diversity $H' = -\Sigma p_i \log p_i$

Where:

H' Shannon-Wiener Index

pi proportion of species i

Catch per Effort $CPE = \frac{n}{T}$

Where:

CPE catch per effort (#/minute)

n total number of individuals or sample size (catch)

T sampling time in minutes (effort)

Species Composition $SC_i = \frac{n_i}{n}$

Where:

SCi species composition of species i

ni number of species i

n total number of individuals or sample size

Sørensen's Similarity Index $\beta = \frac{2c}{n_1 + n_2}$

Where:

β Sørensen's Similarity Index (0-1, dimensionless)

c number of species common between sample stations

n1 number of species in station 1 sample

n2 number of species in station 2 sample

The Shannon-Wiener diversity index has been used extensively in the scientific literature to evaluate the difference in biological diversity over time or between sampling stations/treatments. Hutcheson (1970) is credited with developing a t-test for the Shannon-Wiener Index as noted and cited by Poole (1974) and Magurran (2004). The variance of the Shannon-Wiener index (varH'), degrees of freedom (df), and t-statistic are calculated using the equations below from Hutcheson (1970). Hutcheson's t-test for the Shannon-Wiener Index will be used with α=0.10 to test for statistically significant differences between the pre- and post-construction fish community diversity and between sampling reaches.

Variance $$\operatorname{var} H' = \frac{\Sigma p_i \ln^2 p_i - \left(\Sigma p_i \ln p_i\right)^2}{n} + \frac{s-1}{2n^2}$$

Where:

varH' variance of the Shannon-Wiener Index (H')

pi proportion of species i

ln natural log

s number of species

n number of individuals of all species

t-Statistic $$t = \frac{H'_1 - H'_2}{\left[\operatorname{var} H'_1 + \operatorname{var} H'_2\right]^{1/2}}$$

Where:

varH'1 variance of the Shannon-Wiener Index (H') for community 1

varH'2 variance of the Shannon-Wiener Index (H') for community 2

n1 number of individuals for community 1

n2 number of individuals for community 2

Degrees of Freedom $$df = \frac{\left[\operatorname{var}\left(H'_1\right) + \operatorname{var}\left(H'_2\right)\right]^2}{\left[\operatorname{var}\left(H'_1\right)^2 / n_1\right] + \left[\operatorname{var}\left(H'_2\right)^2 / n_2\right]}$$

Where:

H'1 Shannon-Wiener Index for community 1

H'2 Shannon-Wiener Index for community 2

varH'1 variance of the Shannon-Wiener Index (H') for community 1

varH'2 variance of the Shannon-Wiener Index (H') for community 2

The Shannon-Wiener Index and statistical testing described above can show a significant difference between communities at station or over time (i.e. pre- to post site restoration) based on taxonomic diversity. However, the index cannot adequately characterize the difference or quantify the magnitude of the difference. To further evaluate differences and change within fish communities of the historic channel before and after dam removal, the other community indices proposed and a conversion of the Shannon-Wiener Index will be used as described below.

When the number of species in a community doubles, the community diversity intuitively doubles. This is not the case with the Shannon-Wiener Index, which is highly non-linear. A very large change in true diversity within a community can be represented by a very small change in the Shannon-Wiener Index, thereby masking the true magnitude of the change. Banos (2006) suggests a means of converting the Shannon-Wiener Index from a measure of entropy to a true measure of diversity expressed as the "effective number of species." The effective number of species is the number of species with equal frequency that would result in a Shannon-Wiener index of a certain value. Banos (2006) equates it to true diversity. Mathematically, Banos (2006) defines the effective number of species as the exponential of the Shannon Index [exp(H') or eH'; the base of the natural logarithm raised to the power of H']. The effective number of species is proportional to the number of equally common species in a community. If the number of equally common species in a community doubles, the measure of diversity used should also intuitively double.

As the Shannon-Wiener index measures it, diversity is high when there is a high number of species in the community with high equitability (i.e. evenness). Therefore, a high effective number of species equates to high diversity and vice-versa. It is useful to convert the Shannon-Wiener index to the effective number of species because it allows an assessment of the magnitude of difference/change in addition to the statistical significance of that difference/change when used to compare two communities or compare diversity over time in response to a change/disturbance/experimental treatment within a system.

Species composition will be used as a side-by-side comparison of fish assemblages. That is, the percent composition or abundance for all species between two communities will be compared side-by-side to illustrate compositional differences in the communities. Consideration of habitat preferences and species rarity/absence will be considered in the analysis to highlight differences in the communities that could be attributed to the effects of dam removal on aquatic habitat within the historic channel.

Sørenson's Similarity Index will be used to assess similarity between communities. Sorenson's provides an estimate of the percent similarity between species assemblages based on presence-absence data. More overlap in species between two communities will result in a higher index value, meaning the two communities are similar. Two communities with the same species assemblage will be 100% similar (i.e. index value of 1).

2.2 MARK-RECAPTURE

Sucker species (Catostomidae) were used as representative and important fish species to assess fish passage. Some sucker species are potadromous (migrate from large fresh water bodies into rivers to spawn) while others are resident (spend their entire lives in the river system). Suckers are an important ecological species and provide a recreational sport fishery. Suckers do not jump and have poor swimming ability similar to other warm water species such as walleye and bass. Consequently, they are not able to navigate barriers like the Wayne Road Dam.

The anal fin was clipped on all sexually mature suckers captured downstream of the dam prior to construction. This method creates a distinct mark that allows fish captured prior to dam removal to be identified after dam removal. After the dam was removed all suckers captured upstream of the dam were inspected for the anal fin clip. Capturing a fin-clipped sucker upstream of the dam after removal would indicate that fish in the Lower Rouge River can freely move from downstream reaches to upstream reaches and vice-versa.

2.3 MACROINVERTEBRATE COMMUNITY

Macroinvertebrates were collected from the constructed riffle located at the former dam site using methods described in Michigan's Procedure 51, a macroinvertebrate index of

biological integrity (IBI). The IBI was not used, however, as sampling was biased by collecting from a riffle habitat only. However, the sampling method was used to standardize sampling effort. The riffle was sampled for 60 minutes using a D-frame dip net with a 500 micron net to capture macroinvertebrates dislodged from rocks and debris found in the riffle. Organisms were dislodged by kicking finer substrates and hand-wiping rock surfaces while the dip was held downstream. Rocks were also removed from the riffle and hand-picked for organisms. Samples were preserved in 80% denatured ethyl alcohol for later identification. Merrit and Cummins (1996) and Voshell (2002) were used as necessary to sort and identify organisms to the family level.

The Wayne County Water Quality Management Division (WQMD) conducts annual macroinvertebrate monitoring in the Lower Rouge River watershed. This ongoing monitoring effort was used to assess project results. Two monitoring sites, within the Rouge River Lower 2 sub-watershed are located near the dam removal project: LR-6 (Woody Debris Management 201 site) is immediately upstream of the dam removal project and LR-3 is downstream of the project at Goudy Park. Benthic macroinvertebrate collection, record keeping and water quality ratings were performed in accordance with procedures established by the Michigan Clean Water Corps (MiCorps) and Friends of the Rouge (FOTR). Through these procedures a Stream Quality Index (SQI) is determined by the number and type of different organisms found in the sample. A higher proportion of sensitive organisms such as mayflies and caddisflies and or a high number of different organisms results in a higher score. The SQI is given a rating: a score >48 is Excellent, 34-48 is Good, 19-33 is Fair, and <19 is Poor. Prior to dam removal macroinvertebrates were collected at both stations on April 25, 2012. Following dam removal macroinvertebrates were collected at both stations on May 1, 2013.

2.4 MORPHOLOGY

Thirty cross-sections were surveyed by a Registered Land Surveyor prior to removal of the dam. The pre-removal cross-section data were used to develop a hydraulic model using HEC-RAS, to determine morphological dimensions of the channel, determining the bed slope, and for developing construction drawings. Fifteen of those cross-sections were resurveyed following dam removal. Figure 2 shows the location of the cross-sections that were chosen for post-removal surveying and monitoring. Cross-sections were chosen to represent boundary conditions upstream and downstream of the project

and based on expected outcomes. Cross-sections were also chosen to represent the project area where direct alterations were made and where indirect changes were possible both upstream and downstream of the project. Pre-removal and post-removal cross-section data were plotted in Microsoft Excel and visually compared.

3. RESULTS

3.1 FISH COMMUNITY

3.1.1 PRE-REMOVAL FISH COLLECTION SUMMARY

Pre-construction catch data are summarized in Table 1. The total fishing effort was 75 minutes of electrofishing and four net-nights, resulting in capture of 205 fish representing 18 species. White sucker, creek chub, and emerald shiner were the most frequently captured species. Results for reach pre-removal reach are discussed below.

3.1.1.1 Reach 1, Upstream Reference Site

The upstream reach (Reach 1) was located at the CSX railroad crossing located approximately 1.1 miles upstream of Wayne Road and continued upstream from the railroad. The sampling effort was seperated into two sections shocked individually to decrease fish holding times and reduce fish stress. The reach was shocked a total of 27 minutes with a catch per unit effort (CPUE) of 2.44 fish per minute. A total of 67 specimens were collected representing 9 species. The dominant species were creek chub (37%) and white sucker (13%).

3.1.1.2 Reach 6, Downstream Reference Site

The sampling effort within downstream reach (Reach 6) was divided into four separate sections which were shocked individually to decrease holding times and reduce fish stress. The reach was shocked a total of 47 minutes yielding a catch per unit effort (CPUE) of 2.78 fish per minute. During this time, 132 specimens were collected, representing 18 species. The dominant species were white sucker (Catostomus commersonii, 27%), emerald shiner (Notropis atherinoides, 27%), and creek chub (Semotilus atromaculatus, 17%). Nine white suckers and one northern hogsucker (Hypentelium nigricans) were fin clipped prior to release.

3.1.1.3 Reach 2, Impounded Reach

The impounded site (Reach 2) could not be sampled with electrofishing gear due to poor access and deep water. Fyke nets were used instead. Of the four fyke nets deployed, only the 2 large fyke nets captured fish. A total of six specimens were collected representing five species. The species collected were creek chub, bluegill (Lepomis macrochirus), fathead minnow (Pimephales promelas), green sunfish (Lepomis cyanellus), and white sucker.

3.1.2 POST-REMOVAL FISH COLLECTION SUMMARY

Post-removal catch data are summarized in Table 2. Total post-monitoring fish sampling time was 97.25 minutes resulting in capture of 490 individuals representing 27 species, and a CPUE of 5.04. The dominant species collected during post-removal sampling were white sucker (34%), gizzard shad (16%), and striped shiner (9%). There were three species not collected during post-removal sampling that were collected during pre-removal sampling: goldfish (Carassius auratus), longnose dace (Rhinichthys cataractae), and smallmouth bass (Micropterus dolomieu). Conversely, there were 11 species collected after removal that were not collected before removal: black bullhead (Ameiurus melas), bluntnose minnow (Pimephales notatus), bowfin (Amia calva), common carp (Cyprinus carpio), central mudminnow (Umbra limi), gizzard shad, logperch (Percina caprodes), northern pike (Esox Lucius), quillback carpsucker (Carpoides cyprinus), spottail shiner (Notropis hudsonius), and striped shiner.

3.1.2.1 Reach 1, Upstream Reference Reach

Reach 1 sampling resulted in capture of 77 individual fishes representing 14 different species were collected at the upstream reach (Reach 1) on May 2, 2013. The area was sampled for 29 minutes resulting in a CPUE of 2.65 fish per minute. The most frequently collected species by number included white sucker (Catasomus commersonii, 21%), fathead minnow (Pimephales promelas, 18%) and pumpkinseed (Lepomis gibbosus, 17%).

3.1.2.2 Reach 2, Former Impounded Reach

A total of 46 individuals were collected representing 11 species on April 23, 2013. The reach was sampled for 14 minutes resulting in a CPUE of 3.32 fish per minute. The dominant species collected were white sucker (65%), with creek chub (Semotilus

atromaculatus) and gizzard shad (Dorosoma cepedianum) making up a very small percentage of the next abundant species (6.5% combined). One white sucker with a fin clip was captured within this upstream reach, indicating potadromous fish species within the Rouge River are capable of migrating through the constructed riffle and confirm that the project fish passage objective has been achieved.

3.1.2.3 Reach 3, Constructed Riffle

This sampling reach was sampled on two separate occasions, on April 23 and May 10, 2013. The reach was divided into left and right sides (in relation to the bridge pilings) and catch data were combined, both sampling sides and days. A total of 113 individuals representing 20 species (the highest species diversity for all sampling reaches) were collected with a CPUE of 3.33 fish per minute. The dominant species collected were white sucker (28%), gizzard shad (17%), green sunfish (Lepomis macrochirus) and pumpkinseed (11%). There were two species collected that either had the highest abundance in this reach or were only found within this reach, both of which have an affinity for riffle habitat. There were seven central stonerollers collected within this reach, which was the highest amount collected than any other reach. Also, this reach contained the only Johnny darters collected during post-monitoring sampling.

3.1.2.4 Reach 4, Downstream of Riffle

A total of 44 individuals representing 7 different species were collected just downstream of the project riffle to the end of the project area on May 10, 2013. The dominant species collected within this area were gizzard shad (36%), white sucker (30%), green sunfish and pumpkinseed (11%). The reach was sampled for approximately 7.3 minutes with a CPUE of 6.06 fish per minute.

3.1.2.5 Reach 5, Downstream of Project Site

This sampling reach was sampled on May 10, 2013 for approximately 12 minutes with a CPUE of 3.80 fish per minute. A total of 47 individuals were collected representing 11 different species. The dominant species collected were gizzard shad (34%), white sucker (15%), green sunfish and pumpkinseed (11%).

3.1.2.6 Reach 6, Downstream Reference Reach

This sampling reach was sampled on May 2, 2013 and was separated into 2 separate reaches to reduce holding times for fishes. Results were then combined. A total of 163 individuals were collected representing 13 different species. The reach was sampled for a total time of approximately 38 minutes with a CPUE of 4.27 fish per minute. The dominant species collected at this site were white sucker (42%), striped shiner (Luxilus chrysocephalus, 20%), and gizzard shad (13%).

3.1.3 DISCUSSION

Table 3 provides a list of species captured in the pre- and post-removal sampling. There were three species not collected during post monitoring sampling that were collected during pre-monitoring sampling: goldfish (Carassius auratus), longnose dace (Rhinichthys cataractae), and smallmouth bass (Micropterus dolomieu). Conversely, there were 11 species collected during post monitoring that were not collected during pre-monitoring sampling: black bullhead (Ameiurus melas), bluntnose minnow (Pimephales notatus), bowfin (Amia calva), common carp (Cyprinus carpio), central mudminnow (Umbra limi), gizzard shad, logperch (Percina caprodes), northern pike (Esox Lucius), quillback carpsucker (Carpoides cyprinus), spottail shiner (Notropis hudsonius), and striped shiner. Post removal sampling resulted in capture of 27 species versus just 18 species during pre-removal sampling.

In 2013, the constructed riffle located at the former dam site contained the highest species richness (20) of all sites sampled (Table 2). At this site, two species which have a high affinity for riffle habitats were found in the constructed riffle: three Johnny darters and seven central stonerollers. More central stonerollers were captured in the constructed riffle than any other reach sampled both pre- and post-removal. The constructed riffle and the former impounded site combined had 21 species and 159 individuals (catch per unit effort CPUE 3.33 fish per minute), which is more species rich but comparable in terms of individual numbers as the downstream reference reach (Reach 6).

Prior to dam removal Reach 6 had a higher Shannon-Wiener index than Reach 1 with an effective number of species 1.4 times higher (Table 4). However, after dam removal Reach 1 had a higher diversity index with an effective number of species 1.6 times

higher. Based on Hutcheson's t-test, the differences in diversity between the reaches both pre- and post-removal is significant (Table 5). This is likely due to the variance in habitats present at each site as well as seasonal differences in fish utilization (e.g., differences in spawning times for some species) and weather patterns in 2012 versus 2013.

The pre- and post-removal fish community at Reach 1 and 6 were also significantly different based on the Shannon-Wiener diversity index and Hutcheson's t-test (Table 5). The effective number of species in Reach 6 decreased from 7.92 to 5.85 from pre- to post-removal (Table 4). The Reach 1 effective number of species increased from 5.51 to 9.43. It is possible that the upstream reference station fish community became more diverse as a result of greater connectivity with downstream habitats. However, sampling cannot explain the decrease in diversity in Reach 6. Removal of the dam should not have caused the decrease in diversity.

Sites directly affected by the removal of the dam (Reaches 2, 3, and 4) also differed from one another in diversity during post-construction monitoring (Tables 4 and 5). Despite this, results from the Hutcheson's t-test for diversity showed that fish community diversity at three sampling reaches near the project site (Reaches 2, 4, and 5) were not significantly different from either the upstream or downstream reference site (Reach 1 or 6) (Table 5). However, Sorenson's index (Table 4) indicates that while the diversity between two of those stations is not significantly different, the fish communities are not very similar (index value well below 1.0). Interestingly, the post-removal diversity index of the former impoundment reach (Reach 2) was not significantly different than the reach just downstream of the constructed riffle (Reach 4), although the similarity index is low. Still, the similar diversities in Reach 2 and 4 suggests that fish movement was not impeded by the constructed riffle and the restored reach of the Rouge River contained suitable habitat for native fish species.

The effective number of species (eH'; true diversity) can be used to evaluate the magnitude of difference in diversity (Table 4). The highest effective number of species correlates to the highest Shannon-Wiener diversity and vice-versa. The fish community of the constructed riffle in Reach 3 was the most diverse reach sampled with an effective number of species of 10.39. The reach with the lowest diversity index and effective

number of species was the former impounded site (Reach 2) with 4.08. However, this may be a result of sampling after dam removal during the peak of the white sucker run, which accounted for 65% of the total catch. This is also evidenced by this site containing the lowest species evenness of all sites sampled (0.59).

3.2 MARK-RECAPTURE

One fin-clipped white sucker was captured upstream of the former Wayne Road Dam location in sampling Reach 2, the former impounded reach, on April 23, 2013 (Figure 3). The fish was fin clipped in 2012 in Reach 6, the downstream reference station prior to dam removal. Recapture of this marked fish upstream of the former dam location verifies that target fish species are now able to freely move within the Lower Rouge River.

3.3 MACROINVERTEBRATE COMMUNITY

A total of five different families of macroinvertebrates and two different mollusk families were collected from the constructed riffle (Table 6). The most abundant aquatic insect families were Chironomidae (77%) and Hydropsychidae (20%). The other three families collected were found in low abundance, comprising 1% or less of the total sample collection. Because a reference riffle was not available within the Rouge River, it is unknown if this riffle diversity is comparable to other natural riffles. The most abundant macroinvertebrate, Chironomidae, are typically considered to be pollution tolerant. Simuliidae (black fly) and Heptageniidae (mayfly) are considered to be moderately pollution tolerant. It is possible the lack of diversity found is a result of the poor water quality found within this section of the Rouge River and not because the constructed riffle lacked appropriate substrate. Regardless, the results indicate that the riffle is providing habitat for macroinvertebrates. As water quality continues to improve in the Lower Rouge River watershed, the riffle should become a productive macroinvertebrate habitat.

In the spring of 2013, a Michigan Clean Water Corps (MiCorps) stream quality index (SQI) was conducted at two sites within the project area, one directly upstream and one directly downstream of the constructed riffle at the former dam site. The SQI scores are rated as : >48 is Excellent, 34-48 is Good, 19-33 is Fair, and <19 is Poor. The upstream site went from a “poor” rating to a “fair” rating following removal of the dam (16 to 28),

and the downstream site remained at a “fair” rating following removal. The SQI rating, as quantified using macroinvertebrate data from this project, resulted in a score of 16 (Poor). While this number is lower than the previously mentioned scores, it falls within the long-term trend seen at either MiCorps station. Full results from the long-term SQI studies can be found in Appendix A.

3.4 MORPHOLOGY

Plotted cross-section data are presented as Figures 4 through 18. The channel cross sections were mostly unchanged at sites outside of the immediate project area, with the exception of XS2, XS3, and XS14. Bed elevations were similar pre and post-construction in these locations, however the channel has narrowed up at XS2 and migrated North at XS3, which is located in a meander bend. Differences in cross sectional shape at XS14 are likely due to a lack of data points in the pre-construction survey. Cross sections immediately upstream of the Wayne Road dam (XS4 – XS9) had minimal changes to the cross sectional geometry. Cross sections immediately downstream of the Wayne Road dam (XS10, XS11, and XS12) represent the portion of the river which was altered. Alterations included removal of an inner channel bar, construction of a floodplain bench, and installation of riprap bank stabilization measures. Cross-sections located at the boundaries of the surveyed area (Sites 1 and 15) did not see changes in cross section shape or bed elevation.

4. CONCLUSIONS

4.1 FISH COMMUNITY

Fish community results were inconclusive, but suggested that the fish community diversity upstream of the dam increased between 2012 pre-removal sampling and 2013 post-removal sampling. This increase could be due to greater connectivity to downstream reaches. The inconclusive results are due primarily to high variability between pre- and post-construction sampling results that is most likely caused by different habitat conditions and environmental conditions linked to weather patterns. Although sampling was conducted at the same time of year in 2012 and 2013, weather patterns were much different between the two years during and prior to the sampling periods. Therefore, the timing of spawning runs was different. In 2013, sampling was conducted during the peak of white sucker spawning activity, as indicated by the higher

numbers of white sucker captured (Table 1 and 2), particularly in Reach 6. The variability in sampling reaches, and from pre- to post-removal, was evident by the inconsistent similarities in fish community diversity: adjoining reaches were significantly different, but were not significantly different to one or more of the other reaches sampled (Table 5). These differences are not due to the dam removal, but due to differences and similarities in habitat and fish distribution at the time of sampling.

Nonetheless, fish community sampling revealed some important facts about fish abundance and distribution that do suggest the dam removal affected fish distribution. Most notably, the number of white sucker captured in Reach 1 (upstream reference reach) increased from 19 prior to dam removal to 68 after dam removal. Habitat in Reach 6 did not change after dam removal. Therefore, this result suggests that upstream white sucker movement was formerly restricted by the Wayne Road Dam. Following dam removal, white sucker preferentially moved upstream of the dam seeking habitat required for various life stages. Interestingly enough, the number of white sucker captured in Reach 6 (downstream reference) decreased from 36 prior to dam removal to 16 after dam removal. Again, those contrasting results suggest preferential upstream movement by white sucker.

While the fish community assemblages of Reaches 2 and 4 were not strongly similar based on Sorenson's similarity index, there were several species common to both reaches and the diversity index for the two Reaches were not significantly different during post-removal sampling. This result indicates that the channel realignment and restoration immediately downstream of the former dam location produced habitat preferred by fish and that fish were able to move freely between the two reaches.

The constructed riffle is an important component of the channel restoration following dam removal because it protects utilities and infrastructure, but also because it has the potential to provide an important type of habitat that is not abundant in the Lower Rouge River. Therefore, the riffle was sampled during post-removal monitoring. Sampling results demonstrate the high value of the created riffle habitat to fish of the Lower Rouge River. The Shannon-Wiener diversity index was higher than any other reach sampled; with a species richness of 20 and effective number of species of 10.39. In addition, two species with high affinity for riffle habitat, Johnny darter and central stoneroller, were

captured in the riffle. More stonerollers were captured in the constructed riffle than any other reach. In addition, 32 white sucker were captured in the riffle, a significant finding given white sucker were actively spawning in the river during the post-removal sampling. Monitoring results clearly show that the constructed riffle is providing important and valuable habitat for fishes.

4.2 FISH PASSAGE

Use of a mark-recapture technique successfully demonstrated that target fish species could freely move between downstream reaches and upstream reaches. A white sucker marked in 2012 downstream of the Wayne Road Dam in Reach 6 (downstream reference) was recaptured in 2013 after dam removal in Reach 2. Furthermore, the fish community diversity upstream of the dam in Reach 2 was similar to the diversity downstream of the dam in Reaches 4 and 5, although the assemblage was slightly different. This indicates that the improved habitat and access to Reach 2 (former impounded reach has improved and the number of species using habitat located immediately upstream of the dam has increased due to greater connectivity.

4.3 MORPHOLOGY

Channel cross-section surveys pre- and post-removal shows that headcutting and sedimentation have not occurred upstream or downstream of the former dam location. Dam removal can lead to deposition of sediment on the bed downstream of dams and erosion of the bed upstream of dams that results in formation of a headcut that propagates upstream. Appreciable decrease or increase in bed elevations were not observed at any of the cross-sections surveyed prior to and after dam removal. Observed changes were minor and due to natural variability in sediment transport processes.

5. TABLES

Table 1. Fish catch data from pre-removal surveys of the Rouge River in the vicinity of the Wayne Road Dam, Wayne, MI

	Downstream Reference (Reach 6)		Upstream Reference (Reach 1)	Impounded Reach (Reach 2)	Total Captured
Species	Number	Clipped	Number	Number	
Blacknose Dace	2		1		3
Blackside Darter	4				4
Bluegill	3		1	1	5
Central Stoneroller	1		4		5
Common Shiner	1		3		4
Creek Chub	23		25	1	49
Emerald Shiner	35				35
Fathead Minnow	4		3	1	8
Goldfish	1				1
Green Sunfish	2		6	1	9
Johnny Darter	1				1
Longnose Dace	1				1
Northern Hogsucker	2	1			3
Pumpkinseed	7		5		12
Round Goby	7				7
Smallmouth Bass	1				1
Steelhead	1				1
White Sucker	36	9	19	2	66
Total	132	10	67	6	215

Table 2. Fish catch data from post-removal surveys of the Rouge River in the vicinity of the Wayne Road Dam, Wayne, MI.

Species	Reach 1	Reach 2	Reach 3	Reach 4	Reach 5	Reach 6	Total	Total %
Black Bullhead			1				1	0.2
Blacknose Dace		2	1				3	0.6
Blackside Darter						1	1	0.2
Blue x Pumpkinseed			3	1			4	0.8
Bluegill	1	1	1				3	0.6
Bluntnose Minnow	2	1	2	1	1	2	9	1.8
Bowfin	1						1	0.2
Central Mudminnow			1				1	0.2
Central Stoneroller	5		7		3	1	16	3.3
Common Carp	8						8	1.6
Common Shiner	1	2			2	9	14	2.9
Creek Chub	2	3	6	3		16	30	6.1
Emerald Shiner			1				1	0.2
Fathead Minnow	14	1	1		1	4	21	4.3
Gizzard Shad	3	3	19	16	16	22	79	16.1
Green Sunfish	4	1	12	5	5		27	5.5
Johnny Darter			3				3	0.6
Logperch						2	2	0.4
Northern Hogsucker						2	2	0.4
Northern Pike			1				1	0.2
Pumpkinseed	13		12	5	5		35	7.1
Quillback						2	2	0.4
Round Goby			5		1	2	8	1.6
Spottail Shiner		1	1		4		6	1.2
Steelhead	1		2				3	0.6
Striped Shiner	6	1	2		2	32	43	8.8
White Sucker	16	30	32	13	7	68	166	33.9
Total Number	77	46	113	44	47	163	490	
Total Species	14	11	20	7	11	13	27	

Table 3. Total species list from pre- and post- monitoring at Wayne Road Dam, Wayne, Michigan.

Common Name	Scientific Name	Pre-Monitoring	Post-Monitoring
Black Bullhead	*Ameiurus melas*		●
Blacknose Dace	*Rhinichthys atratulus*	●	●
Blackside Darter	*Percina maculata*	●	●
Blue x Pumpkinseed			●
Bluegill	*Lepomis macrochirus*	●	●
Bluntnose Minnow	*Pimephales notatus*		●
Bowfin	*Amia calva*		●
Central Mudminnow	*Umbra limi*		●
Central Stoneroller	*Campostoma anomalum*	●	●
Common Carp	*Cyprinus carpio*		●
Common Shiner	*Luxilus cornutus*	●	●
Creek Chub	*Semotilus atromaculatus*	●	●
Emerald Shiner	*Notropis atherinoides*	●	●
Fathead Minnow	*Pimephales promelas*	●	●
Gizzard Shad	*Dorosoma cepedianum*		●
Goldfish	*Carassius auratus*	●	
Green Sunfish	*Lepomis cyanellus*	●	●
Johnny Darter	*Etheostoma nigrum*	●	●
Logperch	*Percina caprodes*		●
Longnose Dace	*Rhinichthys cataractae*	●	
Northern Hogsucker	*Hypentelium nigricans*	●	●
Northern Pike	*Esox lucius*		●
Pumpkinseed	*Lepomis gibbosus*	●	●
Quillback	*Carpiodes cyprinus*		●
Round Goby	*Neogobius melanostomus*	●	●
Smallmouth Bass	*Micropterus dolomieu*	●	
Spottail Shiner	*Notropis hudsonius*		●
Steelhead	*Oncorhynchus mykiss*	●	●
Striped Shiner	*Luxilus chrysocephalus*		●
White Sucker	*Catostomus commersonii*	●	●
	Total Species	18	27

Table 4. Diversity statistics for all sampling sites during pre and post construction monitoring at the Wayne Road Dam project site.

Sampling Period	Sampling Reach	Shannon-Weiner Index (H')	Species Evenness €	Effective Number of Species ($e^{H'}$)
Pre-construction	Reach 6, Dns reference	2.07	0.72	7.92
	Reach 1, Ups reference	1.71	0.78	5.51
Post-construction	Reach 1, Ups reference	2.24	0.85	9.43
	Reach 2, Impounded reach	1.41	0.59	4.08
	Reach 3, Constructed riffle	2.34	0.78	10.39
	Reach 4, Dns riffle	1.58	0.81	4.84
	Reach 5, Dns prect	2.03	0.85	7.59
	Reach 6, Dns reference	1.77	0.69	5.85

Table 5. Cross-wise comparisons of the sampling reaches using the Sørensen's Similarity Index and Hutcheson's t-Test. Bold text indicates statistical significance (α = 0.1). The designation "R" indicates reference site.

Cross-wise Comparison	Sørensen's Similarity	*df*	Hutcheson's t-value
Reference Reaches (Reaches 1 and 6)			
Pre-removal Reach 1 v. Reach 6 (ups. Reference v. dns. Reference)	0.67	161	**2.423**
Post-removal Reach 1 v. Reach 6 (ups. Reference v. dns. Reference)	0.59	189	**3.790**
Reach 6 Pre- v. Post-removal (downstream reference pre/post)	0.52	275	**2.351**
Reach 1 Pre- v. Post-removal (upstream reference pre/post)	0.70	136	**-3.652**
Former Impounded Reach (Reach 2)			
Post-removal Reach 2 v. Reach 1 (former impoundment v. ups. Reference)	0.72	65	**3.665**
Post-removal Reach 2 v. Reach 6 (former impoundment v. dns. Reference)	0.58	62	1.603
Downstream Riffle (Reach 4)			
Post-removal Reach 4 v. Reach 1 (downstream of riffle v. ups. Reference)	0.57	96	**4.416**
Post-removal Reach 4 v. Reach 6 (downstream of riffle v. dns. Reference)	0.40	93	1.306
Downstream Project Site (Reach 5)			
Post-removal Reach 5 v. Reach 1 (downstream of project site v. ups. Reference)	0.72	94	1.348
Post-removal Reach Downstream R * Downstream of Project Site	0.67	89	**-1.689**
Upstream of Riffle * Downstream of Riffle	0.56	72	-0.714

Table 6 Macroinvertebrate colonization of the constructed riffle located at the former Wayne Road dam site, Wayne, MI. Macroinvertebrates were collected for 60 minutes using methods described in the Michigan Procedure 51.

Order	Family	Number
Annelida	Oligochaeta	1
Bivalve	Corbiculidae	1
Diptera	Chironomidae	159
Diptera	Simuliidae	1
Ephemeroptera	Heptageniidae	1
Mollusca	Gastropoda	2
Trichoptera	Hydropsychidae	42
	Total	207

6. FIGURES

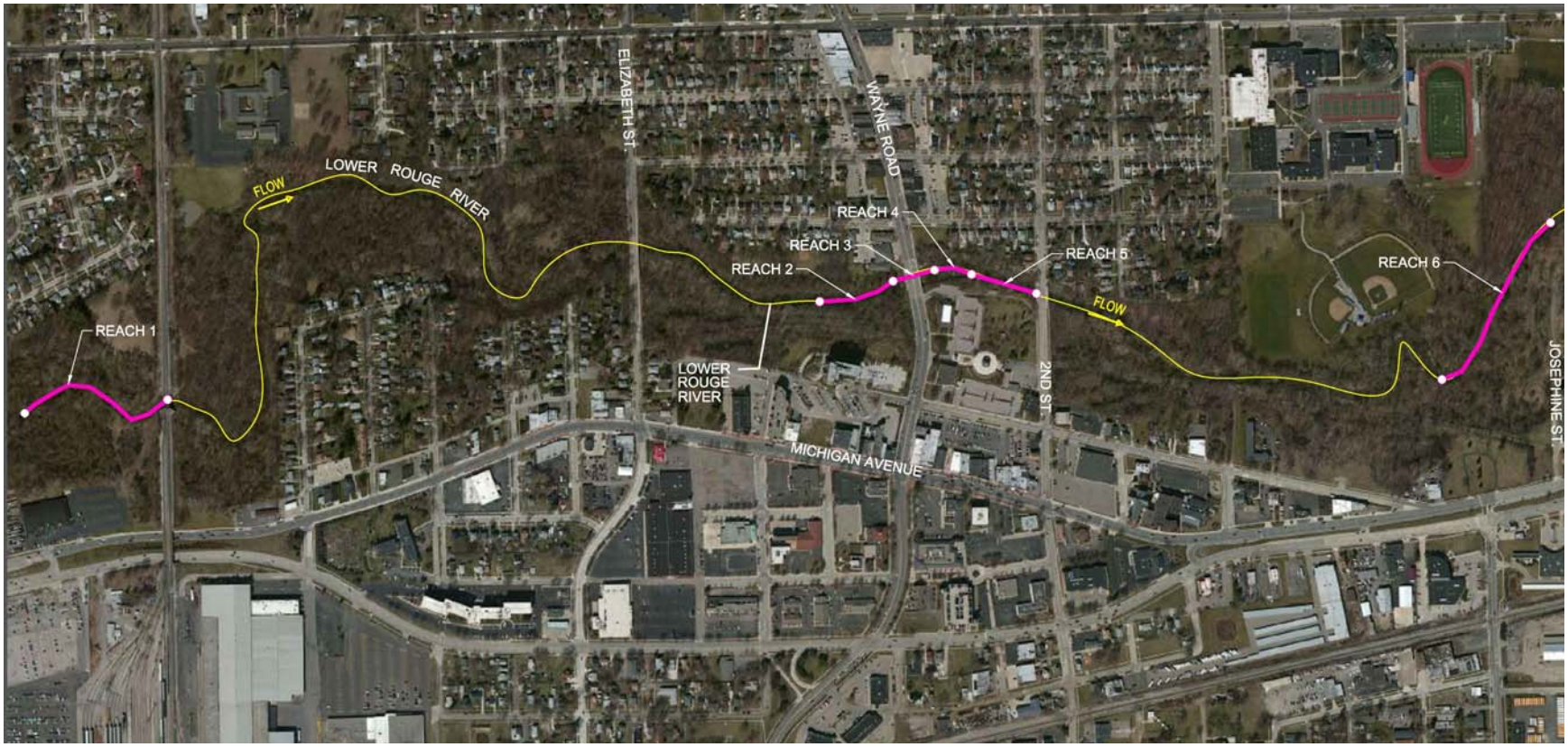


Figure 1. Location of fish community sampling reaches in the vicinity of the former Wayne Road Dam, Wayne, Michigan.

Figure 2. Location of channel cross-sections used to monitor morphological changes in the Lower Rouge River in response to removal of the Wayne Road Dam, Wayne, Michigan.

Figure 3. Fin-clipped white sucker (*Catostomus commersoni*) marked in Reach 6 downstream of the Wayne Road Dam on April 4, 2012 and recaptured in Reach 2 upstream of the Wayne Road Dam on April 23, 2013.

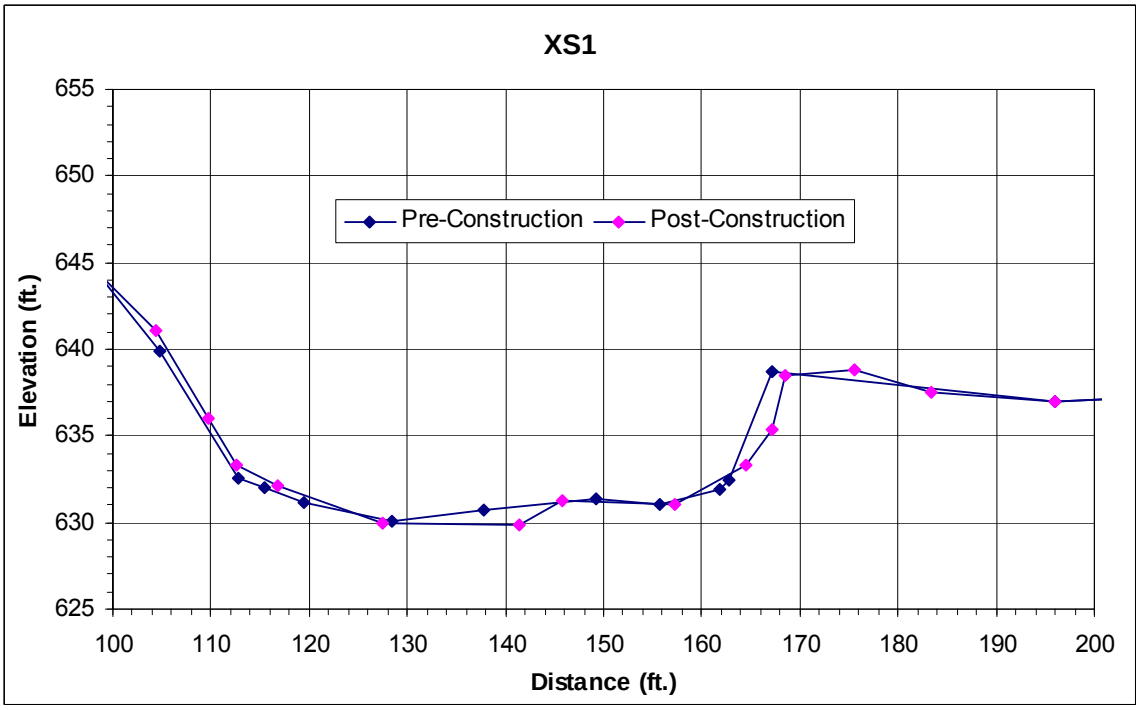


Figure 4. Cross-section profile XS1 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

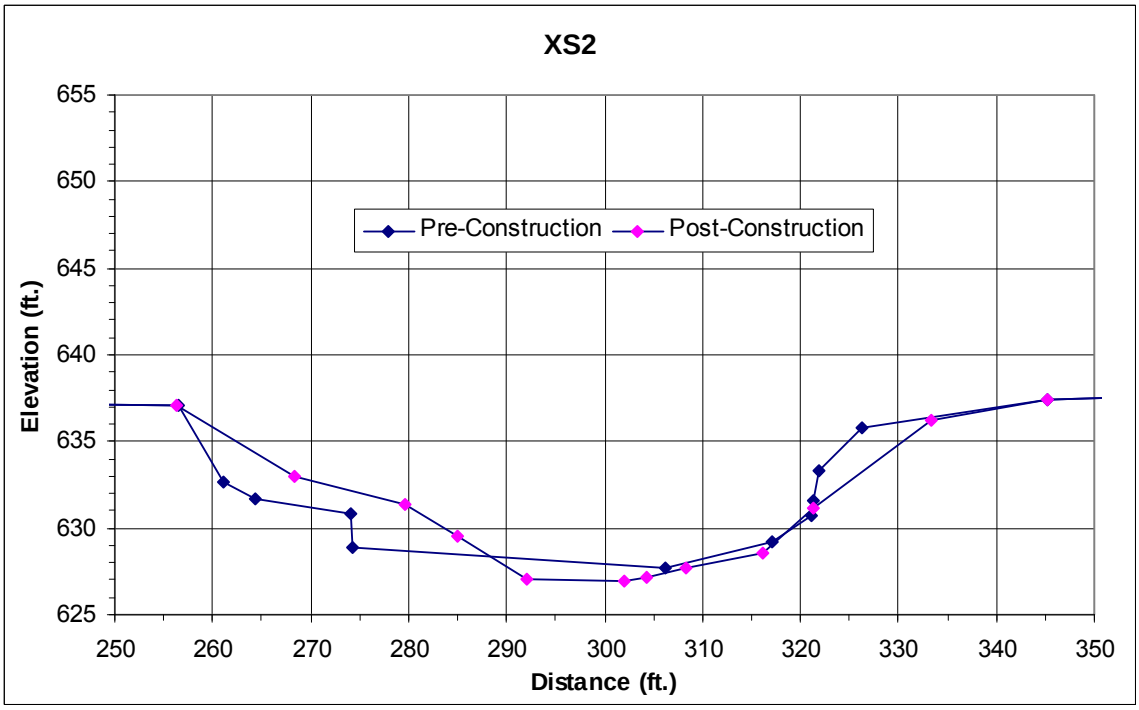


Figure 5. Cross-section profile XS2 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

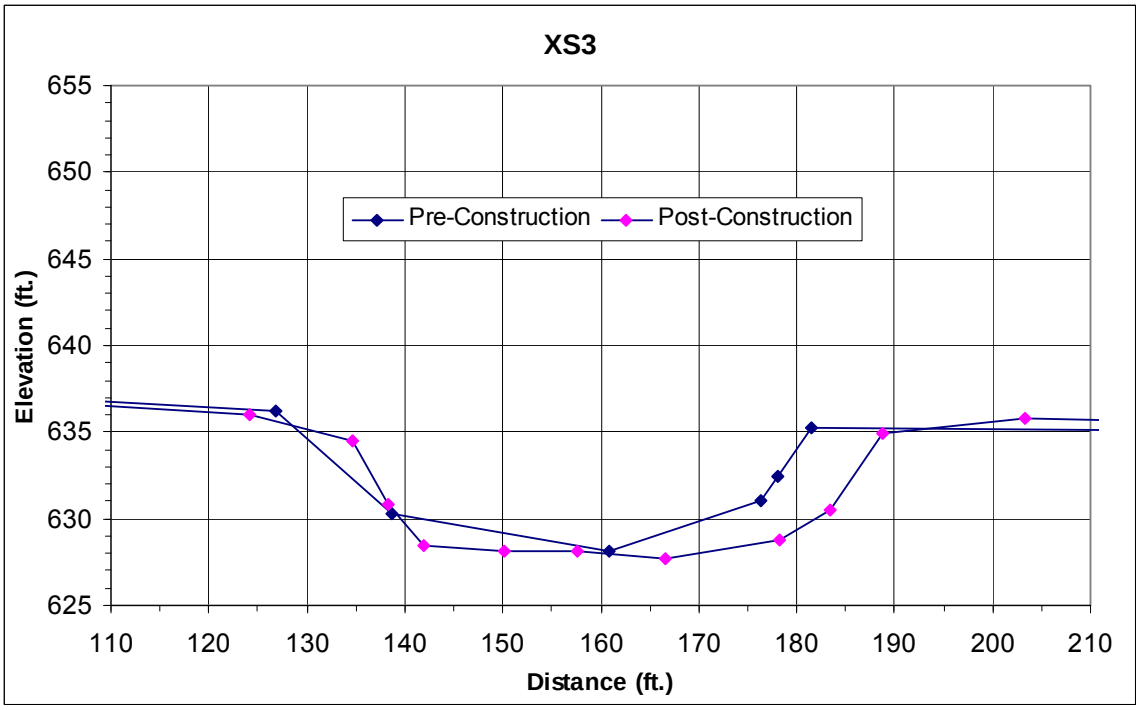


Figure 6. Cross-section profile XS3 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

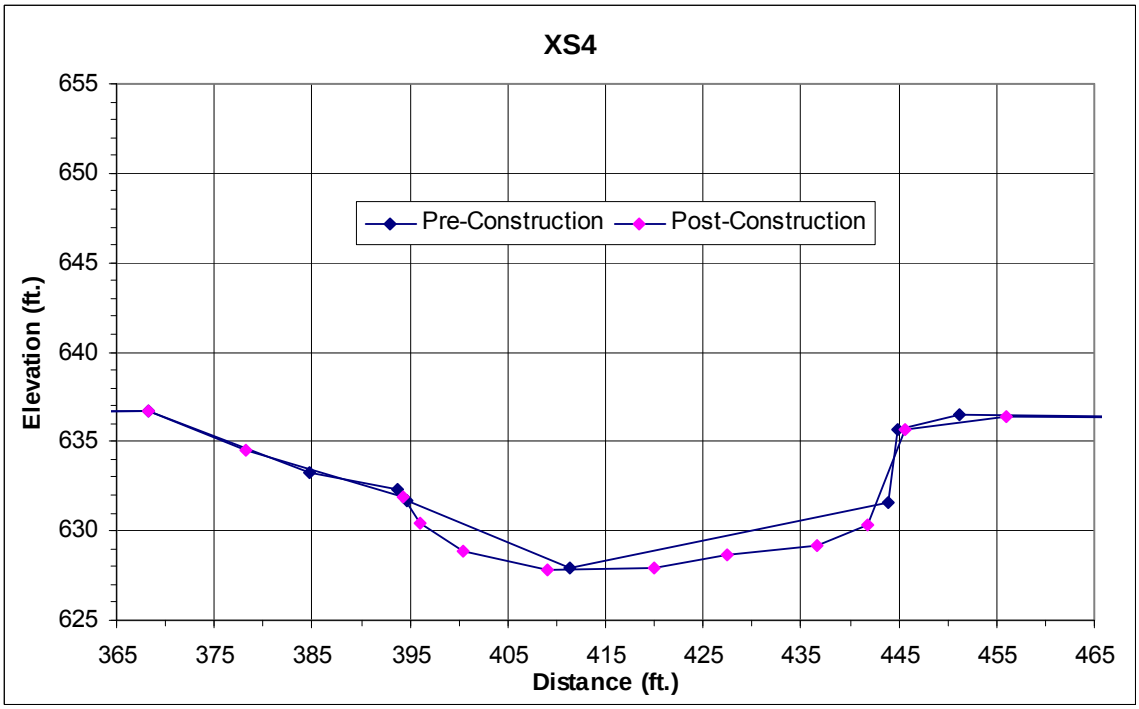


Figure 7. Cross-section profile XS4 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

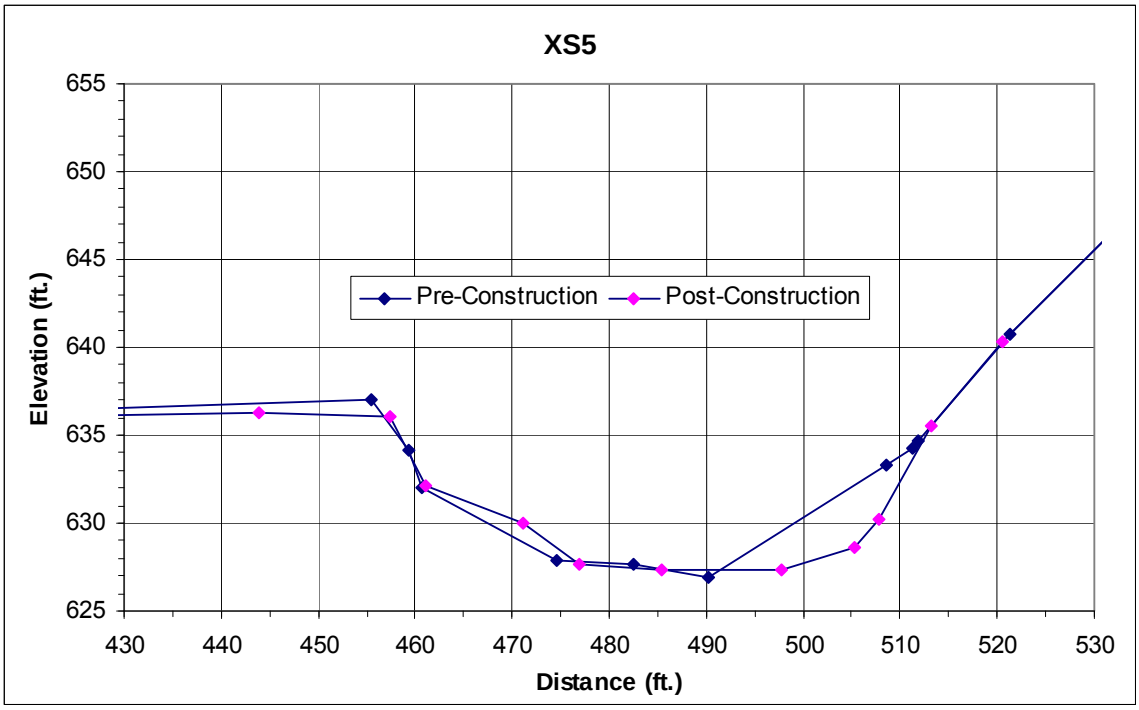


Figure 8. Cross-section profile XS5 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

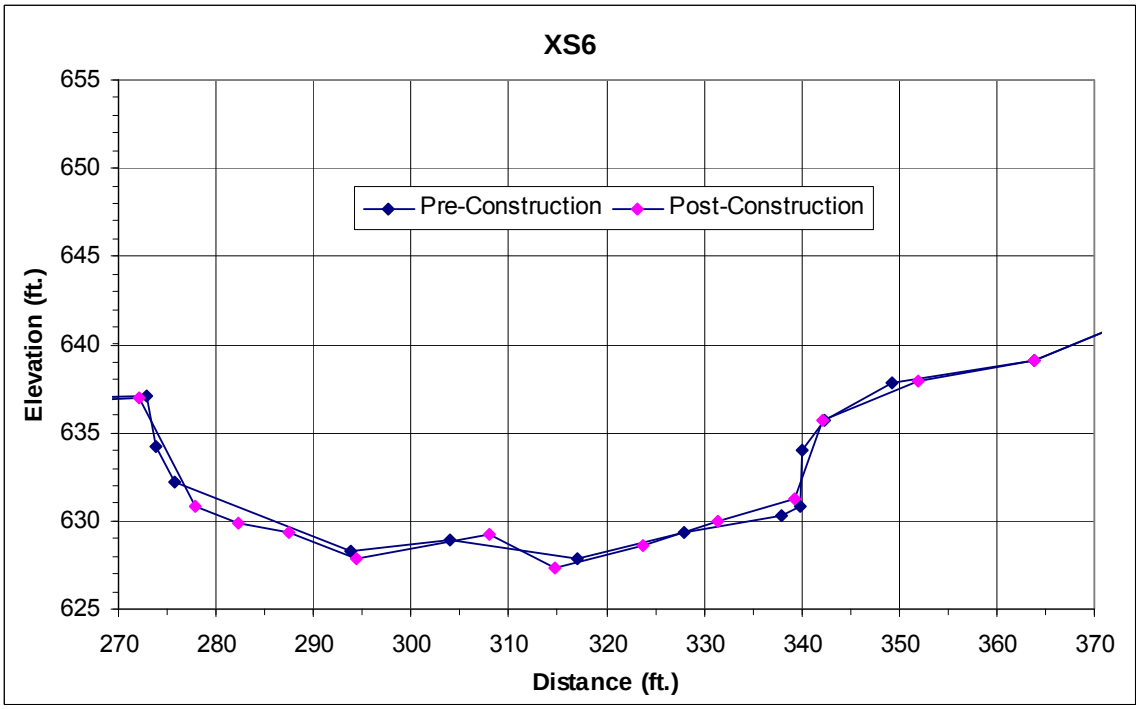


Figure 9. Cross-section profile XS6 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

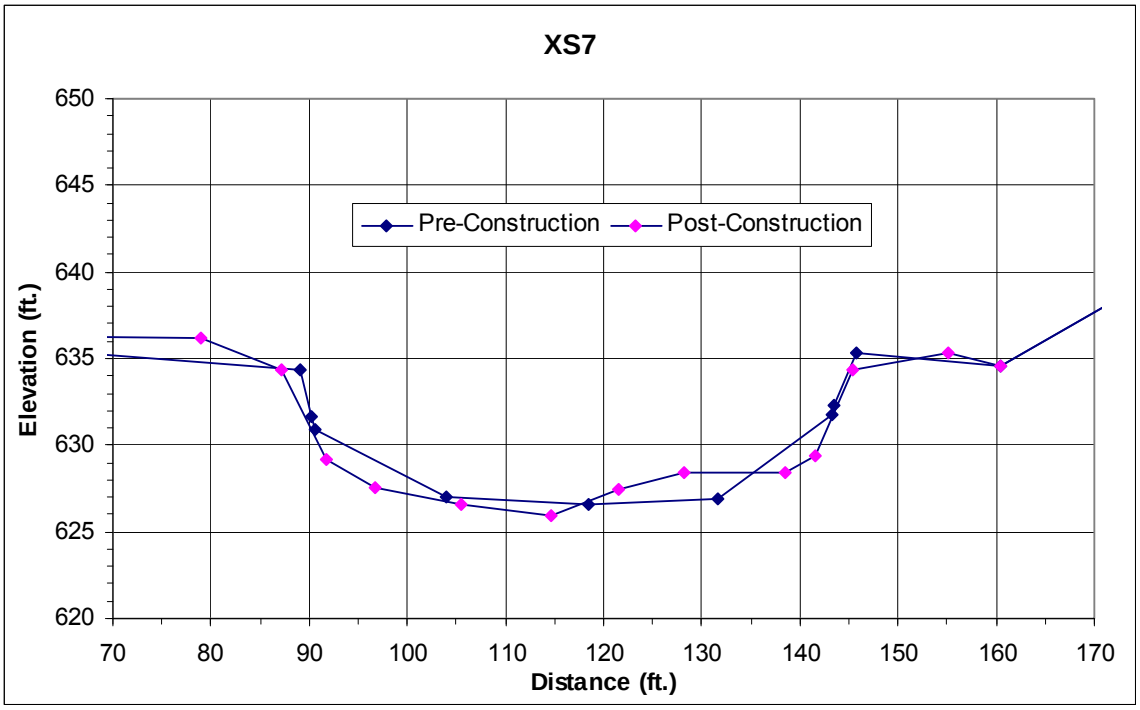


Figure 10. Cross-section profile XS7 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

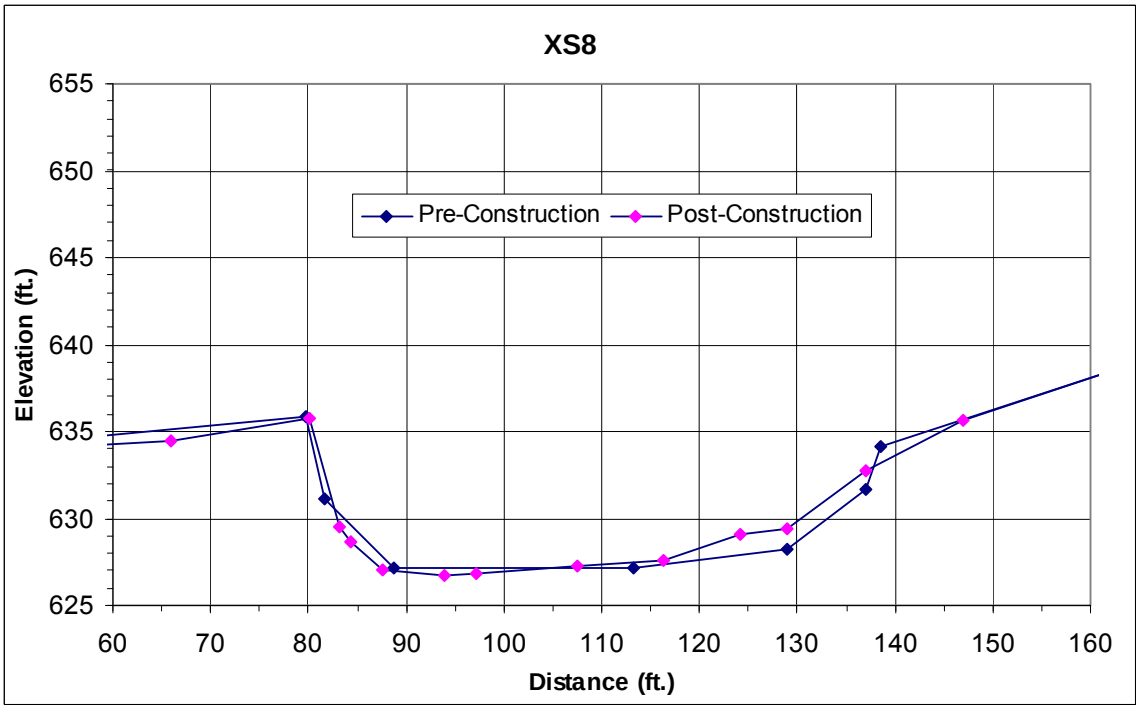


Figure 11. Cross-section profile XS8 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

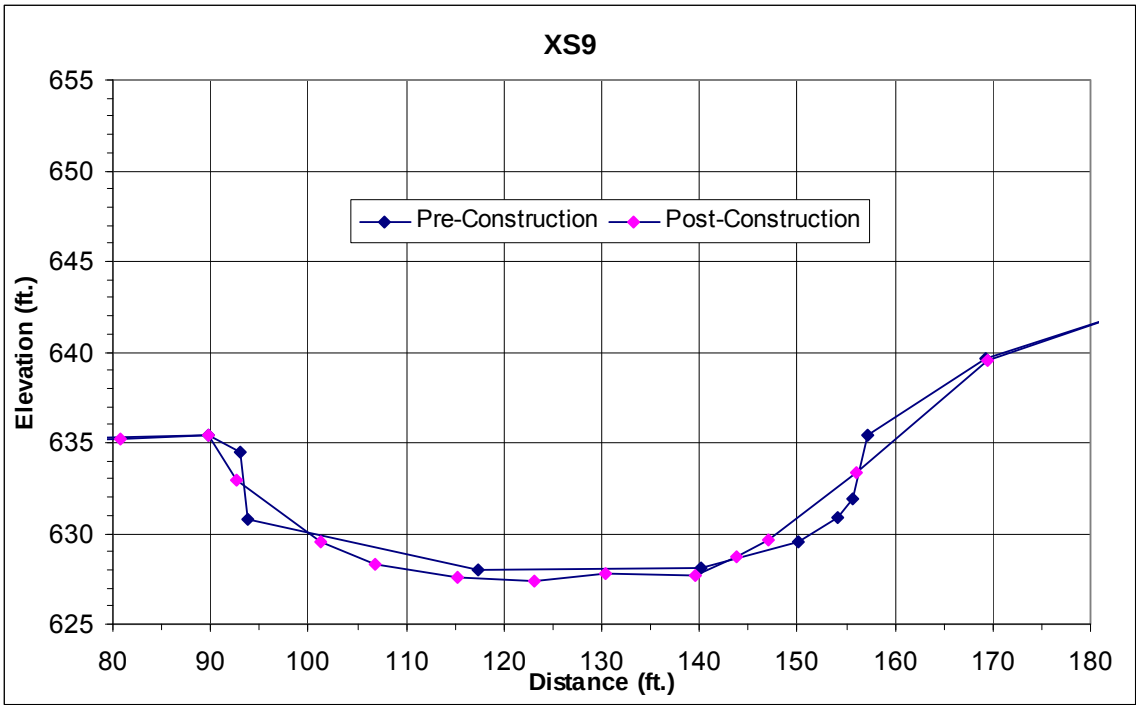


Figure 12. Cross-section profile XS9 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

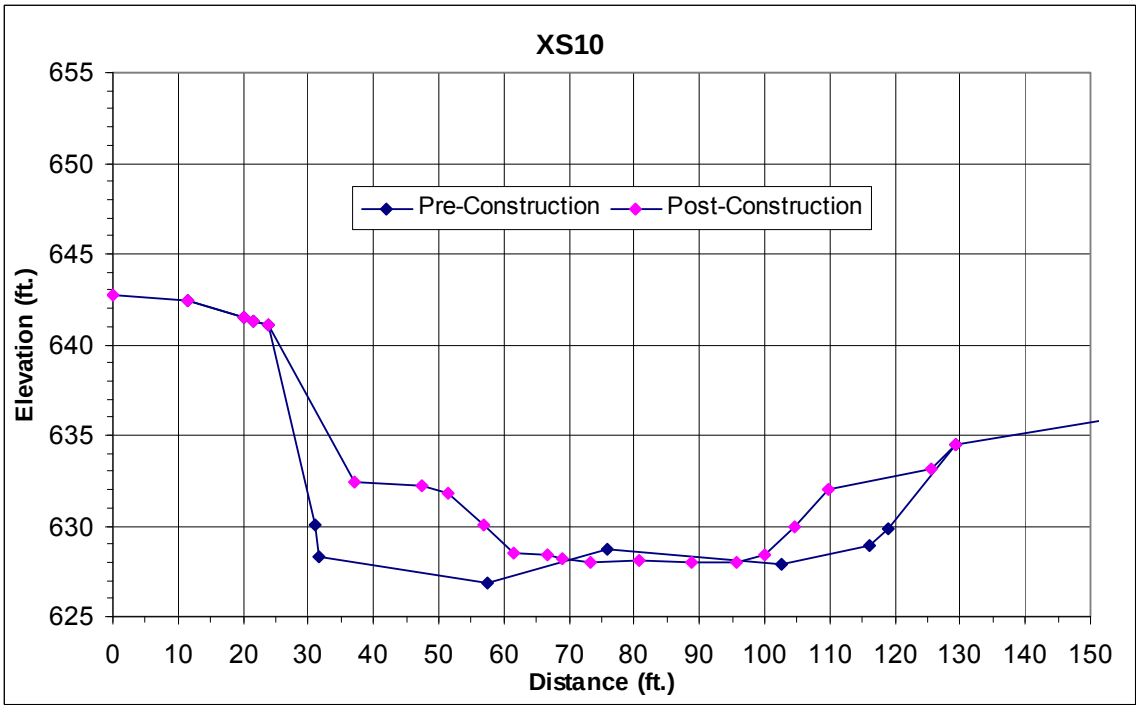


Figure 13. Cross-section profile XS10 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

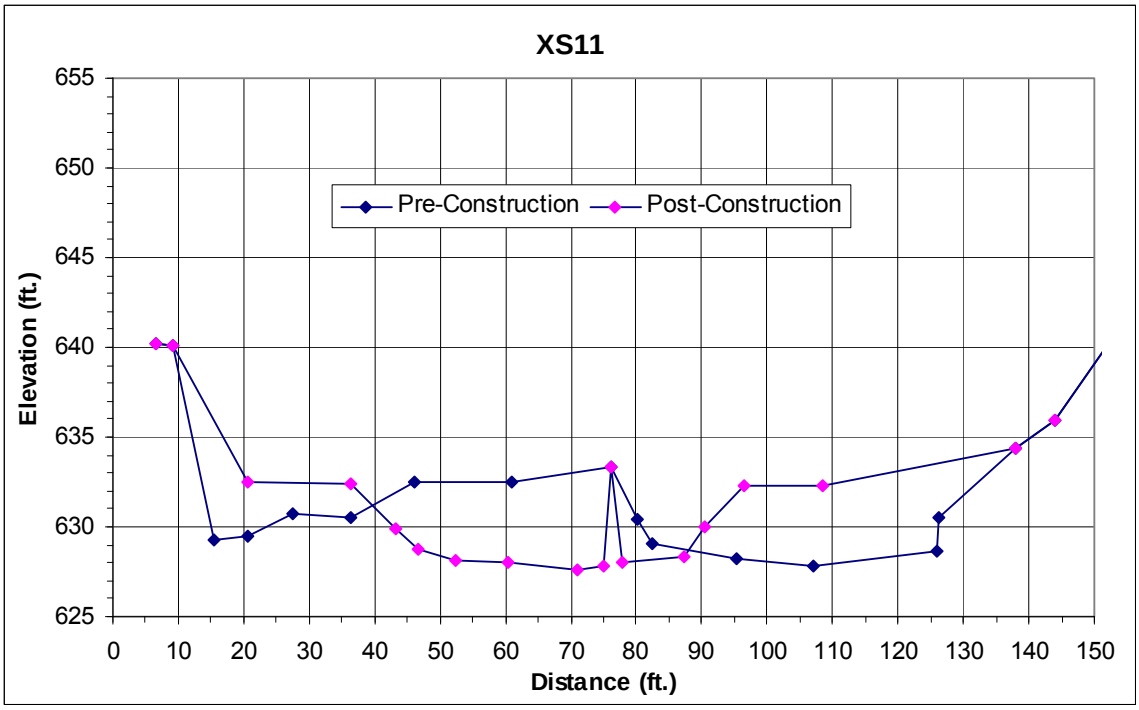


Figure 14. Cross-section profile XS11 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

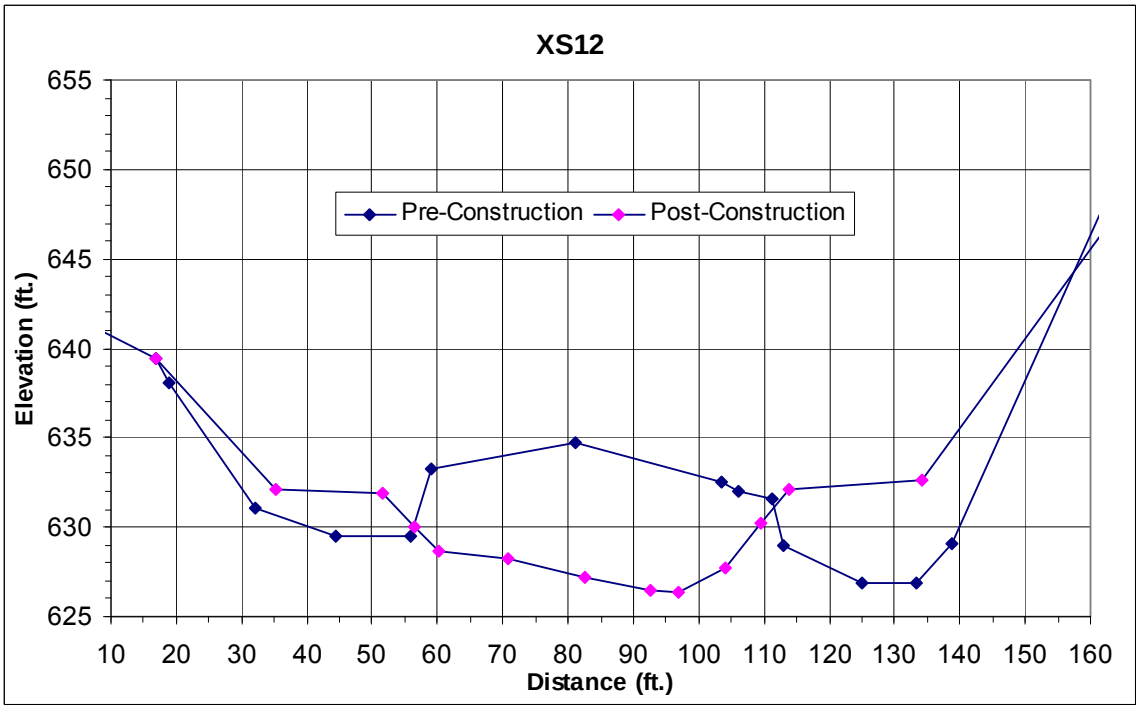


Figure 15. Cross-section profile XS12 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

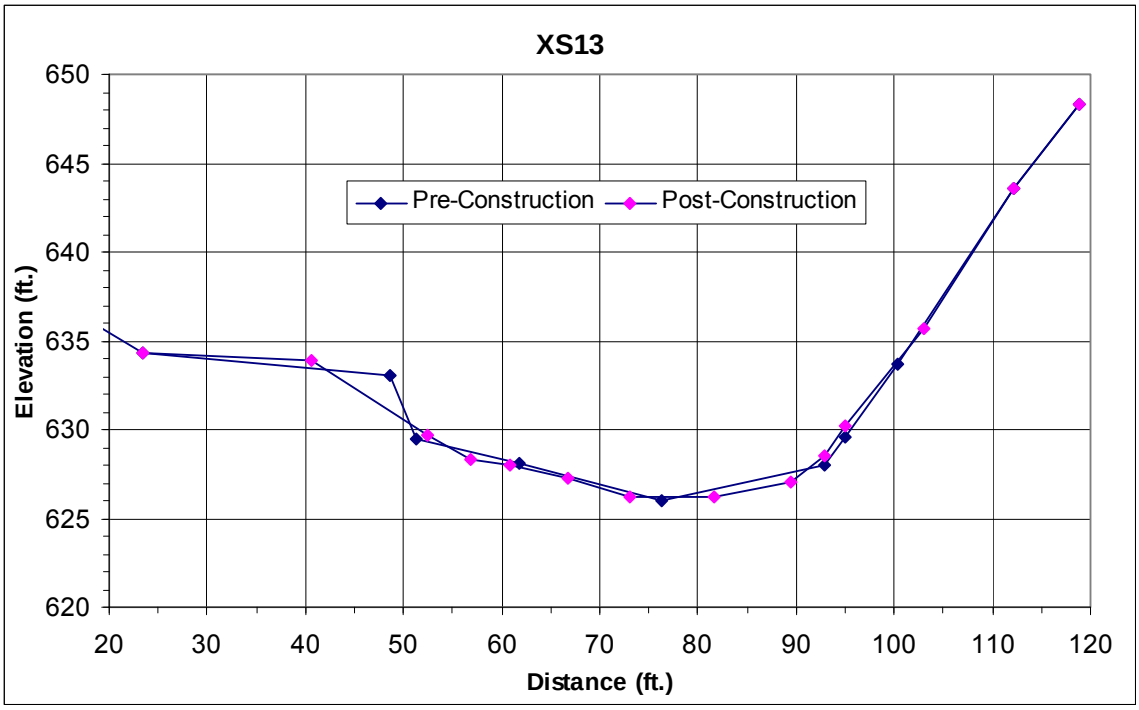


Figure 16. Cross-section profile XS13 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

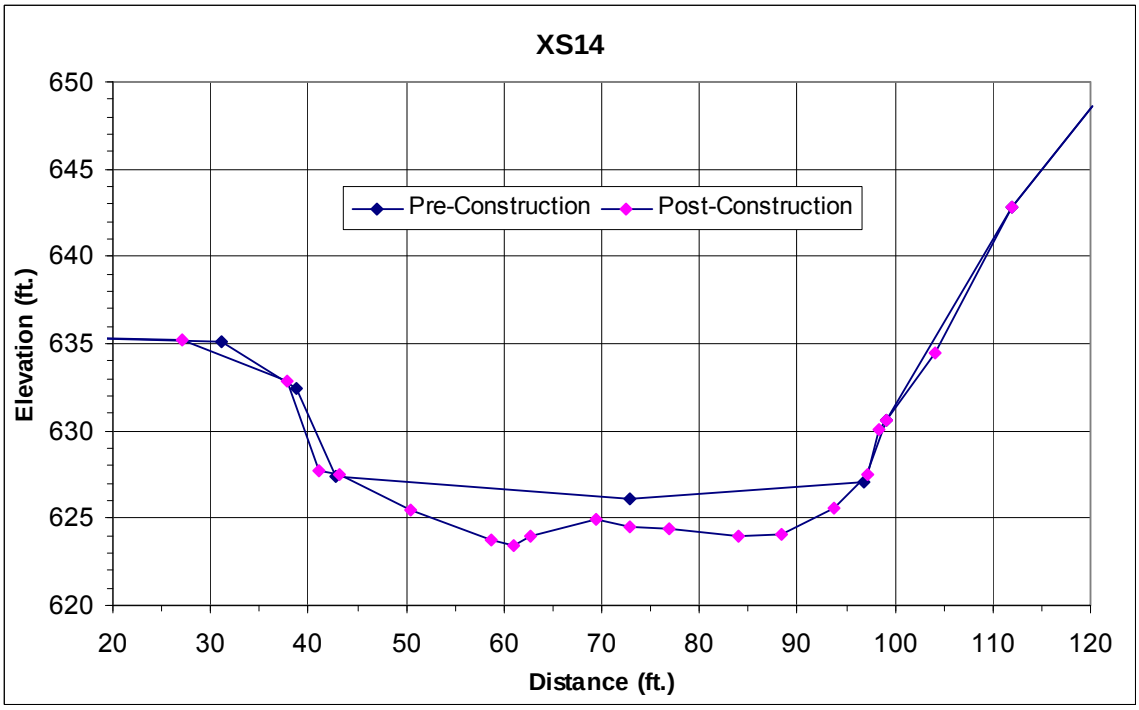


Figure 17. Cross-section profile XS14 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

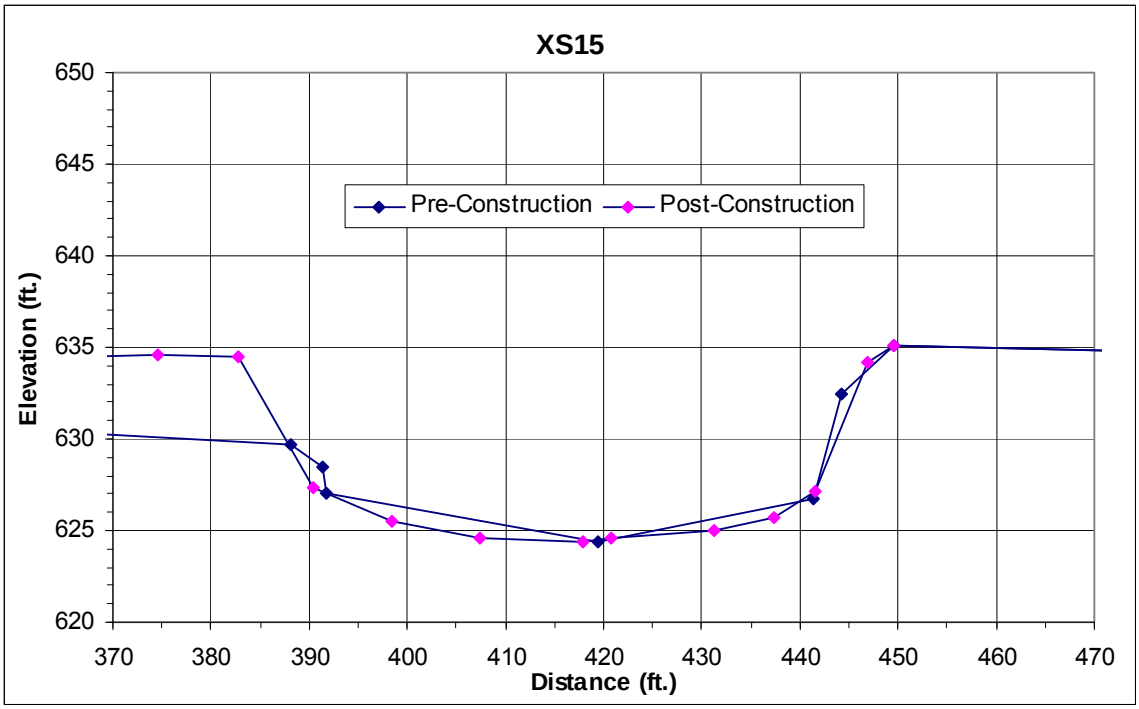


Figure 18. Cross-section profile XS15 of the Lower Rouge River before and after removal of the Wayne Road Dam. See Figure 2 for cross-section locations.

APPENDIX A

Wayne County MiCorps Monitoring Report

Introduction

The physical removal of the Wayne Road Dam and river bank restoration was initiated in July 2012 and completed by December 2012. Benthic macroinvertebrate monitoring was one of the parameters selected to determine habitat improvement at the location. Sites upstream and downstream of the Wayne Road Dam were assessed to determine benthic macroinvertebrate water quality before and after the dam removal project. This report was prepared by the Wayne County Water Quality Management Division (WQMD) as a summary of the benthic macroinvertebrate monitoring associated with the project.

Procedure

Benthic macroinvertebrate collection, record keeping and water quality ratings were performed in accordance with procedures established by the Michigan Clean Water Corps (MiCorps) and Friends of the Rouge (FOTR). Through these procedures a Stream Quality Index (SQI) is determined by the number and type of different organisms found in the sample. A higher proportion of sensitive organisms such as mayflies and caddisflies and or a high number of different organisms results in a higher score. The SQI is given a rating: a score >48 is Excellent, 34-48 is Good, 19-33 is Fair, and <19 is Poor.

Statistical analysis is performed on the data at sites that have more than three years of data per season. The data for spring and fall are analyzed separately due to different sampling conditions associated with the separate seasons. The trend is considered significant if the *p*-value is less than 0.05. A positive slope indicates an upward trend (scores increasing) and a negative slope indicates a downward trend (scores decreasing).

Collection Sites and Dates

Two monitoring sites, within the Rouge River Lower 2 subwatershed, are specific to the dam removal project: LR-6 (Woody Debris Management 201 site) is immediately upstream of the dam removal project and LR-3 is downstream of the project at Goudy Park. *Table -1* is a summary of the collection dates for the pre and post monitoring of the Spring/Fall benthic monitoring and winter stonefly sampling events relative to the dam removal project.

Table 1: Macroinvertebrate Collection Dates

Pre Dam Removal		Post Dam Removal	
Spring	4/25/2012	Spring	5/1/2013
Fall	10/11/12	Fall	NA
Winter Stonefly	1/26/12	Winter Stonefly	2/4/2013

Results

WQMD performed Winter Stonefly Searches in January/February 2012 and 2013. The stonefly search is a simple presence or absence survey for this water quality sensitive species. In 2012, WQMD sampled three sites in the Lower Rouge River watershed (LR-6 LR-10, and LR-12). No stoneflies were found. WQMD again sampled three sites on the Lower Rouge in 2013 (LR-3, LR-6, & LR-10). No stoneflies were found.

Table 2 is a summary of the Spring Stream Quality Index (SQI) scores for the Lower 2 for macro-invertebrate samples collected by Friends of the Rouge volunteers and Wayne County staff. *Figure 1* is a long term macroinvertebrate trend analysis of Rouge Lower 2 for the spring. The trend is slightly negative but not significant.

Table 2: Spring Lower 2 Sites & Scores

Sample Site ID	Spring 2005	Spring 2006	Spring 2007	Spring 2008	Spring 2009	Spring 2010	Spring 2011	Spring 2012	Spring 2013	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
LR-1	20	25	34	26	29				35	+	No	27
LR-3	26	22	20	36			28	16	28	–	No	23
LR-4	25	15	18	26						–	No	19
LR-6			28	26	36		19	26	23	+	No	30
LR-7				38	33	35	30			-	No	35
LR-10							24	28	26	+	No	26
LR-11							25	22	12	–	No	20
Year Average	24	21	25	30	33	35	25	23	25			

Figure 1: Spring Lower 2 Data Trend

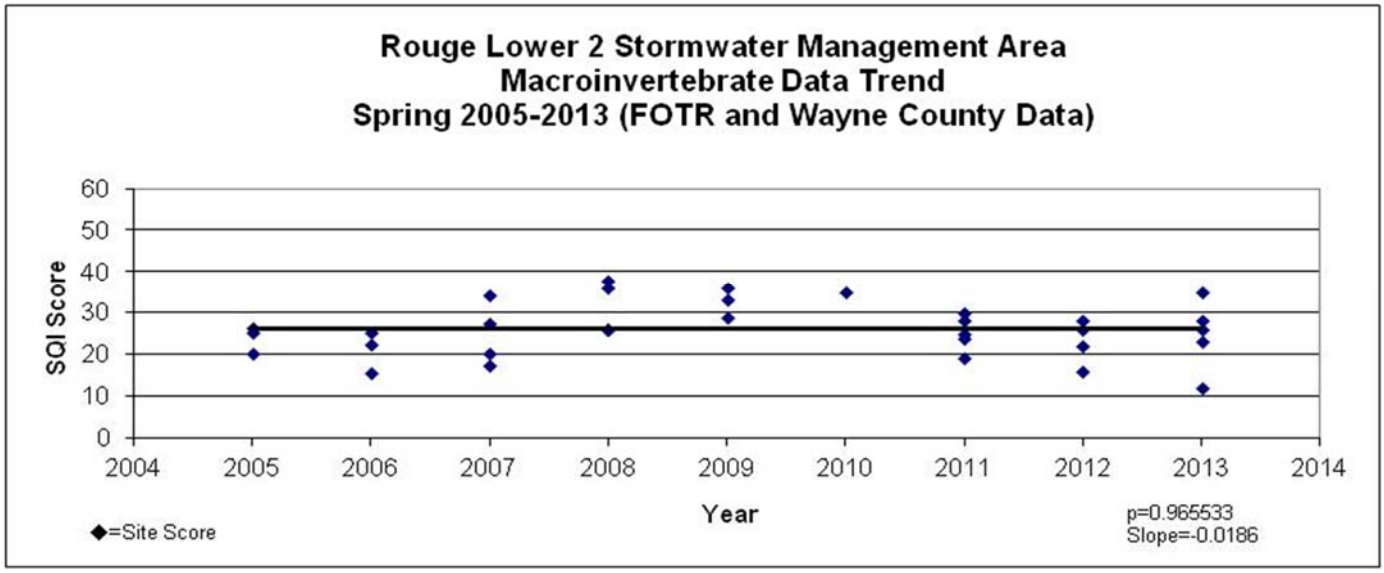


Table 3 is a summary of the Fall Stream Quality Index scores for the Lower 2 for macro-invertebrate samples collected by Friends of the Rouge volunteers and Wayne County staff. *Figure 2* is a long term macroinvertebrate trend analysis of Rouge Lower 2 for the fall. The trend is again slightly negative but not significant.

Table 3: Fall Lower 2 Sites & Scores

Sample Site ID	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009	Fall 2010	Fall 2011	Fall 2012	Trendline (+/-)	Significant Yes/No	Site Baseline (1st 3-Yrs) Average
LR-1	18	30	20	36	26				+	No	23
LR-3	35	30	35			22		26	–	No	33
LR-4	24	25	25						+	No	25
LR-6			20	24	24		18	21	–	No	23
LR-7			40	25	30		31		+	No	32
LR10						31	32	22	–	No	28
LR11						18	21	25	+	No	21
Year Average	26	28	28	28	27	24	26	24			

Figure 2: Fall Lower 2 Data Trend

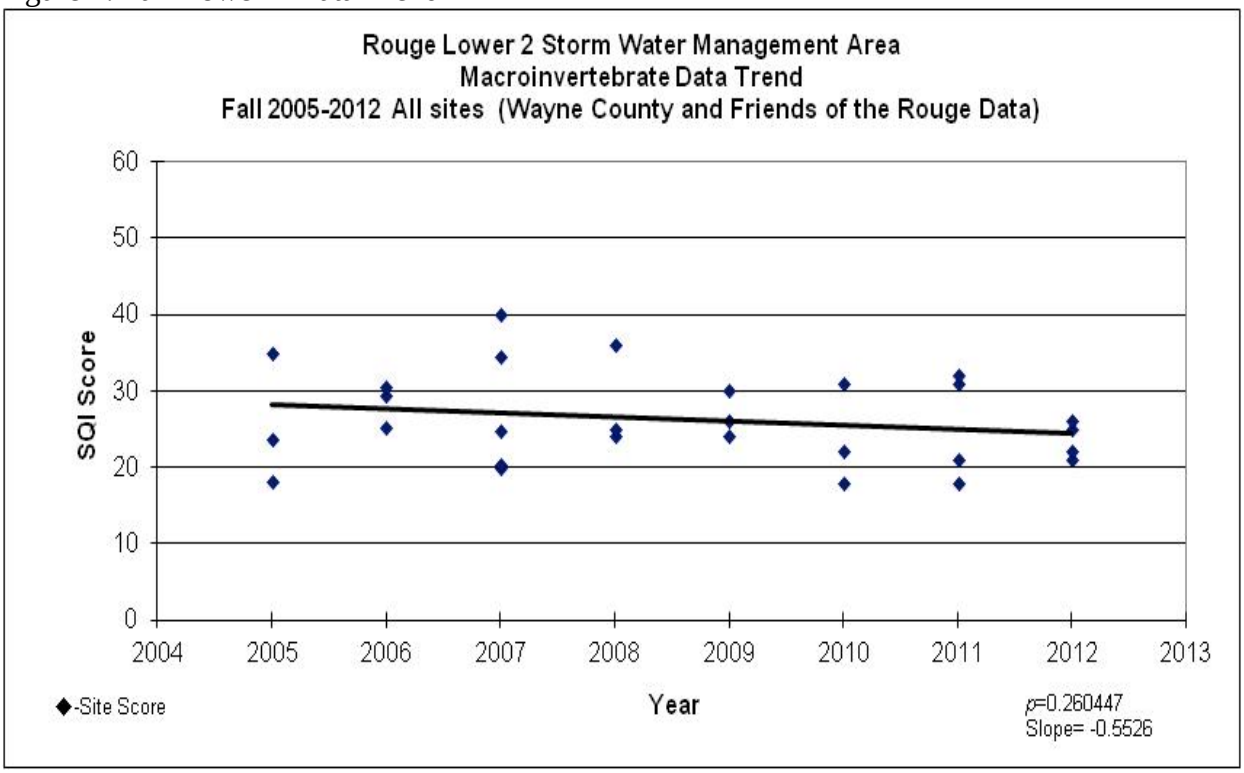


Table 4 is a summary of the SQI scores pre and post dam removal for the upstream and downstream sites for the seasons.

Table 4: Pre and Post dam removal SQI scores for LR-3 and LR-6 for each season

		Pre Dam Removal		Post Dam Removal	
Site	Location to dam	Event	SQI Score	Event	SQI Score
LR-3	Downstream	Spring April 2012	16	Spring May 2013	28
LR-3	Downstream	Fall October 2012	26	Fall	NA
LR-6	Upstream	Spring April 2012	26	Spring May 2013	23
LR-6	Upstream	Fall October 2012	21	Fall	NA

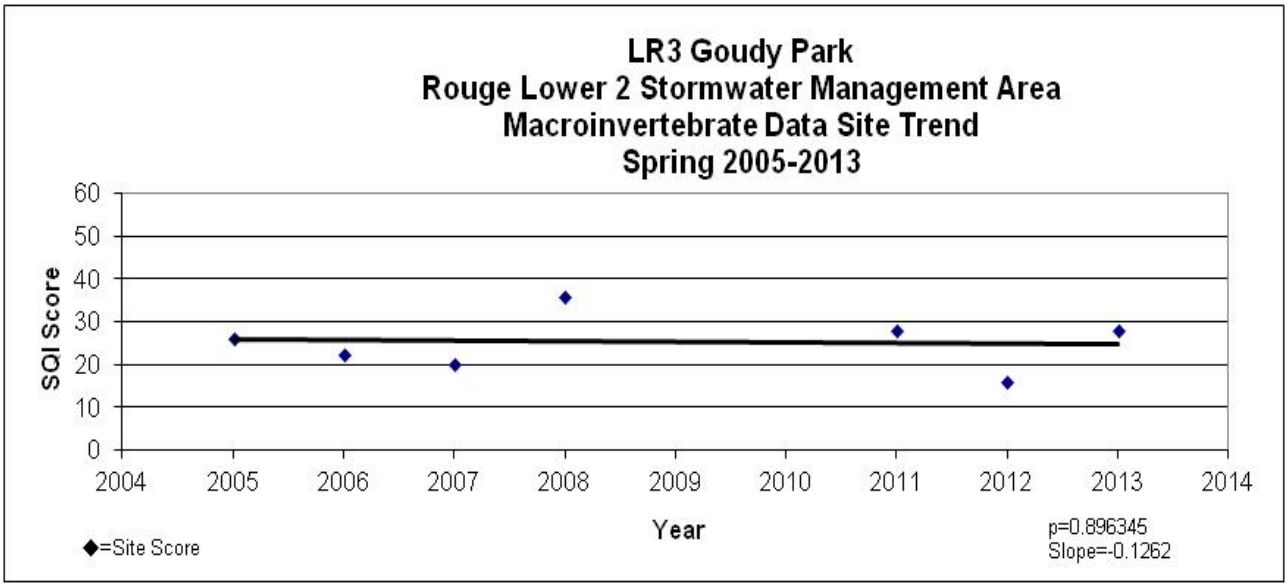
Table 5 is a summary of the trend analysis for the upstream and downstream sites for each season. The trends at each site appear negative but are not statistically significant. *Figure 3* is a long term macroinvertebrate trend analysis of the upstream site (LR-6) and downstream (LR-3) for the spring

Table 5: Trend Summary Lower Rouge Dam Removal Sites

Spring trend analysis project sites			
Site	Slope	*p*-value	Significance
LR3	-0.531	0.6857	No Trend
LR6	-1.093	0.5356	No Trend
Fall trend analysis project sites			
LR3	-2.457	0.1174	No Trend
LR6	-0.743	0.5771	No Trend

Note: The fall data is through fall 2012

Figure 3: Data trends for LR3 and LR6 Benthic Macroinvertebrate sites Spring 2013



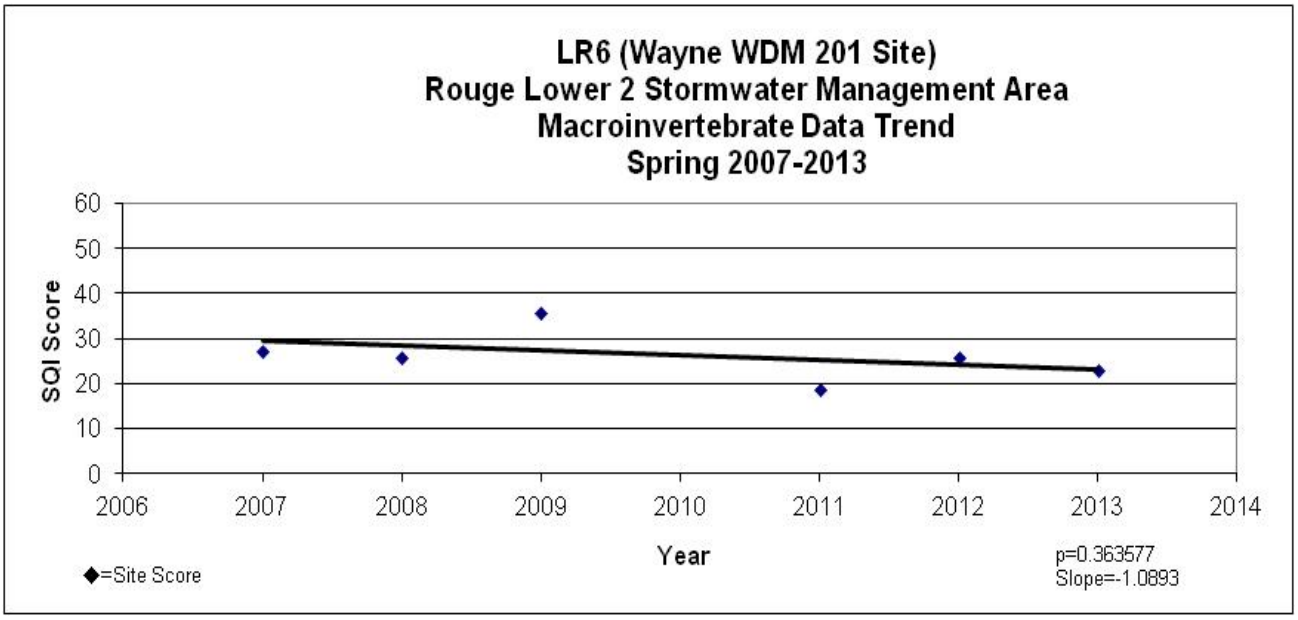


Figure 4: Spring 2012 Results

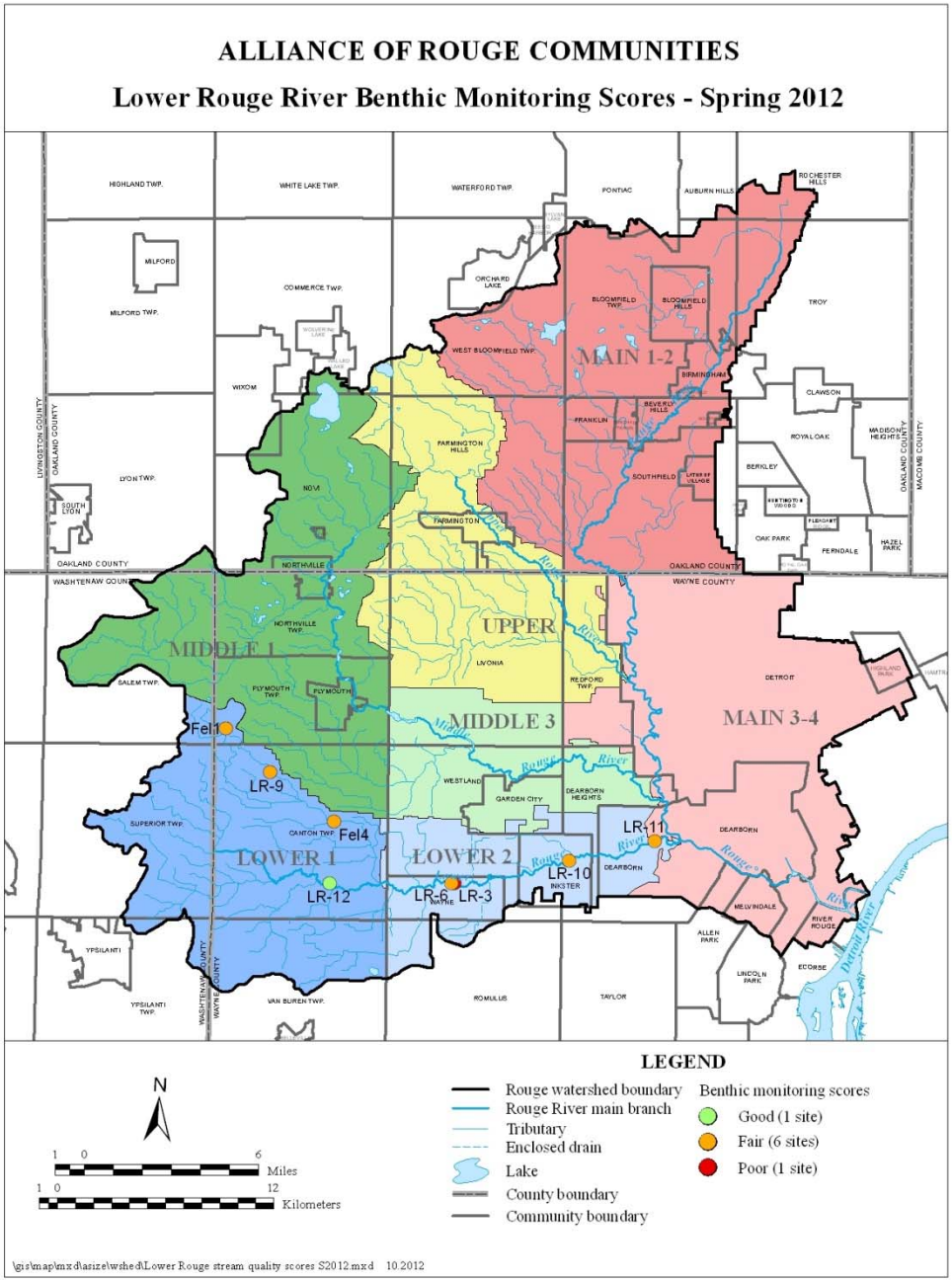


Figure 5: Spring 2013 Results