THE ROUGE RIVER NATIONAL WET WEATHER DEMONSTRATION PROJECT EIGHTEEN YEARS OF DOCUMENTED SUCCESS

James W. Ridgway, PE
Executive Director
Alliance of the Rouge Communities

ABSTRACT

The Rouge River National Wet Weather Demonstration Project (Rouge Project) was provided a unique opportunity to demonstrate that a watershed-wide approach to restoring and protecting an urban river system by using a cooperative, locally based approach to pollution control could restore a highly polluted urban river. More importantly, they were given the funds to document their success.

The Rouge Project took a more holistic approach and considered the impacts from all sources of pollution and use impairments in receiving waters by using known watershed management techniques. The traditional piecemeal approach of focusing only on sources of pollution or a group of sources had not achieved the desired results nor did it achieve the acceptance of the residents of the watershed. The Rouge Project demonstrated several very important elements of using the watershed management approach including the need to: analyze all of the various sources of stressors to the water quality problems in a watershed-physical, chemical and biological; establish a hierarchy of pollution sources in a watershed-point sources and nonpoint sources-based upon the adverse water quality impacts of those sources; and keep reinforcing, at a watershed level, the concept of prioritizing the control of those sources and the other stressors to get desired environmental protection; recognize it may take a long time to correct some of these pollution sources or other physical, chemical or biological stressors so it is important to prioritize the control programs to get the maximum environmental improvement as soon as possible; critically assess the cumulative watershed impacts to quantitatively assess the physical, chemical and biological processes and then fashion the watershed-based solutions to prevent treating the symptoms rather than effecting a cure.

This Presentation includes summaries on millions of data points including chemical, biological and physical parameters that document the water quality benefits of the massive investment in the Rouge Project.

KEY WORDS

CSO control, SSO control, Lake Restoration, Streambank Stabilization, Urban Storm Water, Measures of Success

INTRODUCTION

This paper was written for one reason alone – to encourage our federal legislators and appropriators to find a way to fund the restoration of urban rivers. The Rouge River National Wet Weather Demonstration Project has proven that it can be done. The data has proven that Water Quality Standards can be achieved. Documented increases in biodiversity have shown the remarkable recuperative abilities of a river. The American Academy of Environmental Engineers (AAEE) awarded the Rouge River Project its prestigious Superior Achievement Award in the Academy's Excellence in Environmental Engineering competition. And most importantly, the Federal Agencies, including the US Environmental Protection Agency (EPA) and the Office of Inspector General (OIG) has recognized it as being cost effective.

This paper documents the success that can be achieved when a community-driven, well-financed urban river restoration is performed. It presents summaries of the data collected and analyzed, the priority projects that made the most difference, and the resulting institutional arrangement that keeps the communities working cooperatively.

A BRIEF HISTORY OF THE RESTORATION EFFORTS ON THE ROUGE RIVER

The Rouge River Watershed covers 466 square miles of southeast Michigan and is home to more than 1.3 million people in parts of Oakland, Wayne and Washtenaw counties. The watershed's 48 communities comprise a diversity of land uses from the urbanized areas of Detroit, Livonia and Southfield to the developing areas of Troy, Canton Township and Novi, to the rural areas of Salem, Superior and Van Buren townships.

Like most urban rivers, the Rouge River has experienced more than a century of bad environmental practices. As a result, there were many stretches that virtually never met the water quality standards. These areas were devoid of an active fishery and the habitat to support one. The water stank and the riparian property owners had turned their back on the resource.

But that all changed.

This report is a good news story. It proves that with substantial federal, state, and local support, a river can be revitalized. Yes, this took a great deal of money but it took much more. It took a broad spectrum of stakeholders banding together to "do the right thing." – and they did.

USEPA's Office of Inspector General (OIG) conducted a nationwide audit of the national CSO control program interviewing EPA headquarters personnel, three EPA Regions, eight states, 22 communities and others. Their final Evaluation Report, "Wastewater Management - Controlling and Abating Combined Sewer Overflows" in August 2002 stated:

"Rouge River Project a Blueprint for Success - - The Rouge River National Wet Weather Demonstration in Michigan is an excellent example of how utilizing a watershed approach can help to achieve water quality goals more efficiently."

But we cannot underestimate the importance of federal financial support. The Rouge River National Wet Weather Demonstration Project received nearly $300 million in federal grant funds. Yes it required over $300 million of local matching

funds but without this tremendous financial commitment the challenge was insurmountable. The cost of repairing the aging infrastructure was simply too high to be borne exclusively by the local units of government. However, given this federal "windfall," the communities found a way to make the match and they built the facilities that were required. Some local elected officials told their constituents that "this is the largest financial commitment of my lifetime" yet they stood together and they got it done.

And once the river began to show signs of recovery, many of the local residents, businesses and industries that had given the Rouge up for dead, began to invest the time, energy, and money required to improve the housekeeping on all of the land that drained to their river.

The results are amazing.

I began working on the Rouge River in 1975 preparing the first watershed plan under the 208 program. I was young enough to see the potential but wise enough to recognize the odds. They were staggering. Since that time there have been several poorly financed attempts to restore the river. There was usually enough money for the study but never enough to do the work recommended by the study.

That all changed when Congressmen John Dingell found the funds to initiate the Rouge River National Wet Weather Demonstration Project (the Rouge Project). Like most urban rivers, the Rouge had been well studied. The communities had long known what needed to be done but the commitment for substantial federal funds freed them to get those plans implemented.

HISTORY OF ROUGE RIVER RESTORATION ACTIVITIES

The Rouge River 208 Plan

When the Clean Water Act was passed in 1972, it called for watershed-wide planning throughout the country. Specifically it called for all waters of the US to be "fishable and swimmable" within 20 years. The Rouge, like many watersheds were given the opportunity to identify problems and prioritize them. A great deal of federal money was made available through the federal grants program. This allowed substantial upgrades to sewage collection and treatment systems. At the same time, "non-point source pollution" was identified as a major concern but unfortunately the funding to the EPA non-point program (the 319 program) was not proportional to the problems it was to address. As a result, communities like those in Southeast Michigan could detail the challenge of urban storm water but were provided no tool to fund the projects needed to address this challenge.

The Rouge River National Urban Runoff Program

Using the 208 plans as the base data, the EPA choose to compare the effectiveness of storm water best management practices though the National Urban Runoff Program (NURP). Using this funding, best management practices (BMPs) were tested in the Rouge and throughout Southeast Michigan. The results were used to allow municipalities to identify which practices best addressed the storm water challenges within their borders. Unfortunately, there was no implementation funding and many of the best practices were not implemented immediately.

Rouge River Remedial Action Plan (RAP)

Due to public outcry about the condition of the Rouge River in 1985, the State of Michigan adopted the Rouge River Basin Strategy. A key element in this strategy was the development of a plan to clean up the river – the Rouge River Remedial Action Plan (Rouge River RAP). The original RAP was completed in 1989 consistent with the commitments made by the states, Canadian provinces and two federal governments as part of a Great Lakes Water Quality Agreement. This international agreement signed by the United States and Canada identified 42 Areas of Concern (AOCs) in the Great Lakes Basin that needed attention. The Rouge River was one AOC listed (RRAC, 2004).

In 1989, the original Rouge River RAP, a nine-volume document, defined an ambitious 20-year program of actions needed to protect the public health and to make substantial progress to restore the impaired uses of the river. Since most of the large industrial and municipal wastewater treatment plant discharges were either in compliance or under corrective action plans, the RAP placed the major emphasis for corrective actions on the combined sewer overflows (CSOs) and storm water discharges. At the time, the full cost of clean-up was estimated at $900 million. Subsequent updates of the original RAP indicate that the full cost to restore the river is much higher – exceeding $2 billion (1990 dollars).

The Rouge River RAP Advisory Council (RRAC) was established in 1993. The RRAC published the 1994 Rouge River Remedial Action Plan Update, identified the causes and sources of pollutants of concern, and determined what actions were needed to correct the problems to prevent future ones. A Rouge RAP Progress Report was published in 1998.RRAC published "report cards," in 1999 and 2005 to evaluate the condition of the Rouge River and rate the progress of various initiatives.

The RRAC is currently working on delisting criteria for the Rouge River AOC and will continue to help implement projects that accomplish the Rouge River RAP goals.

THE ROUGE RIVER NATIONAL WET WEATHER DEMONSTRATION PROJECT

The Rouge River National Wet Weather Demonstration Project (Rouge Project) was initiated in 1992 by Wayne County (Michigan). This cooperative effort between federal, state and local agencies is supported by multi-year federal grants from the United States Environmental Protection Agency and additional funding from local communities.

The Rouge Project is a working example of how a systematic watershed approach to pollution control can result in cost-effective, timely achievement of designated uses in a water body. The early focus of the Rouge Project was on the control of combined sewer overflows (CSOs) in the watershed. Although control of pollution from CSOs was identified as a major priority, it was determined that CSO control alone would not provide sufficient improvements to meet water quality standards. Sanitary sewer overflows (SSOs), storm water runoff, discharges from illicit connections, discharges from failed on-site sewage disposal systems and other sources would continue to degrade the river. Additionally, wetlands, habitat and lakes needed restoration to support the fishery and wildlife desired by the citizens. This also required that flow variability needed to be controlled. Based upon these earlier studies, the focus of the Rouge Project became

holistic and considered the impacts from all sources of pollution and use impairments in receiving waters.

ALLIANCE OF ROUGE COMMUNITIES

The Alliance of Rouge Communities (ARC) is a voluntary public watershed entity currently comprised of 36 municipal governments (i.e., cities, townships, and villages), three counties (Oakland, Wayne, and Washtenaw) and the Wayne County Airport Authority as authorized by Part 312 (Watershed Alliances) of the Michigan Natural Resources and Environmental Protection Act (MCL 324.101 to 324.90106) as amended by Act No. 517, Public Acts of 2004.

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 to restore beneficial uses of the river to area residents.

Overview of the Rouge Project

All of these planning efforts focused on the four primary pollutants affecting the Rouge River: pathogens, flow rate and volume, sediment, and nutrients. Each plan, while differing in priorities, was driven by six basic goals that intended to focus efforts on addressing these pollutants, the sources and their respective causes. These goals are:

1) Reduce sources of pollution that threaten public health;
2) Reduce runoff impacts through sustainable storm water management strategies and programs;
3) Inform and educate the public to become watershed stewards;
4) Protect, restore and/or enhance natural features to maintain/improve river and watershed ecosystems;
5) Maximize community assets related to the watershed, and
6) Support regional partnerships for the implementation of watershed management.

Prior to the Rouge Project, remedial actions had almost exclusively focused on flooding. In retrospect we find that many of the solutions were detrimental to the overall health of the river. Thus, as the Rouge project continued to chip away at the challenges of combined and sanitary sewer overflows and storm water management, the need for habitat restoration became apparent.

Wet weather water pollution control is a costly challenge for local units of governments. Sanitary sewers are designed to carry sewage (and only sewage) to the wastewater treatment plant (WWTP). Similarly, storm water drainage systems are not designed to transport sanitary sewage. In practice, however, storm water enters the sanitary sewage collection systems and sanitary sewage often enters the storm water systems during rain events. The Phase II Storm Water regulations coupled with the traditional NPDES permitting program has done much to identify these constraints within the sewage collection systems and the storm water drainage systems. The Rouge communities have addressed these challenges head-on and are among the

very few urban communities that have a comprehensive program to address all of their wet weather problems.

The Alliance of Rouge Communities (ARC) has been a strong supporter of the efforts of the local communities to improve the quality of life in Southeast Michigan. Together with the ARC, many Rouge communities have completed their Combined Sewer Overflow (CSO) control projects, completed their Illicit Discharge Elimination Program (IDEP), initiated a locally driven on-site sewage disposal system (OSDS) inspection program and spent the better part of five years grappling with the challenges of Sanitary Sewage Overflows (SSO). All Rouge communities with remaining SSO challenges have signed Consent Orders that establish the plan to finally address the last of the wet weather challenges.

CSO Control

The first order of business on the Rouge River was CSO control. A three-phased CSO control program was implemented that began with the construction of ten (10) CSO retention treatment basins and six sanitary and storm sewer separation projects. These projects have been completed and accepted by the Michigan Department of Environmental Quality (MDEQ). Examples of Phase I CSO Retention Treatment Basins constructed under the Rouge Projects are shown below.

As a result of these costly efforts, approximately 89 of the 127 miles of stream in the Rouge River watershed are now free of the adverse impacts of uncontrolled CSO discharges.

Acacia Park CSO Control Facility

Birmingham CSO Control Facility

Bloomfield Village CSO Facility

The success of our CSO control facilities demonstrate our commitment to work with the general public. These major CSO control facilities are nestled in to some of the most exclusive neighborhoods in Oakland County. As you can tell, these facilities are quite attractive. They are all outfitted with odor control. They have all exceeded the requirement set forth by the MDEQ. The Rouge communities have documented that well-designed, well-operated CSO control facilities can co-exist with even the most exclusive neighborhoods and become a community asset.

SSO Control

Unfortunately, as these massive CSOs were controlled, the many other sources of sewage getting into the river began to become apparent. SSOs, once believed to be controlled statewide, were discovered throughout the Rouge.

The design of SSO control facilities is often constrained by legal, technical, and administrative challenges. Both the regulators and the regulated communities agree that the unique position of Michigan, surrounded by the Great Lakes, require that the standards for water quality protection must exceed those of most other states. Still the communities must seek the least costly solution to achieve these high standards. Thus the parties have looked for ways to provide consistency in the decision-making process while providing the flexibility required to control costs.

The Rouge Communities shared information and initiated a variety of SSO control measures. The projects are grouped into the following classifications:

1) System Flow Management
2) SSO Treatment Demonstration
3) Infiltration/Inflow Reduction
4) System Capacity Expansion
5) System Monitoring and Reporting

Illicit Discharge Elimination Programs

The early focus of the Rouge Project was on the control of CSOs in the older urban core portion of the downstream areas of the Rouge Watershed. As a finite number of point source CSO discharges could be identified and responsibility for each defined, the traditional regulatory approach of issuing NPDES permits mandating corrective action worked relatively well. Additional monitoring of the river showed that the other sources of pollution such as storm water runoff, discharges from illicit connections, and discharges from failed on-site septic systems, needed to be controlled before full restoration of the river would be achieved throughout the watershed.

In addition to the large scale sources of sewage in our waterways, the Rouge Communities quickly found that there were thousands of smaller sources – up stream of the older urban areas – in which sewage was entering the Rouge. Thus the ARC established the procedures for locating and eliminating these sources. The ARC then went on to provide training for municipal employees and contracts. The result of these efforts has been the elimination of millions of gallons of sewage from the Rouge River and a consistent improvement in *E. coli* levels – even during wet weather.

Measurable Results

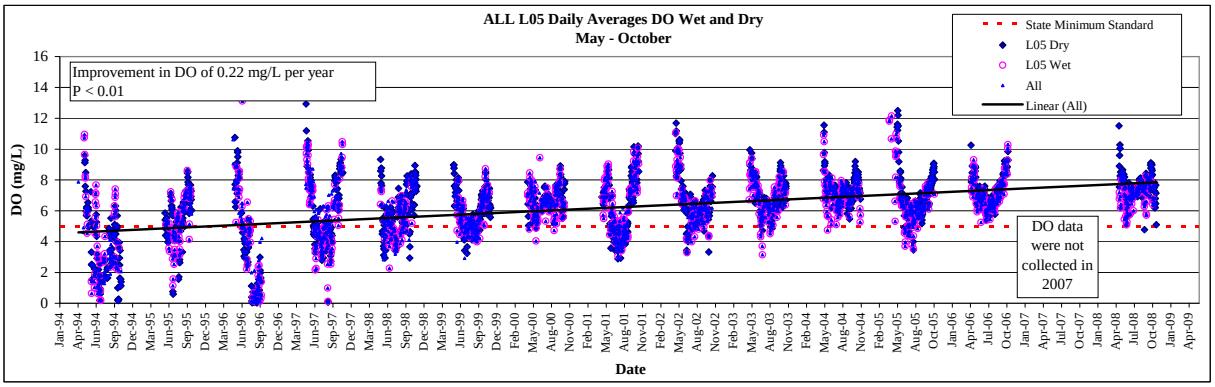
The Rouge Project is a success using any of several measures of achievement. Major progress has been made in the control of sewage being discharged to the Rouge River. For example, CSO pollutant loads to the river have been cut by 90 to 100 percent during most events. SSOs have been controlled throughout the Rouge and progress is being made on those remaining.

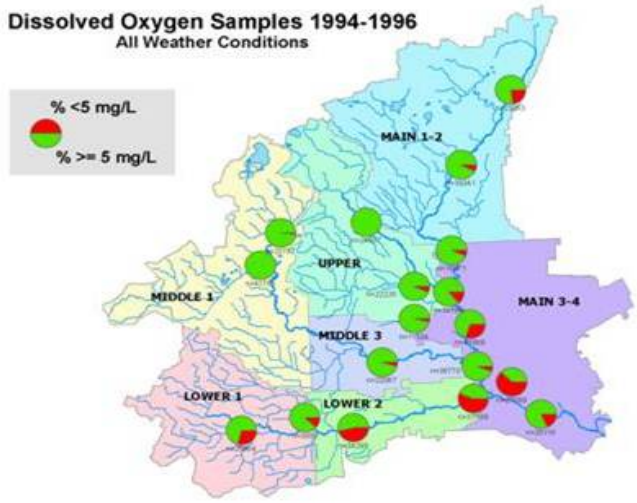
The most impressive part of the Rouge Project is the documented improvement. There are tens of millions of data points and they are say the same thing – the Rouge is getting cleaner every day.

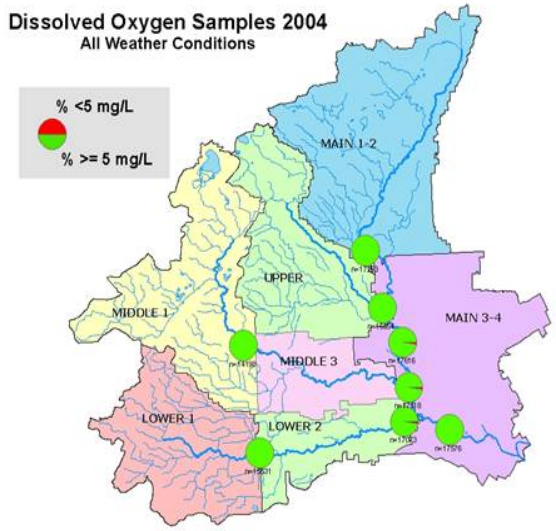
Dissolved Oxygen

One of the best indicators of improved water quality is the dissolved oxygen (DO). The following graph presents the continuous dissolved oxygen concentrations since 1994. The DO has improved 0.22 mg/l per year for fifteen years. In 1994, the DO routinely went to zero. As a result the fishery was extremely diminished. As the graph shows, now the DO never goes to zero and rarely goes below 5 mg/l. This, of course, will support a diverse fishery.

The Data collected from other branches show a similar improvement. That data can be review on the ARC web site (www.allianceofrougecommunities.com).



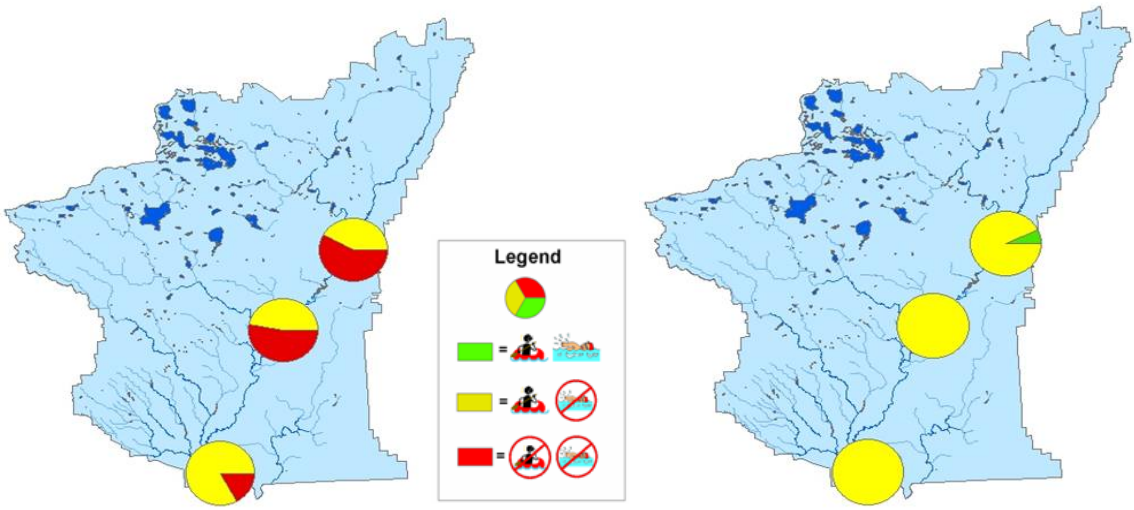




Equally important, the bacterial data continues to improve. In some areas of the Rouge, like the Upper Rouge River, all of the CSOs have been controlled, the SSO program is well underway and years of aggressive illicit discharge elimination programs have proven successful. These

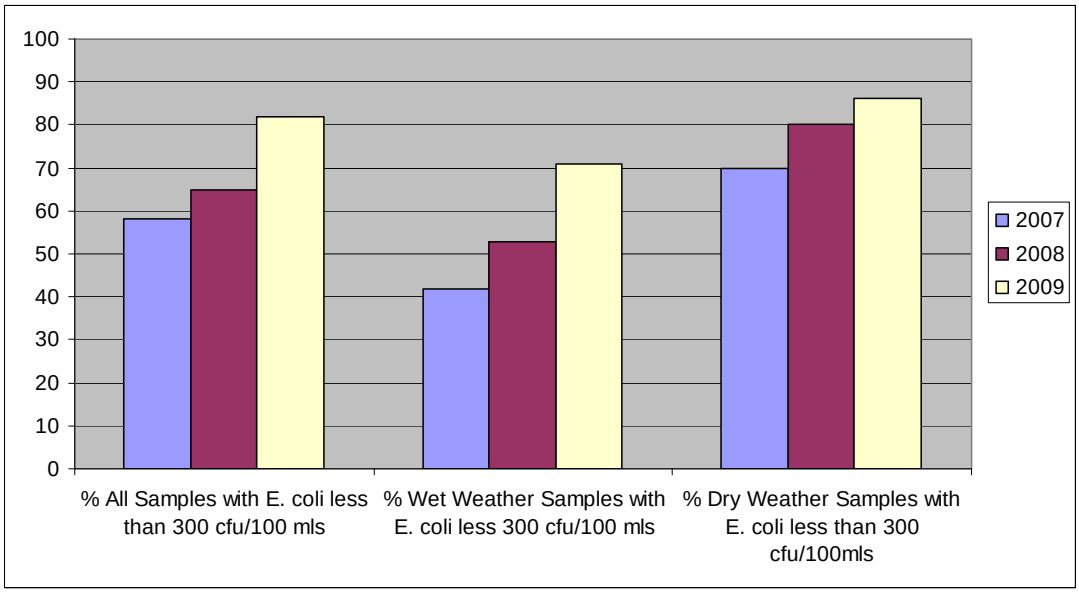
areas have shown remarkable improvement to the point that the bacterial levels allow partial body contact at all time.

E. coli improvements in the upper Rouge River 1994 to 2004



In other reached, like the Middle Rouge, CSOs have been controlled but SSOs remain a challenge and are methodically being removed. These actions, coupled with ongoing illicit discharge eliminations, have allowed the return of a variety of water related recreation in the Impoundments created over hundred years ago by Henry Ford. The E coli data has improve to the point that partial body contact is normally allowed during dry weather. More importantly, the trends continue in the right direction. This is not a surprise. Once a sewage source is eliminated – whether it is CSO, SSO or an illicit discharge – the source is eliminated forever. Michigan imposes very stringent standards in all waterways under all flow conditions. These standards are tough but the communities continue to strive to meet these standards.

Middle Rouge River E coli Monitoring 2007 - 2009



Pollution Control beyond Sewage - Addressing Historic Pollutants

But even after all of the sewage sources are eliminated the Rouge Communities recognize that some of the historic practices have caused problems that are not going to go away by themselves. Within the Rouge River are a number of impoundments that have created a large number of lakes that provide recreational opportunities. Unfortunately many of these lakes had become sediment filled including PCB contaminated sediments. When the River was foul smelling and sewage laden, there was little cry for restoration of these recreational lakes. As the water quality improved, however, the citizens and the communities wanted these historic problems addressed. The following projects are just three among over a hundred restoration projects.

Carpenter Lake Restoration

The Rouge Project and the City of Southfield lead a team to investigate, design, permit and provide construction oversight for the complete restoration of Carpenter Lake. The purpose of the project was to restore Carpenter Lake for storm water management, public recreation and fish and wildlife habitat. The overall project included the removal and replacement of the existing dam; reduction of downstream sediment loading by removal of accumulated sediment; removal of exotic fish and plant species and re-introduction of native fish and aquatic species; enhanced habitat by establishing fish and wildlife habitat features in the lake; improved aesthetics and recreation facilities including trail development, interpretive signage, shoreline stabilization and habitat restoration. In order to accomplish this, the project scope was divided into three main components:

1) The removal/demolition of the existing dam structure and construction of a new dam,
2) Restoration of the lake itself, and
3) The development of upland park trails and nature experiences. The lake restoration included the removal of over 30,000 cubic yards of sediment, development of wetland shelves, construction of fish habitat structures within the open water and wetland areas, and removal of the predominant carp fish species. The upland was constructed as a nature preserve, with wooded trails, a fishing pier and parking with integrated storm water BMPs.

Newburgh Lake Restoration

Newburgh Lake, a 105-acre impoundment of the Middle Rouge River, had been accumulating sediments since it was created in the 1930s by Henry Ford. These sediments, some containing elevated levels of metals and polychlorinated biphenyls (PCBs) substantially diminished the

recreational opportunities of the lake. Nutrient-rich water and sediments supported excessive aquatic plant growth and bioaccumulative toxics such as PCBs lead to fish contamination and a potential human health hazard. The Rouge Project in cooperation with Michigan Department of Environmental Quality, US EPA, City of Livonia and Plymouth Township, Michigan, initiated a project that would resurrect an urban resource. The specific objectives for this project included:

1) Restoration of water quality,
2) Elimination of the fish consumption advisory for PCBs and thus reduce potential human health risks,
3) Increase the amount and diversity of aquatic life,
4) Increase the use of the lake for canoeing, boating, and fishing, with the long-term goal of full body contact, and
5) Enhance the public perception of Newburgh Lake as a resource for both recreation and education.

The largest challenge of the project was the requirement to complete all construction activities on the face of the lake to prevent the spread of PCB contamination. This required a variety of construction techniques.

The Newburgh Lake Restoration Project at completion:

- Removed 558,000 tons of sediment, approximately 350,000 removed contained PCBs
- Eradicated, removed, and disposed of approximately 30,000 pounds of contaminated and rough fish
- Established 10 acres of aquatic vegetation,
- Created structural and bed fish habitat,
- Restocked the lake with game fish,
- Resurfaced roads,
- Provided a new boat ramp and docks,
- Opened up areas for more recreational use, and
- Repaired the controls on the dam outlet structure.

Rouge River Oxbow Restoration

The main objective of the Oxbow Restoration Project was to restore valuable fish and wildlife habitat within the Rouge and to restore functioning riverine wetlands that have been lost due to channelization of the Rouge River. Secondary

objectives included improvement of water quality, increased floodplain storage, educational/interpretative opportunities and improved aesthetics.

The first phase of the project included excavation and plantings completed in Spring 2002 to restore Oxbow Wetlands similar to a riverine wetland system. The restoration provides a 2,200 foot channel that varies in width from 15 to 105 feet and depths of 3 to 6 feet. The channel is surrounded by 3 acres of submergent and emergent wetland systems (0-3 foot depths) that provide habitat for various fish species.

The wetland transitions to 10 acres of existing and restored upland woodlands and meadow. Uplands are planted with various tree, shrub, grass and wildflower species. Bioengineering (planted slope stabilization) techniques also provide shrub areas. Native fish species were introduced to the oxbow wetlands, including bass, channel catfish and bowfin.

The island created in the middle of the oxbow will become and interpretive area for educational and public programs, to include camps, classes, and a Native American Village that originally occupied the area.

<u>Measurable Results</u>

Coupled with water quality improvements, the ecosystem health continues to improve as well, as demonstrated by several measures including increased sightings of fish and wildlife along the river each year since 1999. Improvements in the water quality and removal of contaminated sediment in Newburgh Lake resulted in the lifting of the fish consumption advisory in 2003 for some species of fish in the lake. This is the first time fish caught in the Rouge River system has been safe for consumption in decades.

Before

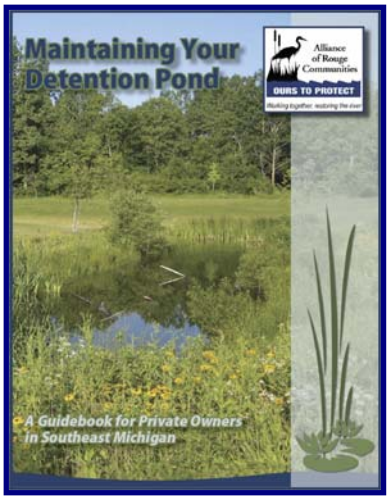
After

Managing Storm Water

With continued progress on the largest pollutant sources, the ARC began to focus on more dispersed yet significant sources. In addition to the pollutant sources mentioned above, the focus was refined the focus on managing storm water runoff.

While the previous storm water management efforts focused on implementing ordinances to address flooding, there was a renewed focus on storm water runoff quantity, quality, and rate of flow. As development has progressed across the watershed, natural areas like wetlands, woodlands riparian corridors and vegetated areas have been converted to a variety of land use types that consist of higher percentages of impervious surfaces such as streets, parking lots, rooftops, and compacted ground with turf vegetation. Increased impervious surfaces also cause an increase in the total volume of storm water runoff, the frequency of runoff reaching the streams, the peak flow rate of runoff and the quality of runoff.

Thus the first emphasis was to retrofit and improve proposed infrastructure. While the resulting storm water management standards varied from community to community and from County to County, the overall concept was simple. Store a large quantity (typically the 100 year storm) and release it at a slow rate (typically at a predevelopment/agricultural runoff rate).



The next step was to begin to address our poorly maintained existing drainage system. A simple example of a program that yielded great benefit was Oakland County's effort to inventory and retrofit the outlet structure of existing dry storm water retention ponds. This was a low cost program that yielded tremendous benefits. Similarly, the ARC prepared a series of training programs, videos, and supporting documents to teach homeowners how to maintain their private detention ponds. This, too, yielded tremendous benefits.

Equally important was our effort to reclaim the water course itself. Like most urban rivers, years of flashy hydrology have severely eroded the watercourse making it wider, flatter, sediment laden, and devoid of sustaining habitat. These efforts were lead by the communities. They took responsibility for the large scale projects like bank stabilization and reshaping the water course. This included a variety of projects that relied on research performed across the country. Thus there are examples of channel improvements, rock wing walls, restored pool and riffles, and the whole array of modifications that help support fisheries and the biology that supports it.

Example of Major Streambank Stabilization Project - Kingfisher Bluff - Dearborn, Michigan

Example of Minor Streambank Stabilization Project - Beechwoods – Southfield, Michigan

Example of Citizen Lead Streambank Stabilization using Bioengineering techniques – Firefighters Park, Troy Michigan

These efforts were fortified by advocacy groups and volunteers.

With progress being made on the large scale aspects of water quality management, the Rouge River communities refined their focus to additionally emphasize the reduction of storm water volume using various “green infrastructure” techniques.

The use of green infrastructure techniques across the watershed is primarily intended to address the river’s “flashiness”. Green infrastructure techniques are sometimes referred to as Low Impact Development (LID) techniques. While LID is the terminology generally used for land

development (or re-development), the “green infrastructure” is a broader term representing application in all areas, including new developments, redevelopment and existing properties. It is this last application that is the primary focus of green infrastructure implementation in the Rouge River watershed. Green infrastructure employs principles such as preserving and re-creating natural landscape features, minimizing effective imperviousness to create functional and appealing site drainage that treat storm water as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements. By implementing green infrastructure principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, green infrastructure can maintain or restore a watershed's hydrologic and ecological functions.

Poorly Drain, poorly maintained parkland transformed into restored Prairie

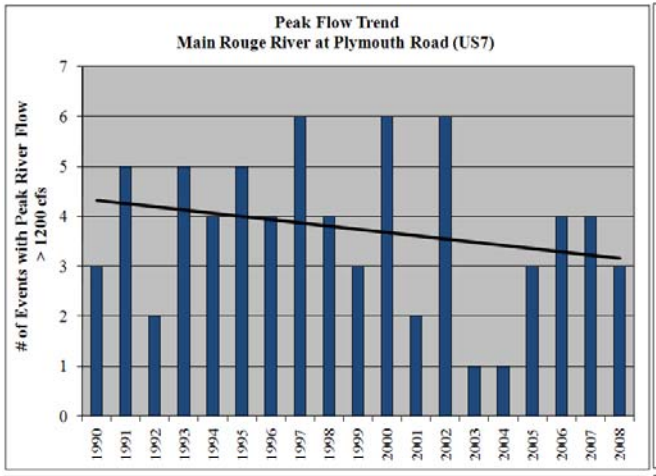
And finally, the ARC must recognize the innovative things that our industrial partners have done in support of improved water quality in the Rouge River. While there have been thousands of smaller projects that warrant recognition, the most impressive restoration was the complete reconstruction of the Ford Rouge Automotive Assembly Plant. Besides building a completely new, state of the art assembly plant, Ford installed constructed wetlands, pervious pavement, and the world’s largest green roof.

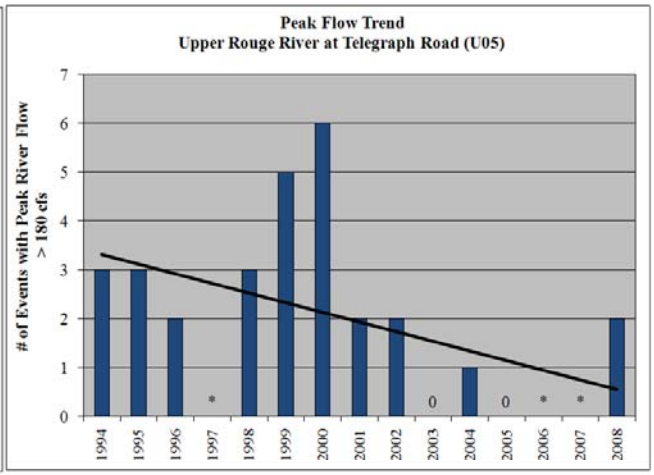
Newly assembled Ford Mustangs parked on a pervious parking lot.

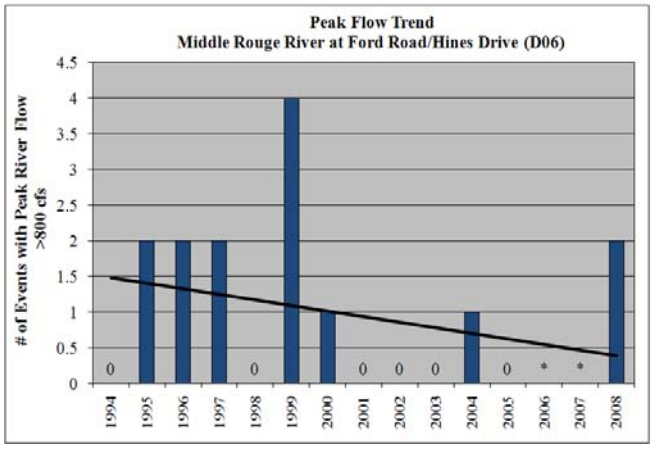
Workers install a green roof on assembly plant.

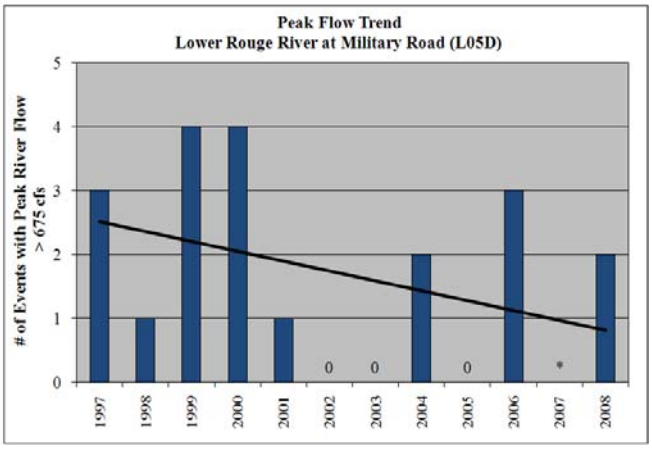
Measurable Results

The slow but steady progress being made within the Rouge River can only be appreciated by reviewing the data. The results are striking. The amount of data is extremely large but the simple conclusion is that the number of peak flow events is decreasing, the runoff volume of these events is decreasing and the frequency of these events is decreasing.



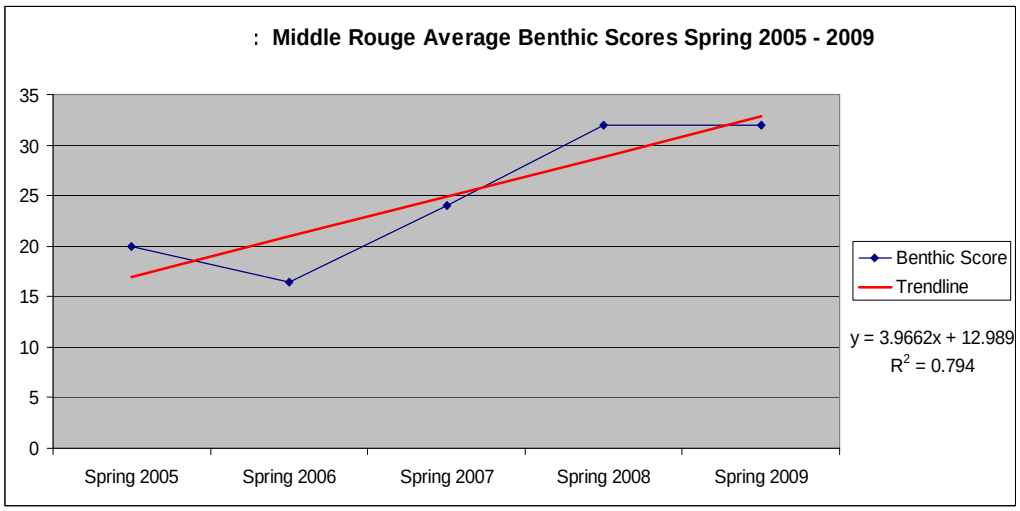


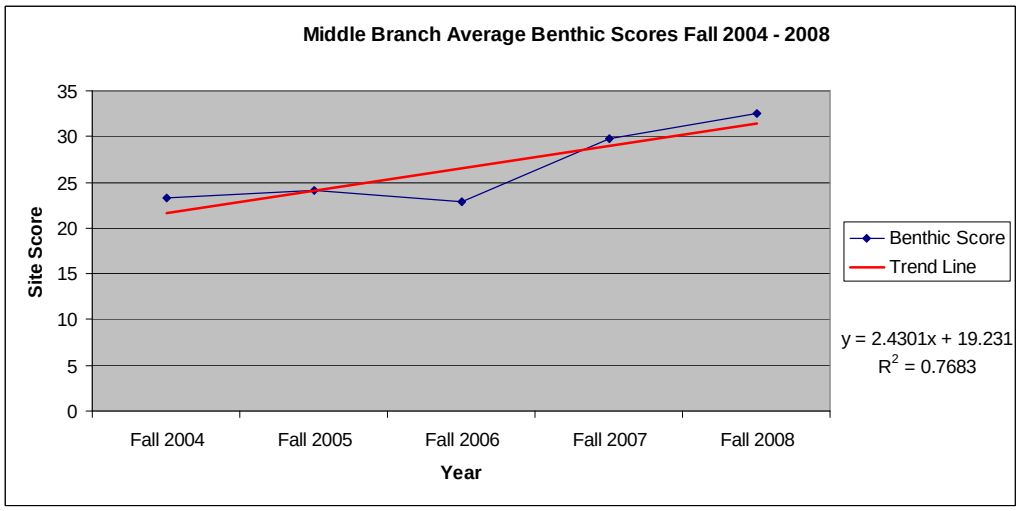




But the most promising measurement is the return of our fishery and the biology that supports it. Throughout the Rouge Project, the Friends of the Rouge (FOTR) have worked the MDEQ, the University of Michigan, the Communities, and their members to develop a benthic monitoring program (the Bug Hunt) that had sufficient scientific rigor to be used as an indicator of improved water quality. Their data is now accepted by the regulators and the communities as the appropriate way of measuring success in implementing a storm water permitting program.

And these data, too, indicate the continued success of the Rouge Project. In the five years since the FOTR program has been accepted by the MDEQ, the numbers and diversity of the benthic community continues to increase. The ARC and the communities will continue to sponsor these data collecting activities and use the results to evaluate performance of their various storm water management activities.





CONCLUSIONS

The use of the watershed approach has emerged as the most cost-effective and logical approach to water resource management in the Rouge Watershed and elsewhere. The challenge for the Rouge Project became to develop innovative solutions to achieve water quality objectives that may be:

1) More cost-effective,
2) Implemented in a more timely fashion and

3) Better able meet local needs. It has also become clear that water resources management must have the support of the general public in order to be effective and to become self-sustaining.

The Rouge Project has provided a unique opportunity for a watershed-wide approach to restoring and protecting an urban river system by using a cooperative, locally based approach to pollution control.

Stonecat found at Firefighters Park in Troy, Michigan

Based upon what was learned, the focus of the Rouge Project became more holistic to consider the impacts from all sources of pollution and use impairments in receiving waters by using the watershed management approach. There is a clear inter-relationship of the pollution sources within a watershed that demands an inter-related approach to a solution in order to achieve water quality standards and associated designated uses within a watershed. A piecemeal approach of focusing only on sources of pollution or a group of sources will not achieve the desired results nor will it achieve the acceptance of the residents of the watershed. The Rouge Project has learned several very important elements of using the watershed management approach. Those include the need to: analyze all of the various sources of stressors to the water quality problems in a watershed-physical, chemical and biological; establish a hierarchy of pollution sources in a watershed-point sources and nonpoint sources-based upon the adverse water quality impacts of those sources; and keep reinforcing, at a watershed level, the concept of prioritizing the control of those sources and the other stressors to get desired environmental protection; to recognize it may take a long time to correct some of these pollution sources or other physical, chemical or biological stressors so it is important to prioritize the control programs to get the maximum environmental improvement as soon as possible; critically assess the cumulative watershed impacts to quantitatively assess the physical, chemical and biological processes and then fashion the watershed-based solutions to prevent treating the symptoms rather than effecting a cure. The management plan and tools that are developed must be tailored to address watershed specific problems.

However, the Rouge Project also proves that given the funding to develop the tools, the urban communities can work together to accomplish great things – include the restoration of an urban river.