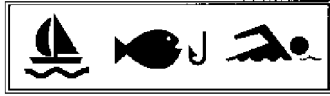


THE ROUGE RIVER PROJECT
A WORLD CLASS EFFORT



BRINGING OUR RIVER BACK TO LIFE

Rouge River National Wet Weather Demonstration Project

Wayne County, Michigan

TECHNICAL MEMORANDUM Evaluation of NPS Control from Wetlands WETL-1 Annual Report

RPO-NPS-TM17.00

June 1997

Rouge River National Wet Weather Demonstration Project

Wayne County, Michigan

TECHNICAL MEMORANDUM EVALUATION OF NPS CONTROL FROM WETLANDS WETL-1 ANNUAL REPORT

Author: Douglas Denison

The Rouge River National Wet Weather Demonstration Project is funded, in part, by the United States Environmental Protection Agency (EPA) Grant #X995743-01, #X995743-02, #X995743-03 and #C995743-01. The views expressed by individual authors are their own and do not necessarily reflect those of EPA. Mention of trade names, products, or services does not convey, and should not be interpreted as conveying, official EPA approval, endorsement, or recommendation.

Rouge River National Wet Weather Demonstration Project

MISSION STATEMENT

The mission of the Rouge River National Wet Weather Demonstration Project is to demonstrate effective solutions to water quality problems facing an urban watershed highly impacted by wet weather and develop potential solutions and implement projects which will lead to the restoration of water quality in the Rouge River. The project will address both conventional and toxic pollutants to:

- provide a safe and healthy recreational river resource for present and future generations;
- re-establish a healthy and diverse ecosystem within the Rouge River Watershed;
- protect downstream water resources such as the Detroit River and Lake Erie; and
- help ensure compliance with federal, state and local environmental laws which protect human health and the environment.

This will be accomplished through the development, implementation and financial integration of technical, social and institutional frameworks leading to cost-efficient and innovative watershed-based solutions to wet weather problems. This watershed-based national demonstration project will provide other municipalities across the nation facing similar problems with guidance and potentially effective solutions.

ABSTRACT

The Rouge River National Wet Weather Demonstration Project (Rouge Project) is a federally funded initiative with the objective of developing demonstration projects to evaluate a variety of urban nonpoint source (NPS) pollution reduction best management practices (BMPs) for the Rouge River Watershed. These demonstration projects will improve the quality of storm water runoff to the Rouge River. The function of wetland filtration for water quality improvement has been recognized as one potential BMP.

Wetlands increase storm water detention capacity, increase storm water attenuation, moderate low flows, and improve overall water quality by removing nutrients, sediments and metals. The goal of the WETL-1, wetland demonstration project was to evaluate the effectiveness of wetlands in the treatment of storm water. The wetland demonstration project utilized existing, enhanced, and created wetlands to demonstrate the value and effectiveness of wetlands in treating storm water runoff. Future evaluations will identify pollutants removed by the demonstration wetlands, the efficiency of the removal processes and the effects of sediments on this removal efficiency.

This document summarizes the WETL-1 demonstration project activities including wetland designs and implementation activities required to implement the Rouge River wetlands wet weather management demonstration system.

PREFACE

The Rouge River and its watershed are a primary source of pollution to the Great Lakes. The Clean Water Act of 1972 intended to make waterways "fishable and swimmable" by 1972. Although that goal has not been reached, great progress has been made in improving water quality in most waterways. The Rouge River Remedial Action Plan (RAP) provided a basis for which The Rouge River National Wet Weather Demonstration Project (Rouge Project) efforts were created: it identified the major sources of pollution and measured the relative contributions of each. The RAP is the continuing foundation for the Rouge Project and presents a framework for addressing the problems within the Rouge River by looking beyond treatment and focusing instead on prevention methods.

The Rouge Project was established under the initial Rouge Grant 1 from the United States Environmental Protection Agency, Region 5, and enabled Wayne County to initiate a comprehensive watershed-wide pollution-control approach that addresses combined sewer overflow (CSO), stormwater management, and other nonpoint source controls through the application of innovative technologies, progressive financial and institutional arrangements, and creative public involvement and education programs.

Rouge Grant 2 provides the framework for the progression and implementation of Project goals as Wayne County continues its mission to develop potential solutions and implement projects which will lead to the restoration of water quality in the Rouge River. The Project will address both conventional and toxic pollutants to:

- provide a safe and healthy recreational river resource for present and future generations;
- re-establish a healthy and diverse ecosystem within the Rouge River Watershed;
- protect downstream water resources such as the Detroit River and Lake Erie; and
- help ensure compliance with federal, state, and local environmental laws which protect human health and environment.

This will be accomplished through the development, implementation, and financial integration of technical, social, and institutional frameworks leading to cost-efficient and innovative watershed-based solutions to wet weather problems. This watershed-based national demonstration project will provide other municipalities across the nation facing similar problems with guidance and potentially effective solutions.

Under Rouge Grant 2, the Rouge Project will build on lessons learned from Grant 1 efforts and focus on further integration of the goals of the overall Mission. To this end, Rouge Grant 2 concentrates on the following key Project areas:

- **Watershed Management** will continue under Rouge Grant 2 with the development and evaluation of wet weather and stormwater alternatives, the planning of long-term monitoring

programs, and the ongoing efforts to enhance instream water quality, monitor rain and flow levels, interpret data analysis, and present recommendations.

- **Nonpoint Source Pollution Control** will provide for the stormwater management, permit applications, and development of financial and institutional alternatives for wet-weather watershed management in concert with enhanced efforts to establish institutional partnerships. Toward the goal of institutional partnering, several community projects will be undertaken with watershed communities. Additional efforts include the inventory of wetlands and measurement of pollutant loads from abandoned dumps and air deposition with possible remediation of some sites.
- **CSO Construction Coordination** will continue to monitor the construction of CSO demonstration projects established under Grant 1. Additional planning and assistance will allow project coordinators to make additional recommendations on the design criteria of future CSO abatement facilities.
- **Public Involvement and Information** will reach and interact with more stakeholders, institutions, and regulatory agencies, thus fostering a renewed understanding and continued commitment to reducing pollution, and continuing the transfer of watershed management approaches way beyond the project. It will be the central mechanism for transmittal of the Project's Decision Support System tools, processes, and information necessary for sustaining a watershed management support system directly to varied audiences both within and outside the Rouge watershed.

Additional information on the Rouge River Project is available from many sources, including the Wayne County Department of Environment (WCDOE) and the Rouge Program Office (RPO).

This document has been generated under the Nonpoint Source Best Management Practices (BMPs) Program Element and is a product of Work Plan WETL-1 Task 6. This document provides a summary of wetland design criteria and conceptual approaches for the wetland wet weather management demonstration system.

TABLE OF CONTENTS

<u>Section</u>	<u>Page</u>
EXECUTIVE SUMMARY	1
1.0 INTRODUCTION	2
1.1 DESCRIPTION OF PROJECT	2
1.2 PURPOSE OF THE WETLANDS PROJECT	2
2.0 IMPLEMENTATION OF THE WETLANDS PROJECT	4
2.1 SITE SELECTION PROCESS	4
2.2 WETLAND DESIGN DEVELOPMENT	4
2.3 DESIGN CHARACTERISTICS OF WETLAND AREA 1	5
2.4 DESIGN CHARACTERISTICS OF WETLAND AREA 2	5
2.5 DESIGN CHARACTERISTICS OF WETLAND AREA 3	6
3.0 CONSTRUCTION OF THE WETLANDS PROJECT	9
3.1 CONSTRUCTION SUMMARY OF THE WETLANDS PROJECT	9
4.0 BENEFITS OF THE WETLANDS PROJECT	10
4.1 PRELIMINARY ASSESSMENT OF BENEFITS	10
5.0 COSTS OF THE WETLANDS PROJECT	11
5.1 COSTS	11

EXECUTIVE SUMMARY

The wetland demonstration project seeks to increase storm water detention capacity by utilizing wetlands in the Rouge River Watershed. Wetlands increase storm water attenuation, moderate low flows, and improve water quality by removing nutrients, sediments and metals. The future goal of this demonstration project is to evaluate the effectiveness of the demonstration wetlands in the treatment of storm water. This evaluation will include identification of pollutants removed by the demonstration wetlands, the efficiency of the removal processes and the effects of sediments on this removal efficiency. Ultimately, the demonstration project will compare the pollutant removal effectiveness of different types of wetlands:

- An existing forested wetland;
- An enhanced mixed forested, open water and scrub wetland system;
- Newly created emergent wetland; and,
- A mature created emergent/shrub/scrub wetland system.

An extensive investigation was completed to identify and select appropriate wetland sites in the watershed where pollution abatement is feasible and prudent. The investigation included collecting relevant information to aid in the search for targeted wetland sites. The information included Michigan Resource Information System (MIRIS) maps, National Wetlands Inventory maps, soil maps, aerial photography, land use maps, recreation maps, RPO Geographic Information System (GIS) mapping of storm water discharges, and existing and historical drainage maps. This investigation also included a review of the existing information on site specific wetland ecology, wetland ecosystem processes, and the use of specific wetland sites for the control of storm water. Utilizing this information, potential sites were field surveyed.

As a result of the site selection process, five sites were identified (three existing and two newly constructed wetlands) as prudent and feasible for the demonstration project. The wetland projects as nonpoint source pollution control sites incorporated similar design elements that will provide comparable experimental data. These elements included sediment forebays, treatment of "first flush" for most storm events, and designed discharge outlets with monitoring capabilities. The contributing storm sewer areas are of similar land use and size, wetland areas of similar size, and design criteria developed from hydrological data in combination with characteristics of the available treatment area.

Construction of the two newly created wetlands and modification of the three existing wetlands was substantially completed in December 1996.

Beginning in the Spring 1997, water quality monitoring will begin to quantify the effectiveness of wetlands in treating storm water. The results of this demonstration will evaluate pollutants removed, efficiency of removal process, and effects of inundation of wetland functions. The created wetlands have been designed to function in perpetuity and will be monitored as required by MDEQ. In

addition to monitoring the success of the wetland creation, all of the wetlands will be monitored for water quality improvement by the Rouge Project under separate work plans.

1.0 INTRODUCTION.

1.1 DESCRIPTION OF THE PROJECT. The Rouge River National Wet Weather Demonstration Project (Rouge Project) is a federally funded initiative with the objective of developing a wet weather management plan for the Rouge River Watershed. The project includes a variety of demonstration projects which will improve the quality of storm water runoff to the Rouge River. The projects include a variety of urban NPS reduction BMPs including structural controls, source controls, treatment of impoundment sediments, detention basins, public participation and wetland treatment. This report summarizes the activities associated with the demonstration project, "Evaluation of NPS Control from Wetlands".

1.2 PURPOSE OF THE WETLANDS PROJECT. Although past storm water management designs utilized natural wetlands to treat storm water, regulatory agencies discourage this approach. This position is primarily a function of jurisdictional policy implemented against poorly designed systems that have traditionally impaired the functional uses of natural wetlands. There is a lack of research on the quantity and quality of storm water that natural wetlands are capable of treating without being negatively impacted. Constructed wetlands in contrast, are being built specifically for treating point source discharges and storm water runoff. Consequently there is no intention of replicating ecological functions other than water quality treatment. Only a few examples of wetland BMP's occur in the Rouge River Watershed.

The Rouge Project included a demonstration of NPS control from the use of existing, restored and created freshwater wetlands (WETL-1). The overall NPS pollution control strategy of WETL-1 consisted of demonstrating: 1) a site selection strategy that emphasizes the potential for integrated solutions, "Selection of Appropriate Wetland Nonpoint Source Pollution Abatement Locations" (RPO-NPS-TM36.00); 2) a basis for design development that accounts for wetland habitat protection and water quality improvement goals, "Conceptual Design of Wetland Management Systems" (RPO-NPS-TM37.00); 3) biological and water quality monitoring program unique to wetland habitats, "Wetland Biological Monitoring Program" (RPO-NPS-TM); and 4) the construction and operation of several wetlands providing NPS pollution control sites and the operation and maintenance program for the wetland systems "Operation and Maintenance Manual Nonpoint Work Plan (WETL-1), Task No. 3 RPO-NPS-TPM37.00). The current status of the wetland project of the Rouge Project is that site selection, design development, monitoring plans and construction documents have been completed. Construction of the wetland projects was virtually completed in November 1996 and preliminary water quality monitoring data will be available during the summer of 1997.

The intent of the WETL-1 project was to increase storm water detention capacity by utilizing wetlands in the Rouge River Watershed. Wetlands increase storm water attenuation, moderate low flows, and improve water quality by removing nutrients, sediments and metals. The future goal of this demonstration project is to evaluate the effectiveness of the

demonstration wetlands in the treatment of storm water. This evaluation will include identification of pollutants removed by the demonstration wetlands, the efficiency of the removal processes and the effects of sediments on this removal efficiency. Ultimately, the demonstration project will compare the pollutant removal effectiveness of different types of wetlands:

- An existing forested wetland;
- An enhanced mixed forested, open water and scrub wetland system;
- Newly created emergent wetland; and,
- A mature created emergent/shrub/scrub wetland system.

2.0 IMPLEMENTATION OF THE WETLAND PROJECT.

The basis for design of NPS pollution control sites that use wetlands, regardless of whether the wetlands are existing, restored or created, presents an integrated approach that accounts for wetland ecology, wetland hydrology, water quality considerations, watershed characteristics and surrounding land use. Utilizing these guiding principles, a selection process was initiated to identify appropriate sites for wetland demonstration projects.

2.1 SITE SELECTION PROCESS. As part of this project, an extensive investigation was completed to identify and select appropriate wetland sites in the watershed where pollution abatement is feasible and prudent. The investigation included collecting relevant information to aid in the search for targeted wetland sites. The information included Michigan Resource Information System (MIRIS) maps, National Wetlands Inventory maps, soil maps, aerial photography, land use maps, recreation maps, RPO Geographic Information System (GIS) mapping of storm water discharges, and existing and historical drainage maps. Utilizing this information, potential sites were field surveyed. The sites included existing constructed wetlands, naturally occurring wetlands, potential CSO sites for constructing new wetlands, and sites draining approximately 100 acres where wetlands could be restored.

This investigation also included a review of the existing information on site specific wetland ecology, wetland ecosystem processes, and the use of specific wetland sites for the control of storm water. A review of the wetland types and existing plant communities existing in the watershed identified four wetland types: forested wetlands, wet meadows, scrub-shrub and shallow water wetlands. These Rouge River wetland types periodically flood with nutrient-enriched waters.

A total of 25 sites (nine constructed, 13 existing, and three CSO) were considered as potential NPS Abatement locations. Five Areas were selected (three existing and two constructed wetlands) as prudent and feasible for further consideration. Technical Memorandum, "Selection of Appropriate Wetland Nonpoint Source Pollution Abatement Locations" (RPO-NPS-TM36.00) is available at the RPO for review. These Areas are located within the City of Inkster, north of Michigan Avenue between Inkster and Henry Ruff Roads. A created wetland built approximately eight years ago in West Bloomfield Township has also been selected to evaluate and compare its effectiveness with newly created wetlands.

2.2 WETLAND DESIGN DEVELOPMENT. The design of the wetland projects as NPS pollution control sites incorporated features that allows manipulation of storm water flow quantity and duration, and allows for the direct comparison of the effectiveness of NPS pollution control in existing and created wetlands receiving storm water runoff from a single watershed. Design criteria for each of the wetland areas were developed from modeled hydrological data in combination with characteristics of the available treatment area. The wetland creation and enhancement areas contain similar design elements that provide comparable experimental data which can be related to known design parameters. These

elements include the incorporation of a sediment forebay to filter the large particles before the storm water enters the wetland system; treatment of "first flush" for most storm events; designed discharge outlets to the Rouge River with monitoring capabilities; and, intermediate monitoring points where applicable. The contributing storm sewer area for each area has been defined and modeled so that the effect of a given wetland area on water quality and quantity can be determined. The influence of directly adjacent land is assumed to be negligible.

2.3 DESIGN CHARACTERISTICS OF WETLAND AREA 1. Wetland Area 1 is proposed to demonstrate the efficiency of storm water treatment by a newly created emergent wetland. Approximately 3.0 acres of emergent wetland was designed and constructed to storm water from an approximately 48 acre older residential neighborhood. Storm water from the storm sewer area is currently discharged into a swale directly connected to the Rouge River. The design elements of Area 1 includes a sediment forebay, designed to capture the storm water flowing from the existing 42-inch storm. All of the storm water from each rain event is directed to the wetland system via the sediment forebay and vegetated swale.

Soil boring information was acquired to document and test wetland creation designs with varying soil types. Area 1 will test the need for a clay liner in sandy soils, soil fertility, soils in direct contact with ground water, etc. An outlet structure that includes a manhole for the installation of water quality and flow monitoring equipment. The outlet will discharge to the Rouge River, 1,100 feet from the current outlet of the storm water discharge pipe. Manipulation of flow rates and retention periods may be discontinued at the end of the demonstration period. The wetland area however has been designed to be sustained by the contributions from the existing storm sewer area. This area will continue to function as an emergent wetland after completion of the demonstration project.

2.4 DESIGN CHARACTERISTICS OF WETLAND AREA 2. Among the wetland sites, the project selected two forested wetlands. These were selected to demonstrate the effectiveness of this type of wetland in controlling NPS pollution. The majority of the existing wetland habitat in the Rouge River Watershed is forested, and forested wetlands are frequently the most common wetland type in certain parts of the world. The demonstration of the effectiveness of forested freshwater wetlands in control of NPS pollution is critical to the long-term implementation of a wetland component in a comprehensive NPS pollution management strategy. Forested wetlands as NPS pollution control sites have not been widely studied, although emergent and open water systems have been studied and are utilized much more frequently. One of the more frequent negative environmental impacts of the use of forested wetlands is flooding and destruction of tree species, and subsequent loss of forested wetland habitat. The site selection methodology and basis for design of the forested wetland basins were adapted to account for the sensitive nature of these wetlands and the hydrologic impacts of using forested wetlands will be assessed. Demonstrating the use of forested wetlands as effective NPS pollution control sites and, perhaps more importantly,

demonstrating the design elements necessary to protect forested wetland habitat from adverse impacts associated with NPS pollution control is one benefit of the demonstration project.

Wetland Area 2 is proposed to demonstrate the efficiency of storm water treatment by an existing forested wetland. Approximately 3.0 acres of forested wetland has been enclosed by berms designed to retain a specified amount of storm water from the storm sewer area. Storm water from approximately 165 acres of mixed land use has historically been discharged directly to the Rouge River via a 60-inch pipe. Area 2 wetland utilizes a lift station to deliver a specified portion of the storm water from the storm sewer to the wetland. Storm water is transported to the wetland area from the storm sewer via an underground pipe into a catch basin designed to function as a sediment forebay. Both the pipe and catch basin are constructed in an upland area. The water is piped under an existing bermed powerline easement and discharged into the wetland area. The wetland area is enclosed by a berm along the northern boundary of the site to isolate it to a known and measurable area. This berm runs parallel to the Rouge River and is set at an elevation of 610 which will be crested by 100-year flood waters from the Rouge River.

This wetland previously discharged water to the Rouge River at one location situated at the far eastern point of the site. Overflow from wetland Area 2 will continue to discharge from this location. The outlet has been modified to control the outflow rate and allow for monitoring activities. Minor grade modifications were necessary for the installation of a weir and valve to control outlet flow levels. The lowpoint of the weir has been set to retain water within the wetland and slowly release it to the Rouge River.

Implementation of this project will involve alterations of the area's hydrologic regime. The forested wetland is maintained by both surface drainage and groundwater contributions. The volume of surface runoff entering the system will increase from the current levels during the proposed period. In addition, the installation of a weir to control outflow and water depths may result in increased retention time. It is unlikely that substantial changes to the existing forested wetland system will occur in this limited amount of time. The site's hydrology will be returned to its current condition upon completion of the period.

2.5 DESIGN CHARACTERISTICS OF WETLAND AREA 3. Area 3 is also located south of the Rouge River between Inkster and Middlebelt Roads, approximately 1,800 feet west of Area 2. The entire site is within the 100-year floodplain of the Rouge River. The site is bisected by an 80-foot long channel which currently conveys storm water runoff from the 183-acre, residential and commercial watershed directly to the Rouge River. The ditch has partially filled with sediments resulting in some storm water flow being diverted to the wetlands on the east and west sides of the ditch. The 4.7-acre wetland on the east side of the ditch contains forested/scrub/shrub/emergent and open water communities. Existing vegetation includes willow, cattail, water plantain, elm, cottonwood, sedges, rushes and

snags. Water discharges from this wetland to the river via surface flow from a shallow swale along the site's eastern river bank.

Approximately 2.4 acres of emergent/scrub/shrub wetland are located along the west side of the ditch. This wetland also receives storm water from the existing sewer line due to the clogged ditch. This wetland contains primarily willow, dogwood and cattail. While no detailed hydrogeological data has been collected, moderate baseflow in the ditch indicates groundwater may also contribute to the wetland hydrology.

Wetland Area 3 contains two separate treatment areas, 3-East and 3-West. A sediment forebay is located at the inflow of each wetland area. Three outlets were constructed in this basin to direct first flush and small storm event flow to wetlands 3-East and 3-West, and overflow from larger storms is discharged directly to the Rouge River.

Wetland Area 3-East. Wetland area 3-East is an existing wetland system that supports forested, emergent, scrub/shrub, and open water systems. The objective of the design is to enhance the flow through this wetland to utilize each of the wetland types in the treatment of storm water. The designated area is enclosed by 18 inch berms. In addition, short berm segments were constructed within the wetland to direct flow through various wetland types and lengthen the flow path. Storm water flow from the sediment forebay is discharged into the existing wetland. A containment berm was constructed along the northern portion of the wetland area. Within the wetland, the flow achieves a maximum flow length ratio and utilizes various wetland types in the treatment train. Berms do not impede the 100-year flood flow from the Rouge River flood conditions. Area 3-East drains to the Rouge River at a low point located along the eastern boundary. Overflow from this area will continue to discharge from this location. The outlet has been modified to control the flow rate and allow for monitoring activities

Wetland Area 3-West. Wetland 3-West contains an emergent and scrub/shrub wetlands created within a former upland area. The created wetland was apportioned into two areas; one and two acre wetland cells. The first wetland cell in the series is approximately one acre in size. Flow from the sediment forebay is released directly into this one-acre wetland. The succeeding wetland is approximately two acres in size. This sizing allows for an assessment of water quality treatment from specified areas of created wetland. The water flows through this two-tier system to an outlet to the Rouge River. This outlet is located at a naturally occurring low point within the forested wetland along the River's banks. A controlled outlet structure was installed at the outlet point to control retention time, water depth and allow for monitoring activities. These wetlands are created in conjunction with wetland mitigation; therefore, they are designed to function as wetlands with minor modifications, if any, after the demonstration is completed.

3.0 CONSTRUCTION OF THE WETLANDS PROJECT.

3.1 CONSTRUCTION SUMMARY FOR THE WETLAND PROJECTS. Construction documents and specifications for the construction of these projects were completed in November 1995. Bidding and award of the projects allowed construction to begin in February, 1996. Construction was substantially complete in December 1996. The construction schedule for these projects was extended by approximately five months. Various reasons accounted for project delays including, spring flooding of the Rouge River, vandalism of power supply panels, delays in equipment orders, unknown utilities encountered, land owner disputes, and contractor delays due to poor coordination with subcontractors. The operation and maintenance of this wetland demonstration project will require an effort for inspections of earthwork, landscaping, structural components and other aspects of the distribution system. This task will be provided by the construction contractor as part of the contract. An "Operation and Maintenance Manual" (RPO-NPS-TPM37.00) was prepared for the wetland projects. A written summary of Operations and Maintenance activities will be provided on an annual basis.

4.0 BENEFITS OF THE WETLANDS.

4.1 PRELIMINARY ASSESSMENT OF BENEFITS. Assessments of the benefits relative to these wetland systems will be provided on an annual basis for five years in a separate biological and water quality monitoring report. Two annual biological monitoring reports, RPO-NPS-TPM36.00 and RPO-NPS-TPM36.01 (pending) have been prepared to develop baseline information. Direct assessment will begin in the spring of 1997 when the wetland water quality monitoring program is implemented and initial data results are reported. Preliminary assessments indicate that the hydrology of the existing forested wetlands will be modified during the study. In anticipation of this altered hydrology a tree survey was completed as part of the biological monitoring report. All trees greater than six inches were surveyed using GPS technology. The trees identified, exhibited a wide range of tolerance to inundation; therefore, it is not anticipated that the altered hydrology will greatly affect the wetland areas. The volume of water flowing through the systems will not be significantly different from the preconstruction condition. However, the wetlands will be monitored closely to ensure the existing function and structure are not impaired.

5.0 COSTS OF THE WETLANDS PROJECT.

5.1 COSTS. Costs associated with the construction and monitoring of the existing wetland projects were borne by money made available through RPO Demonstration Funds as approved by the EPA Region V, the Michigan Department of Environmental Quality, and Wayne County. In addition to the two forested wetland areas, two created wetlands were developed under grant money designated for wetland creation within the Rouge River Watershed. The money was designated under an MDEQ permit which required Waste Management of Michigan, Inc. (WMI) to provide Wayne County a grant to create wetlands within the Rouge River Watershed for the purpose of providing water quality improvement to the Rouge River (RPO-NPS-TM35.00). The created wetlands have been designed to function in perpetuity and will be monitored as required by MDEQ. In addition to monitoring the success of the wetland creation, all of the wetlands will be monitored for water quality improvement by the Rouge Project under separate work plans.