



# Rouge River National Wet Weather Demonstration Project

**Wayne County, Michigan**

## **GIS PILOT PROJECT REPORT EXECUTIVE SUMMARY TO THE FEDERAL COURT**

**December 1998**

# INTRODUCTION

The mission of the Rouge River National Wet Weather demonstration Project is to restore the water quality in the Rouge River as necessary to:

- provide a safe and healthy environment for ourselves and future generations,
- protect down river water resources such as the Detroit River and Lake Erie, and
- re-establish a healthy and diverse ecosystem within the Rouge River Watershed.

This will be accomplished through the development, implementation, and financial integration of a technical, social, and institutional framework leading to cost efficient, and innovative, watershed-based solutions to control the wet weather problems in the Rouge River Watershed.

Geographic Information Systems (GIS) is just one of many tools that can be used to help meet support that mission. GIS unto itself will not restore the river.

Because GIS is a very powerful tool for the communities to use in their efforts to manage the Rouge River, the information in the GIS must be able to be shared and exchanged among all the players involved in cleaning up the river. A GIS pilot project was initiated by the Rouge Program Office (RPO) to examine the issues associated with integrating and sharing community-based data at the watershed level. Data integration and data sharing are two concepts which the Rouge GIS pilot project was designed to evaluate.

The basic questions posed by this GIS pilot project were:

## **What is the utility of GIS in watershed management?**

The use of GIS technologies can be very useful in conducting watershed management and planning. GIS can provide information relating two or more sets of data, such as land use and instream monitoring data, which can be used to evaluate potential causes of the recorded monitoring results. This process assists watershed managers in selecting and prioritizing their clean up activities. Information sharing is critical among the different types of watershed managers which will range from local communities to county/regional agencies to state/federal agencies.

## **Why should we share data in managing the watershed?**

We should share data to provide information on watershed activities among the local communities, state and regional agencies, and the federal agencies. There may be, however, technical issues that might prohibit data sharing such as incompatible file formats. Given the GIS technologies of today this should not be a problem.

## **Why should we integrate data at the Rouge Project?**

Data integration should be completed by watershed managers which needs to work with information crossing multiple political jurisdictions like the county, regional, state, and federal agencies. We will be required to integrate a variety of data sets at the Rouge Project to ensure that we have the best (accuracy, content, currency) information available for watershed management. There are, however, technical issues related to integrating data provided by local communities - basically, the spatial accuracy of the base map used to build the data themes AND the content of the data themes.

Data integration differs from data sharing in that integration actually links the data sets together into a seamless data set for use at the end user's required level. Data integration will only occur when one organization needs to utilize another organization's data themes in their work. The data integration will probably only occur at the regional and state level. There will be little or no data integration horizontally among user groups (i.e. all the communities within one county) unless/until they are all using the same base map.

The purpose of this document is to present the findings of the RPO's Upper 2 GIS Pilot Project. The beginnings of the Upper GIS Pilot Project started several years ago and are now culminating in this project report. The history of events leading up to this report are provided below:

**November 1996:** Federal Court requested information on the use of GIS in watershed management.

**January 1997:** RPO created a work plan to address the Federal Court request and also created the RPO Core Advisory Group GIS Technical Subcommittee to discuss the uses of GIS in watershed management. The work plan:

- Developed a generic community GIS needs matrix
- Documented Rouge Watershed community GIS status
- Conducted technical GIS forums (Core Advisory Group GIS Technical Subcommittee)
- Developed minimum common components for watershed GIS
- Documented issues for Rouge communities to develop minimum components

**May 1997:** SEMCOG was asked by the Federal Court to address two questions:

1) *What kind of watershed database, containing land use information, is necessary to support clean up of the River and a coordinated, watershed approach to address water quality issues of the Rouge River?*

2) *Do the Rouge communities currently have the type of information needed to develop a watershed database and GIS?*

**June 1997:** The RPO distributed a DRAFT report from the Core Advisory Group Technical Subcommittee for GIS presenting the recommendations and minimum requirements for a community based watershed GIS. Recommendations included the following items

- 1) a list of data requirements for watershed GIS
- 2) list of data sources for the watershed GIS; and
- 3) the continued involvement of the communities in watershed GIS.

These data requirements and data sources were documented in the Subcommittee's report.

**July 1997:** SEMCOG issued a response to the questions posed by the Federal Court:

What kind of watershed database, containing land use information, is necessary to support clean up of the River and a coordinated, watershed approach to address water quality issues of the Rouge River?

*The database needed to support watershed management will actually need to be a collection of databases involving each of the communities and several other organizations. These databases can be stored and maintained by individual communities and other organizations, with access through a computer network. The databases will need to be developed under a common set of standards in order to ensure compatibility between databases and for use in GIS to support watershed management.*

Do the Rouge communities currently have the type of information needed to develop a watershed database and GIS?

*Much of the data needed to develop a watershed database currently exists within municipal records and files. However, most of this information is in paper form and will need to be converted to an appropriate and compatible electronic format before it can be included in a watershed database. Additionally, much of this information is dynamic and will require periodic updating.*

**September 1997:** Federal Court prepared to issue a show cause order addressing why

- a formal organization known as the Rouge River Watershed , and/or Subwatershed, in the Rouge River basin should not be created;
- an advisory board consisting of representatives of the counties and communities in the watershed should not be formed;
- since the major purpose of the Rouge Project is to address nonpoint source pollution problems in appropriate NPDES general permits within the watershed or subwatersheds, a geographic information study (GIS) should not be made;
- the Southeast Michigan Council of Governments (SEMCOG) should not be appointed data base manager; and
- funding for the creation and maintenance of the GIS data base for the watershed, or subwatersheds, should not be provided from funds in the Rouge River National Wet Weather Demonstration project.

**October 1997:** The RPO proposed a GIS Pilot Project to be conducted in the Upper 2 subwatershed to demonstrate the use of GIS in watershed management and to evaluate the issues of sharing and integrating disparate GIS data sets into one system for use in watershed management.

The RPO GIS Pilot Project work plan was designed to:

- define the applications necessary to drive a watershed GIS program and prioritize the required data themes;
- establish both a technical advisory and a watershed management advisory group for the pilot program to maximize coordination with existing and planned GIS programs with communities, counties, and other organizations;
- obtain and analyze existing community information needed to support the pilot program;
- document the data sharing procedures needed to support watershed management activities.; and
- establish templates for Interagency Agreements (IAAs) for communities to implement in support of the full Rouge Watershed management GIS program.

The efforts within the work plan also provided the Federal Court information on the issues related to the design and construction of a watershed GIS that will support watershed

management in the Rouge River Watershed. The development of the pilot information was conducted at the RPO with additional support from communities within the watershed. Demonstrations of the pilot program were conducted at the project Technical Advisory Group meetings and at the Federal Court committee meetings.

## **SUMMARY AND CONCLUSIONS**

The purpose of the RPO Upper 2 GIS Pilot was to address key questions related to the utility of GIS for watershed management. In addition, the pilot project was intended to discuss the specific issues of data transfer and data integration, as well as any residual issues found as results of this study. A work plan was developed to provide the strategy for conducting the study which was to:

- 1) establish technical and management advisory groups;
- 2) identify and define a number of GIS applications for watershed management;
- 3) identify and acquire available GIS data necessary for prototype development of the applications;
- 4) conduct integration of the data to illustrate issues of data compatibility; and
- 5) document findings and procedures for data transfer and integration.

## **FINDINGS**

The Upper 2 GIS Pilot is now complete and the findings below summarize the primary issues found to be significant in the transfer and integration of data.

### **Regarding the utility of GIS in watershed management**

The Technical Advisory Group (TAG) found as many as eight separate watershed management applications over and above the traditional mapping and data management capabilities of GIS. Based on specific selection criteria the list was reduced to three applications best suited for prototyping within the scope of this pilot. Those are:

- 1) Illicit Connection/Illegal Discharge,
- 2) Drainage System Management, and
- 3) Soil Erosion/Flow Management.

Each of these applications have an element of utility at the local community level, a role in the goals and objectives of subwatershed management, and a relationship with the MDEQ General Permit. Each application was described in terms of its role in watershed management and its data requirements through a consensus type definition process. And

each application was subsequently developed into a prototype application for illustration purposes of functionality.

The TAG found that there are significantly more watershed applications, the development of which are beyond the scope of this effort, but sufficient justification for encouraging common practices in developing storm water related data for use in GIS watershed-wide.

### **Regarding data transfer**

Given the costs of developing GIS data, most watershed managers, and GIS users in general, would rather obtain available data than digitize and develop new data. For the pilot project, base map data was available, or was soon to be available from the local communities. This would facilitate the transferring and integrating of data from numerous sources. Additional findings of data sharing include the following:

- Data exchange occurs predominantly in a vertical direction either from the state and federal sources to the local government users or visa versa. Horizontal exchanges of data are rare due to the fact that local communities are engaged in applications that cross over political boundaries. However, all up-line users (i.e. county, state and federal and regional planning agencies) will typically use data from many local units of government, and will benefit from communities forethought in developing GIS data according to common specifications.
- Data for the pilot project was acquired from six primary sources with no major complications. The only concerns with the data sets were due to data access, standards, map projection and metadata issues. These are briefly described below.
  - Access - Though many communities are actively converting paper data to digital formats, most or all data owners intend to charge fees for the data in order to recover costs of automation and technology related operations. Therefore, providing data sets to the RPO without some type of security against further distribution was a concern and was addressed in the project.
  - Metadata - In most cases data were delivered with no additional information (metadata). Technical specifications (i.e., source/lineage, accuracy, projection, purpose for initial development, technical contact people, etc.) that are important for establishing and verifying the integrity of the data, were not documented in conjunction with the data development. Results, conclusions, and interpretations generated by the use of GIS data can be consequently ambiguous without the capability to understand the strengths and limitations of the underlying digital data.

- **Map Projection** - Though less of an issue, map projection may complicate or even prohibit the integration of map data. The City of Detroit, for instance, developed its base map data on a coordinate grid and map unique only to the City. Computer programs written for the translation of this data to the same specifications as all other community map data were marginally successful and may eventually generate a completely compatible data set; however, additional research is required beyond the scope of this project. All other data obtained for the pilot project were found to be of the same projection and coordinate system.

### **Regarding the potential for data integration**

Successful integration of data depend on three major issues: 1) the type of data to be integrated; 2) any technological advances/hindrances; and 3) the technical approaches used in data development. The type of data is an issue due to the available attribute information provided with the data set from the local communities. While geographic data conversion is a relatively recent endeavor in the Rouge Watershed, the attribute data (descriptive information about the map features) has been well established for each community. These data sets are organized and managed according to the unique needs and styles of each community.

Technological advances in software and hardware have overcome any hindrances that may affect the successful integration of data sets. The Rouge Watershed communities are all using standard GIS software technologies and developing their data sets according to traditional specifications.

The approaches used in community data development can be achieved can be either: 1) a coordinated effort among multiple data developers (communities) adhering to a set of minimum specifications; or 2) a centralized effort of all data development forcing uniformity over broad geographic areas. In both approaches the following technical issues need to be addressed:

**Accuracy** - With few exceptions, the pilot project found little or no differences in the accuracy of the data obtained from the various sources of this study. State and federal data did not match up as well as local data, however, it was considerably better than expected. This enables the state or federal data user to import local data and overlay at large scales without a great deal of editing. The converse is true for the local users for some data sets such as the centerline data used for address ranges and geocoding.

**Scale** - Data are typically developed to meet the purposed of the source user. Local communities typically require greater positional accuracy than state or

federal agencies. Data transfer from the small scale users (i.e. federal) requires substantial editing to integrate with the maps of large scale users (i.e., local communities). Such is not the case in the transfer of local data to the state and federal agencies. More precise positional accuracy of map features (i.e. streams, roads, etc.) is not an issue for up-line users since most mapping and viewing scales are so small, positional placement (or displacement) is indiscernible.

**Standards** - Recognizing the implications of standards, a few TAG members who are actively engaged in GIS development were concerned about the potential for this pilot project to influence the standards and procedures for GIS data development across the watershed. This issue was a persistent topic of discussion in the TAG meetings and was resolved by a consensus that the process of establishing and promoting standards of any sort was more appropriately convened in the forum of the regional planning agency (SEMCOG) to which all communities are members.

## **FEDERAL COURT ISSUES**

The Federal Court raised several issues related to the use of GIS in watershed management at two separate times. The first time the issue arose, the Federal Court asked how could GIS be used in watershed management. The RPO report (RPO-PI-TM24) distributed from the Core Advisory Group GIS Technical subcommittee, addressed this question and listed examples of watershed GIS applications and the data themes required to support those applications.

The second time the Federal Court raised issues of using GIS technologies in watershed management came in the form of a potential “show cause order.” The proposed show cause order, which was never formally issued, asked why several items should not be ordered by the court. The items relevant to GIS in the Rouge Watershed are presented below:

***Why...since the major purpose of the Rouge River Wet Weather Demonstration Project is to address nonpoint source pollution problems in appropriate NPDES general permits within the watershed or subwatersheds, a geographic information study (GIS) not be made;***

The RPO GIS pilot project for the Upper 2 subwatershed along with a previous RPO project addressing community GIS implementation plans addresses this issue very effectively. Since the inception of the Rouge Project, the number of Rouge Watershed communities involved in GIS , especially for watershed management, has increased four fold. A formal study does not seem to be relevant at this time.

***Why...the Southeast Michigan Council of Governments (SEMCOG) should not be appointed database manager;***

Since Rouge Watershed communities are sharing data and the GIS pilot project demonstrated that those same data sets can be integrated for regional use, the need for a formal database manager does not seem apparent. The new formed SEMCOG regional GIS data management committee will be facilitating the common issues which thread throughout the communities.

One aspect of the GIS pilot project which SEMCOG could assist in is the management, storage and distribution of the metadata for the community GIS data. By establishing a metadata format for the communities in the SEMCOG service area, the improvements in sharing data can be greatly increased. In addition, the metadata could all be stored at a single location for easy reference by all communities and agencies. This service could be provided by SEMCOG.

***Why...funding for the creation and maintenance of the GIS database for the watershed, or subwatersheds, should not be provided from funds in the Rouge River National Wet Weather Demonstration Project.***

The RPO is a watershed focused project and will collect and build a GIS for use in watershed management. The source of this GIS information will be the best data available. This best available data will come from the communities plus state, regional and federal sources. The GIS pilot project demonstrated that these community data sets can be integrated for use by the RPO for RPO purposes.

## **CONCLUSIONS**

There are several basic conclusions that can be drawn from the RPO GIS pilot project conducted in the Upper 2 subwatershed. These are:

- Data from the Rouge communities can be readily and easily shared using commercial software technology and the consistency of the approaches used by

watershed communities to develop the data themes will continue to support data sharing.

- Community data development standards and approaches are fairly consistent and will further promote data integration as new data sets are created.
- Computer hardware obstacles to data sharing, such as transfer media, are virtually non-existent due to the advances in storage technologies.
- Metadata, the information describing the available data sets, is weak and must be given a higher priority by all communities developing data. This will greatly enhance the efficiencies of sharing data sets.
- Data sets available from the Rouge communities can be integrated for use in watershed wide applications. This is possible due to the similarities in GIS software and approaches in developing data themes.
- Applications can be developed using commercial software technologies that will support watershed management and utilize these integrated data sets to their fullest.
- The issues raised by the Federal Court related to GIS implementation for watershed management are being addressed through the cooperative efforts of all the watershed stakeholders – the communities, counties, SEMCOG, the RPO, the state and the federal agencies.