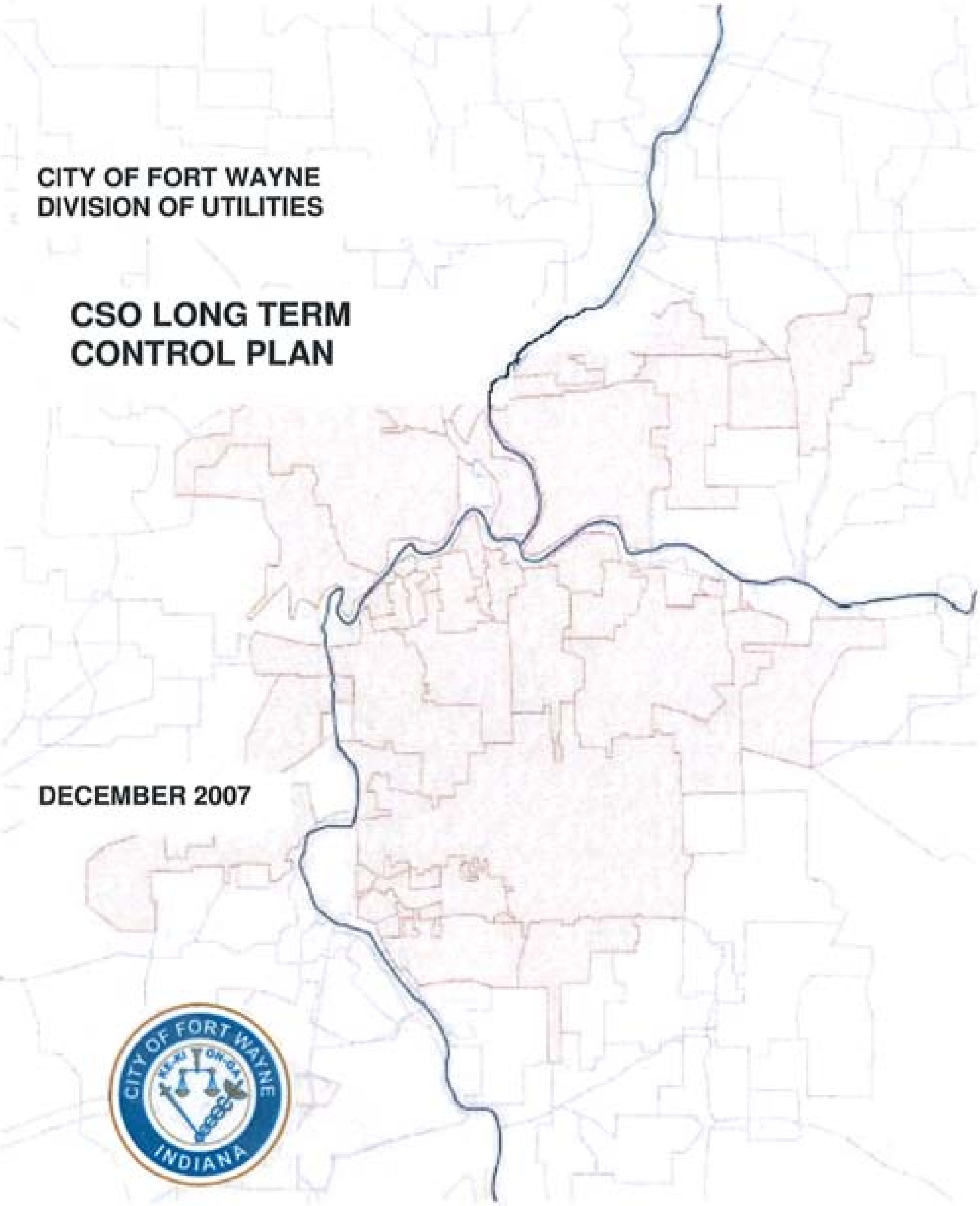
CITY OF FORT WAYNE
DIVISION OF UTILITIES

CSO LONG TERM CONTROL PLAN

DECEMBER 2007



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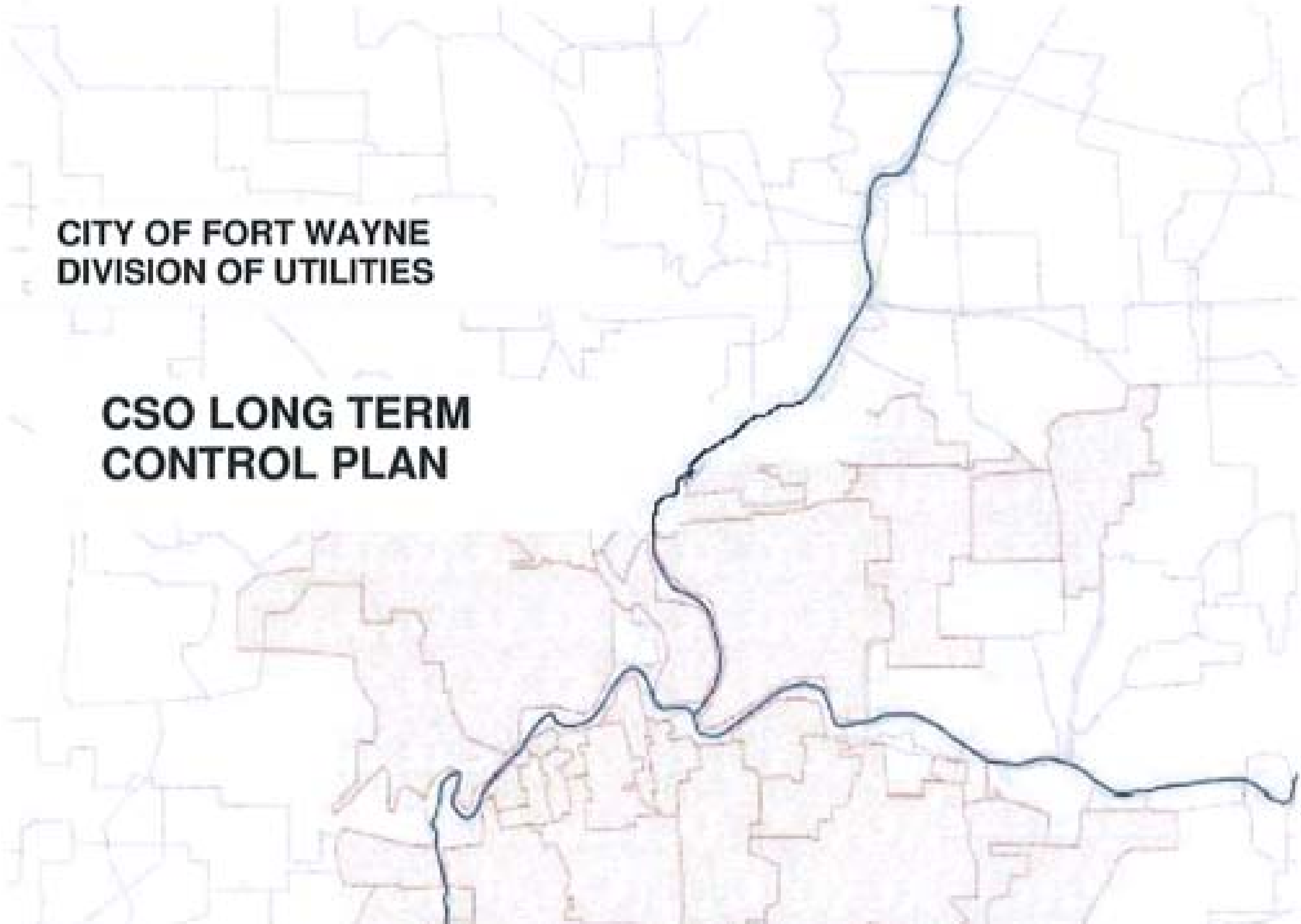

MALCOLM PIRNIE

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CHAPTER 1

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1.0 CHAPTER 1 - INTRODUCTION

1.1 OVERVIEW

This document represents the Combined Sewer Overflow (CSO) Long-Term Control Plan (LTCP) for the City of Fort Wayne, Indiana ("City"). The LTCP describes a water quality-based approach that will dramatically reduce the discharge of untreated CSOs, improve water quality in Fort Wayne's CSO-impacted streams, is technically feasible, and is consistent with the federal CSO Control Policy and associated Indiana guidance.

Nationally, most CSO communities are located in the Northeast, the Great Lakes Region and the Pacific Northwest. In Indiana, 105 municipalities have utilized or still utilize combined sewer systems that include CSOs. The majority of Fort Wayne's CSOs are located in the older or central part of the City. Separate sanitary and storm sewers serve the newer, outlying areas of the City. A map of the City's Sewer Service area is shown in Figure 1.1.1.

On average, over 1 billion gallons of raw sewage per year is discharged into Fort Wayne's receiving streams as a result of wet weather conditions. The City is proposing a watershed-based plan that, when fully implemented, will improve river water quality, but in a way the community can afford. In a typical year, the plan is designed to achieve a level of control in which no more than 4 overflows occur to the St. Mary's and Maumee Rivers without adequate treatment or control and no more than 1 overflow on the St. Joseph River without adequate controls. The City currently experiences approximately 71 overflow events in a typical year. This LTCP represents an impressive level of control for previously uncontrolled wet weather discharges from CSOs. Impressive as these controls may be, the City's LTCP is dependent on a revision of applicable recreational water quality standards which acknowledges the infeasibility of meeting the water quality criteria associated with the current recreational use designated for the City's waterways under all storm events, regardless of intensity and duration.

1.2 BACKGROUND

The City operates a combined sewer system (CSS) with combined sewer overflows, as well as a separate sanitary sewer system in some parts of the service area for the City's wastewater utility. Also owned and operated by the City is a waste water treatment plant known as the Paul L. Brunner Water Pollution Control Plant (WPCP). The CSS includes regulator structures that direct dry-weather flows from the combined trunk sewers to interceptor sewers which transport the flows to the WPCP for treatment. During periods of wet weather, the regulator structures control the amount of combined sewage that is allowed to enter the interceptor system. Flows in excess of the hydraulic capacity of the interceptor sewers are conveyed to the St. Joseph, St. Mary's, and Maumee Rivers and tributary creeks and ditches through CSO outfalls.

The main pollutants in CSOs are untreated human and industrial wastes, toxic materials like oil and pesticides, and floating debris that may wash into the sewer system. The pollutants in CSOs can impair the recreational use of the rivers. These pollutants may be harmful to the health of humans who swim in CSO-polluted water due to high levels of bacteria. *E. coli* bacteria is an indicator organism that estimates the level of fecal contamination in the CSO-receiving streams. High levels of *E.Coli* indicate bacterial contamination and the possible presence of pathogenic organisms that may cause or contribute to intestinal disease in humans.

Water quality in Fort Wayne's receiving streams is affected by many sources other than CSOs. For example, stormwater runoff, failing septic systems, as well as pollutants flowing into Fort Wayne from upstream communities, woodlands and agricultural areas affect the water quality of Fort Wayne's receiving waters. Because many sources of pollution impact the quality of Fort Wayne's streams, a watershed-based strategy will be used for characterizing the CSO-receiving streams.

CSOs are regulated under the Clean Water Act (CWA) (Section 402) and its National Pollutant Discharge Elimination System (NPDES) program. The NPDES program permits and regulates wastewater discharges.

Although IDEM issued the WPCP's current NPDES permit effective December 1, 2004, a modified NPDES permit is expected to be issued shortly with an effective date in December 2007 or January 2008.

1.3 FEDERAL CSO CONTROL POLICY

The United States Environmental Protection Agency (U.S. EPA) published a CSO Control Policy in April 1994 (*59 Federal Register 18688*) mandating that communities and states control CSOs and meet CWA requirements, including water quality standards. IDEM subsequently developed guidance for Indiana CSO communities in developing LTCPs that will comply with the federal CSO Control Policy. Both Indiana and federal policies require the following actions:

1. Characterize the combined sewer system and the affected streams
2. Implement certain minimum operational measures known as the Nine Minimum Controls (NMC). The NMCs are as follows:
    - Proper operation and maintenance of the combined sewer system and the CSOs
    - Maximum use of the collection system for storage
    - Review and modify pretreatment requirements to assure CSO impacts are minimized
    - Maximum flow to the POTW for treatment
    - Prohibition of CSOs during dry weather
    - Control of solid and floatable material in CSOs
    - Pollution prevention

  - Public notification
  - Monitoring to characterize CSO impacts and the efficacy of CSO controls
3. Develop a CSO long-term control plan.

1.3.1 Key Elements of the CSO Control Policy

The CSO Guidance for Long-Term Control Plan development provides guidance to CSO communities to assist them in developing appropriate, site-specific programs to control CSOs in compliance with documented NPDES permit program and Clean Water Act requirements. Among other things, this guidance identifies the following nine essential elements of LTCPs:

1. Characterization, monitoring and modeling.
2. Public Participation
3. Sensitive Areas
4. Evaluation of Alternatives
5. Cost/Performance Considerations
6. Operational Plan
7. Maximization of Treatment at the Existing POTW Treatment Plant
8. Implementation Schedule
9. Post-construction Compliance Monitoring Program

These key elements have been addressed in the City's LTCP.

1.3.2 Four Key Principles

As outlined in the CSO Guidance, the four key principles for cost-effective CSO controls are:

- *Provide clear levels of control that would be presumed to meet appropriate health and environmental objectives*
- *Provide sufficient flexibility to municipalities, especially those that are financially disadvantaged, to consider the site-specific nature of CSOs and to determine the most cost-effective means of reducing pollutants and meeting CWA objectives and requirements*
- *Allow a phased approach for implementation of CSO controls considering a community's financial capability*
- *Review and revise, as appropriate, WQS and their implementation procedures when developing long-term CSO control plans to reflect the site-specific wet weather impacts of CSOs*

1.3.3 Long-Term Planning Approach Summary

System characterization, development and evaluation of control alternatives, and selection and implementation of CSO controls are the three major steps in the LTCP planning approach. In its effort to develop the LTCP, the City has followed, step-by-step, these guidance documents provided by U.S. EPA:

- Guidance for Long-Term Control Plan
- Guidance for Nine Minimum Controls
- Guidance for Screening and Ranking of Alternatives
- Guidance for Monitoring and Modeling
- Guidance for Financial Capability Assessment

1.3.4 Document organization

The format of the City's LTCP generally reflects that outlined in the above mentioned guidance documents.

This LTCP is organized as follows:

Chapter 1 provides an introduction and describes the principles and goals that have guided Fort Wayne in developing this LTCP.

Chapter 2 describes the City's CSS, the local waters impacted by the City's CSOs, CSO and non-CSO pollutant sources, and CSS and receiving water monitoring and modeling.

Chapter 3 describes the City's development and evaluation of alternatives for CSO control. Additionally, the LTCP approach and financial capability analysis are included in this chapter.

Chapter 4 describes the City's selection and implementation of the LTCP. This includes sections on public participation, final selection and development of the plan, a financing plan, an implementation schedule, an operational plan, post construction and compliance monitoring.

Chapter 5 describes federal and state requirements associated with a UAA, provides an introduction to the City's draft UAA to be submitted to IDEM for consideration, and requests approval by IDEM (and ultimately EPA) of a revision to the recreational designated use for the waterways impacted by the City's CSOs to the Indiana CSO Wet Weather Limited Use Subcategory.

1.4 PRELIMINARY ACTIONS & CONSIDERATIONS FOR LTCP DEVELOPMENT

1.4.1 Initial Activities

A Sewer Master Plan developed by the City in 1993 recognized the need to develop a LTCP like-plan. An internal CSO program team comprised of staff members from Fort Wayne's Sewer Engineering Department and various consulting firms was organized for CSO control planning. The team produced a CSO Operation Plan in 1995/1996.

In addition to the Engineering Department, a number of other Fort Wayne City entities were involved in the CSO control planning efforts including: the City's Public Information Office, Utility Administration, City Controller, City Engineering, and Utility Operations and Maintenance. Consultants involved include: Malcolm Pirnie, Donohue and Associates, CH2M Hill, Jones and Henry Engineers, Ltd., Rust Environment and Infrastructure, and Michael Hoggarth, PhD of Otterbein College.

In the late summer of 1995, the Mayor of Fort Wayne created a citizen task force to give feedback to the City on various sewer planning issues. The Sewer Task Force (STF) worked on a number of sewer issues, in addition to CSOs, between September 1995 and October 1996. To implement recommendations of STF, the City developed the CSS Capacity Improvement Program which in turn developed early action projects and produces early modeling efforts.

In 1997 the City initiated a "Total Watershed Quality Management" approach to identify water quality problems, develop water quality goals, priorities and solutions for Fort Wayne's receiving streams. This effort involved "stakeholders" from Fort Wayne City Utilities, the Civil City, Allen County government and other organizations that have responsibilities and jurisdictions relating to the Upper Maumee Watershed. Citizens – particularly those who had been active in river water quality issues – were also included. Interviews were conducted with these stakeholders and three workshops were held to establish a set of community-based water quality goals for the Upper Maumee Watershed. This approach addresses pollutant sources and water quality concerns that have not been adequately addressed by traditional point source control mechanisms.

1.4.2 Public Participation and Agency Interaction

Involving both public and regulatory agencies is crucial to the success of a CSO control program. The STF recommended to the Mayor that an advisory group be established to oversee implementation of the original recommendations of the Sewer Task Force and provide input on CSOs controls and other water quality issues. The Sewer Advisory Group (SAG) was formed in January 1997 to continue through the development and implementation of the LTCP.

Regulatory agency interaction began in 1995 when the City received an Administrative Order from U.S. EPA's Region V office. Among the requirements of the Order were for the City to submit a detailed monitoring plan for measuring flows in the receiving waters and all CSO discharge points, submit a CSO Operational Plan for approval and implement the plan and prepare a CSO Long term Control Plan.

Agency interaction continued in 1999 when the City submitted its first LTCP draft to U.S. EPA. A schedule for CSO controls was not included in the original submittal. The City resubmitted a complete LTCP draft in 2001 and received first comments in November 2002. LTCP negotiations began with U.S. EPA and IDEM in January 2003.

1.4.3 Coordination with State Water Quality Standards Authority

The CWA requires that uses be designated by the state for each water body it regulates. Indiana Water Quality Standards (WQS) prescribe the minimum water quality specifications that are to be attained for particular use designations.

The Indiana Water Pollution Control Board (IWPCB) has designated virtually all Indiana waters as "fishable/swimmable" meaning that the State's WQS to protect aquatic life and full-body contact recreation are applicable in all Indiana waters (with the exception of a small group of waters designated for limited uses). Indiana has also established use designations for public drinking water supply, industrial and agricultural uses.

Full-body contact recreation includes, but is not limited to, swimming and other activities that potentially involve total body immersion and/or potential for incidental water ingestion. The full-body contact recreation standard in Indiana is based on an indicator organism, *E.coli* bacteria, and is set at 235 colony forming units per 100 ml in any one water sample in a 30 day period. While water quality in the waterways associated with the City's CSS will improve with improved control of CSOs, the City believes it is not feasible to control CSOs under more substantial wet weather events sufficiently to meet the *E. coli* criteria under such conditions. In addition, due to stormwater runoff from agricultural and urban areas, including areas with failing septic systems, and other pollutant sources, Indiana's full-body contact recreational water quality standard is still likely to be exceeded, occasionally if not frequently, in the waters historically impacted by the City's CSOs after LTCP implementation.

The CSO Control Policy describes options that are available to states to revise WQS "…to adapt to their WQS, and implementation procedures to reflect site-specific conditions including those related to CSOs." Some options include:

- Adopting partial uses
- Adopting seasonal uses
- Defining use with greater specificity
- Granting a temporary variance to a specific discharge

In conjunction with this LTCP, the City is requesting the IDEM and the IWPCB to approve a revision of the recreational designated use that is applicable to the CSO-impacted waters to instead apply a CSO wet weather limited use subcategory during periods of wet weather impact.

1.4.4 Request for a Water Quality Standards Revision Relating to Impacts of CSOs

Federal and Indiana law allow for consideration of revisions to existing water quality standards in limited circumstances. In April 2005, in an effort to better define a potential option for revisions to Indiana water quality standards for recreational use which are affected by CSO discharges, the Indiana General Assembly approved SEA 620, which provides for the following:

- A limited wet-weather use subcategory may be approved for application to CSO impacted waters where there is an approved LTCP and other appropriate conditions are met;
- The CSO wet weather limited use subcategory and its water quality based requirements may remain in effect for up to four days after the discharge ends.

Such revisions to existing water quality standards may be considered and approved only if a UAA is first prepared by the state water quality agency (IDEM in this case) to evaluate whether full attainment of the existing designated use is infeasible. A UAA refers to a structured scientific assessment of the physical, chemical, biological, and economic factors affecting the attainment of a designated use as provided in 40 CFR 131.3(g).

Federal Regulations (40 CFR 131.10(g)) allow only six reasons for removing or revising a use designation based on the infeasibility of attainment:

1) Naturally occurring pollutant levels prevent attainment;
2) Natural ephemeral, intermittent, or low flow prevents attainment;
3) Human caused pollution prevents attainment and cannot be remedied without causing worse environmental harm;
4) Dams, diversions, and other hydrologic modifications prevent attainment and it is not feasible to restore the water or operate the modification in a way that would result in attainment;
5) Natural physical features prevent attainment;
6) Attainment requires controls more stringent than effluent limitations or new source performance standards and these extraordinary controls would result in substantial and widespread social and economic hardship.

Detailed information on the City's UAA process can be found in Chapter 5.

1.4.5 Integration of Current CSO Control Efforts

The City has already implemented many projects and programs for CSO control prior to approval of its LTCP, including:

- Implementation of the NMCs

- Upgrading the WPCP through construction of new headworks and primary treatment facilities
- Partial implementation of the Combined Sewer System Capital Improvement Program begun in 1997 with the primary intent of reducing the likelihood of sewage backups into basements
- Analysis of the operation of the City's CSO ponds to maximize their benefit in controlling CSOs
- Completion of design and initiation of bidding process (as of November 2007) for the interim CSO Ponds Bleedback / Dewatering Project

1.4.6 Watershed Approach to CSO Control Planning

- Watersheds may be impaired by a variety of other factors besides CSOs. Sources of impairment and pollution may include other point source discharges; discharges from storm drains; urban and agricultural runoff; real estate development and resultant habitat destruction; other land use activities; erosion; failing septic systems and landfills

The demonstration approach to CSO control allows a permittee to demonstrate attainment of WQS, provide for consideration of natural background conditions and pollution sources other than CSOs, and promotes the development of total maximum daily loads (TMDLs). Further discussion of the City's selection of the demonstration approach in the attainment of WQS is located in section 3.2 (Long-Term Control Plan Approach).

1.4.7 Project Goals

Through its LTCP, the City will implement a series of controls to reduce and control the amount of combined sewage discharged to the St. Joseph, St. Mary's and Maumee Rivers and their tributaries in an affordable and cost-effective manner. Reducing combined sewage overflows will improve river water quality, river habitat and aesthetics (fewer floatables and other objectionable materials).

The City will meet technology-based CSO requirements by implementing the NMCs through the Amended Combined Sewer System Operational Plan (CSSOP). The CSSOP is designed to be used by the City, through its wastewater utility, Board of Public Works, and other departments involved in programs that affect the operations and maintenance of the City's CSS.

CSO control alternatives have been evaluated based on cost, performance and non-monetary factors. However, even if all CSOs were eliminated, the receiving streams would still not meet Indiana's current water quality standards.

The ultimate degree of CSO control to be achieved by the City under the LTCP process is closely tied to the results of the City's UAA, which will define local wet-weather water quality requirements for the receiving streams in accordance with SEA 620. The LTCP presented in this document targets the level of control required to achieve the water quality requirements expected from the UAA and the City's request for an appropriate water quality standard revision.

1.5 SUMMARY OF ALTERNATES EVALUATED AND DETERMINATION OF FINAL LONG TERM CONTROL PLAN

This section summarizes the development and evaluation of CSO control alternatives, cost to implement the plan, as well as how the City will monitor and report progress.

1.5.1 Development and Evaluation of Alternatives

The City considered seven alternatives for reducing overflows and meeting Clean Water Act requirements. The options included capturing and storing sewer overflows for later treatment, increasing treatment capacity, and separating combined sewers into sanitary and storm sewers.

1. **Deep Tunnel Storage:** This option would build one or more tunnels 50 to 150 feet below ground to capture and store sewer overflows during a storm. After the storm, sewage would be pumped to the Water Pollution Control Plant for treatment. Many cities have built or are planning tunnels to reduce sewer overflows, including Toledo, Indianapolis, Cleveland and Chicago.

2. **Satellite Disinfection Basins**: This option would build basins in neighborhoods to capture overflows, disinfect the captured wastewater to kill bacteria and then discharging it to the river. This would provide less treatment than the City's wastewater treatment plant provides.

3. **CSO Ponds with Storage/Treatment:** The City has two existing combined sewer overflow (CSO) ponds that store wet-weather flows across the Maumee River from the Water Pollution Control Plant. This option would use the ponds to temporarily store additional wet-weather flows. After the storm, the stored wet weather flow in the CSO ponds would be either transported back to the plant for treatment or discharged through new high rate, wet weather treatment facilities. Five different storage/treatment options were considered under this alternative. Larger sewers would need to be built to get additional flow to the ponds.

4. **CSO Ponds with Treatment plus Satellite Treatment at Foster Park:** This option would transport most overflows to the CSO ponds, but build high-rate, wet-weather treatment facilities at an overflow location at Rudisill Boulevard near Foster Park. The Rudisill Boulevard overflow is the most active in the City's system, contributing 390

million gallons to the St. Mary's River in a typical year. It is also located far from the City's treatment plant, making on-location treatment a more attractive option.

5. **Partial Sewer Separation:** This option would reduce the amount of stormwater entering the combined sewer system by partially separating the sewers. Partial separation projects are already planned in several areas of the City and in some areas have already been completed. This option looks at additional neighborhoods where the City could improve sewer capacity by redirecting stormwater away from the combined sewers. This option will not meet all overflow reduction requirements, but may be beneficial in some areas to supplement the technologies above.

6. **CSO Ponds with Treatment plus Complete Separation in the Rudisill Subbasin:** This option would eliminate overflows at the Rudisill Boulevard location by completely separating sewers the Rudisill subbasin (K11010), which is the City's largest combined sewer subbasin. Overflows elsewhere in the City would be captured by new, larger sewers and sent to the existing CSO ponds for high-rate treatment, similar to Option 3.

7. **Complete Separation:** This option would eliminate sewer overflows by building separate storm and sanitary sewers in all neighborhoods that now have combined sewers. This option is extremely expensive, disruptive to neighborhoods and increases urban stormwater pollution. However, it was analyzed to estimate the cost and effort required to eliminate combined sewer overflows.

City Utilities evaluated and scored each alternative using a number of criteria. Each alternative included additional options that could be used in various combinations. CSO Ponds with Storage/Treatment received the highest score because of high to medium scores across all criteria and no unfavorable ratings. In scoring alternatives, the City placed greater weight on capital costs, rate impacts, level of treatment and long-term operation and maintenance issues. More detailed scoring and analysis can be found in Chapter 3 of the long-term control plan.

1.5.2 Selection of Recommended Alternate

After the initial scoring of alternatives, the City selected two options for further analysis: Alternative 3, CSO Ponds with Storage/Treatment, and Alternative 4, CSO Ponds with Treatment plus Satellite Treatment at Foster Park. The City evaluated these two using additional performance measures and analysis and chose Alternative 3 for the following reasons:

- Uses the City's existing infrastructure to meet overflow control goals
- Lower operation and maintenance costs
- Lower total cost over time (capital costs plus operations and maintenance)
- Greater water quality benefits due to a higher level of treatment
- Less difficulty in locating facilities

- Fewer demands on the City's operation and maintenance programs

In order to store and treat additional sewage using the CSO ponds, more of the sewage that is currently discharged to the rivers during wet weather must be transported to the ponds. Large interceptor sewers will be built parallel to the St. Mary's and Maumee Rivers. These sewers will "intercept" a large portion of the sewage flow that might otherwise have gone into one of these rivers and carry the flow to the ponds.

In the St. Joseph River basin, some sewage will be stored at several locations during wet weather. Treatment will be provided at one location in the basin. Most of the sewage will go back into the existing sewers to be transported to the treatment plant once the wet weather event is over.

A map illustrating the LTCP selected alternate is shown in Figure 1.5.2.1.

1.5.3 Cost of the Plan

Once a technology alternative was chosen, the next key decision was how to size the new facilities. Larger pipes and treatment facilities will capture more flows, but at increasing costs. The infrastructure should capture as much rainfall as possible without going beyond the point of diminishing returns – the point where additional dollars spent yield fewer and fewer benefits. What the community can afford was another vital consideration.

The City analyzed different sizes for the CSO Ponds and Storage/Treatment Facilities based upon how much sewage would be released each year (volume), how often sewage would overflow (frequency), and the number of days our waterways could be expected to exceed the bacteria standards. This analysis found the point of diminishing returns fell at four overflow activations per year.

The City investigated whether going beyond that point, to three activations per year, would benefit water quality enough to justify the cost. This analysis showed that while annual overflow volume would be reduced by an additional 25 percent, the hours of overflow would be reduced by only two to four hours. The City did not believe that the benefit of two to four hours of overflow reduction was worth the additional $30 million in ratepayer dollars.

The City then investigated whether it made sense to target the St. Joseph River for a higher level of overflow control because of its value to the community as a location for recreational hiking and wildlife habitat. Reducing overflows to the St. Joseph River to one in a typical year would cost an additional $18.5 million. The City determined that the additional investment is worthwhile to protect this valuable community asset.

The plan's costs are shown below for each construction program area:

Collection and Storage Program	
Ponds	$ 53.9 million
Interceptor sewers	$ 72.4 million
Satellite storage/treatment	$ 34.8 million
Treatment Plant	$ 10 million
Combined Sewer Capacity (sewer separation)	$ 68.3 million
Total	$239.4 million

It will be costly for Fort Wayne to implement its plan to comply with federal water quality mandates. But, according to the U.S. EPA, the costs remain affordable for the community.

The City's annual costs for its wastewater system are expected to grow nearly 10.5 percent per year between 2008 and 2014, and by 7 percent per year through 2025. This includes the cost of expanding, improving, operating and maintaining existing wastewater facilities and the cost to build new infrastructure to reduce sewer overflows. The estimated cost to build just the facilities that are needed to meet federal mandates is $239.4 million at the 2005 value of the dollar. Overall, Fort Wayne will need to increase sewer utility revenue by about 380% over the 18 years it will take to implement the plan

Sewer rate increases will be required over time to pay for these clean water improvements. Based on the U.S. EPA's definitions, Fort Wayne will face a medium burden to finance sewer overflow controls with annual residential costs at between one and two percent of Fort Wayne's median household income. The City plans to borrow money for the construction projects that will be required. The City will work to keep rates affordable by seeking low interest rates for project financing, managing construction costs and pursuing state and federal grant funding.

1.5.4 Monitoring and Progress Reports

The City must regularly monitor and report its progress to U.S. EPA and IDEM during the plan's implementation. The City also needs to keep Fort Wayne's public ratepayers informed of where, how and for what benefit their money is being spent.

As U.S. EPA noted in a December 2001 Report to Congress, "it is often difficult, and in some instances impossible, to link environmental conditions or results to a single source of pollution, such as CSOs. In most instances, water quality is impacted by multiple sources, and trends over time reflect the change in loadings on a watershed scale from a variety of environmental programs." Therefore, it is unlikely that the City will be able to link sewer overflow controls to a specific water quality improvement. However, the City will issue the following reports to help regulatory agencies and the public monitor the program's progress.

Milestone Reports: After all projects in a specific watershed have been completed, the City will prepare and submit a milestone report. The report will include overflow monitoring, rainfall monitoring, river water quality sampling and an evaluation of the effectiveness of the overflow control projects. If projects are not performing as expected, the City will develop a plan to correct or expand them. The City will issue reports for the Maumee, St. Joseph and St. Mary's watersheds within two years of completing all projects in those watersheds.

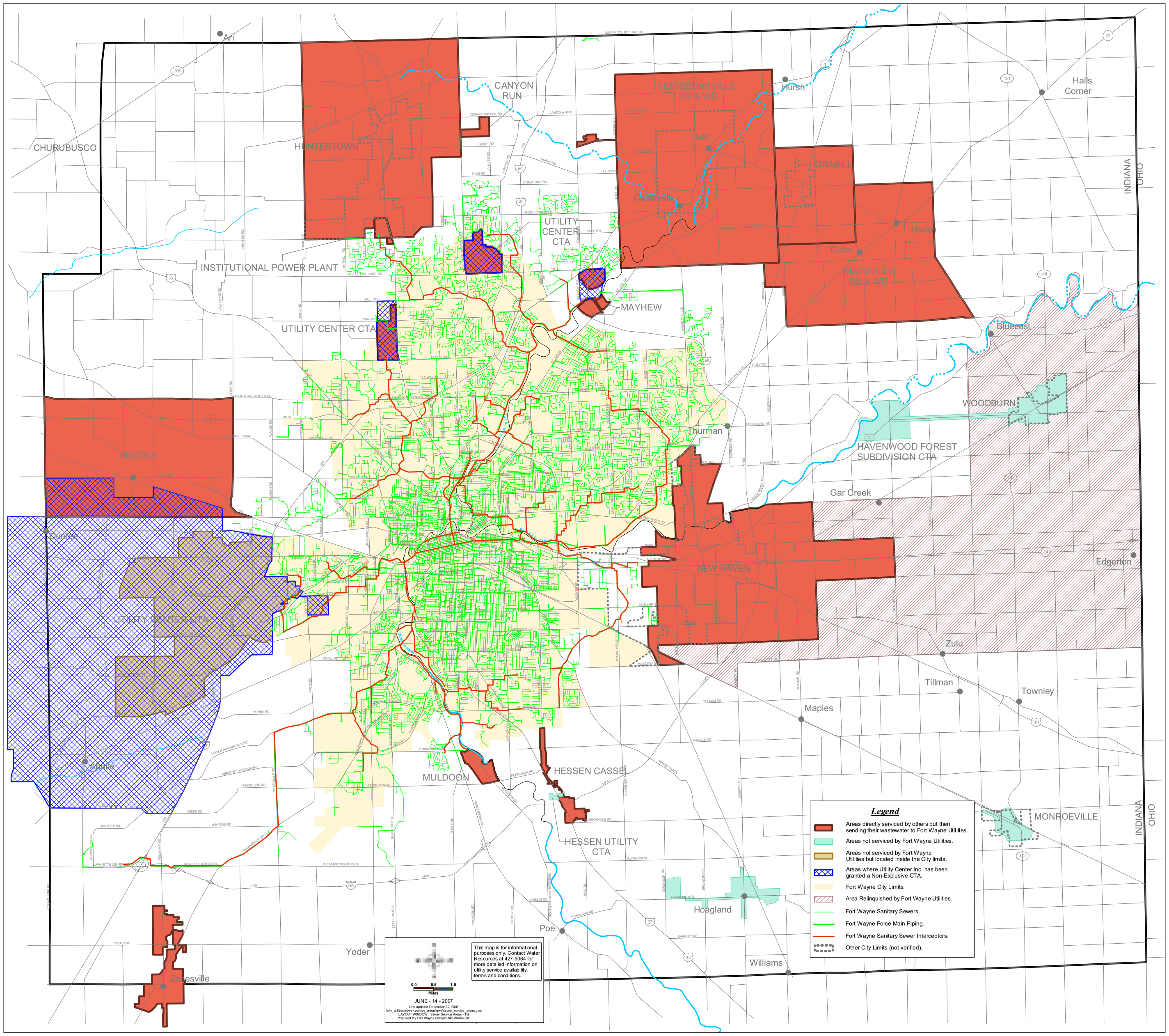
Final Report: Within five years of completing all projects, the City will submit a final report that documents their performance and whether they are meeting state and U.S. EPA requirements. If the report reveals any deficiencies or performance limitations, the City will develop a corrective action plan to ensure that the facilities will meet required performance measures.

Progress Report to Public: The City's public information program will continue to disseminate information on the plan's implementation, program costs and water quality improvements. One of the City's key goals is to ensure that public monies are spent prudently and effectively. The City takes this obligation very seriously, given that ratepayers are funding the projects required under the long-term control plan. Therefore, progress reporting to the public is equivalent to informing an owner on the status of his or her investment.

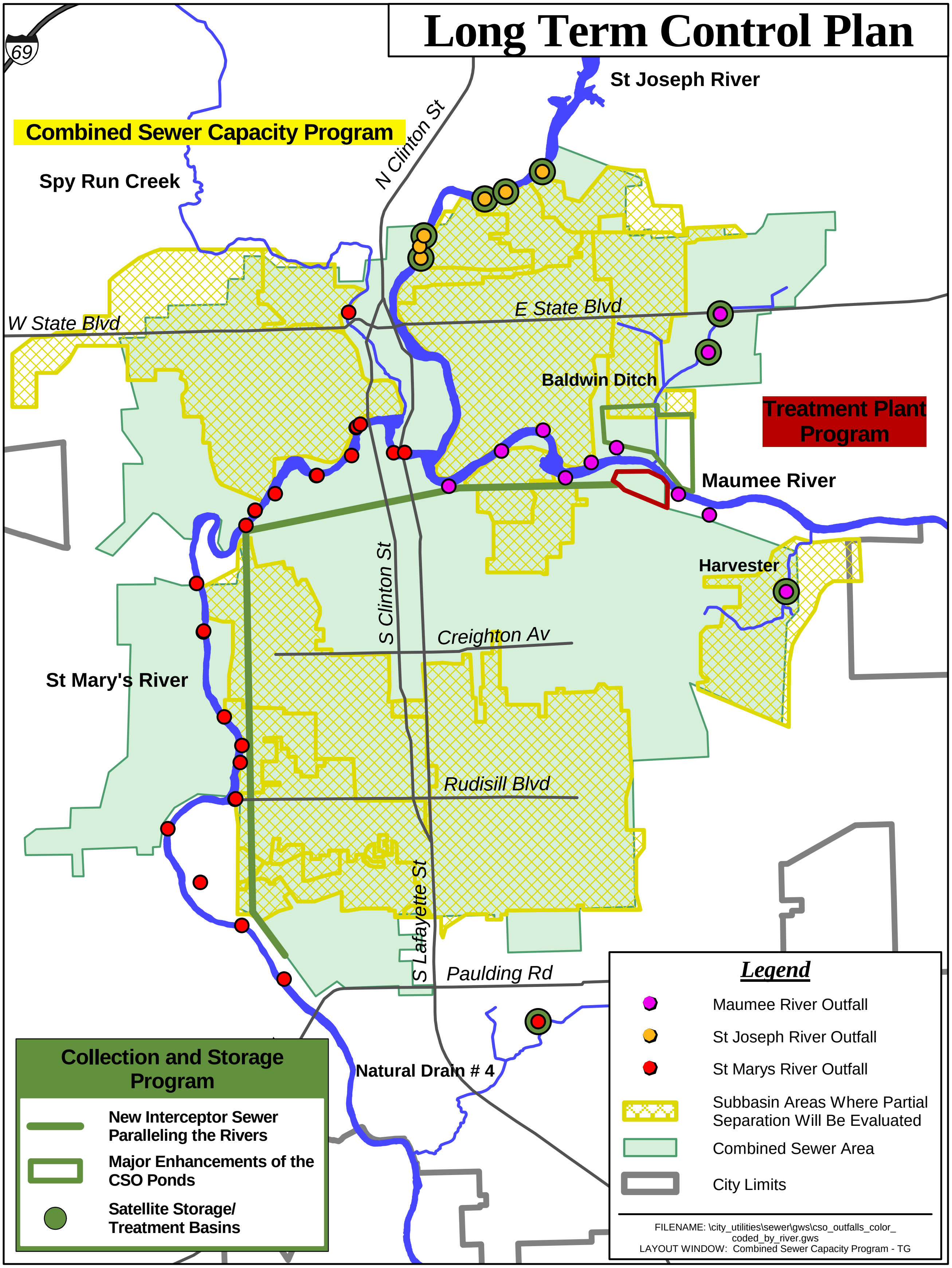
APPENDIX 1

FIGURES

SEWER SERVICE AREAS



LTCP - CHAPTER 1 FIGURE 1.1.1



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2.0 CHAPTER 2 SYSTEM CHARACTERIZATION

This Chapter of the LTCP addresses the City's characterization of its CSS and receiving waters, including both monitoring and modeling activities.

2.1 *PUBLIC PARTICIPATION AND AGENCY INTERACTION*

Wastewater in the City of Fort Wayne is collected by a system of combined and separated sanitary sewers. Combined sewers account for approximately one-third of the total length of the City's publicly owned sewers. Combined wastewater flows to the City's Water Pollution Control Plant (WPCP) for treatment. The WPCP provides secondary treatment with effluent wastewater discharged to the Maumee River. During wet weather conditions, excess flows are conveyed to the St. Joseph, St. Mary's, and Maumee Rivers, Spy Run Creek, Baldwin Ditch, Wayne Natural Drain #4 and Harvester Drain through combined sewer overflow (CSO) outfalls.

Water quality in Fort Wayne's receiving streams is affected by multiple sources in addition to CSOs. Therefore, a watershed-based strategy has been used for characterizing the receiving streams.

In 1995 the City formed a citizen-member Sewer Taskforce to help consider wet-weather issues faced by the City. The taskforce was asked to become informed about sewer issues, recommend actions to address those issues, and recommend ways to pay for the actions recommended. This group, (called the Sewer Advisory Group today) has since continued to serve and provide the City with valuable public input on all major sewer issues.

The City initiated a program in 1997 to further identify water quality problems and to develop water quality goals, priorities and solutions. The program is detailed in *Community Based Water Quality Goals for the Upper Maumee Watershed* dated 1998, by Malcolm Pirnie. As a result of the program, the City initiated a "Total Quality Watershed Management" approach to coordinate various water related efforts.

Seventy-five individuals, consisting of representatives and employees of City departments, community leaders and representatives of other organizations (these organizations include the Sewer Advisory Group, St. Joseph River Watershed Initiative, Soil and Water Conservation, Fort Wayne Chamber of Commerce, American Electric Power, Agriculture Industry, Fort Wayne Journal Gazette, City of New Haven, Adams Center Landfill, and representative of Lugar & Coats Office) with an interest in water quality were interviewed. A detailed discussion of these interviews can be found in Chapter 2 "Stakeholder Interviews" and Appendix C of *Community Based Water Quality Goals for the Upper Maumee Watershed* completed by Malcolm Pirnie in 1998. Below is a summary of the comments:

- The highest priority of watershed management should be the protection of drinking water and public health as it relates to drinking water.
- The attainment of the fishable, swimmable designated uses was possible and necessary, but was not practical or affordable.
- The current uses of the rivers primarily consisted of biking, running, and walking on the river greenway with some fishing and boating. No full-body-contact recreational uses were identified within river segments downstream of CSOs.
- Silt and litter/debris were listed as the top detractor from river aesthetics. Floatables were listed at the bottom of the same list.
- There was wide agreement public education and increased funding would be necessary to accomplish river improvements.
- Interviewees were willing to spend up to $10 per month more to get better quality rivers. They felt their neighbors would be willing to pay about half that amount.

Three workshops were also held. Approximately thirty of the seventy-five individuals who participated in the above-described interviews attended at least one of three workshops held. Eight persons participated in all three workshops.

The focus areas of the workshops were on the Upper Maumee and the St. Joseph Watershed. The workshops resulted in the identification of water-quality issues and the establishment of community water quality goals. Water quality issues that participants ranked as the highest priorities were:

- Drinking Water
- Habitat
- *E. coli*
- Odor
- Debris and Litter

Of Fort Wayne's three rivers, EPA's watershed index lists the St. Joseph River as having the highest water quality concerns. Such is at least partially due to a relative lack of information about the Maumee and St. Mary's Rivers and that the St. Joseph River is the City's drinking water source (The intake point for the City's Three Rivers Water Filtration Plant is within the St. Joseph River, upstream of the St. Joseph Dam near Coliseum Blvd. Importantly, this location is also upstream of all of the City's CSO outfalls). While not impacted by CSOs, interviewees nonetheless expressed concerns about pollutant sources upstream of the St. Joseph Dam. Although there seems to be at least some community interest in both the Maumee and St. Joseph River watersheds, little interest was apparent for the St. Mary's River watershed. This may be at least somewhat attributable to the relatively low flow of the St. Mary's River and its shallow depth.

The City's engagement with regulatory agencies concerning CSO issues began long ago. Efforts toward a final LTCP began shortly after EPA's 1994 issuance of its CSO Control Policy. The City submitted a draft technical component of the LTCP to EPA and IDEM in 1999 and a complete draft in 2001. EPA responded with comments to the complete draft in 2002. An active dialog between the City, IDEM and EPA has since been ongoing. Pursuant to administrative orders issued by EPA in 1995 and 1996, the City submitted a Combined Sewer System Operational Plan and SSO Elimination Plan to EPA and IDEM in 1996.

2.2. *OBJECTIVE OF SYSTEM CHARACTERIZATION*

To help obtain a more detailed understanding of existing conditions of the City's CSS and receiving waters, the City conducted a detailed system characterization. The process led to the establishment of baseline conditions (including CSO impacts), determination of receiving water goals, and the identification of potential CSO controls. An understanding of baseline conditions is important in predicting the effectiveness of the proposed CSO controls.

2.3 *IMPLEMENTATION OF THE NINE MINIMUM CONTROLS*

The City's Amended Combined Sewer System Operational Plan (CSSOP) submitted to EPA and IDEM on November 16, 2007 details the implementation of each NMC.

2.4 *COMPILATION AND ANALYSIS OF EXISTING DATA*

2.4.1 Watershed Characteristics and Mapping

The City is located in Allen County in northeast Indiana. Fort Wayne's 2003 population was 220,486. Fort Wayne is centered around the confluence of three rivers: the St. Joseph which originates near Hillsdale, Michigan and flows from the northeast; the St. Mary's River which originates near Celina, Ohio and flows from the southwest; and the Maumee River which is formed by the confluence of the St. Joseph and St. Mary's Rivers in downtown Fort Wayne. The Maumee River flows east to New Haven, Indiana, then northeast and discharges to Lake Erie at Toledo, Ohio.

Fort Wayne's defined watersheds include several water bodies and the entire land area that drains into them. The watersheds for the St. Joseph, St. Mary's and Maumee Rivers are shown in Figure 1. The USGS has subdivided these watersheds into hydrologic units (HU). The smallest unit is a 14-digit unit. Figure 2 shows the 14-digit HUs in Allen County. These HUs are also the basis for identifying stream segments. IDEM uses these segment identifiers to report water quality in their 303(d) and 305(b) reports. Identified stream segments are shown in Figure 3. Allen County has further subdivided watersheds into areas that can be identified with local ditches and streams. See Figure 4.

Table 2.4.1.1 below shows the watershed characteristics in Fort Wayne. The watershed characteristics within Fort Wayne are relatively similar. The land is mostly used for residential and commercial purposes. The majority of the City's industrial uses are located within the Maumee watershed.

Table 2.4.1.1
Watershed Characteristics

Watershed Name	Acres	HU	Land Use Description
St. Joseph River-Schoppman Drain	7,128	04100003100040	Mostly residential with some commercial and industrial use
St. Mary's River-Spy Run Creek	9,863	04100004060060	Residential with some commercial and industrial use
St. Mary's River-Junk Ditch	11,382	04100004060050	Primarily residential with some commercial
ND #4 (St. Mary's tributary) Shed No. 31D	1,090	04100004060050	Mostly residential, parks and recreation, and small open spaces
St. Mary's River-Snyder Ditch	12,655	0400004060030	Residential and some commercial
Maumee River-River Haven	9,177	0400005010010	Mostly industrial, transportation/utilities, parks & recreation, some residential
Baldwin Ditch (Maumee tributary) Shed No. 32B	970	0400005010010	Transportation/utilities, parks & recreation, residential
Harvester Drain (Maumee tributary) Shed No. 11J	1,545	0400005010010	Mostly industrial, some residential and commercial

Fort Wayne's long-term water quality goals, as identified in 1997 through the community workshops described above, are detailed in Table 2.4.1.2.

Table 2.4.1.2
Initial Long-Term Water Resource Goals for Fort Wayne, Indiana

Watershed Name	Current Uses	Known Problems	Qualitative Assessment of Importance	Long-Term Goals
St. Joseph River-Schoppman Drain	Aesthetics, River Greenway, Recreation - fishing, some boating, drinking water intake for the City, wildlife habitat	CSOs, stormwater, septic tanks, SSDs	Most important town waterbody resource	Meet swimmable and fishable water quality standards
St. Mary's River-Junk Ditch	Aesthetics, River Greenway, fishing and boating, wildlife habitat, wetlands nature area	CSOs, stormwater, flooding, agriculture	Second most important for drainage and stormwater runoff	Meet swimmable and fishable water quality standards
St. Mary's River-Snyder Ditch	Aesthetics, River Greenway, fishing and boating, wildlife habitat	CSOs, stormwater, agriculture, TMDL for *E. coli* on Snyder Ditch	Third most important for drainage and stormwater runoff	Meet swimmable and fishable water quality standards
ND#4 (St. Mary's tributary)	Aesthetics, wildlife habitat, drainage	CSOs, stormwater	Minor importance-drainage ditch	Meet swimmable and fishable WQS
Maumee River-River Haven	Aesthetics, River Greenway, some fishing and boating.	CSOs, stormwater, Industrial area, CSO ponds	Fourth most important	Meet swimmable and fishable WQS
Baldwin Ditch (Maumee tributary)	Aesthetics, wildlife habitat, drainage	CSOs, stormwater	Minor importance – drainage ditch	Meet swimmable and fishable WQS
Harvester Drain (Maumee tributary)	Aesthetics, wildlife habitat	CSOs, stormwater, industrial area	Minor importance-drainage ditch	Meet swimmable and fishable WQS
St. Mary's River-Spy Run Creek	Aesthetics, River Greenway, some fishing and boating, wildlife habitat	CSOs, stormwater, excess flooding, significant industrial area	Significant importance for drainage and stormwater runoff	Meet swimmable and fishable WQS

Table 2.4.1.3 contains existing data sources available to characterize watersheds.

Table 2.4.1.3
Data Sources Available to Characterize Watersheds

Description	Source
Environmental	
Land Use	Master Plan – Figure III – 1 and figure III – 2; and page 11 (1994) State of Indiana GIS – Environmental layer CSO Operational Plan – appendix B, figure B-2 (1996) Storm Water Quality Management Plan – Part B – Sections 2.2, 3.4, 3.5, 2.2 (2004)
Recreational and Open Areas	Storm Water Quality Management Plan – Part B – Section 3.6.3 (Identification of Sensitive Areas) (2004) Recreational Waterbody Uses City's White Paper on Water Quality – Existing Conditions, Uses and Goals – CH.2
Soils and Bedrock Geology	Master Plan – Page 12 (1994) USGS Low Flow Characteristics of Indiana Streams (1996) CSO Facility Plan – Section 2.3 (1982) Hydrology of Allen County – CH. 2 (1994) Indiana State GIS – Geology layer
Natural Resources	Water Power, mineral deposits, gas, oil, electric – No sources
Temperature	NOAA USGS Low Flow Characteristics of Indiana Streams – Page 7 (1996) CSO Facility Plan – Section 2.2 (1982)
Precipitation	USGS Low Flow Characteristics of Indiana Streams – Pages 227-230 (1996) CSO Facility Plan – Sections 9.3, figure 2.2 (1982) Master Plan – Page 13 (1996) 2001 LTCP – Appendix A
Hydrology	Hydrology of Allen County (1994) CSO Facility Plan – Section 2.4 (1982) Flood Maps Indiana State GIS – Hydrology layer Topography - USGS topographic maps and hydrologic unit codes GIS contour maps GRW contour maps FIRM maps County Surveyors maps
Infrastructure	
Roads and Highways	Street Maps (hard copy and GIS)
Storm Drainage System	Record Drawings Sewer Maps (hard copy and GIS)
Sanitary Sewer & Combined Sewer Systems	Record Drawings Sewer Maps (hard copy and GIS) Master Plans (1994) Combined Sewer Relief Plan CSSCIP Preliminary Design Reports XPSWMM Model
Treatment Facilities	Record Drawings Facility Plans
Other Utilities	Utility Engineering Department
Potential Sources	
Landfills	NPDES permit list; Indiana State GIS – environmental layer
Waste Handling Areas	Waste treatment storage disposal, waste transfer stations, open dump sites, septic storage sites – Indiana State GIS –environmental layer
Salt Storage Facilities	City, County, State Highway department
Vehicle Maintenance Facilities	No sources
Underground Tanks	No sources
NPDES Discharges	NPDES List of permitees

Municipal	
Population	Census tracts from Planning GIS; City interactive map
Zoning	Planning GIS
Pollution Control Facilities	WPCP operating and maintenance manuals
Land Ownership	City Assessor's maps
Regulations and Ordinances	City codes (utility zoning), BPW rules & Regulations
BMP's	
Retention/Detention Ponds	Development Services (City Utilities)
Flood Control Structures	Levees, Relief Channel
Municipal Source Control BMPs	Sewer ordinances; stormwater ordinance; pollution prevention; CSSOP

Source input and receiving water data are important to understand the current status of the receiving waters and what affects that status. Table 2.4.1.4 contains existing data sources available to characterize receiving waters.

Table 2.4.1.4
Data Sources Available to Characterize Receiving Waters

Description	Source
Source Inputs (Flow and Quality)	
CSO	1996 LTCP River Sampling Program (outfalls), 2005 River Sampling Program, SIU Discharge Reports
Stormwater	Stormwater Map Atlas
Receiving Water	
Physiographic and Bathymetric Data	USGS Gages – Stages; UAA White Paper (table 2-1), Impact Characterization of CSOs Final Report 1998 - Chapter 7 (Dry weather Calculations), Impact Characterization of CSOs – Addendum 1999 - Chapter 3, Dam plans, Relief Channel plans
Flow Characteristics	USGS Gauge records, CE QUAL model
Sediment Data	None
Water Quality Data	IDEM 303(d) reports, 1996 LTCP Sampling Program (river), 2005 Sampling Program, IDEM river sampling program 2002, City sampling program 2000-2004
Fisheries Data	Fish consumption advisory,
Benthos Data	*Report on the federal and Indiana listed mussels (family Unionidae) of the St. Joseph, St. Mary's and Maumee Rivers and Spy Run in Fort Wayne, Indiana* (2005)
Biomonitoring Data	No sources available
Federal Standards and Criteria	CWA, CSO policy, CFR
State Standards and Criteria	IAC, NPDES permit

Analysis of Existing Data

Existing information and data was assessed and will be discussed in further detail throughout this Chapter.

- The City conducted field studies and assessed area maps, and developed XPSWMM models to determine flow and other hydraulic characteristics of the collection system. The information collected was adequate in order to understand the CSS. The City has made extensive efforts to document its collection system data. Collection system data is discussed and analyzed in sections 2.4.2, 2.5.2 and 2.6.1 of this Chapter.

- Possible pollutants of concern and discharge reports from significant industrial users were analyzed to characterize CSO and non-CSO sources. The City also collected information during wet weather events to assess the affect of these pollutants. CSO and non-CSO source characterization are discussed and analyzed in sections 2.4.3, 2.5.2 and 2.6.1 of this Chapter.

- Extensive data exists on Fort Wayne's receiving waters. Two significant river sampling programs took place on Fort Wayne's receiving waters in addition to weekly and monthly monitoring and sampling efforts long conducted by the City. The data demonstrates that Fort Wayne's receiving waters are not meeting currently designated water quality standards at all times. A biological study was conducted in 2005 to identify any sensitive areas within the receiving waters. The biological study (*Report on the Federal and Indiana listed mussels (family Unionidae) of the St. Joseph, St. Mary's and Maumee Rivers and Spy Run in Fort Wayne, Indiana (2005))* concluded that the City's CSO discharges were not adversely impacting any endangered or threatened species. The City submitted said study to EPA and IDEM shortly after its completion. Receiving water data is discussed and analyzed in sections 2.4.4, 2.5.3 and 2.6.2 of this Chapter.

- The City's utility maintenance department conducts daily inspections of the combined sewer system. This data is analyzed to determine the existence, volume and duration of CSOs.

Potential Pollution Sources

In addition to CSOs, a number of possible pollutant sources exist within the Fort Wayne's watersheds. Stormwater discharges and discharges from regulated industries, are but two of the possible other sources. Understanding land uses within a watershed help identify pollutant sources. Land use and sewer service area information can be found within the City's Master Plan – Figure III-1 and figure III-2. Additional land use information can be found in the City's GIS system, CSS Operation Plan and Storm Water Quality Management Plan – Part B.

Nonstructural Controls

Nonstructural controls provide pollution control by reducing the amount of runoff and improving the runoff quality that enters the receiving waters. Regulations and ordinances, municipal source control BMPs and zoning all assist in regulating pollution prevention. Nonstructural control practices are used to prevent the source of pollution at the source when possible to reduce contaminants entering receiving waters. The City participates in a variety of nonstructural control practices. Table 2.4.1.5 below describes City nonstructural control efforts. Each control aids in reducing pollutant at the source. The City's Zoning Ordinance and Land Use Management plan help control development plans within each watershed. Detailed information of each solid waste management control is located in the receiving water discussion below.

Table 2.4.1.5
Nonstructural Control Efforts

Nonstructural control	Stormwater Management (within City Utilities)	Floodplain management	Zoning Ordinance	Subdivision Control Ordinance	Garbage and Refuse (City Code of Ordinances)	Sewer Use Ordinance
Scope of regulation	Reduce pollutants entering receiving streams caused by stormwater runoff	Regulates development within floodways	Specify zoning districts based on existing or proposed development. Use and classification of land	Provide for land division under Comprehensive Plan; promote utilization of land to promote health and safety and assure the best possible environment	Reduce potential solids and pollutants from entering the receiving streams and to make for a cleaner, healthier environment through various practices	Regulates sewer use in the City
Runoff Quantity contro						
Open space	Forested riparian areas along streams	Discourages development in open spaces within a floodplain	Establish standards for development	No subdivisions shall be built in the City within the floodplain. Keep floodplain areas open.	None specified	BPW approval for expansion of sewers outside corporate limits
Post development flov control	Detention and Retention Basins	None specified	Required to maintain structures	None specified	None specified	None specified
Additional controls						
Solids controls	Erosion control	Permits are required for working in floodplains; Erosion control	None specified	Development permits required	Reduces solids from entering into the CSS or Stormwater system	Reduces floatable from entering the streams
Other pollution contro	Minimize agricultural runoff	None specified	Establishes permitted and prohibited land use	Assesses floodplain areas and zoning prior to approving plan	Reduces bacteria, wastes, and pollutants from entering receiving streams	Federal pretreatment standards for SIUs, prior approval of certain wastes

2.4.2 Collection System Understanding

EPA's 1994 CSO Control Policy recommends that the municipality "*…evaluate the nature and extent of its combined sewer system through evaluation of available sewer system records, field inspections and other activities necessary to understand the number, location and frequency of overflows and their location relative to sensitive areas and to pollution sources in the collection system, such as indirect significant industrial users"* (Part II.C.1.b).

The objectives of existing data analysis and field investigation are:

- To determine the current level of understanding and knowledge of the CSS
- To assess the design and current operating conditions of the CSS

- To identify the data that still need to be collected through the monitoring and modeling program

2.4.2.1 Review of Historical Information

The purpose of reviewing historical information is to compile, catalogue, and review information on the design and construction of the CSS and to evaluate how the CSS operates, particularly how it responds to wet weather.

Design and construction information was collected concerning the:

- location and capacity of the WPCP
- location and capacity of the interceptor system
- location and operation of flow regulating structures
- location of all CSO outfalls

Table 2.4.2.1 contains an inventory of existing sources of information used to identify and describe the above items.

Table 2.4.2.1

Inventory of Existing Sources to Describe the CSS

DESCRIPTION	SOURCE
Location and capacity of the WPCP	Sewer Maps (hard copy and GIS) Record Drawings WPCP Facilities Planning Study May, 1998 Stress Test Report
Location and capacity of the interceptor system	Sewer Maps (hard copy and GIS) Record Drawings XP SWMM model documentation (dendograms)
Location and operation of flow regulating structures	Sewer Maps Record Drawings 1976 Regulator drawings 1998 review of 1976 regulator drawings
Location of all CSO outfalls	Sewer Maps Field information CSO Solids and Floatables Tech Memo – Pictures

Information was also gathered to analyze the following:

- CSS drainage areas
- Rainfall throughout the CSS drainage area
- Sources of discharge into the CSS
- CSS hydraulics

Table 2.4.2.2 contains an inventory of existing sources of information that provide analysis or data for analysis of the above items.

Table 2.4.2.2
Inventory of Existing Sources to Analyze the CSS

DESCRIPTION	SOURCE
CSS drainage area	Sewer Maps Topographic maps Subbasin Manuals
CSS drainage area rainfall	1994 Sewer Master Plan 2001 draft LTCP Appendix A City of Fort Wayne's CSO area Rainfall Monitoring Data
Sources of discharge into the CSS	Pre-Treatment program records Sewer tap permit records Land use maps Aerial photographs
CSS hydraulics	1994 Sewer Master Plan model 1999 XPSWMM Model development and calibration CSSCIP Preliminary Design Reports

2.4.2.2 Study Area Mapping

Mapping can improve one's understanding of the CSS and how it was designed to work. Three types of maps have been prepared to graphically illustrate features of the CSS. The first is a general CSS map. It shows the WPCP, interceptor sewers system, CSS subbasins, CSS trunk sewer system, diversion structures, CSO discharge points, receiving water bodies, river crossings, and outlying separate sanitary sewer areas draining to the CSS. This map illustrates where flow comes from, how flows combine, and how flows are transported to the WPCP. See Figure 5. The second type of map is a CSS sampling map. It shows sampling sites such as river sampling and overflow sampling locations. It also shows rain gauge and river gauge sites. This map helps illustrate the completeness of sampling information. See Figure 6. The third type of map is the subbasin map. The City has developed one of these maps for each of the City's 40 CSS subbasins. Each shows CSS drainage areas, general land uses, CSS subbasin sewers, regulators, CSO discharge points, sampling access points, and non-domestic discharges to the CSS. These maps provide detailed information on how the CSS was designed to work and on the area drained by the CSS. Copies of each CSS subbasin map can be found in the PDS Library at the City.

2.4.2.3 System Field Investigation

While mapping helps to clarify how the CSS was designed, field investigations provide information on its operation and condition. The City has undertaken a number of field investigations to increase its knowledge of the CSS. Table 2.4.2.3 lists some of activities undertaken to verify record drawings and sewer maps.

Table 2.4.2.3
Activities to Verify Record Drawings and Sewer Maps

ACTIVITY	PURPOSE
1998 Diversion Structure Investigations	Provide drawings of CSS diversion structures
GIS Map updating program	Update GIS sewer maps any time field operations discover information not shown correctly on the GIS sewer maps
CSO Area Storm Water Inventory October, 2001	Verify the accuracy of the City's sewer maps in 2 quarter sections
1976 Regulator Survey	Provide regulator drawings to explain the operation
1998 Regulator Survey	Verify physical descriptions in the 1976 Regulator Survey

Table 2.4.2.4 lists some of the activities that were undertaken to identify facility characteristics that are not normally shown on record drawings or sewer maps.

Table 2.4.2.4
Activities to Identify Facility Characteristics

ACTIVITY	PURPOSE
Preparation of visual inspection procedures	Identifies when CSO discharge points are submerged
Development of manual for each subbasin	Summarizes inspection and operational info and miscellaneous site/area aspects of each outfall, regulator and CSS system

Table 2.4.2.5 lists some of the activities that were/are undertaken to determine the condition and operability of CSS facilities.

Table 2.4.2.5
Activities to Determine the Condition and Operability of CSS Facilities

ACTIVITY	PURPOSE
1976 Regulator Survey	Evaluate the condition of system regulators
1997 Regulator Evaluation Study	Evaluate the condition of all mechanical regulators, established inspection and maintenance procedures
Catch Basin Cleaning Program	Catch Basins are inspected for damage
Sewer Televising Program	Identify structural defects in the CSS and verify sewer mapping
Manhole Inspection Program	Identifies the condition of manholes
Tide Gate Inspection Program	Identifies the condition of tide gates
Regulator Inspection and Maintenance Program	Identifies and repairs mechanical regulator deficiencies

Table 2.4.2.6 lists some of the activities undertaken to detect dry weather overflows.

Table 2.4.2.6
Activities to Detect Dry Weather Flows

ACTIVITY	PURPOSE
CSO Dry Weather Inspection Program	Detect dry weather overflows and determine their causes
CSO Flow Monitoring Program	Detect dry weather overflows, measure their volume, and initiate corrective action.

Field investigations were also used to collect preliminary information of sewer flows. The City completed a number of temporary flow monitoring studies and has established a permanent CSO flow monitoring program. Below is a list of the most recent flow monitoring studies.

- 1996 CSO flow monitoring
- 1997 Interceptor system flow monitoring
- 2001 St. Joseph subbasin flow monitoring
- 2004-Current CSO flow monitoring (the monitoring includes the use of flow meters and pump data) - as collected for CSO outfall monitoring requirements

2.4.2.4 Preliminary CSS Hydraulic Analysis

A XPSWMM hydraulic model of the City's interceptor system was developed during the preparation of the 1994 Sewer Master Plan. The model was not calibrated at that time but it did provide a preliminary understanding of the operation of the City's interceptor system. A system schematic, or dendogram, was created using this model to visually represent how the system worked. The documentation of these efforts can be found in the City's 1994 Sewer Master Plan.

Between 1997 and 1999 the original XPSWMM model was refined and calibrated. Thirty-eight subbasin models were developed and calibrated and all the models were combined into a single Full System Model. The documentation of these efforts can be found in the *Combined Sewer System Analysis*, January 1999. EPA and IDEM approved the City's model for LTCP development purposes in 2005.

2.4.2.5 Additional Activities

The City has made extensive efforts to document the condition of its collection system. Between mapping efforts, the use of historical documents, and efforts related to the development of the City's model, the City has developed a comprehensive understanding (relative to the fact that the City's sewer system was constructed over a 130 year period and includes more than 1,239 miles of sewers (as of July 2006)) the location, size, condition, and flow characteristics of the CSS. The City's documentation includes the location, design, condition, and operation of structures within the CSS. However, new information will continue to be discovered as design and construction of new facilities is undertaken. The City has developed procedures to incorporate new information into its knowledge base as it becomes available.

The City has identified the activity level of all CSO outfalls, the threshold rain event that usually triggers overflows at particular CSO outfalls, and the approximate magnitude of CSO discharges will be during a given rain event. A summary of this information can be found in CSSOP Chapter 9. The City has also identified which interceptors surcharge under certain wet-weather conditions and the associated causes. A detailed study was conducted and presented in Chapter 2 of the City's CSSOP on the feasibility of reducing CSOs through the use of inline storage, i.e., by raising overflow weirs.

2.4.3 CSO and Non-CSO Source Characterization

The objectives of existing data analysis and field investigation are:

- To determine the current level of understanding and knowledge of CSS overflows and non-CSO pollutant sources
- To identify relative impacts of CSOs and non-CSO sources of pollution on receiving water quality
- To identify the data gaps and methods to fill those gaps through the monitoring and modeling program

2.4.3.1 Characterization of Combined Sewage and CSOs

2.4.3.1.1 Historical Data Review

The City reviewed available historical data to help identify pollutants of concern, their concentrations, their volumes, and likely pollutant sources. The characteristics of the WPCP influent were first studied. Results of these studies can be found in:

- 1994 Sewer Master Plan, Section III.F.1.b, pp 39-41
- *Significant Industrial Users' Impact on Combined Sewer Overflow – Finding Report* dated September 24, 2004, pp 56-57
- CSSOP Chapter 3

Discharge reports from significant industrial users were also reviewed to identify possible pollutants of concern. The result of this review can be found in:

- *Significant Industrial Users' Impact on Combined Sewer Overflow – Finding Report* dated September 24, 2004, pp 59
- CSSOP Chapter 3

The above-referenced report yielded a list of pollutants observed in the collection system. The information reviewed did not characterize CSO discharges, only what might be found in CSOs given the characteristics of insystem flows.

In order to characterize CSO discharges, the City conducted two CSO sampling programs. The details of those programs are discussed in Section 2.5.2.1 of this Chapter. CSO flow monitoring was also done during the two CSO sampling programs and a permanent CSO flow monitoring program was implemented in 2004. All regulators with upstream SIU discharges were identified during the preparation of CSSOP Chapter 3 and sampled during the sampling programs.

2.4.3.1.2 Mapping

Figure 6 shows the regulators that were sampled for both the 1996 LTCP River Sampling Program and the 2005 River Sampling Program   Figure 7 shows the location of SIUs as of 2006.

2.4.3.2 Characterization of Non-CSO Pollutant Sources

The City's watershed mapping efforts identified several non-CSO pollutant sources. These sources include stormwater sources, upstream septic areas, upstream agricultural areas, and upstream community pollution.

2.4.4 Receiving Waters

The main impetus for CSO control is attainment of water quality standards, including designated uses. To this end, the review of existing information should include characterization of CSO impacts and other watershed pollutant sources and their effects as completely as possible.

The objectives of existing data analysis and field investigation were:

- To determine the current level of understanding and knowledge concerning receiving waters
- To assess any known CSO impacts on receiving waters
- To identify the data that still needs to be collected through the monitoring and modeling program

2.4.4.1 Review of Historical Data

The purpose of reviewing historical information is to establish the status of each receiving water body impacted by CSOs. To accomplish this purpose, information needs to be gathered to identify and describe the following:

- Sensitive areas
- Water quality standards (WQS) and attainment of WQS
- Problems attributable to CSOs
- Hydraulic characteristics
- Other sources of pollutants – quantity of pollutants
- Water quality upstream of CSOs
- Ecologic and aesthetic conditions of the receiving waters

Table 2.4.4.1 below contains existing data sources available to describe the above items.

Table 2.4.4.1
Data to Describe CSO Impacted Waters

Description	**Source**
Sensitive areas	CSO control policy, *Report on the federal and Indiana listed mussels (family Unionidae) of the St. Joseph, St. Mary's and Maumee Rivers and Spy Run in Fort Wayne, Indiana* (2005), Community Based Water Quality Goals for the Upper Maumee Watershed, *Recreational Waterbody Uses in Fort Wayne's Combined Sewer Area* (2005)
WQS and attainment of WQS	IDEM 303(d) report, Fish Consumption Advisory Report, CWA, IAC – Indiana Environmental Rules: Water, IDEM river sampling program 2002, City sampling program 2000-2004, 2005 sampling program, 1996 LTCP sampling program, IDEM 305 (b) report, 304 (l) report, 319 report
Problems attributable to CSOs	Chapter 9 CSS Operation Plan
Hydraulic Characteristics	Low-Flow Characteristics of Indiana Streams, USGS gauge records, Hydrology of Allen County 1994 CE QUAL model documentation
Other Pollutant sources – quantity of pollutants	Operating reports of NPDES permits, IDEM SSO reports, Storm Water Part II NPDES permit, Allen County Health Department's septic tank study
Water quality upstream of CSOs	1996 LTCP sampling program by Malcolm Pirnie, City sampling program 2000-2004, St. Joseph Watershed Initiative 2004 Water Quality Sampling Report
Ecologic and aesthetic conditions of receiving waters	*Report on the federal and Indiana listed mussels (family Unionidae) of the St. Joseph, St. Mary's and Maumee Rivers and Spy Run in Fort Wayne, Indiana* (2005)

2.4.4.2 Mapping

Mapping improves the understanding of the receiving water characteristics. Three maps have been prepared to graphically illustrate the characteristics of Fort Wayne's receiving waters.

The first map is an overall representation of the receiving waters. It shows the location of dams, sampling sites, bridges, USGS stations, pump stations, rain gauges, CSO outfall points, 14-digit hydrological unit areas, public access points and parks. See Figure 8. The second map is actually a series of WQS excursion maps. These maps identify which streams are currently exceeding WQS and for what parameter. They can be found in Chapter 9 of the CSSOP. The third map is the Land Use Map found in the 1994 Master Plan – Figure III. This map describes the land use within Fort Wayne's service area.

2.4.4.3 Field Investigations

Field investigations provide information to characterize areas of the receiving waters not adequately described by existing documents. Field investigations also identify physical features of the receiving waters. The City has conducted several river characterization studies, including field investigations, to increase knowledge of the receiving waters. Table 2.4.4.2 lists some activities that were undertaken to characterize the rivers and Table 2.4.4.3 illustrates characteristics of the City's receiving streams.

Table 2.4.4.2
Activities to Characterize the City's Rivers

Purpose	**Activity**
Differences in depth and width	Recreational use survey (2005), Recreation river bank characterization (2005), 1997-1998 water quality model development
Tributaries	River bank characterization – canoe trip, (2005)
Point sources	CSO inspections, Storm Water NPDES permit application
Suspected non-point sources	No sources
Plant growth and vegetation	Recreational use survey (2005), Recreation river bank characterization (2005), canoe trip
Riparian zones along banks	Recreational use survey (2005), Recreation river bank characterization (2005), canoe trip
Access points	Recreational use survey (2005), Recreation riverbank characterization (2005), canoe trip. Dan Wire – Sewer Advisory Group member
Wildlife	No sources
Aquatic life	*Report on the federal and Indiana listed mussels (family Unionidae) of the St. Joseph, St. Mary's and Maumee Rivers and Spy Run in Fort Wayne, IN* (2005)
Floatable Material	2004 Floatable Study

Table 2.4.4.3
Stream Characteristics

Parameter	Stream			
	St. Joseph	**Maumee**	**St. Mary's**	**Spy Run**
USGS Gage Number	04180500	04183000	04182000	04182810
Drainage Area (at Gage)	1060 mi^2	1967 mi^2	762 mi^2	14.0 mi^2
7Q10 Flow (at Gage)	64.0 cfs [a]	78.0 cfs [c]	9.8 cfs [b]	1.5 cfs [a]
Annual Average Flow (at Gage)	1061 cfs [a]	1772 cfs [c]	613 cfs [b]	18.1 cfs [a]
Typical Dry Weather Surface Width	161 ft [g]	159 ft [h]	110 ft [i]	NA
Typical Dry Weather Cross Sect. Area of Flow	928 ft^2 [g]	486 ft^2 [h]	122 ft^2 [i]	NA
Typical Dry Weather Depth of Flow	5.2 ft [g]	3.1 ft [h]	1.1 ft [i]	NA
Typical Dry Weather Depth of Channel	8.6 ft [g]	5.0 ft [h]	2.0 ft [i]	NA
Typical Bed Slope of Channel	0.9 ft/mile [g]	0.3 ft/mile [h]	1.4 ft/mile [i]	NA
Maximum Water Temperature	81 F	82 F	82 F	NA
Minimum Water Temperature	32 F (as liquid)	32 F (as liquid)	32 F (as liquid)	NA

Notes:
NA = not available
[a] For the period of October 1983 – September 2000
[b] For the period of October 1931 – September 1933 and October 1934 – September 2000
[c] For the period of October 1956 – September 2000
[d] For the period of May 1964 – September 1991
[e] "Typical Dry Weather" values based on modeled conditions preceding a storm event on October 30, 1996.
[f] Water temperature statistics derived from City of Fort Wayne water-quality sampling program at six stations located at the upstream and downstream points of each river in the study area between August 1996 and October 2000.
[g] St. Joseph River characteristics shown for the 8.5 mile-long reach from upstream gage to City Utilities Dam. For the 4.3 mile-long reach extending downstream from the City Utilities Dam to the Hosey Dam, the average dry-weather width is 148 ft, flow area is 522 ft^2, average depth is 3.2 ft, average channel depth is 5.4 ft, and the typical bed slope is 2.4 ft/mile.
[h] Maumee River characteristics shown for the 6.0 mile-long reach from Hosey Dam downstream to the gage at Landin Road.
[i] St. Mary's River characteristics shown for the 11.5 mile-long reach from upstream gage to confluence.

Pollutants from both point and non-point sources are discharged to the receiving waters. Municipal and industrial point sources locations are known and have been analyzed through extensive monitoring. Specific information on non-point source pollutants are limited to land use maps which help define potential pollutant sources within each watershed.

2.5 *COMBINED SEWER SYSTEM AND RECEIVING WATER MONITORING*

2.5.1 Monitoring Plan Development

The steps required to develop a monitoring plan are:

- Define the short- and long- term objectives
- Decide whether to use a model
- Identify data needs
- Identify sampling criteria
- Develop data management and analysis procedures
- Address implementation issues

2.5.2 Combined Sewer System Monitoring

As described below, the City devoted significant efforts to identify system flow characteristics and the pollutants in its combined sewage through several flow monitoring programs. The first of these programs, identified throughout this chapter as the "1996 LTCP Sampling Program," was conducted by the City to help it characterize its flows and discharges. The second program, identified throughout this chapter as the "1997 Sewer System Flow Monitoring Program," implemented a system-wide flow monitoring effort to collect model calibration data. The third program, identified throughout this chapter as the "2005 Sampling Program," was conducted in cooperation with IDEM and EPA at the agencies' request to address perceived data gaps. These efforts produced a list of pollutants whose concentrations were measured at representative regulator overflow points. All regulators downstream of SIUs were sampled. The flow monitoring associated with these programs has given the City necessary information on insystem flow characteristics and the discharge volumes for each regulator. Watershed mapping identified pollutant sources for each regulator. Through these efforts and others described in this Chapter, average pollutant concentrations for all pollutants of concern were determined as necessary to support an evaluation of long-term CSO control alternatives.

The objectives to be accomplished by combined sewer system monitoring are:

- Determination of CSO pollutant concentrations.
- Support for model input, calibration, and verification.

Each of these objectives will be discussed individually below.

2.5.2.1 Determine CSO Pollution Concentrations

Concentrations of pollutants during overflows at various locations, during a range of rain events, and for discrete time periods during the rain events were needed to properly capture the characteristics of CSO pollution concentrations.

In 1996 the City undertook a CSO sampling program. This sampling program is described in detail in the *Impact Characterization of Combined Sewer Overflows* completed with Addendum in January 1999, by Malcolm Pirnie. It entailed sampling of 7 locations listed and depicted at Table 3-3 and Figure 2-1 of the *Impact Characterization of Combined Sewer Overflows, Final Report*. The selection of these representative sites is explained at Attachment 1.

Only storms that followed 72 hours of dry weather, and which had a total depth of more than 0.2”, were sampled. Four storms that met these criteria were monitored during the study period. The characteristics of these storms are shown in Table 2.5.2.1.

Table 2.5.2.1
1996 Rain Summary

	Storm 1	Storm 2	Storm 3	Storm 4
DATE	9/21/96	9/27/96	10/10/96	10/29/96
DAY OF WEEK	Saturday	Friday	Thursday	Tuesday
START TIME	8:45 AM	1:45 AM	9:45 PM	11:00 PM
DURATION	11 HRS	23 HRS	7 HRS	1.25 HRS
TOTAL DEPTH	1.4”	1.65”	.70”	.41”
MAX. INTENSITY	.76 in/hr	.52 in/hr	.18 in/hr	1.44 in/hr
RECURRENCE INTERVAL	5 months	5 months	<2 months	<2 months

The program utilized automatic samplers, equipped with 24 one-liter bottles and programmed to fill one bottle every 15 minutes after receiving an initial flow signal from the accompanying flow meter. In addition, grab samples were collected at each location for bacteria analysis. An explanation of the parameters analyzed and associated sampling protocols is given in section 3.3 of the *Impact Characterization of Combined Sewer Overflows, Final Report.*

The following pollutants were sampled:

- *E. coli*
- Fecal Coliform
- TSS
- CBOD
- DO
- pH
- Temperature
- NH_3-N
- P
- Metals
- Volatiles
- Acids
- PCBs
- Pesticides
- Total Cyanide

The sampling results are presented in Appendix B of the *Impact Characterization of Combined Sewer Overflows, Final Report*. In general all pollutants exhibited a "first-flush effect". That is, they were found to have higher concentrations during the early stages of overflows than during the later stages of the overflow. The pollutant concentrations also showed greater variation by storm than by location. Both of these observations can be expected given that pollutants have a tendency to build up in sewers during dry weather and are flushed at the start of overflows.

Table 2.5.2.2 contains the arithmetic mean of all samples, the range of location means, and the range of event means for each parameter. The variation during the rain events are shown graphically in figures 4-1a to 4-39 of the *Impact Characterization of Combined Sewer Overflows, Final Report.*

Table 2.5.2.2
POLLUTANT ANALYSIS SUMMARY

Pollutant	Unit	Avg.	Sample Range	Location Range	Event Range	90th Percentile Value	Standard Deviation
TSS	mg/l	238	564-43	325-158	450-68	549	179
CBOD5	mg/l	67	244-3	92-36	139-18	162	67
Total Phosphorus	mg/l	1.65	4.75-.11	2.34-.64	3.44-.55	3.65	1.45
Ammonia	mg/l	3.15	9.34-.17	4.82-.87	4.27-2.24	5.73	2.27
E.coli	Col/ 100 ml	99,589	317,601-14,900	137,350-53,050	158,343-24,000	200,600	75,478
Cadmium	mg/l	.005	.010-.005	.006-.005	.006-.005	.005	.001
Chromium	mg/l	.025	.026-.005	.069-.005	.042-.013	.040	.049
Copper	mg/l	.099	.38-.055	.161-.018	.201-.025	.218	.101
Lead	mg/l	.053	.160-.005	.088-.019	.086-.014	.123	.045
Nickel	mg/l	.039	.620-.005	.161-.015	.110-.009	.030	.114
Silver	mg/l	.026	.530-.005	.138-.005	.083-.005	.013	.099
Zinc	mg/l	.195	.760-.005	.298-.090	.354-.063	.456	.187
Dissolved Oxygen	mg/l	7.82	9.24-3.77	8.62-6.58	8.47-6.91	5.61	1.35

In 2005 the City undertook a second CSO sampling program. The sampling was done between April 20, 2005 and May 19, 2005 according to a sampling plan approved by EPA and IDEM.

Samples were taken at 3 locations. These are listed in Table 2.5.2.3 and shown on Figure 6. These sites were chosen because they were the only regulators with active SIU dischargers upstream that had not been previously sampled.

Table 2.5.2.3
Combined Sewer Overflow Sampling Locations

Regulator SIP No.	Regulator Permit No.	Name	Location	River
L06-086	025	Fort Wayne Newspapers	Northwest corner of Ewing and Superior	St. Mary's
P06-014	057	Glasgow	North side of Wayne west of Glasgow	Maumee
Q06-057	057	Plant Regulator	North side of Dwenger in front of new headworks	Maumee

Only storms that followed 72 hours of dry weather and had a total depth of more than 0.2" were sampled. Three storms that met these criteria were monitored during this study. The characteristics of these storms are shown in Table 2.5.2.4.

Table 2.5.2.4
2005 Rain Summary

	Storm 1	Storm 2	Storm 3
Date	4/20/05	5/13/05	5/19/05
Day of Week	Wednesday	Friday	Thursday
Start Time	11:15 AM	3:15 PM	8:00 AM
Duration	9.75 hrs	7.25 hrs	4.5 hrs
Total Depth	.39"	.70"	.62"
Max. Intensity	.27 in/hr	.48 in/hr	.39 in/hr
Recurrence Interval	<2 month	<2 month	<2 month

Attempts were made to get 3 grab samples for each site during each rain event. The first sample was taken shortly after the overflow began. Two more samples were taken at 30 to 60 minute intervals.

The following pollutants were sampled:

- TSS
- CBOD5
- Total Phosphorus
- Ammonia
- E Coli
- Cadmium
- Chromium
- Copper
- Lead
- Nickel
- Silver
- Zinc
- Dissolved Oxygen

The sampling results are presented in Attachment 2. Table 2.5.2.5 contains the arithmetic means of all samples.

Table 2.5.2.5
2005 POLLUTANT ANALYSIS SUMMARY

Pollutant	Unit	Avg.	90th Percentile Value	Standard Deviation
TSS	mg/l	329	487	156
CBOD5	mg/l	122	192	71
Total Phosphorus	mg/l	1.27	2.03	.72
Ammonia	mg/l	3.38	5.51	2.14
E. coli	Col/ 100 ml	327,566	650,199	285,574
Cadmium	mg/l	.003	.007	.004
Chromium	mg/l	.038	.076	.030
Copper	mg/l	.101	.169	.065
Lead	mg/l	.055	.106	.041
Nickel	mg/l	.094	.183	.090
Silver	mg/l	.011	.029	.021
Zinc	mg/l	.326	.486	.159
Dissolved Oxygen	mg/l	6.53	2.14	3.71

The results were generally consistent with the 1996 study data. An exception was observed with respect to location 57B, the WPCP regulator. *E. coli* concentrations were higher at that location than expected and dissolved oxygen concentrations were lower than expected. It was also noted that overflows at this location began later in a rain event than at other regulators and the overflows continued longer. All these observations can be explained by the much longer travel time of pollutants to the WPCP than to other sampling locations.

Both sampling studies showed that pollutant concentrations generally vary more from rain event to rain event than from site to site. They also tended to exhibit first flush effects. Pathogens are present in expected concentrations in all overflows. They also show that some metals such as copper show up intermittently in the first flush at several sites. Other pollutants included in the analysis were not found in significant concentrations.

2.5.2.2 Support Model Input, Calibration, and Verification.

The City developed a system of models to serve as wet-weather analysis tools. The components of this modeling system are discussed in the *Combined Sewer System Analysis, Report*, completed in January 1999 by Malcolm Pirnie. A dry-weather flow model, wet-weather surface runoff model, wet-weather infiltration and inflow model, and hydraulic collection system model were used to:

- Predict the wet weather performance of the CSS including portions of the CSS that have not been monitored extensively.
- Predict CSO occurrences and volumes for rain events of interest

- Develop CSO statistics such as annual number of CSOs and percent of combined sewage captured.
- Evaluate and select long-term CSO control alternatives.
- Evaluate and optimize control alternatives.

The City undertook the 1997 Sewer System Flow Monitoring Program to develop and calibrate the above models. This flow monitoring project is described in detail in the project report *1997 Pitometer Sewer System Flow Monitoring Services*. A brief discussion of that project follows.

> The 1997 flow monitoring study was conducted during the months of April, May, and June. Sixty flow meters and 10 rain gauges were installed. Flow velocity and depth were recorded at 15-minute intervals. Rainfall totals were also recorded at 15-minute intervals. Twelve rain events of more than .1-inch were recorded during this period.

Management and analysis of the data collected in this study are discussed in Sections 3.2 and 5 of the 1999 C*ombined Sewer System Analysis Report.* The City's collection systems models were developed and calibrated with this data.

The CSO sampling data described above in Section 2.5.2.1 was used in part of calibrating the City's water quality model. The water quality modeling process is described below in section 2.5.3.3.

2.5.2.3 Evaluate the Effectiveness of the NMCs.

The City's CSSOP addresses, by chapter, the City's evaluation of the effectiveness of its implementation of the NMCs.

2.5.3 Receiving Water Monitoring

As will be detailed below, the City made extensive efforts to characterize the condition of the receiving waters through monitoring and field investigation efforts. This included the following activities:

- Assessing the possible presence of sensitive areas through an endangered species study and recreational use study
- Assessing receiving water quality through sampling programs and analysis of hydraulic characteristics and operating reports from NPDES permits and through field investigations.

Hydraulic characteristics of the receiving waters are known for the Spy Run Creek, St. Mary's, St. Joseph and the Maumee Rivers. USGS has established a number of monitoring stations to measure stream flow and are located on each of the receiving streams listed above (note: the Spy Run Creek station has been deactivated by the USGS, but historical data is available). USGS provides information on annual total, annual mean, highest daily mean, and lowest daily mean and annually 7-day minimum.

There are significant structures that influence both the hydraulic and physical characteristics of the receiving water bodies. The St. Joseph Dam, located downstream of Coliseum Blvd. on the St. Joseph River, was constructed to pool water for the Fort Wayne Water Filtration Plant water intake. The Hosey Dam located upstream of Anthony Blvd. on the Maumee is used to regulate river flow to access CSO outfalls and to control the river level during the dry season to reduce odor and improve aesthetics.

The objectives of the receiving water monitoring are to:

- Assess the attainment of WQS, including designated uses
- Establish baseline conditions in the receiving waters
- Evaluate the impacts of CSOs on receiving water quality
- Support model input, calibration and verification

2.5.3.1 Assess the Attainment of WQS, including Designated Uses

The results of five sampling programs have been used by the City to evaluate impacts of CSOs upon receiving waters. The first two studies, the 1996 LTCP Sampling Program and the 2005 Sampling Program introduced previously in Section 2.5.2.1 above,, included instream sampling to characterize the receiving streams. The third study consists of ongoing monitoring efforts have conducted by the City weekly during the recreational season, while the fourth study is a monthly program conducted in coordination with IDEM. The results of these two ongoing programs have helped to verify the findings from the 1996 LTCP Sampling Program and the 2005 Sampling Program. The last study was a pollutant-specific analysis concerning DO excursions observed during the ongoing monitoring efforts. A description of each study is provided below.

Table 2.5.3.1

River Sampling Studies

Data Source	Locations	Frequency	Years	Parameter Group
1996 LTCP Sampling Program (Malcolm Pirnie)	Mayhew Bridge – St. Joseph Tennessee Bridge – St. Joseph Ferguson Bridge – St. Mary's Harrison Bridge – St. Mary's Landin Bridge – Maumee Anthony Bridge - Maumee	11 dry weather samples (8/6 – 11/3) 4 rain events - 12 grab samples per event at each site	1996	TSS, $CBOD_5$, total phosphorus, NH_3-N, *E. coli*, fecal coliform, pH, DO, total cyanide, hardness, volatiles, PCBs, pesticides, temp, metals - Cd, Cr, Cu, Pb, Hg, Ni, Ag, & Zn
2005 Sampling Program (City of Fort Wayne)	Baldwin U = Upstream Baldwin Ditch Baldwin D = Downstream Baldwin Ditch Spy Run U = Upstream Spy Run Creek Spy Run D = Downstream Spy Run Creek Relief RCD-1 = The Maumee relief channel where Baldwin ditch enters the relief channel and upstream of the rock dam Relief RC-4 = Downstream of the rock dam and upstream of Pond 3 outfall in the relief channel River MR-6 = Parallel to RC-4 in the Maumee River Lower Relief LRC-5 = Downstream of Coliseum Bridge River MR-7 = Downstream of Coliseum Bridge	2 dry weather samples (3/29) and (4/15) 2 rain events - **5/13** (sample 5/13, 5/14, 5/15, 5/16) - **5/19** (sample 5/19, 5/20, 5/21, 5/22) - 1 grab sample per day	2005	DO, NH_3-N, pH, TDS, TSS, *E. coli*, Phosphorus, $CBOD_5$, metals - Ag, Cd, Cr, Cu, Pb, Ni, Zn
Recreational Season Weekly Sampling Program (City of Fort Wayne)	Mayhew Bridge – St. Joseph Tennessee Bridge – St. Joseph Ferguson Bridge – St. Mary's Spy Run Bridge – St. Mary's Landin Bridge – Maumee Anthony Bridge – Maumee	Weekly (April-October)	2001-current	DO, pH, NH_3-N, total phosphorus, TSS, TDS, *E. coli*, temp, depth
Year-Round Monthly Sampling (City and IDEM)	Hursh Rd. Bridge – Cedar Creek Mayhew Bridge – St. Joseph Tennessee Bridge – St. Joseph Ferguson Bridge – St. Mary's Spy Run Bridge – St. Mary's Anthony Blvd. – Maumee WPCP – Maumee SR 101 Bridge – Maumee	Monthly	2002-current	Chloride, COD, cyanide, fluoride, NH_3-N, phosphorus, sulfate, $TBOD_5$, TDS, TKN, TOC, TS, TSS, DO, pH, temp, hardness, metals - As, Cd, Cr, Cu, Re, Pb, Mn, Hg, Ni, Zn
Short-Term DO Monitoring (City of Fort Wayne)	Harrison Bridge – St. Mary's Lawton Park Footbridge – Spy Run Creek Tecumseh Bridge – Maumee St. Mary's - DO isolation - Elizabeth St. Bridge - Clinton St. Bridge - State St. Bridge - Oakridge Bridge	- Samples collected each working day between 8/23/04 – 10/28/04 - Continuous sampling every hour 10/28/04 – 11/18/04	2004	DO, temp, depth

The results of the sampling program are discussed below. The Indiana Administrative Code states that the "Criterion Continuous Concentration" (CCC) is an estimate of the highest concentration of material an aquatic community can be exposed to indefinitely. The "Criterion Maximum Concentration" (CMC) is an estimate of the highest concentration of material an aquatic community can "briefly" be exposed to. *E. coli* is the indicator organism for pathogens. *E. coli* standards are not expressed as CCC/MCM values, but rather in terms of a geometric mean and single sample maximum: 125 colonies per 100 ml, based on a geometric mean of 5 samples over a 30-day period and a maximum *E. coli* count of 235 colonies per 100 ml in any one sample.

1996 LTCP Sampling Program (Malcolm Pirnie Study)

The 1996 Malcolm Pirnie sampling data can be found in Appendix A and Appendix C of *Impact Characterization of Combined Sewer Overflows, Final Report* completed in 1998. The 1996 Malcolm Pirnie dry weather sampling results on the St. Joseph, St. Mary's and Maumee Rivers showed geometric means of *E. coli* samples during dry weather as listed below:

- Mayhew at St. Joseph = 90 colonies/100 ml
- Tennessee at St. Joseph = 106 colonies/100 ml
- Ferguson at St. Mary's = 240 colonies/100 ml
- Harrison at St. Mary's = 314 colonies/100 ml
- Anthony at Maumee = 192 colonies/100 ml
- Landin at Maumee = 238 colonies/100 ml

There were no metal CMC excursions observed. There were, however, metal sample concentrations that exceeded CCC standards for cadmium and copper. These appear to be isolated incidents rather than chronic conditions. Table 2.5.3.2 shows the samples that exceeded CCC standards for cadmium and copper during dry weather.

Table 2.5.3.2
Cadmium and Copper Concentrations in Dry Weather

Parameter	Date	Time	Location	Hardness (mg/l $CaCO_3$)	CCC Allowable (ug/l)	CMC Allowable (ug/l)	Actual (ug/l)
Cadmium	8/6/96	12:55 p.m.	Tennessee @ St. Joseph	328	6.2	17	13
Copper	10/16/96	11:10 a.m.	Harrison @ St. Mary's	308	24	40	26

No other parameters exceeded WQS in dry weather sampling.

The 1996 Malcolm Pirnie wet weather sampling results on the St. Joseph, St. Mary's and Maumee Rivers showed geometric mean *E. coli* concentrations as listed in Table 2.5.3.3.

Table 2.5.3.3
***E. coli* Concentrations in Wet Weather**
(Geometric Mean of All Samples Collected During an Event)

River Sampling Site	**Event 1**	**Event 2**	**Event 3**	**Event 4**
Mayhew at St. Joseph	413	1,444	341	427
Tennessee at St. Joseph	2,599	2,381	650	1,158
Ferguson at St. Mary's	800	5,070	1,238	610
Harrison at St. Mary's	14,823	20,957	2,785	6,779
Anthony at Maumee	7,078	7,312	11,270	7,379
Landin at Maumee	2,292	9,198	1,134	2,758

There were no metal CMC excursions observed. There were metal concentrations that exceeded CCC standards for cadmium and copper. These appear to be isolated incidents rather than chronic conditions. Table 2.5.3.4 shows the samples that exceeded the CCC for cadmium and copper during wet weather.

Table 2.5.3.4
Cadmium and Copper Concentrations in Wet Weather

Parameter	Event	Data	Time	Location	Hardness (mg/l $CaCO_3$)	CCC Allowable (ug/l)	CMC Allowable (ug/l)	Actual (ug/l)
Cadmium	1	9/21/96	7:35 p.m.	Mayhew @ St. Joseph	302	5.9	16	10
Cadmium	1	9/22/96	4:15 p.m.	Tennessee @ St. Joseph	266	5.3	14	10
Copper	2	9/27/96	9:30 a.m.	Harrison @ St. Mary's	217	18	28	20

In summary, parameters met water quality standards most of the time on the St. Joseph, St. Mary's and Maumee Rivers during dry weather. *E. coli* did not meet WQS at Ferguson Road on the St. Mary's, Harrison Street on the St. Mary's or Landin Road on the Maumee River. Note, however, that the geometric mean values for the dry-weather sampling events are calculated over a longer period than the 30 days specified in the WQS. There were traces of cadmium detected at the Tennessee Bridge on the St. Joseph River and copper at the Harrison Bridge on the St. Mary's River. Copper and cadmium did not exceed CMC limits. However, they did exceed the CCC limits on two occasions. This appears to be an isolated incident of metal excursions rather than a chronic condition.

In terms of wet weather, parameters met WQS most of the time on the St. Joseph, St. Mary's and Maumee Rivers. However, the *E. coli* concentrations are clearly elevated and exceeded the geometric mean WQS at each sampling site for all four wet weather events. Note, however, that the geometric mean values for the sampling events are calculated over a much shorter period than the 30 days specified in the WQS. Cadmium exceeded CCC WQS at the Mayhew and Tennessee bridges on the St. Joseph River once. Copper exceeded CCC WQS at Harrison Bridge on the St. Mary's River once. These metals did not exceed the CMC limits. Again, this appears to be an isolated incident of metal excursions rather than a chronic condition.

These studies made it clear that the primary pollutant of concern is *E. coli* for LTCP purposes. Cadmium and copper appeared to be secondary pollutants of concern.

2005 City of Fort Wayne Study

The City's 2005 sampling data can be found in Attachment 3. The 2005 Sampling Program collected data on the Maumee River relief channel, Maumee River, Baldwin Ditch and Spy Run Creek. Specific sampling locations were identified previously in Table 2.5.3.1.

Arithmetic means of *E. coli* samples during dry weather are listed below:

Sampling Site	Average
Baldwin U	2,943
Baldwin D	547
Spy Run U	207
Spy Run D	174.5
Relief RCD1	188.5
Relief RC4	160
Lrelief LRC5	21.5
River MR6	100.5
River MR7	191

There were no acute limit WQS excursions for any parameter during dry weather. Ammonia exceeded the chronic limit WQS for dry weather at RCD1 once. Table 2.5.3.5 shows this sample.

Table 2.5.3.5

Ammonia Concentrations in Dry Weather

Parameter	Location	Acute limits	Chronic Limits	3/29/05 Actual (mg/l)	4/15/05 Actual (mg/l)
Ammonia	Relief RCD1	.6777 – 28.48	.1545 – 2.48	2.63	3.52

All other parameters met WQS for dry weather sampling.

Arithmetic means of *E. coli* samples during wet weather are listed below:

Sampling Site	Average Event 1	Average Event 2
Baldwin U	48,728	64,486
Baldwin D	53,985	20,349
Spy Run U	3,775	8,788
Spy Run D	12,965	6,523
Relief RCD1	70,608	50,840
Relief RC4	10,143	2,237
Lrelief LRC5	3,410	1,764
River MR6	3,708	2,951
River MR7	2,312	1,116

There were no acute limit WQS excursions for any parameter observed during wet weather. Ammonia exceeded the chronic limit WQS for wet weather at RCD1 for events 1 and 2. Table 2.5.3.6 shows this result.

Table 2.5.3.6

Ammonia Concentrations in Wet Weather

Parameter	Location	Acute limits	Chronic Limits	Event 1 (5/15/05) Actual (mg/l)	Event 2 (5/21/05) Actual (mg/l)	Event 2 (5/22/05) Actual (mg/l)
Ammonia	Relief RCD1	.6777 – 28.48	.1545 – 2.48	2.81	4	3.69

All other parameters met WQS for wet weather sampling.

In summary, parameters met WQS most of the time on the Maumee River relief channel, Maumee River, Baldwin Ditch and Spy Run Creek during results for dry weather. *E. coli* (geometric mean nor single-sample maximum) did not meet WQS at Baldwin upstream and downstream, Spy Run upstream and downstream, RC4 and MR7 for the first dry weather sampling event. Baldwin upstream and RCD1 did not meet WQS for *E. coli* (geometric mean nor single-sample maximum) during the second dry weather sampling event. Ammonia did not meet the chronic limit WQS for both dry weather sampling events at RCD1. Ammonia did meet the acute limit WQS. All metals met WQS during dry weather.

In terms of wet weather, parameters meet WQS most of the time on the Maumee River relief channel, Maumee River, Baldwin Ditch and Spy Run Creek. As expected, higher concentrations of *E. coli* were present after wet weather events. *E. coli* exceeded WQS for most sites during each wet weather event. Both upstream and downstream sites on the Baldwin ditch exceeded WQS and had the highest *E. coli* concentration for each wet weather event. The lowest *E. coli* concentration was sampled at MR-7 and LRC-5 along with MR-6 and RC-4. *E. coli* concentrations were found to be similar in both the relief channel and the main channel of the Maumee River. Ammonia met the acute limit WQS. Ammonia did not meet the chronic limit WQS for wet weather sampling events at RCD1 on 5/15/05, 5/2/05 and 5/22/05. This is most likely due to the Baldwin Ditch along with the pooling effect upstream of a rock dam in the relief channel. All metals met WQS during wet weather.

The main channel and the relief channel displayed similar values for each parameter tested during both dry and wet weather events. This data supports that the main channel and the relief channel of the Maumee River share similar water quality characteristics.

This study confirmed that, for LTCP purposes, the primary pollutant of concern is *E. coli*. Ammonia appeared to be a secondary pollutant of concern, although all indications are that the reported ammonia exceedance was an isolated incident rather than a chronic condition.

2001-2003 Recreational Season Weekly Sampling Program (City of Fort Wayne)

The following information includes data collected by the City during the period 2001-2003 on the St. Mary's, St. Joseph and Maumee Rivers. This study was conducted to verify the information established in the 1996 LTCP Sampling Program and the 2005 Sampling Program. Samples were collected once a week on a regular basis; therefore data was not separated for dry and wet weather events. Sampling results from the City study can be found in Attachment 4. Parameters met WQS most of the time. Results from this study are similar to the 1996 and 2005 studies. However, the 2001-2003 Program also revealed that DO exceeded WQS in 2002 and 2003. The DO results are listed below.

Table 2.5.3.7
2002 DO Sampling Results

Sampling Site	Date	DO concentration
St. Mary's at Spy Run	8/12/02	1.9
St. Mary's at Spy Run	8/19/02	4.04
St. Mary's at Spy Run	8/26/02	2.69
Maumee at Landin	8/26/02	4.88
Maumee at Landin	9/9/02	4.76
Maumee at Landin	9/16/02	4.26
St. Mary's at Spy Run	9/23/02	0.77
St. Mary's at Spy Run	9/30/02	3.21

Table 2.5.3.8
2003 DO Sampling Results

Sampling Site	Date	DO concentration
Maumee at Landin	10/27/03	4.9
St. Mary's at Ferguson	6/16/03	3.11
St. Mary's at Spy Run	6/16/03	3.14
St. Joseph at Mayhew	6/16/03	4.07
St. Joseph at Tennessee	6/16/03	4.22
Maumee at Landin	6/16/03	3.64
St. Mary's at Ferguson	7/7/03	2.78
St. Joseph at Mayhew	7/7/03	4.19
Maumee at Landin	7/7/03	2.84
St. Mary's at Ferguson	7/15/03	1.38
St. Mary's at Spy Run	7/15/03	1.43
St. Joseph at Mayhew	7/15/03	4.43
Maumee at Anthony	7/15/03	2.77
Maumee at Landin	7/15/03	2.74
St. Mary's at Ferguson	8/04/03	2.3
St. Joseph at Mayhew	8/04/03	3.32
St. Joseph at Tennessee	8/04/03	3.45
Maumee at Landin	8/04/03	2.66

Data for DO was not available for 2001. The only DO excursion in 2002 was at Spy Run Avenue on the St. Mary's and Landin Road on the Maumee. There were several DO excursions in 2003 at all six sampling sites. There was a significant rain event on July 4, 2003 that started a 100-year flood in the Fort Wayne area, particularly on the St. Mary's River. Due to the flood event, the DO excursions may not be accurate because of abnormal conditions. All other parameters have similar concentrations as those in the 1996 and 2005 studies.

Year-Round Monthly Sampling (City of Fort Wayne and IDEM)

The City and IDEM initiated a joint river sampling program in 2002. The program collects data on Cedar Creek and the St. Mary's, St. Joseph and Maumee Rivers. Samples are collected once a month on a regular schedule; therefore, dry and wet weather samples are not separated in this study. During the recreational season, the City collects samples for the monthly IDEM program as part of the Weekly Sampling Program described above. Sampling results from the joint City/IDEM study can be found in Attachment 5.

Most parameters analyzed as part of the joint program have similar concentrations to those observed in the 1996 LTCP Sampling Program and 2005 River Sampling Program. The only new parameter introduced in the IDEM protocol is lead. Lead has not exceeded the CMC limit, but some samples have exceeded the CCC limit at Spy Run Avenue on the St. Mary's River, Anthony Blvd and SR 101 on the Maumee River. Table 2.5.3.9 shows the metal excursions for lead.

Table 2.5.3.9

Lead Concentrations

Metal	**Date**	**Station**	**Water Hardness**	**Limit (CCC)**	**Limit (CMC)**	**Sample**
Lead	7/21/03	5	159	11.61 ug/L	221.44 ug/L	17.5 ug/L
		6	194	14.94 ug/L	284.94 ug/L	15.0 ug/L
		8	209	16.43 ug/L	313.31 ug/L	25.6 ug/L

Notes:

- **Station 5 is located at Spy Run Bridge on the St. Mary's River**
- **Station 6 is located at Anthony Boulevard on the Maumee River**
- **Station 7 is located at Landin Road Bridge on the Maumee River**

2004 City DO Study

Because there were DO excursions observed in the City 2001-2003 and IDEM 2002-2003 studies, the City conducted a further DO investigation. See Attachment 6 for further detail on this study which concluded that DO is a secondary pollutant of concern.

Designated Use Attainment

The CWA requires that uses be designated for each water body covered by the Act. IDEM has designated all Indiana waters as "fishable/swimmable" for aquatic life and full-body contact recreation. Indiana has also established a use designation for public drinking water supply, industrial and agricultural uses.

Surface waters of the state are designated for full-body contact recreation. The criterion for full-body contact recreation is defined by bacteriological quality during the months of April through October. The *E. coli* bacteria count shall not exceed 125 col/100 ml as a geometric mean based on not less than 5 samples spaced over a 30 day period or 235 col/100 ml in any one sample in a 30 day period. Based on the various river sampling studies on Fort Wayne's receiving streams, the St. Joseph, St. Mary's and Maumee Rivers meet the designated WQS for full-body contact recreation use most of the time during dry weather. Full-body contact recreation during wet weather is attained some of the time. According to the Indiana 303(d) and 305(b) lists, the St. Joseph, St. Mary's and Maumee Rivers and Spy Run Creek list *E. coli* as a parameter of concern. While some recreational activities occur on the St. Joseph, St. Mary's and Maumee Rivers, full-body contact recreation is limited to upstream of the City's CSO outfalls along the St. Joseph River upstream of the St. Joseph Dam. The City conducted a study on recreational activity on the CSO affected portions of the City's three rivers. This study found that, although Fort Wayne's receiving waters meet WQS for recreational use some of the time, the recreational activities that occur in or around the CSO areas mainly consist of canoe/kayaking, fishing from the riverbank, boats, or bridges, and children playing near the riverbank. These activities do not involve full-body contact or the risk of ingesting river water.

In terms of aquatic life, IDEM requires that all waters should be capable of supporting a well-balanced, warm water aquatic community. The criterion for the designated use of aquatic life states that there shall be no substances that impart unpalatable flavor to food fish or offensive odors in the water. The pH values shall be between 6.0 and 9.0 except daily fluctuations that exceed pH 9.0 as a result of photosynthetic activity. Dissolved Oxygen (DO) shall average 5.0 mg/l per calendar day and shall not be less than 4.0 mg/l at any time. There shall be no abnormal temperature changes that may adversely affect aquatic life unless cause by natural conditions. The St. Joseph, St. Mary's and Maumee Rivers meet the designated use and fully support aquatic life. The Spy Run Creek is listed as an Impaired Biotic Community on the Indiana 303(d) list and does not support aquatic life. A waterbody is considered to be impaired, if it does not meet a designated use(s). Listings of impaired biotic communities are based on the narrative standard for aquatic life. The Indiana State Department of Health has issued a Fish Consumption Advisory (FCA) for these waterbodies. Mercury and PCBs are fish tissue contaminants identified in the FCA as pollutants or stressors.

All surface waters used for public water supply are designated as a public water supply. Fort Wayne's public drinking water supply is extracted from the St. Joseph River just upstream of the St. Joseph Dam near Coliseum Boulevard. This is also upstream of the City's first CSO outfall on the St. Joseph River. Some Ohio communities downstream of Fort Wayne use the Maumee River as their public drinking water supply. The following criteria are established to protect the surface water quality where water is withdrawn for treatment for public supply. The coliform bacteria group shall not exceed 5,000 col/100 ml as a monthly average or 5,000 col/100 ml in more than 20% of the samples collected in one month or 20,000 col/100 ml in more than 5% of the samples collect in one month. Taste and odor producing substances shall not interfere with the production of finished water unless it is naturally occurring. Chloride or sulfate concentrations shall not exceed 250 mg/l unless it is a naturally occurring source. Dissolved solids shall not exceed 750 mg/l unless it is a naturally occurring source. Surface waters are acceptable if radium-226 and strontium-90 are present in amounts not exceeding 3-10 picocuries/liter or the gross beta concentrations do not exceed 1,000 picocuries/liter. The combined concentration of nitrate-N and nitrite-N shall not exceed 10 mg/l and the concentration of nitrite-N shall not exceed 1 mg/l. The St. Joseph, St. Mary's and Maumee Rivers meet the designated WQS for public drinking water supply.

All surface waters used for industrial water supply are designated as an industrial water supply. The criterion to ensure protection of water quality at the point at which water is withdrawn for use (either with or without treatment) for industrial cooling and processing is that the dissolved solids shall not exceed 750 mg/l at any time. According to the City sampling data from 2001-present, Fort Wayne receiving waters meet WQS for dissolved solids for industrial water supply use most of the time.

All surface waters used for agricultural purposes are designated as agricultural use water. The criteria to ensure water quality conditions necessary for agricultural use are the same as the minimum surface water quality criteria defined in 327 IAC 2-1.5-8 (b). The St. Joseph, St. Mary's and Maumee Rivers meet the designated WQS for agricultural use.

2.5.3.2 Establish Baseline Condition in Receiving Waters

Flow data, pollutant concentration and an understanding of pollutant sources are needed to establish baseline conditions in receiving streams. The 1996 LTCP Sampling Program and the City's 2005 Sampling Program discussed in Table 2.5.3.1 were used to establish baseline water quality conditions in the receiving waters. A combination of USGS flow data and modeling analysis was used to establish baseline hydraulic conditions in the receiving waters.

Average dry-weather flow rates in the rivers are as follows:

St. Mary's River (near Ft. Wayne) – 45 cfs
St. Joseph River (near Ft. Wayne) – 160 cfs
Maumee River (at New Haven) – 205 cfs

Wet-weather flow rates are impacted by local and upstream rainfall and show high variability. Based on the period of record at available USGS gauges, the range of flows in each of the rivers is as follows:

- St. Mary's River (near Ft. Wayne) – peak recorded flow range up to approximately 16,000 cfs.
- St. Joseph River (near Ft. Wayne) – peak recorded flow range up to approximately 13,500 cfs.
- Maumee River (at New Haven) – peak recorded flow range up to approximately 27,000 cfs.

Average parameter concentrations for each sampling site in the 1996 LTCP Sampling Program and the 2005 Sampling Program can be found in Attachment 7.

2.5.3.2.1 Baseline Conditions - Aquatic Life and Sensitive Areas

Aquatic Life Study

A mussel survey was conducted in March and April 2005 to document the status of the federal and Indiana listed mussels within Fort Wayne's receiving waters. The survey was conducted, as agreed with IDEM and EPA, for the following five reaches of Fort Wayne's rivers and stream.

- St. Joseph River from the St. Joseph Dam at Johnny Appleseed Park to the Parnell Ave. Bridge
- St. Joseph River from Stevies Island to the confluence
- Maumee River from the confluence to approximately 1000 meters downstream
- St. Mary's River from Harrison St. Bridge to the confluence
- Spy Run Creek from Grove St. Bridge to the confluence

A mussel survey is based on the relationship that where mussels exist, habitat and water quality are sufficient to support these sensitive organisms. In contrast, in locations where they historically existed but have been eliminated, one or both of these measures (habitat and water quality) have declined.

A total of 43 species and subspecies of mussels were previously collected from the above reaches. This collection record is based on a wide range of sources, including narrative observations dating back to the early 1900s. The U.S. Fish and Wildlife Service lists three of these species as endangered, while Indiana lists two species as endangered and six species as Species of Special Concern. Of the endangered or special concern species, the only mussels found alive in the 2005 survey were Indiana Species of Special Concern from the Parnell Ave. Bridge to the State St. Bridge on the St. Joseph River. No federally listed endangered or threatened species were found.

Specimens found on the St. Mary's River were 3 years old or less. The lower St. Mary's River does not support a permanent mussel community. Only 5 species were collected on the lower St. Joseph River from State St. Bridge to the confluence. The lower St. Joseph River does not support a permanent mussel community. Only 1 specimen was found on the Maumee River near the confluence; this area does not currently support a permanent mussel community. The Maumee River downstream, near the Ohio Line, supports a diverse mussel community. No living mussels were found in the Spy Run Creek even though conditions were ideal for finding mussels.

This study concluded there are no defined sensitive areas concerning aquatic life on the St. Joseph, St. Mary's or Maumee Rivers within City's CSS receiving waters. The St. Joseph River from the St. Joseph Dam at Johnny Appleseed Park to the State St. Bridge supports an abundant and locally significant mussel community. Additional information on this study can be found in the *Report on the federal and Indiana listed mussels (family Unionidae) of the St. Joseph, St. Mary's and Maumee Rivers and Spy Run in Fort Wayne, Indiana 2005.*

Recreational Use Study

City personnel conducted a recreational use study on Fort Wayne's CSO-impacted areas on the St. Joseph, St. Mary's and Maumee Rivers in 2004 and 2005. This study concluded that recreational activities involving full-body contact within the CSO-impacted reaches of Fort Wayne Rivers are virtually non-existent. According to community surveys described in the study, full-body contact recreation activities are not carried out on a regular basis and, at most, are intermittent or incidental. That is, there are no recreational use sensitive areas in the waterbodies affected by the City's CSO discharges. Detailed information of this study can be found in *Recreational Waterbody Uses in Fort Wayne's Combined Sewer Area 2005.*

2.5.3.3 Evaluate the Impacts of CSOs on Receiving Water Quality

The City's CE-QUAL water quality model was used to evaluate the impacts of CSOs on receiving waters, including a determination of pollutant loads from CSOs, stormwater and other sources. In addition to the data referenced at sections 2.5.3.1 and 2.5.3.2 above, necessary information was gathered to calibrate the model. Elevation, flow, area of flow, pollutant concentrations, cross-sectional bathymetry, dam measurements, current speed and cumulative travel time data are needed to calibrate the model.

Wet weather and dry weather information for the 1996 LTCP Sampling Program was used to calibrate the model. The model was used to estimate the relative contributions from pollutant sources; see section 2.6.2 for model results. The 2005 Sampling Program provided additional instream water quality data to assess the impacts of CSOs. Data summaries from these two sampling programs are described in section 2.5.2.1.

2.5.3.4 Support Model Input

The City developed a system of models to serve as wet-weather analysis tools. The components of the landslide modeling system are discussed in the *Combined Sewer System Analysis Report*, completed in January 1999, while the components of the water quality model are presented in the *Impact Characterization of Combined Sewer Overflows*, completed with Addendum in January, 1999.

The 1996 LTCP Sampling Program collected rain, river flow data and pollutant concentration data from several significant rain events to calibrate the receiving water model.

2.6 *COMBINED SEWER SYSTEM AND RECEIVING WATER MODELING*

2.6.1 Combined Sewer System Modeling

2.6.1.1 CSS Modeling Objectives

As stated at section 2.5.2.2 above, the objectives of CSS modeling was to:

- Predict the wet weather performance of the CSS including portions of the CSS that have not been monitored extensively.
- Predict CSO occurrences and volumes for rain events of interest
- Develop CSO statistics such as annual number of CSOs and percent of combined sewage captured.
- Evaluate and select long-term CSO control alternatives.

- Evaluate and optimize control alternatives.

2.6.1.2 CSS Model Selection

The City needed a hydraulic model that could:

- Adequately estimate runoff flows influent to the sewer system
- Adequately estimate collection system hydraulics including backwater and surcharge conditions
- Predict the behavior of unmonitored overflows
- Perform both short and long term simulations
- Assess the affects of control alternatives

The City selected XP SWMM modeling software, a complex dynamic model, to satisfy the requirements outlined above.

2.6.1.3 CSS Model Application

Development

The City developed a system of models to characterize the CSS. Collectively, the dry weather flow model, the wet-weather infiltration and inflow model, the runoff model, and the hydraulic collection system model are referred to as the CSS model.

The purpose of each component model, the sources of data used to assemble the models, and the level of detail chosen for the models are discussed in Chapters 1, 2, 3, and 4 of the *Combined Sewer System Analysis Report*, completed in January, 1999, by Malcolm Pirnie.

Calibration

The calibration, accuracy, and reliability of the models are discussed in Chapter 5 of the *Combined Sewer System Analysis Report* and in a subsequent document titled *Consolidated Summary of XP-SWMM Model Calibration Information to Support Discussions With USEPA, IDEM, and SAIC*, dated January 26, 2004, prepared by Malcolm Pirnie. These models have been developed to provide a planning level of accuracy and reliability, as is appropriate to support LTCP development.

Model Results

The calibrated CSS model was used to predict CSO occurrences and volumes for rain events of interest, including CSO activity during a typical year. The typical year rainfall record used in the annual simulation was developed to represent an average year, based on an analysis of 40 years of rainfall data. Table 2.6.1.3 presents model results for annual overflow metrics at each overflow (and regulator) under existing conditions, based on the typical year simulations.

Table 2.6.1.3
Predicted Annual Regulator Response

			Existing Conditions		
Overflow Permit ID	Overflow SIP ID	Regulator	Annual Overflow Volume (cf)	Annual Number of Overflow Events	Annual Number of Overflow Hours
18/19	K11165/ K11178	K11163/K11162	52,519,264	71	503
26/33/27	M10151/ M10313/ M10202	M10150/M10148/M10199	19,534,059	56	409
48	O10252	O10312/010311	10,650,200	39	143
13	K06298	K06285/K06275	8,623,553	44	165
CSO PS (57)	NA	P06014	8,006,963	25	139
55	P06192	P06119	4,604,087	47	198
36	M18032	M18256	4,216,299	34	103
20	K15116	K15009	3,908,404	40	130
11/12	K06234	K06231	3,532,237	30	98
39	N06022	N06007	2,980,121	25	77
5	J11164	J11163	2,972,631	48	157
21	K19044	L19018	2,645,744	41	161
17	K07176	K07171	2,378,948	37	103
24	L06420	L06088	2,104,910	23	55
28	M10238	M10279	1,783,417	26	83
50	O10277	O10273	1,705,907	44	106
61	R14137	S18082	1,678,781	14	42
62	R14138	R18188	1,176,229	14	46
NA(2)	NA(2)	O10256	986,456	37	141
4	J02090	J02089	724,620	14	63
64	S02035	Q07022/Q03011	706,082	16	52
52(1)	O22004	P22001	547,406	12	47
54	O23080	O19009	511,038	27	100
51	O22002	O22045	471,221	9	27
NA(2)	NA(2)	L06098	454,898	20	48
53	O22094	O22095	411,440	13	35
60	R06031	R06030	360,417	11	21
32	M10306	M06706	335,513	5	10
68	N18254	N18241	311,151	8	20
23	L06103	L06102	306,128	13	29

67		K15110	186,580	7	13
29[1]	M10265	M10256	168,893	4	8
29[1]	M10265	M10309	147,433	3	6
NA[2]	NA[2]	P18031	144,006	3	19
NA[2]	NA[2]	P18036	76,503	5	8
58	Q06034	Q06036	67,379	3	7
45	N22103	N22101	28,274	2	4
25	L06421	L06086	13,899	1	1
NA[2]	NA[2]	K07006	6,621	9	4
52[1]	O22004	P22139	1,338	1	1
14	K07106	K07101/K07115	0	0	0
56/07	J03313	J03267	0	0	0
44	N22093	N22092	0	0	0
NA[3]	NA[3]	L06438	NA	NA	NA
NA[2]	NA[2]	K15111	NA	NA	NA
NA[2]	NA[2]	M18015	NA	NA	NA

NOTES:

1 These outfalls receive contributions from two regulators

2 Eliminated or gates permanently shut

3 Upstream of L06087/88

Overflow activity in terms of annual overflow volume, number of annual overflow events, and total number of annual overflow hours provides important decisions metrics in analyzing and evaluating alternatives. Following analysis of existing conditions, the configuration of the model was changed to represent proposed controls and run to predict the effects of those proposed controls on annual metrics. Those results are discussed in Chapter 3 of this LTCP.

The models also provide important information on the predicted wet-weather performance of the CSS during single events. A full discussion of predicted CSS performance is provided in the *Combined Sewer System Analysis Report*; some examples of these results and observations are as follows:

- The St. Mary's Interceptor begins to surcharge during conditions associated with a 1-month design storm (6 hour duration).

- The Wayne Street Interceptor begins to be affected by WPCP capacity during conditions associated with a 1-month design storm. The interceptor is already overflowing to the CSO Ponds at this 1-month storm level.

- Regulator K11 163, regulating flow from Subbasin K11 010 into the St. Mary's Interceptor, is at times impacted by downstream interceptor hydraulics. This impact can take the form of backflow from the St. Mary's Interceptor through the regulatory and out of Overflow K11 165 (permit #18).

- The Clinton Street Interceptor is at times impacted by the hydraulics of the downstream Wayne Street Interceptor. The occurrence of actual backflow in the Clinton Street Interceptor is suggested by the monitoring data and modeling results.

- The North Maumee Interceptor is at times impacted by the downstream hydraulic control imposed by the raw pumps at the WPCP. The impact can be severe enough to cause backflow in the North Maumee Interceptor.

2.6.2 Receiving Water Modeling

2.6.2.1 Receiving Water Modeling Objectives

The objectives of the City's receiving water modeling were to:

- Predict the fate and transport of pollutants of interest during both dry-weather and wet-weather conditions.

- Develop estimates of flows, pollutant concentrations, and pollutant loads by source type.

2.6.2.2 Receiving Water Model Selection

Section 7.1 of the *Impact Characterization of Combined Sewer Overflows, Final Report* completed in 1998, discusses the selection of the City's receiving water model. A CE-QUAL-RIV1 model was used to simulate water quality on the St. Mary's, St. Joseph and Maumee Rivers. This model consists of two components: a hydraulic (RIV1H) component and a water quality (RIV1Q) component.

2.6.2.3 Receiving Water Model Application

Model Development

The study area on the three rivers was divided into 39 nodes and then grouped into four segments during the dry weather analysis. The four segments are described below:

- St. Joe Center Road to the St. Joseph Dam on the St. Joseph River (1.7 miles).

- St. Joseph Dam on the St. Joseph River to the Hosey Dam on the Maumee River (4.1 miles).

- Hosey Dam to the USGS gauge near the Landin Road Bridge on the Maumee River (6.2 miles)

- Tributary (St. Mary's) – Ferguson Road to the confluence (10.8 miles)

Cross-sectional bathymetry, bottom roughness, and reach length information are specified for each node. A detailed discussion on the development of the model can be found in section 7.3 of *Impact Characterization of Combined Sewer Overflows, Final Report* and section 3.3 of *Impact Characterization of Sewer Overflows, Addendum*.

Calibration

Hydraulic and water quality data were used to calibrate the model.

Two days, August 13 and September 4, 1996, were selected to represent the dry weather calibration condition. Measured and modeled flow rates for dry weather calibration are listed below.

Location	August 13, 1996	September 4, 1996	Model Input
Ft. Wayne WPCP	71 cfs	69 cfs	70 cfs
St. Mary's River (near Ft. Wayne)	52 cfs	39 cfs	45 cfs
St. Joseph River (near Ft. Wayne)	160 cfs	161 cfs	160 cfs
Maumee River (near New Haven)	216 cfs	198 cfs	205 cfs

Pollutants were measured at upstream boundaries of the model for the dry weather water quality calibration. The upstream concentrations are presented in the table below.

Boundary	TSS (mg/l)	CBOD5 (mg/l)	DO (mg/l)	NH3-N (mg/l)	TP (mg/l)	*E. coli* (org/100 ml)	Fecal Coliform (org/100 ml)
St. Joseph	25.0	2.0	6.35	0.027	0.203	120	120
St. Mary's	65.0	6.6	11.85	0.051	0.349	240	250

Because there are no discharges from storm or combined sewers during dry weather, the only pollutants other than those entering at the upstream boundaries are from the WPCP. The pollutant concentrations assigned to the WPCP are listed below.

Source	TSS (mg/l)	CBOD5 (mg/l)	DO (mg/l)	NH3-N (mg/l)	TP (mg/l)	*E. coli* (org/100 ml)	Fecal Coliform (org/100 ml)
WPCP	6.7	1.6	8.	0.50	0.57	51	51

While the dry weather calibration procedure is considered a constant, steady-state condition, the wet weather calibration procedure considered conditions that varied from storm to storm and from hour to hour. The dynamic nature of the wet-weather response is determined by the rainfall/runoff relationship of upstream watersheds and local drainage basins.

Four wet weather events were used for wet weather calibration. The wet weather events occurred September 21, 1996, September 27, 1996, October 17, 1996 and October 29, 1996. Hydraulic calibration results for each wet weather event can be found in Table 2.6.2.1. Concentration of pollutants from various wet weather sources resulting from model calibrations are presented in Table 2.6.2.2.

Table 2.6.2.1
Hydraulic Calibrations Summary

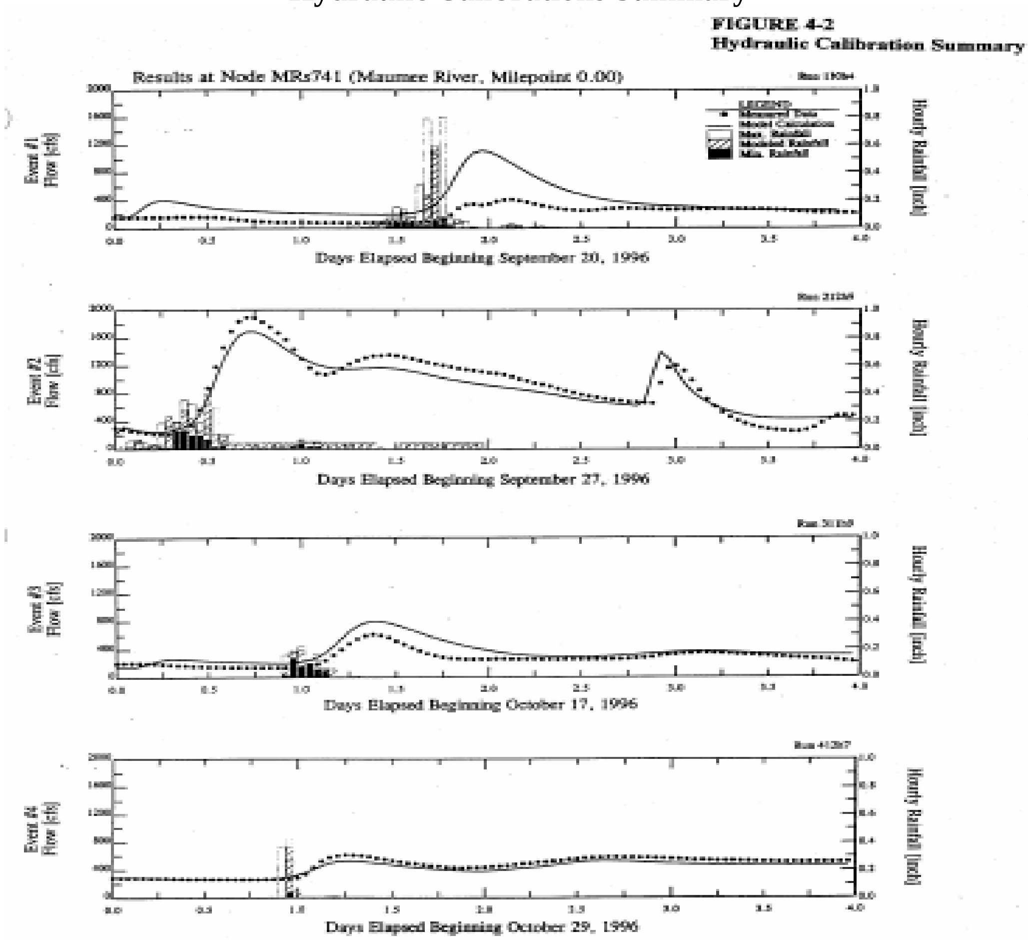


Table 2.6.2.2
Concentrations of Sources Used in the Model

Table 4-2

Concentrations of Sources Used in the Model

Source	TSS mg/L	BOD_5 mg/L	DO mg/L	NH_3N mg/L	TP mg/L	Fecal Coliform[a] org/100mL	ECOLI[a] org/100mL
CSO (Event 1,3,4)							
First Flush	741	151	6.7	5.0	3.3	3.5E+05	1.2E+05
Rest of Storm	75	34	8.2	3.7	0.9	2.0E+05	1.0E+05
CSO (Event 2)							
First Flush	85	22	8.0	3.7	0.8	3.7E+05	2.6E+05
Rest of Storm	61	9	8.7	1.5	0.4	2.1E+05	1.2E+05
Stormwater	61	10	9.0	0.3	0.3	3.0E+04	3.0E+04
Tributary Streams	60	10	9.0	0.3	0.3	3.0E+04	3.0E+04
WPCP Effluent[b]	8	1	9.3	0.2	0.5	9.4E+01	9.4E+01
Pond #2 Effluent[c]	31	21	4.0	12.0	4.1	3.7E+02	3.7E+02

Notes: Constant temperatures were used in model input; 18, 17, 14 and 12 °C were used for event 1, 2, 3 and 4 respectively.

a. CSO bacteria values represent log-mean concentrations at each of 7 sampled locations that were arithmetically averaged to develop event-mean "first-flush" and "rest-of-storm" concentrations. Bacteria values for other sources were assigned based on limited available data.

b. Value shown is average of daily values used in model input during wet-weather calibration periods. Model simulations utilized individual daily values, i.e., concentrations were varied on a daily basis.

c. Value shown is average of values used in model input during wet-weather calibration periods. NH_3N and TP values assume conservatively that Pond #2 is in flow-through mode.

A more detailed description of the wet weather calibration can be found in the *Impact Characterization of Sewer Overflows, Addendum*.

Model Results

The hydraulic calibration indicated that three significant CSO discharge points account for approximately 60-70% of the total overflow volume. These locations are:

- Outfalls M10151 and M10202 at 3rd Street which relieve subbasin M0120
- Outfalls K11165 and K11164 at Rudisill which relieves subbasin K11010
- Outfalls O10257, O10252 and O10097 at Morton Street Pump Station which relieves subbasin O10101

The water quality model was used to estimate pollutant source and inflow distribution for four reaches:

- Ferguson Road to Harrison Street Bridge on the St. Mary's River (upstream)
- Mayhew Road to Tennessee Avenue on the St. Joseph River (upstream)
- Harrison Street (St. Mary's) and Tennessee (St. Joseph) around the confluence area to Anthony Boulevard on the Maumee River.
- Anthony Boulevard to Landin Road on the Maumee River (downstream)

Table 2.6.2.3 summarizes the distribution of land-based inflows and pollutant loads by source for each of these reaches. The inflow consists of CSOs, stormwater or flow from the WPCP. The results in Table 2.6.2.3 represent local inflows to the reach only, i.e., upstream inflows are excluded from the results. As can be seen, separate stormwater sources account for a significant portion of the pollutant load reaching the City's receiving waters.

Table 2.6.2.3
Distribution of Land-Based Inflows and Pollutant Loads

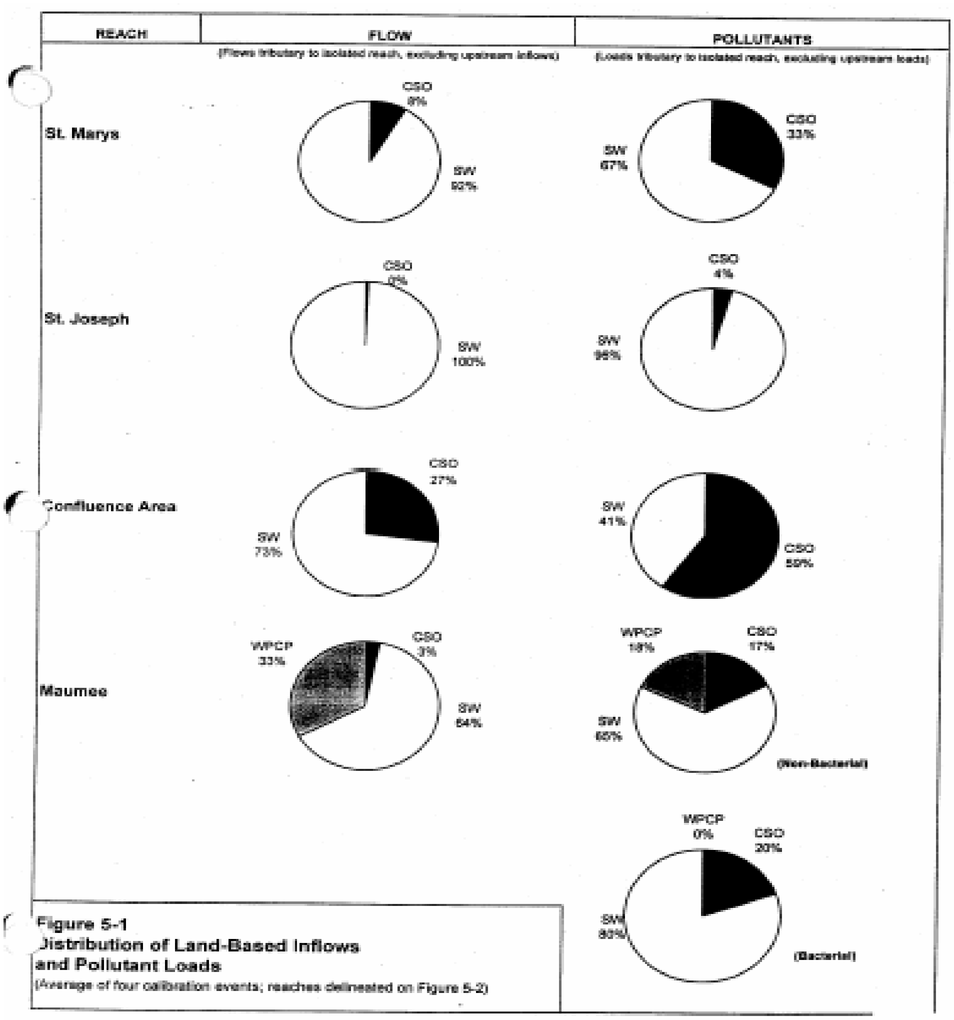
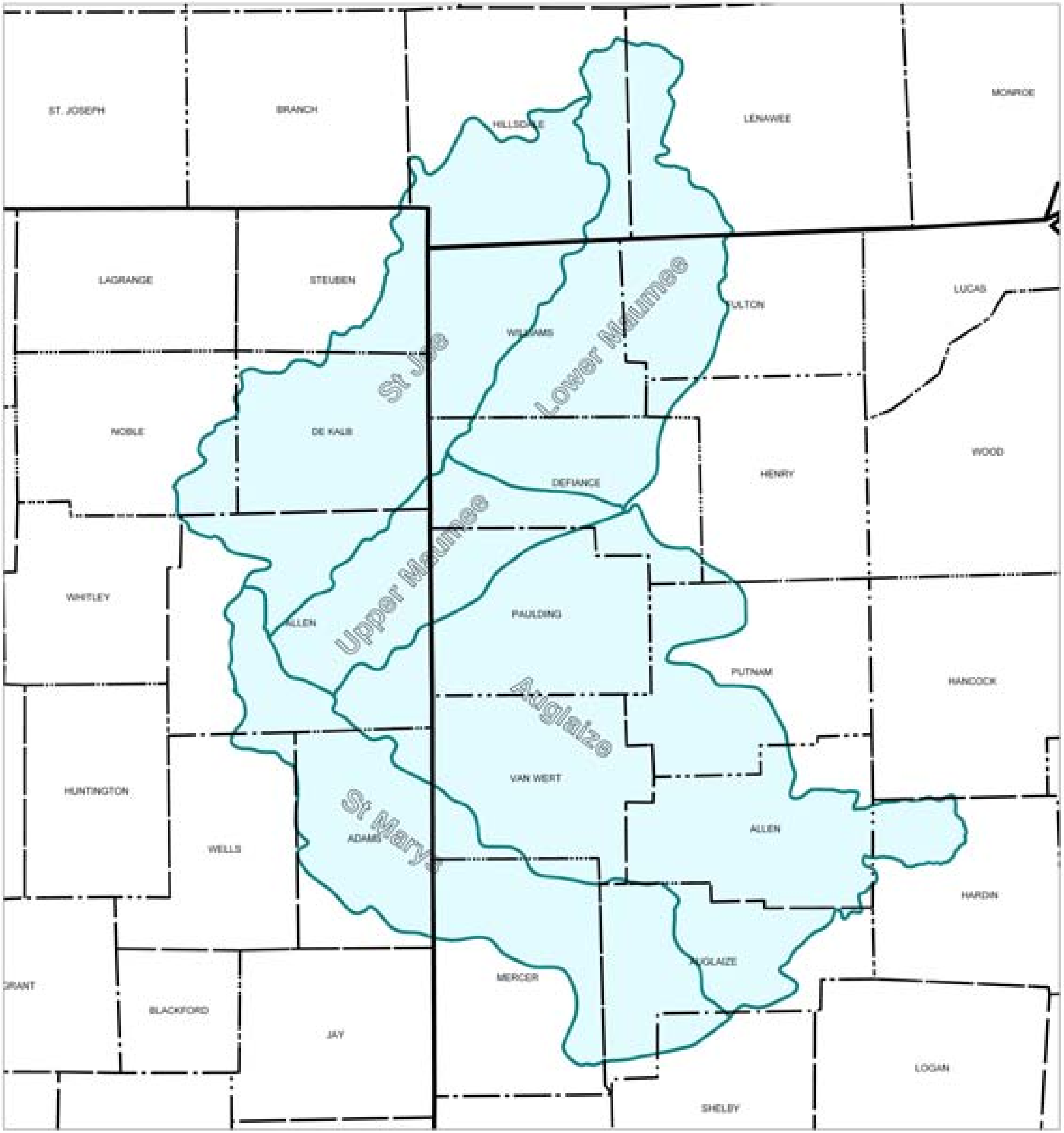


Figure 5-1
Distribution of Land-Based Inflows and Pollutant Loads
(Average of four calibration events; reaches delineated on Figure 5-2)

APPENDIX 2

FIGURES



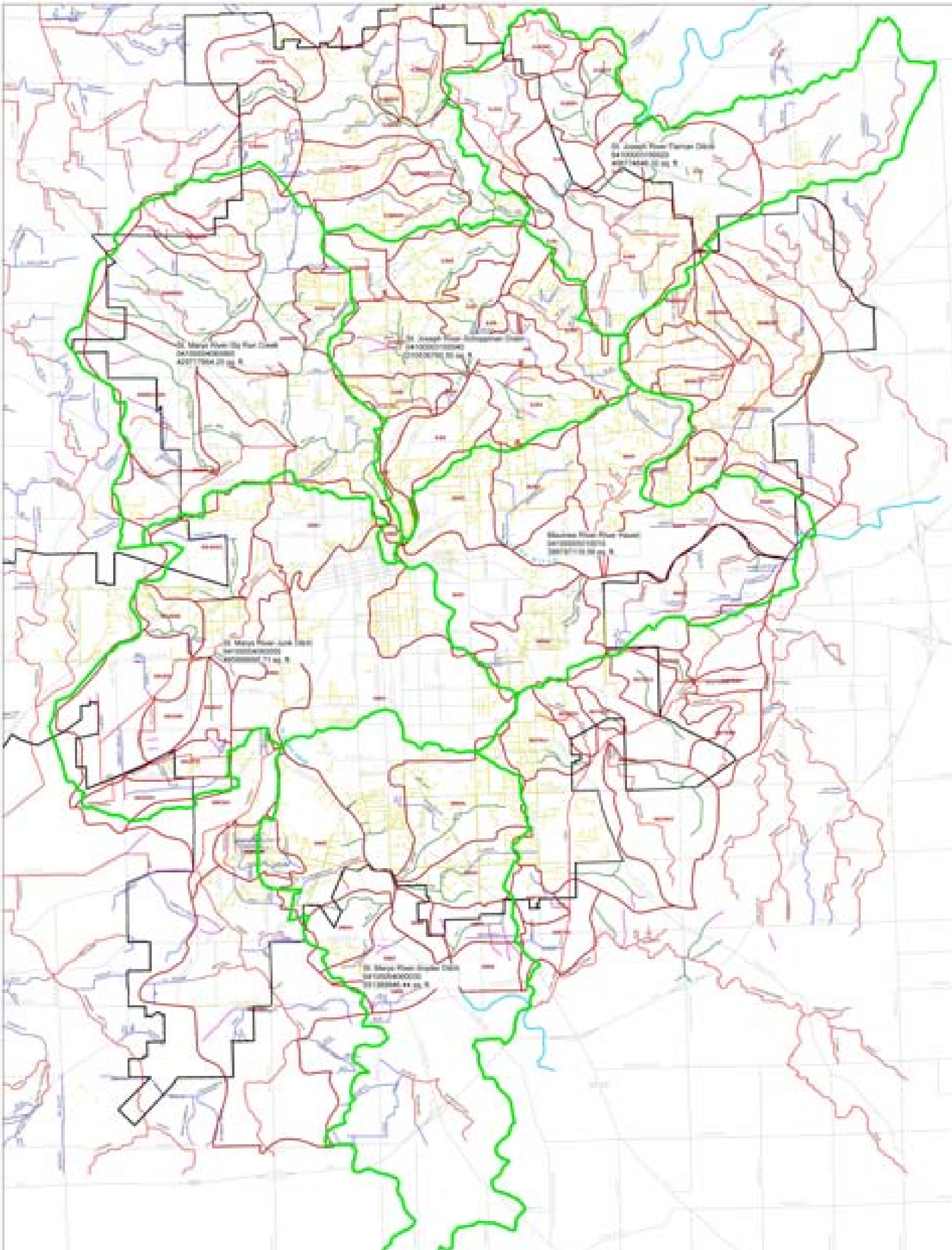
CITY OF FORT WAYNE
RIVER WATERSHEDS
LTCP CH 2 - FIGURE 1

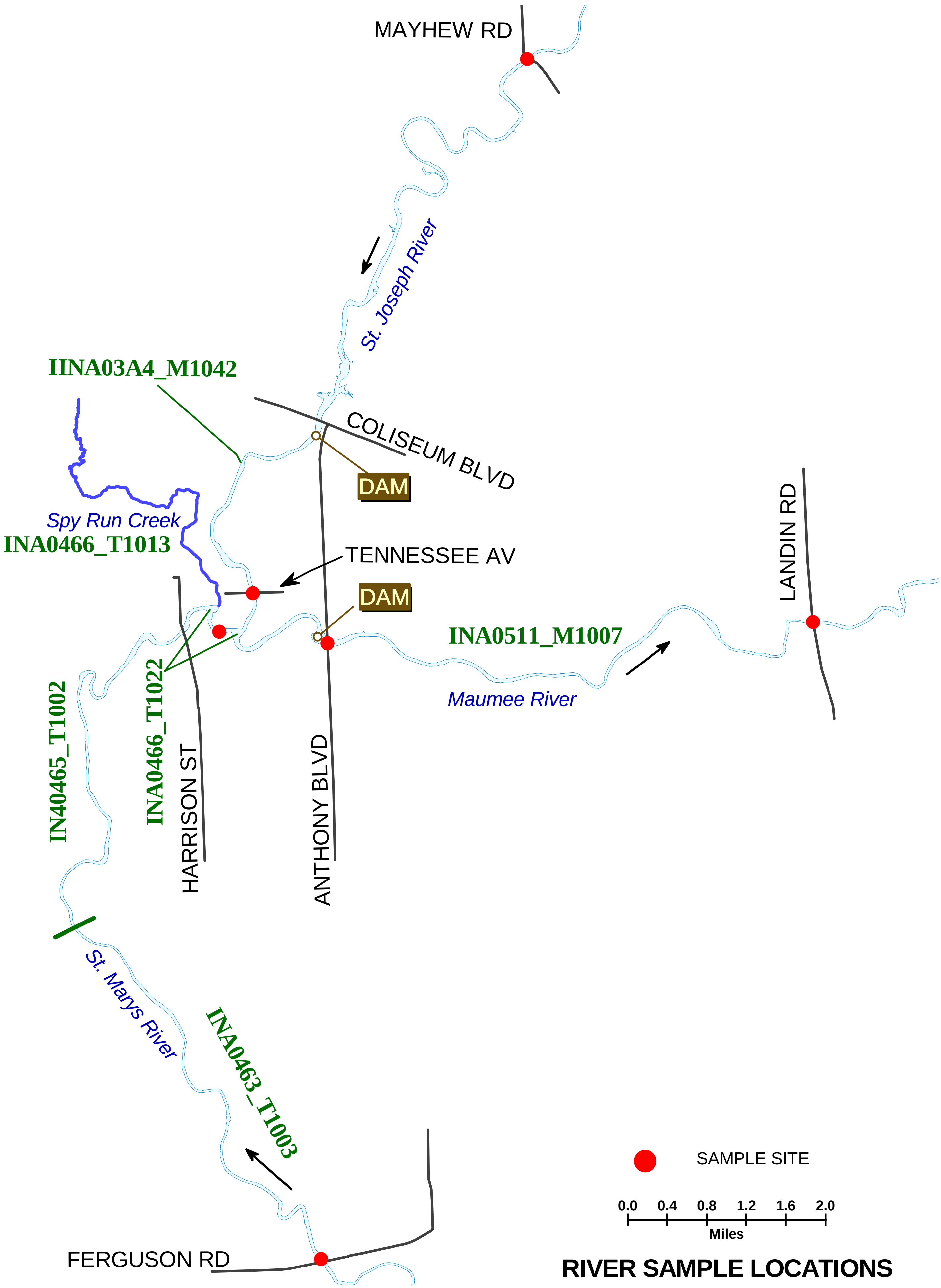
HUC 14 DRAINAGE NETWORK WITHIN WATERSHEDS

LTCP CH 2 - FIGURE 2

LEGEND

- Watershed Boundary
- Natural Open Drain
- Natural Tile Drain
- County Regulated Open Drain
- County Regulated Tile Drain
- City Storm Sewers
- Hydrologic Unit Boundary





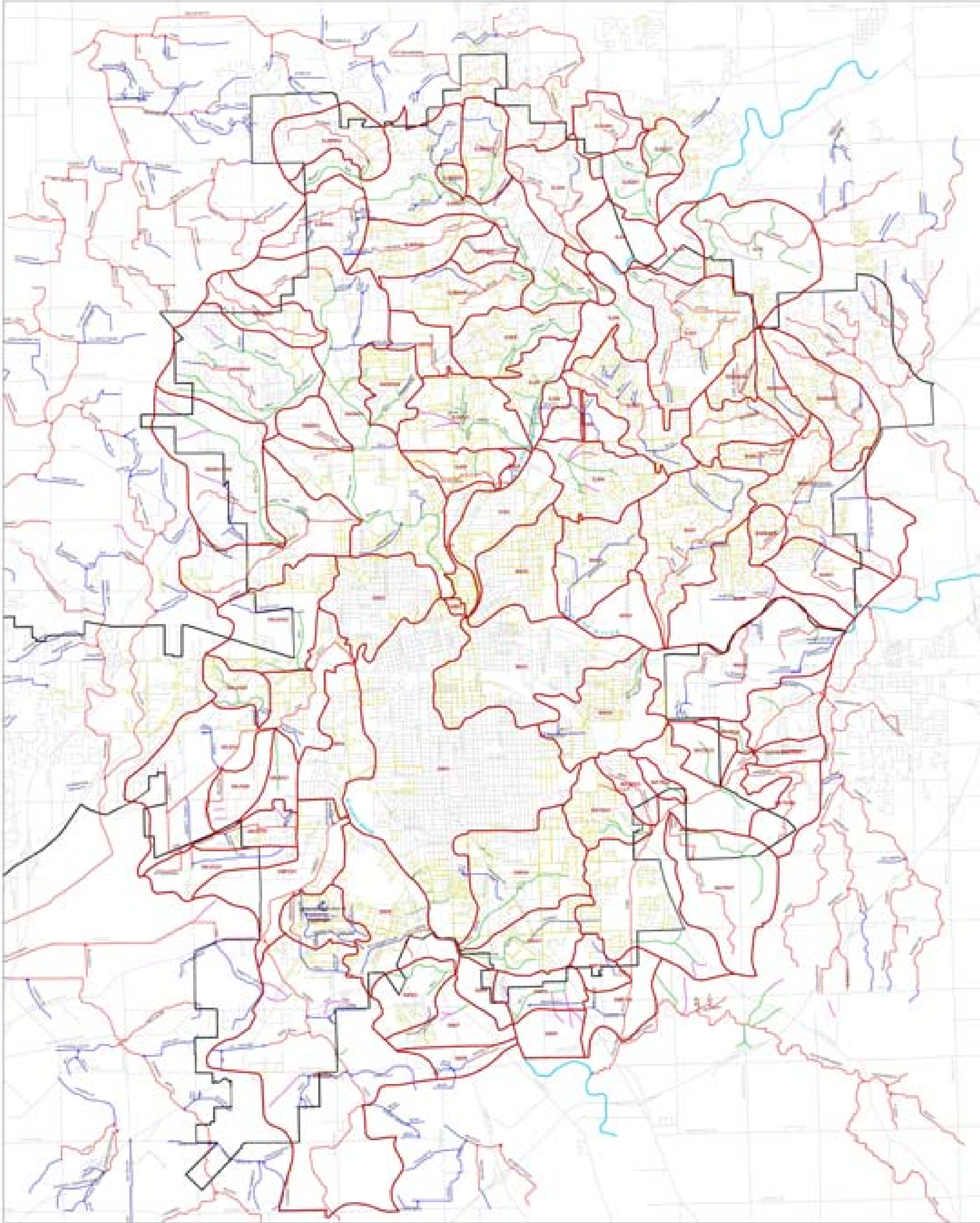
RIVER SAMPLE LOCATIONS

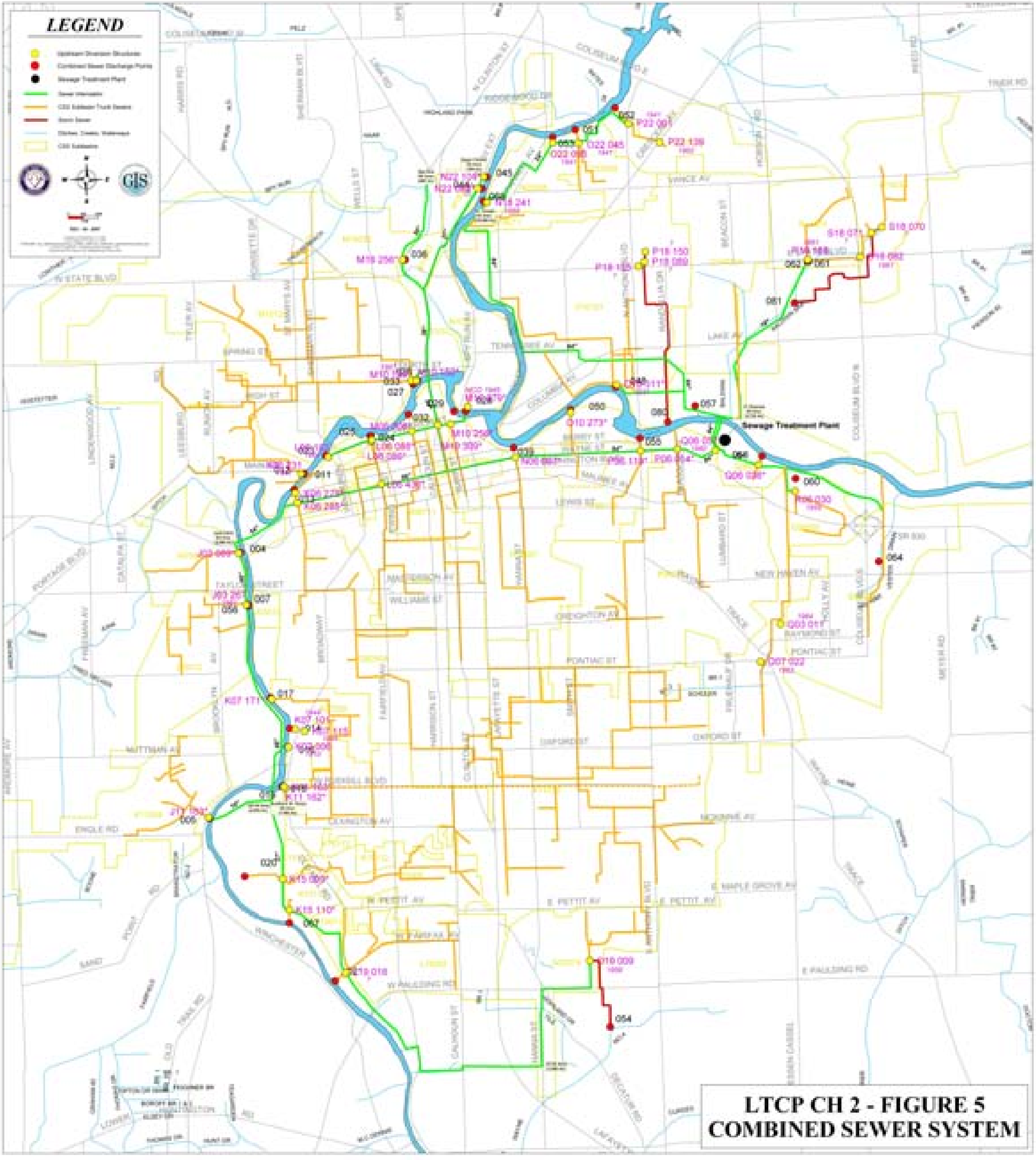
LTCP CH 2 - FIGURE 3

CITY OF FORT WAYNE

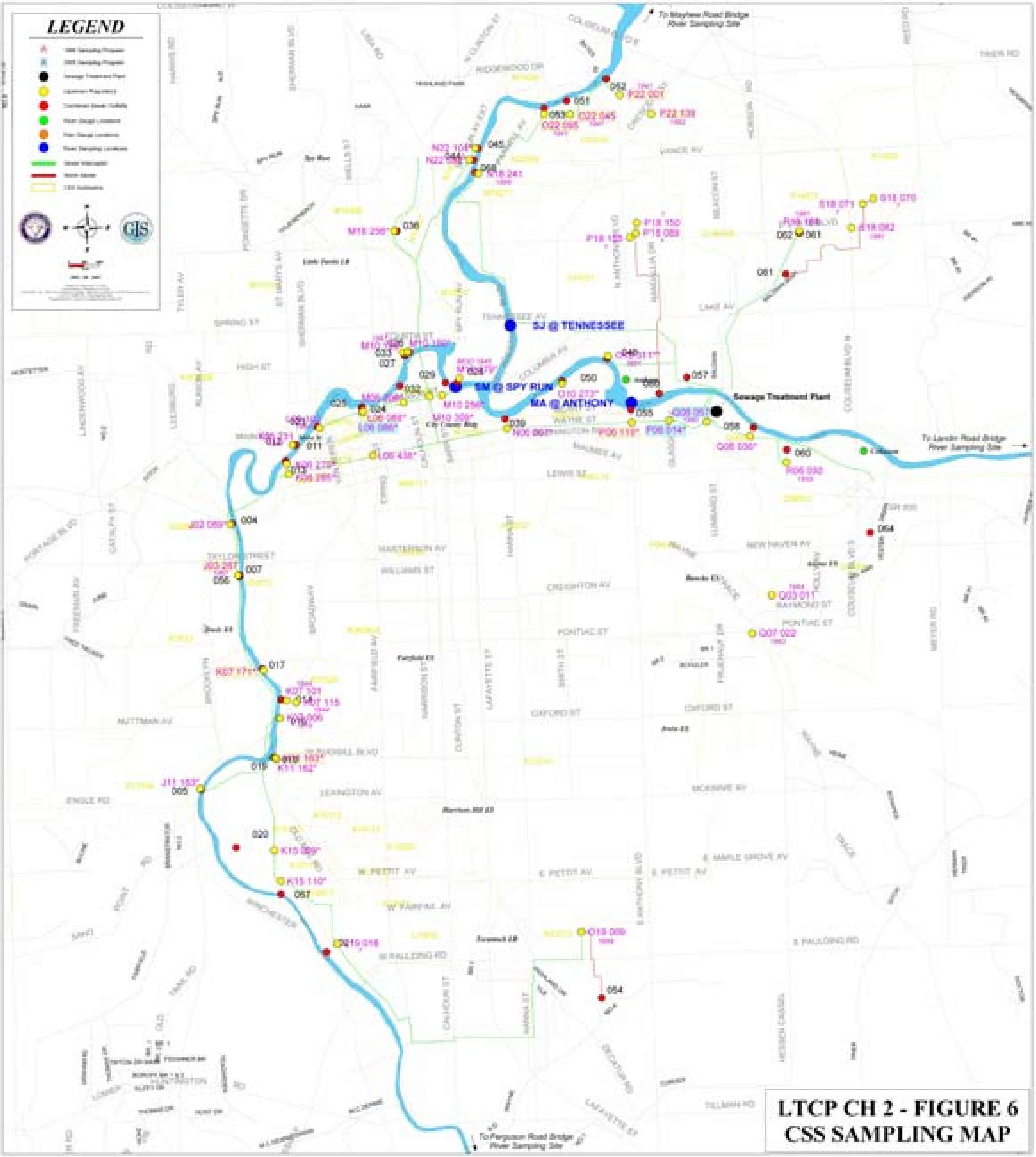
STORM SEWER DRAINAGE

DRAINAGE NETWORK WITHIN WATERSHEDS
LTCP CH 2 - FIGURE 4

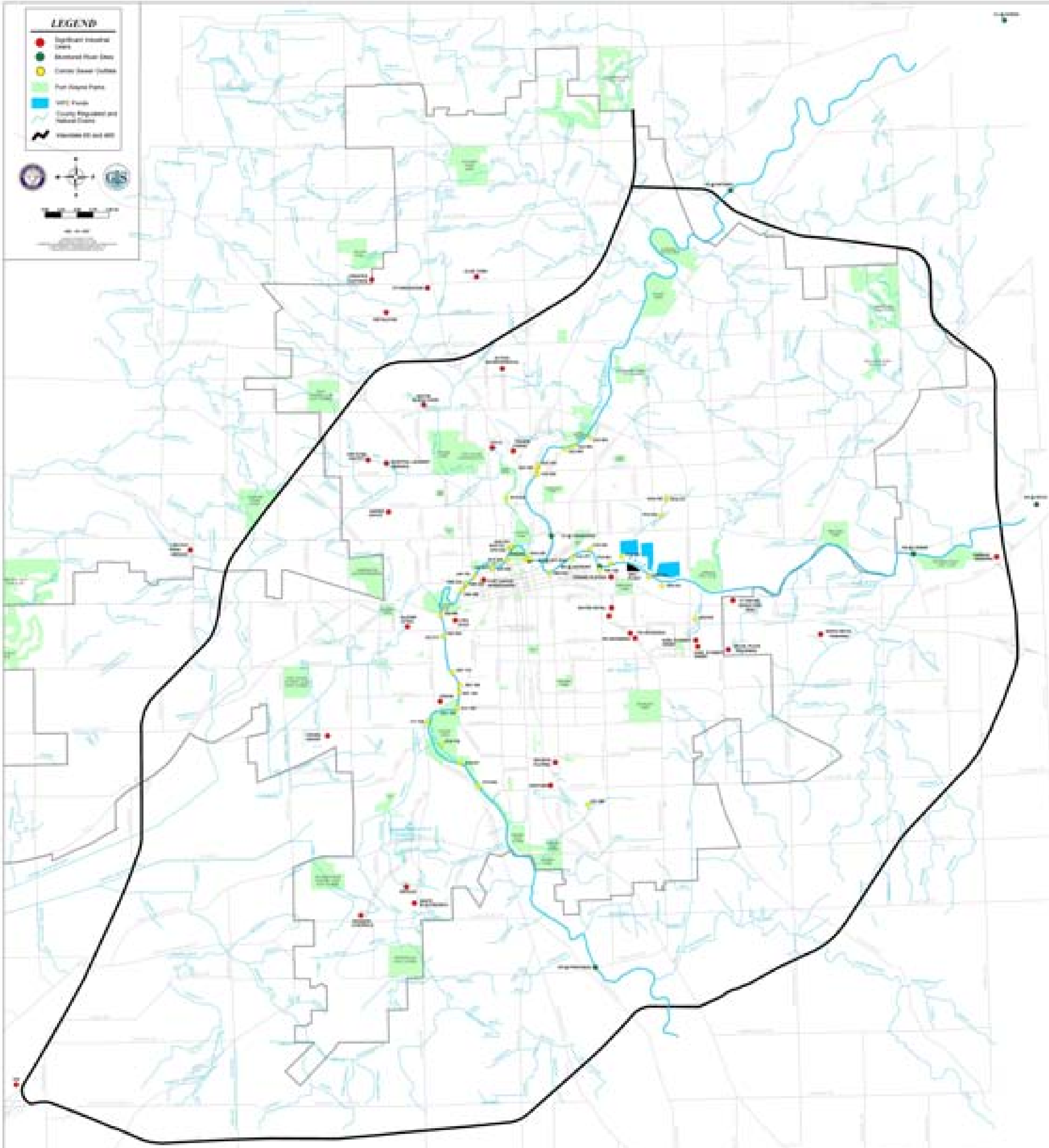




LTCP CH 2 - FIGURE 5
COMBINED SEWER SYSTEM



LTCP CH 2 - FIGURE 6
CSS SAMPLING MAP

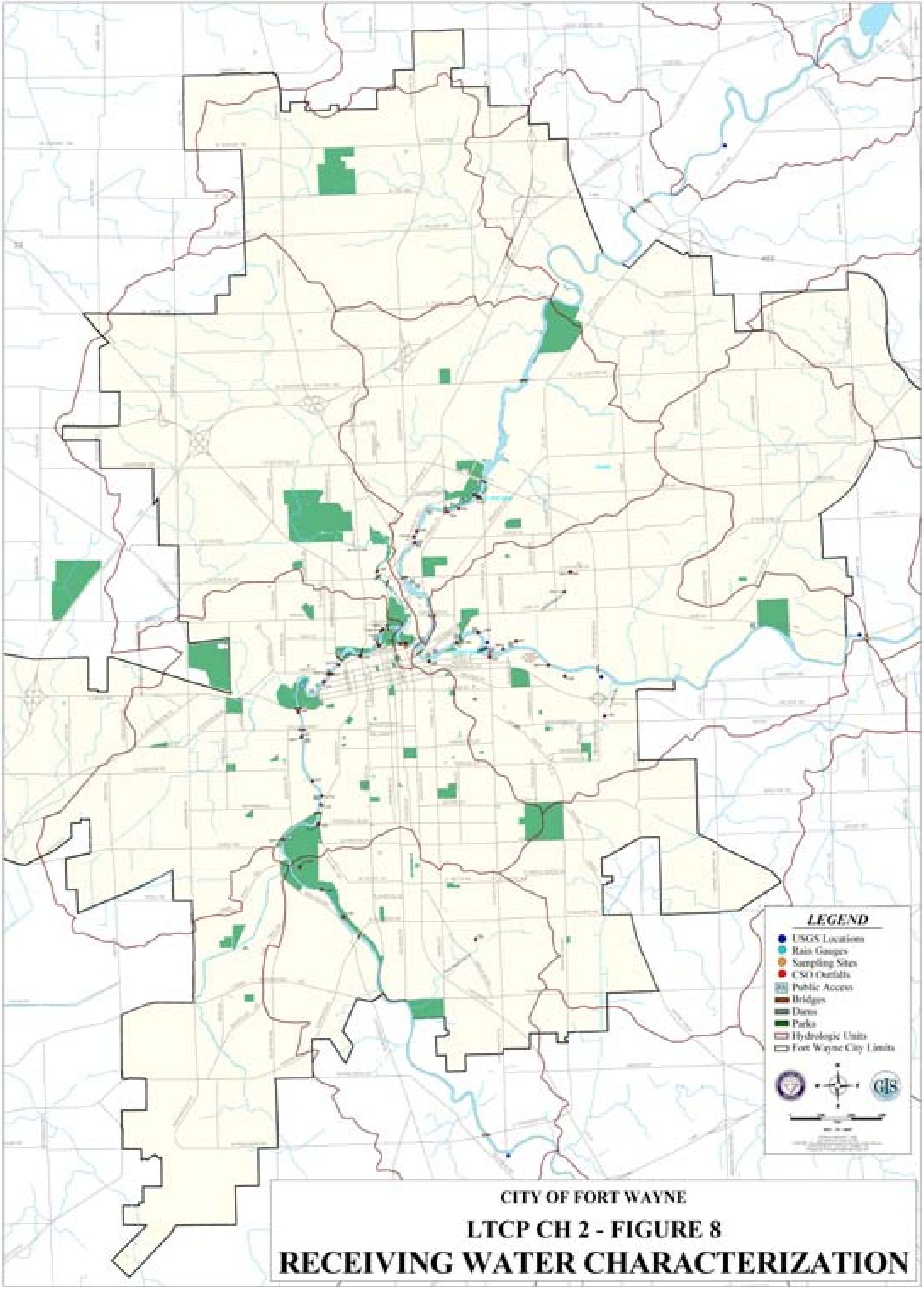


FORT WAYNE CITY UTILITIES

LTCP CH 2 - FIGURE 7

INDUSTRIAL PRETREATMENT SECTION

SIGNIFICANT INDUSTRIAL USERS


LEGEND
USGS Locations
Rain Gauges
Sampling Sites
CSO Outfalls
Public Access
Bridges
Dams
Parks
Hydrologic Units
Fort Wayne City Limits
CITY OF FORT WAYNE
LTCP CH 2 - FIGURE 8
RECEIVING WATER CHARACTERIZATION

ATTACHMENT 1

A short-term wet-weather water quality data collection program was conducted in August through October, 1996. This program collected discrete wet-weather samples at seven CSO outfalls and six receiving water locations during 4 wet-weather events. Fort Wayne has been asked to provide, by November 6, 2003, more information on how these sites were selected and why it feels that these are representative of the City's combined sewer overflows.

Unfortunately, the person who selected these sites left the City several years ago and did not leave any written explanation of his selection process. The City will be doing a complete analysis of all CSO sites to identify representative sites for its long term monitoring plan. The process that will be used will be similar to that illustrated in the case study of Lewiston-Auburn, Maine - CSO and Receiving Water Monitoring that starts on page 2-37 of the **Combined Sewer Overflows - Guidance for Long-Term Control Plan.** This process will take a few months to complete. In the interim the City can provide the criteria parameters for the 7 site monitored.

Fort Wayne has 3 major rivers. Representative sites will be chosen for each river. The Saint Mary's River has 25 points where CSOs enter it. The Saint Joseph River has 6 points where CSOs enter it. The Maumee River has 13 points where CSOs enter it.

Initially sites will be ranked by activity. Activity will be measured by annual overflow volume and frequency of overflows. The 1999 version of the City's SWMM model will be used to estimate annual overflow volume and overflow frequency for each site.

The following final monitoring station selection criteria will be used:

- **Land Use** - The tributary area land uses must be representative of the study area in order to define meaningful rainfall/runoff relationships and pollutant loadings for use in analyzing other tributary areas in the study area.

- **Tributary Area -** An important selection criterion for monitoring CSOs is the ability to define the tributary area boundaries. Tributary areas free of external diversions or transfers will be sought to ensure that the flows and pollutants measured at the monitoring site are actually produced within the subbasin being monitored rather than being imported from adjacent service areas or exported out of the subbasin. The tributary will be identified through detailed study of the sewer systems and topographical maps of the study areas.

- **Hydraulic Compatibility** – The hydraulic control sections at the monitoring stations must be stable and compatible with the proposed monitoring equipment.

- **Accessibility** – The Sites should be readily accessible from public rights-of-way and during adverse weather conditions and should be located away from high traffic areas.

- **Receiving Water** - The ecological, social, scenic, or recreational importance of the receiving water where the discharge occurs will be considered.

Three regulators that discharge to the Saint Mary's River were monitored. They were J03267, K07-171, and Kll-163. The parameters for each are listed below:

Regulator J03-267

Activity:

- Annual Overflow Volume: This is the 38th most active regulator with an estimated annual volume of 63,215 cf per year. (19th on the St. Mary's)
- Annual Number of Overflow Events: This is the 33rd most active regulator with an estimated 10 overflows per year. (21st on the St. Mary's)

Land Use:

Residential -	194
Commercial-	32
Industrial-	69
Institutional/Governmental -	18
Open -	39
Total	352

Tributary Area:

There are no cross connections between this and other subbasins. There are some areas of the subbasin that are served by separate storm sewers.

Hydraulic Compatibility:

There are descent locations to measure inflow and dry weather outflow. Direct measurement of gravity overflows is very difficult. There are also pumped overflows. These can be calculated from pump run times.

Accessibility:

The site is easily reached by vehicle but some of the hatches that need to be opened are very heavy.

Receiving Water:

This discharge is upstream of Sweeny Park and the central city area.

Regulator K07 -171

Activity:

- Annual Overflow Volume: This is the 17th most active regulator with an estimated annual volume of 963,279 cf per year. (11th on the St. Mary's)
- Annual Number of Overflow Events: This is the 23rd most active regulator with an estimated 32 overflows per year. (14th on the St. Mary's)

Land Use:

Residential -	135
Commercial-	12
Industrial-	0
Institutional/Governmental-	3
Open-	1
Total-	151

Tributary Area:

There are 7 cross connections between this and other subbasins. There are 3 other regulators and 2 other discharge points in this subbasin.

Hydraulic Compatibility:

There are descent locations to measure inflow, however it is difficult to measure dry weather outflow and overflows.

Accessibility:

The site is easily reached by vehicle.

Receiving Water:

This regulator discharges upstream of Sweeny Park and the central downtown area.

Regulator KII-163

Activity:

- Annual Overflow Volume: This is the most active regulator with an estimated annual volume of 51,159,119 cf per year. (1st on the St. Mary's)
- Annual Number of Overflow Events: This is the 3rd most active regulator with an estimated 84 overflows per year. (2nd on the St. Mary's)

Land Use:

Residential -	1,586
Commercial-	93
Industrial-	3
Institutional/Governmental-	93
Open-	33
Total-	1,806

Tributary Area:

There are 21 cross connections between this and other subbasins. There is 1 other regulator and 1 other discharge point in this subbasin. The dry weather flows of the 2 regulators are combined just outside the regulators.

Hydraulic Compatibility:

There are descent locations to measure inflow and dry weather outflow. Direct measurement of gravity overflows is difficult.

Accessibility:

The site is easily reached by vehicle but just behind the curb of a heavily traveled street.

Receiving Water:

This regulator discharges at the north end of Foster Park, one of the most historic and used parks in the City.

Three regulators that discharge to the Saint Joseph River were monitored. They were P22-001, 022-045, and 022-095. The parameters for each are listed below:

Regulator P22-00 1

Activity:

- Annual Overflow Volume: This is the 25th most active regulator with an estimated annual volume of 453,625 cf per year. (15t on the St. Joseph)
- Annual Number of Overflow Events: This is the 19th most active regulator with an estimated 45 overflows per year. (15t on the St. Joseph)

Land Use:

Residential -	111
Commercial-	26
Industrial -	0
Institutional/Governmental -	26
Open -	14
Total	177

Tributary Area:

There are no cross connections between this and other subbasins. However, a portion of the subbasin is served by separate sanitary sewers and separate storm sewers. There is 1 other regulator in this subbasin. The wet weather flows of the 2 regulators are combined just outside this regulator and discharge into the river through the same pipe.

Hydraulic Compatibility:

There are descent locations to measure inflow, dry weather outflow, and overflows.

Accessibility:

The site is easily reached by vehicle but just behind the curb of a heavily traveled street.

Receiving Water:

This regulator discharges across the river from Johnny Appleseed Park and just below the City's raw drinking intake.

Regulator 022-095

Activity:

- Annual Overflow Volume: This is the 28th most active regulator with an estimated annual volume of 291,092 cf per year. (3rd on the St. Joseph)
- Annual Number of Overflow Events: This is the 32nd most active regulator with an estimated 10 overflows per year. (3rd on the St. Joseph)

Land Use:

Residential -	101
Commercial -	17
Industrial -	0
Institutional/Governmental -	6
Open -	5
Total	129

Tributary Area:

The dry weather flow from 2 upstream subbasins flows into this subbasin. There are no other cross connections between this and other subbasins. There is 1 other regulator and 1 other discharge point in this subbasin. The dry weather flows of the other regulator flow into this regulator.

Hydraulic Compatibility:

There is a descent location to meter overflows.

Accessibility:

The site is easily reached by vehicle.

Receiving Water:

This regulator discharges a little downstream of Johnny Appleseed Park.

Regulator 022-045

Activity:

- Annual Overflow Volume: This is the 35th most active regulator with an estimated annual volume of 134,659 cf per year. (4th on the St. Joseph)
- Annual Number of Overflow Events: This is the 34th most active regulator with an estimated 9 overflows per year. (4th on the St. Joseph)

Land Use:

Residential -	101
Commercial -	17
Industrial -	0
Institutional/Governmental -	6
Open -	5
Total	129

Tributary Area:

The dry weather flow from 2 upstream subbasins flows into this subbasin. There are no other cross connections between this and other subbasins. There is 1 other regulator and 1 other discharge point in this subbasin. The dry weather flows of this regulator flow into the other regulator.

Hydraulic Compatibility:

There is a descent location to meter overflows.

Accessibility:

The site is easily reached by vehicle.

Receiving Water:

This regulator discharges a little downstream of Johnny Appleseed Park.

One regulator that discharges to the Maumee River was monitored. It is 010-273. The parameters for it are listed below:

Regulator 010-273

Activity:

- Annual Overflow Volume: This is the 13th most active regulator with an estimated annual volume of 1,621,933 cf per year. (5th on the Maumee)
- Annual Number of Overflow Events: This is the 15th most active regulator with an estimated 52 overflows per year. (5th on the Maumee)

Land Use:

Residential-	57
Commercial -	18
Industrial-	32
Institutional/Governmental -	2
Open -	21
Total	130

Tributary Area:

There are no cross connections between this and other subbasins. There is 1 other regulator and 1 other discharge point in this subbasin. The dry weather flows of this regulator flow into the other regulator.

Hydraulic Compatibility:

There is a descent location to meter overflows.

Accessibility:

The site is easily reached by vehicle.

Receiving Water:

This regulator discharges into the river upstream of the treatment plant.

ATTACHMENT 2

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 4/20/05
Intitial Rain event
Fort Wayne Newspapers Outfall number 025

Parameter	Unit	8:40 PM	10:18 PM	10:59 PM
Total Suspended solids	mg/l	N	N	N
Total Dissolved solids	mg/l	O	O	O
CBOD 5-Day	mg/l			
Total Phosphorus	mg/l	F	F	F
Ammonia (as N)	mg/l	L	L	L
E. Coli (g)	Col/100 ml	O	O	O
Cadmium	ug/l	W	W	W
Chromium	ug/l			
Copper	ug/l			
Lead	ug/l			
Nickel	ug/l			
Silver	ug/l			
Zinc	ug/l			
Dissolved Oxygen (g)	mg/l			
pH (g)				
Temperature (g)	Fahrenheit			

Precipitation for 4/20/05 0.52 in.

	Time	Depth
River Stage	8:30 PM	3.45 ft.
in feet	9:00 PM	3.45 ft.
	9:30 PM	3.45 ft.
	10:00 PM	3.46 ft.
	10:30 PM	3.46 ft.
	11:00 PM	3.47 ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 4/20/05
Intitial Rain event
Glasgow (57A)

Parameter	Unit	8:40 PM	9:15 PM	9:50 PM
Total Suspended solids	mg/l	920	292	128
Total Dissolved solids	mg/l	304	124	274
CBOD 5-Day	mg/l	300	88.8	51.8
Total Phosphorus	mg/l	3.74	1.34	1.07
Ammonia (as N)	mg/l	3.71	2.66	2.67
E. Coli (g)	Col/100 ml	461,100	198,630	155,310
Cadmium	ug/l	2.5	0.9	<0.8
Chromium	ug/l	31.5	21.3	21.7
Copper	ug/l	198.6	108.2	62.2
Lead	ug/l	178.1	75.8	36.7
Nickel	ug/l	72.2	52.5	37.5
Silver	ug/l	<3.7	<3.7	<3.7
Zinc	ug/l	767.5	421.4	231.1
Dissolved Oxygen (g)	mg/l	7.16	8.31	8.75
pH (g)		No Data	No Data	No Data
Temperature (g)	Fahrenheit	63.50	62.60	61.60

Precipitation for 4/20/05 0.52 in.

	Time	Depth
River Stage	8:30 PM	3.45 ft.
in feet	9:00 PM	3.45 ft.
	9:30 PM	3.45 ft.
	10:00 PM	3.46 ft.
	10:30 PM	3.46 ft.
	11:00 PM	3.47 ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 4/20/05
Intitial Rain event
Plant CSO (57b)

Parameter	Unit	9:42 PM	9:59 PM	10:31 PM
Total Suspended solids	mg/l	368	380	316
Total Dissolved solids	mg/l	396	320	132
CBOD 5-Day	mg/l	74.5	87.6	70.9
Total Phosphorus	mg/l	1.21	1.53	1.90
Ammonia (as N)	mg/l	4.49	4.47	5.39
E. Coli (g)	Col/100 ml	198,630	173,290	579,400
Cadmium	ug/l	0.8	<0.8	<0.8
Chromium	ug/l	18.1	22.0	20.8
Copper	ug/l	61.1	71.2	83
Lead	ug/l	41.4	44.2	54.9
Nickel	ug/l	23.9	36.8	27.0
Silver	ug/l	<3.7	<3.7	<3.7
Zinc	ug/l	267.7	278.1	295.6
Dissolved Oxygen (g)	mg/l	5.23	4.42	4.43
pH (g)		No Data	No Data	No Data
Temperature (g)	Fahrenheit	60.20	61.40	62.40

Precipitation for 4/20/05 0.52 in.

	Time	Depth
River Stage	8:30 PM	3.45 ft.
in feet	9:00 PM	3.45 ft.
	9:30 PM	3.45 ft.
	10:00 PM	3.46 ft.
	10:30 PM	3.46 ft.
	11:00 PM	3.47 ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/13/05
Intitial Rain event
Fort Wayne Newspapers Outfall number 025

Parameter	Unit	7:15 PM	10:00 PM	10:35 PM
Total Suspended solids	mg/l	N	200	N
Total Dissolved solids	mg/l	O	68	O
CBOD 5-Day	mg/l		48.0	
Total Phosphorus	mg/l	F	0.206	F
Ammonia (as N)	mg/l	L	0.491	L
E. Coli (g)	Col/100 ml	O	6,130	O
Cadmium	ug/l	W	<0.8	W
Chromium	ug/l		9.9	
Copper	ug/l		34.3	
Lead	ug/l		37.5	
Nickel	ug/l		5.8	
Silver	ug/l		<3.7	
Zinc	ug/l		143.4	
Dissolved Oxygen (g)	mg/l		9.88	
pH (g)			7.28	
Temperature (g)	Fahrenheit		64.49	

Precipitation of 0.70 inches total from 7:00 PM 5/13/05 until midnight.

	Time	Stage
River Stage	7:00 PM	3.57ft.
in feet	7:30 PM	3.62ft.
	8:00 PM	3.64ft.
	8:30 PM	3.67ft.
	9:00 PM	3.70ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/13/05
Intitial Rain event
Glasgow (057A)

Parameter	Unit	7:08 PM	7:50 PM	8:44 PM
Total Suspended solids	mg/l	420	287	584
Total Dissolved solids	mg/l	328	360	232
CBOD 5-Day	mg/l	179	165	102
Total Phosphorus	mg/l	1.304	1.322	0.601
Ammonia (as N)	mg/l	4.47	5.04	3.49
E. Coli (g)	Col/100 ml	313,000	387,300	198,630
Cadmium	ug/l	1.7	1.0	0.9
Chromium	ug/l	36.7	165.9	34.5
Copper	ug/l	129.2	100.4	101.3
Lead	ug/l	62.4	30.9	37.6
Nickel	ug/l	49.4	673.6	76.4
Silver	ug/l	154.5	<3.7	4
Zinc	ug/l	472.1	495.1	288.1
Dissolved Oxygen (g)	mg/l	5.91	6.17	7.33
pH (g)		7.53	7.54	7.57
Temperature (g)	Fahrenheit	64.70	64.50	63.60

Precipitation of 0.70 inches total from 7:00 PM 5/13/05 until midnight.

	Time	Stage
River Stage	7:00 PM	3.57ft.
in feet	7:30 PM	3.62ft.
	8:00 PM	3.64ft.
	8:30 PM	3.67ft.
	9:00 PM	3.70ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/13/05
Intitial Rain event
Plant CSO (057B)

Parameter	Unit	7:18 PM	8:00 PM	9:01 PM
Total Suspended solids	mg/l	688	748	146
Total Dissolved solids	mg/l	287	272	368
CBOD 5-Day	mg/l	223	248	235
Total Phosphorus	mg/l	1.869	2.039	0.601
Ammonia (as N)	mg/l	5.41	5.67	7.22
E. Coli (g)	Col/100 ml	173,290	461,100	920,800
Cadmium	ug/l	1.8	1.1	1.0
Chromium	ug/l	30.6	140.9	45.2
Copper	ug/l	198.7	285.8	159.9
Lead	ug/l	152.2	125.5	64.1
Nickel	ug/l	29.2	211.7	56.9
Silver	ug/l	9.0	5.2	<3.7
Zinc	ug/l	535.4	586.7	374.6
Dissolved Oxygen (g)	mg/l	3.72	2.31	2.09
pH (g)		7.27	7.16	7.14
Temperature (g)	Fahrenheit	65.20	64.30	63.90

Precipitation of 0.70 inches total from 7:00 PM 5/13/05 until midnight.

	Time	Stage
River Stage	7:00 PM	3.57ft.
in feet	7:30 PM	3.62ft.
	8:00 PM	3.64ft.
	8:30 PM	3.67ft.
	9:00 PM	3.70ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/19/05
Intitial Rain event
Fort Wayne Newspapers Outfall number 025

Parameter	Unit	11:05 AM	1:10 PM	1:30 PM
Total Suspended solids	mg/l	N	N	N
Total Dissolved solids	mg/l	O	O	O
CBOD 5-Day	mg/l			
Total Phosphorus	mg/l	F	F	F
Ammonia (as N)	mg/l	L	L	L
E. Coli (g)	Col/100 ml	O	O	O
Cadmium	ug/l	W	W	W
Chromium	ug/l			
Copper	ug/l			
Lead	ug/l			
Nickel	ug/l			
Silver	ug/l			
Zinc	ug/l			
Dissolved Oxygen (g)	mg/l			
pH (g)				
Temperature (g)	Fahrenheit			

Percipitation of .62 inches from 8:00 AM to 12:15 PM 5/19/05

	Time	Stage	Time	Stage
River Stage	10:00 AM	3.66 ft.	12:30 PM	4.05 ft.
in feet	10:30 AM	3.74 ft.	1:00 PM	4.07 ft.
	11:00 AM	3.86 ft.	1:30 PM	4.08 ft.
	11:30 AM	3.95 ft.	2:00 PM	4.09 ft.
	12:00 PM	4.01 ft.	2:30 PM	4.09 ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/19/05
Intitial Rain event
Glasgow (57A)

Parameter	Unit	10:44 AM	11:15 AM	12:16 PM
Total Suspended solids	mg/l	404	88	70
Total Dissolved solids	mg/l	84	204	264
CBOD 5-Day	mg/l	74.8	32.2	49.4
Total Phosphorus	mg/l	1.224	0.540	0.627
Ammonia (as N)	mg/l	1.16	1.29	1.80
E. Coli (g)	Col/100 ml	111,900	46,110	104,620
Cadmium	ug/l	7.6	12.3	16.1
Chromium	ug/l	21.5	14.1	18.9
Copper	ug/l	101.6	40.3	41.0
Lead	ug/l	9.6	16.5	12.4
Nickel	ug/l	62.1	32.4	107.4
Silver	ug/l	<3.7	<3.7	<3.7
Zinc	ug/l	456.1	159.7	176.5
Dissolved Oxygen (g)	mg/l	11.14	11.05	9.35
pH (g)		7.96	7.79	7.66
Temperature (g)	Fahrenheit	57.80	58.04	58.47

Percipitation of .62 inches from 8:00 AM to 12:15 PM 5/19/05.

	Time	Stage	Time	Stage
River Stage	10:00 AM	3.66 ft.	12:30 PM	4.05 ft.
in feet	10:30 AM	3.74 ft.	1:00 PM	4.07 ft.
	11:00 AM	3.86 ft.	1:30 PM	4.08 ft.
	11:30 AM	3.95 ft.	2:00 PM	4.09 ft.
	12:00 PM	4.01 ft.	2:30 PM	4.09 ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/19/05
Intitial Rain event
Plant CSO (57B)

Parameter	Unit	1:06 PM	1:26 PM	1:55 PM
Total Suspended solids	mg/l	156	164	226
Total Dissolved solids	mg/l	200	176	184
CBOD 5-Day	mg/l	96.5	98.5	104.2
Total Phosphorus	mg/l	1.890	1.887	2.244
Ammonia (as N)	mg/l	4.78	4.95	5.03
E. Coli (g)	Col/100 ml	959,000	670,000	717,000
Cadmium	ug/l	1.3	1.8	1.5
Chromium	ug/l	17.0	25.5	26.5
Copper	ug/l	53.7	66.7	66.3
Lead	ug/l	16.4	22.4	23.9
Nickel	ug/l	38.7	58.9	118.9
Silver	ug/l	<3.7	<3.7	<3.7
Zinc	ug/l	146.5	157.4	162.6
Dissolved Oxygen (g)	mg/l	1.96	1.59	1.14
pH (g)		7.60	7.53	7.42
Temperature (g)	Fahrenheit	58.28	58.15	58.20

Percipitation of .62 inches from 8:00 AM to 12:15 PM 5/19/05.

	Time	Stage	Time	Stage
River Stage	10:00 AM	3.66 ft.	12:30 PM	4.05 ft.
in feet	10:30 AM	3.74 ft.	1:00 PM	4.07 ft.
	11:00 AM	3.86 ft.	1:30 PM	4.08 ft.
	11:30 AM	3.95 ft.	2:00 PM	4.09 ft.
	12:00 PM	4.01 ft.	2:30 PM	4.09 ft.

ATTACHMENT 3

City of Fort Wayne Indiana
Water Quality Report
Dry Weather monitoring event 3/29/05

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	9:30 AM	10.79	7.09	44.35	1524	2.8	0.09	1733	0.06	3.55	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.06
Baldwin D	9:19 AM	14.36	6.62	45.89	1264	6.4	0.09	866	0.11	3.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run U	9:05 AM	13.91	7.88	44.86	644	8.8	0.06	248	<0.05	4.51	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	9:15 AM	14.14	7.96	44.97	768	9.6	0.09	238	<0.05	4.07	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RCD-1	11:25 AM	9.04	7.52	47.49	952	8	2.63	49	0.17	2.27	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Pond 3	7:00 AM	10.56	7.44	51.03	716	2.8	0.08	649	0.06	0.92	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Relief RC-4	11:16 AM	14.03	8.13	44.21	552	30.4	0.23	291	0.14	2.95	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Lrelief LRC-5	11:49 AM	13.65	8.15	44.39	572	5.2	1.22	23	0.08	2.77	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-6	11:35 AM	13.78	8.16	44.15	404	32.4	0.12	185	0.11	2.74	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	11:55 AM	13.64	7.29	47.78	424	38.4	0.05	365	0.12	2.81	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Relief RCDO-1	11:20 AM	13.83															
Relief RCDO-2	11:16 AM	14.03															
Relief RCDO-3	11:12 AM	13.35															
Relief RCDO-4	11:49 AM	13.64															
Relief RCDO-5	11:31 AM	14.09															
Relief RCDO-6	11:35 AM	13.78															
Relief RCDO-7	11:38 AM	14.00															
Relief RCDO-8	11:55 AM	13.65															
River Stage 6.11 ft.		Precipitation 0.00 in.															

City of Fort Wayne Indiana
Water Quality Report
Dry Weather monitoring event 4/15/05

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	10:40 AM	15.27	7.94	51.53	1836	9.6	0.115	2420	0.122	2.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Baldwin D	10:55 AM	12.80	7.68	58.53	1292	11.6	0.211	228	0.102	1.41	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Spy Run U	10:20 AM	11.64	7.99	52.03	724	4.4	0.0454	166	0.081	2.14	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Spy Run D	10:05 AM	10.95	7.75	52.45	712	5.2	0.0298	111	0.09	3.42	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RCD-1	1:15 PM	15.45	8.06	58.00	868	10.4	3.52	328	0.106	2.66	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pond 3	7:00 AM	9.53	7.34	61.00	652	4.2	0.102	11	0.51	<0.63	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
Relief RC-4	12:57 PM	14.06	8.65	55.93	404	38	0.128	29	0.123	5.99	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Lrelief LRC-5	1:49 PM	11.23	8.10	59.96	548	6	1.61	20	0.075	1.68	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
River MR-6	1:30 PM	13.60	8.63	55.43	416	38.8	0.107	16	0.126	5.39	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	1:41 PM	14.07	8.67	55.57	452	40	0.354	17	0.118	5.64	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Relief RCDO-1	1:05 PM	16.83															
Relief RCDO-2	12:57 PM	14.06															
Relief RCDO-3	12:50 PM	12.56															
Relief RCDO-4	1:49 PM	11.23															
Relief RCDO-5	1:25 PM	13.12															
Relief RCDO-6	1:30 PM	13.60															
Relief RCDO-7	1:35 PM	13.20															
Relief RCDO-8	1:41 PM	14.07															
River Stage 3.73ft		Precipitation 0.00 in.															

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 4/20/05

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	9:32 PM	9.31	8.00	59.21	484	97.6	1.22	12110	0.468	36.9	<0.01	<0.01	0.01	0.03	0.01	0.01	0.19
Baldwin D	9:42 PM	7.68	7.56	60.20	1136	72	1.37	15000	0.419	37.9	<0.01	<0.01	<0.01	0.03	0.01	<0.01	0.015
Spy Run U	9:02 PM	10.08	6.78	60.71	584	28.5	0.165	921	0.153	5.29	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	8:57 PM	8.80	7.77	66.00	644	16	0.182	1300	0.211	8.95	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Glasgow 1	8:40 PM	7.16	No Data	63.50	304	920	3.71	461100	3.74	300	<0.01	<0.01	0.03	0.2	0.18	0.07	0.77
Glasgow 2	9:15 PM	8.31	No Data	62.60	124	292	2.66	198630	1.34	88.8	<0.01	<0.01	0.02	0.11	0.08	0.05	0.42
Glasgow 3	9:50 PM	8.75	No Data	61.60	274	128	2.67	155310	1.07	51.8	<0.01	<0.01	0.02	0.06	0.04	0.04	0.23
Plant CSO 1	9:42 PM	5.23	No Data	60.20	396	368	4.49	198630	1.21	74.5	<0.01	<0.01	0.02	0.06	0.04	0.02	0.27
Plant CSO 2	9:59 PM	4.42	No Data	61.40	320	380	4.47	173290	1.53	87.6	<0.01	<0.01	0.02	0.07	0.04	0.04	0.28
Plant CSO 3	10:31 PM	4.43	No Data	62.40	132	316	5.39	579400	1.9	70.9	<0.01	<0.01	0.02	0.08	0.05	0.03	0.3
Ft. News 1	8:40 PM	No Flow	No sample														
Ft. News 2	10:18 PM	No Flow	No sample														
Ft. News 3	10:59 PM	No Flow	No sample														
Relief RCD-1	9:58 PM	10.61	8.38	65.00	316	68	1.42	9600	0.213	12.4	<0.01	<0.01	<0.01	0.02	0.01	<0.01	0.07
Pond 3	7:00 AM	8.26	7.36	63.30	656	2.8	0.0639	5	0.61	<0.93	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Relief RC-4	9:50 PM	10.84	8.27	65.00	436	42.5	0.228	2310	0.156	6.32	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Lrelief LRC-5	11:07 PM	12.74	7.92	65.00	576	38	3.65	579	0.151	4.68	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-6	10:17 PM	12.10	8.49	65.00	412	38.5	0.25	1300	0.131	5.92	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	10:10 PM	11.08	8.48	65.00	460	48	0.09	921	0.163	5.24	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RCDO-1	9:58 PM	10.61															
Relief RCDO-2	9:50 PM	10.84															
Relief RCDO-3	9:44 PM	10.42															
Relief RCDO-4	11:07 PM	12.74															
Relief RCDO-5	10:20 PM	11.40															
Relief RCDO-6	10:17 PM	12.00															
Relief RCDO-7	10:10 PM	11.08															
Relief RCDO-8	11:11 PM	10.72															

River Stage 3.30 feet

First day of Rain event

Precipitation for 4/20/05 0.52 in.

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 4/21/05

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	8:45 AM	6.86	7.19	52.66	1220	21.5	0.246	7120	0.153	9.9	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.11
Baldwin D	8:35 AM	4.38	7.43	52.77	772	36.5	0.885	18420	0.252	20.8	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.11
Spy Run U	8:10 AM	6.52	7.16	58.65	736	4	0.147	866	0.059	4.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	8:20 AM	6.61	7.03	58.38	728	2	0.13	866	0.062	4.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Relief RCD-1	10:15 AM	5.40	7.37	54.38	960	100	2.95	9590	0.504	19.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04
Pond 3	7:00 AM	8.23	7.43	62.56	648	10.6	0.0806	22	0.55	1.05	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.05
Relief RC-4	10:00 AM	10.83	7.74	63.20	456	35	0.176	5940	0.137	6.37	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Lrelief LRC-5	10:45 AM	10.69	7.65	53.30	616	10.5	1.49	387	0.781	2.26	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-6	10:30 AM	10.70	7.75	63.38	460	42.5	0.133	3840	0.167	5.68	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	10:50 AM	10.83	7.84	62.78	496	42.5	0.0787	3150	0.16	5.88	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
		DO AM	Time	DO PM													
Relief RCDO-1	10:05 AM	8.03	2:20 PM	11.11													
Relief RCDO-2	10:00 AM	10.83	2:15 PM	12.23													
Relief RCDO-3	9:55 AM	10.72	2:10 PM	11.86													
Relief RCDO-4	10:45 AM	10.69	2:00 PM	11.53													
Relief RCDO-5	10:52 AM	10.52	2:25 PM	12.06													
Relief RCDO-6	10:30 AM	10.70	2:28 PM	12.00													
Relief RCDO-7	10:35 AM	10.70	2:30 PM	12.00													
Relief RCDO-8	10:50 AM	10.83	2:05 PM	12.19													
Baldwin U	8:45 AM	6.86	1:05 PM	6.50				First day after rain event									
Baldwin D	8:35 AM	4.38	1:15 PM	6.42													
Spy Run U	8:10 AM	6.52	12:50 PM	9.47													
Spy Run D	8:20 AM	6.61	12:45 PM	9.60													
River Stage 3.49 feet																	

Precipitation for 4/21/05 0.00 in.
Did not collect the two following days as required due to another rain event.
Precipitation for 4/22/05 0.39 in.
Precipitation for 4/23/05 0.62 in.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/13/05
Intitial Rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	8:18 PM	9.51	7.71	62.40	212	73	0.925	173,290	0.498	51.3	<0.01	<0.01	0.01	0.02	0.01	<0.01	0.12
Baldwin D	8:56 PM	9.26	7.84	66.70	236	386	1.04	198,630	0.842	57	<0.01	<0.01	0.01	0.03	0.02	<0.01	0.16
Spy Run U	7:44 PM	7.28	7.51	64.70	236	608	0.627	7,170	0.529	43.8	<0.01	<0.01	0.02	0.03	0.03	0.02	0.18
Spy Run D	7:34 PM	6.45	7.33	65.80	292	684	0.652	43,520	0.499	48.8	<0.01	<0.01	0.02	0.11	0.04	0.02	0.27
Relief RCD-1	7:34 PM	4.58	7.53	65.60	120	280	2.02	>241960	0.947	110	<0.01	<0.01	<0.01	0.04	0.01	<0.01	0.13
Pond 3	7:45 PM	10.61	7.66	63.20	604	1.6	0.263	16	0.31	1.7	<0.01	<0.01	<0.01	<0.01	<0.01	0.02	0.04
Relief RC-4	7:19 PM	10.03	7.39	64.57	324	160	0.501	30,760	0.223	28.3	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.04
Lrelief LRC-5	8:20 PM	10.14	8.07	63.43	564	137	0.365	5,200	0.324	20	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.04
River MR-6	8:01 PM	9.48	7.94	63.52	432	47	0.0767	5,940	0.157	21.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
River MR-7	8:27 PM	10.14	8.07	63.43	416	30	0.0491	167	0.144	18.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Relief RCDO-1	7:22 PM	11.34															
Relief RCDO-2	7:19 PM	10.03															
Relief RCDO-3	7:13 PM	10.63															
Relief RCDO-4	8:20 PM	10.14															
Relief RCDO-5	7:56 PM	10.59															
Relief RCDO-6	8:01 PM	9.48															
Relief RCDO-7	8:07 PM	10.14															
Relief RCDO-8	8:27 PM	10.14															

Precipitation of 0.70 inches total from 7:00 PM 5/13/05 until midnight.

	Time	Stage
River Stage	7:00 PM	3.57ft.
in feet	7:30 PM	3.62ft.
	8:00 PM	3.64ft.
	8:30 PM	3.67ft.
	9:00 PM	3.70ft.

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 5/14/05
First day after rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	2:10 PM	9.50	7.88	61.20	308	17	0.204	14,390	0.11	17.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04
Baldwin D	2:45 PM	8.93	7.76	62.57	260	18	0.247	7,670	0.091	17	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04
Spy Run U	1:49 PM	8.30	7.74	61.68	344	63.5	0.157	5,630	0.11	15.9	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.04
Spy Run D	1:55 PM	8.57	7.75	61.67	360	150	0.16	5,630	0.274	17.2	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.05
Relief RCD-1	10:38 AM	4.03	7.64	60.20	472	46.4	1.48	21,420	0.159	14.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Pond 3	7:00 AM	9.92	7.40	64.00	660	6.2	0.142	13	0.43	<1.42	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04
Relief RC-4	10:17 AM	9.66	7.70	63.47	372	85.6	0.143	9,090	0.203	16.8	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Lrelief LRC-5	11:12 AM	9.75	7.79	61.82	336	16	0.346	6,090	0.053	14.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-6	10:55 AM	8.43	7.82	63.40	380	67.2	0.0505	7,270	0.21	16.6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
River MR-7	11:07 AM	8.46	7.81	63.45	376	62.4	0.059	7,800	0.185	17.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
		DO AM	Time	DO PM													
Relief RCDO-1	10:21 AM	4.39	3:12 PM	4.95													
Relief RCDO-2	10:17 AM	9.66	3:25 PM	6.22													
Relief RCDO-3	10:10 AM	4.69	3:28 PM	7.54													
Relief RCDO-4	11:12 AM	9.75	3:37 PM	5.34													
Relief RCDO-5	10:52 AM	5.42	3:18 PM	5.97													
Relief RCDO-6	10:55 AM	8.43	3:23 PM	6.05													
Relief RCDO-7	11:00 AM	7.86	3:21 PM	6.06													
Relief RCDO-8	11:07 AM	8.46	3:33 PM	7.12													
Baldwin U	2:10 PM	9.50	5:02 PM	11.20													
Baldwin D	2:45 PM	8.93	5:06 PM	10.01													
Spy Run U	1:49 PM	8.30	4:52 PM	9.52													
Spy Run D	1:55 PM	8.57	4:49 PM	9.22													

First day after rain event
Precipitation 0.18 inches

	Time	Stage	Time	Stage
River Stage	10:00 AM	4.67 ft	1:00 PM	4.60 ft.
in feet	10:30 AM	4.66 ft	1:30 PM	4.59 ft.
	11:00 AM	4.64 ft.	2:00 PM	4.59 ft.
	11:30 AM	4.63 ft	2:30 PM	4.58 ft.
	12:00 PM	4.61 ft.	3:00 PM	4.59 ft.
	12:30 PM	4.61 ft.	3:30 PM	4.57 ft.

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 5/15/05
Second day after rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	12:26 PM	11.72	7.95	54.66	1372	8	0.0381	4,670	0.146	3.43	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Baldwin D	12:27 PM	12.07	7.74	57.57	869	11.5	0.191	5,290	0.131	3.86	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run U	12:11 PM	10.69	8.03	56.57	452	19	0.176	1,550	0.103	5.71	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	11:59 AM	10.94	7.95	56.72	456	134.5	0.195	1,970	0.37	7.77	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.07
Relief RCD-1	9:42 AM	No Data	8.01	53.45	576	11	2.81	17,850	0.232	3.6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Pond 3	7:00 AM	9.84	7.21	64.32	560	4.4	0.149	17	0.46	1.55	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04
Relief RC-4	10:01 AM	No Data	7.99	60.75	468	37.5	0.145	200	0.462	5.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Lrelief LRC-5	8:33 AM	No Data	8.53	55.00	348	37.5	0.711	1,600	0.159	3.57	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-6	9:53 AM	No Data	8.10	61.22	436	54.5	0.0644	1,100	0.26	5.17	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	8:37 AM	No Data	8.38	60.80	428	42	0.0658	1,080	0.243	4.6	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
		DO AM	Time	DO PM													
Relief RCDO-1		No Data	2:00 PM	7.50													
Relief RCDO-2		No Data	2:02 PM	7.60													
Relief RCDO-3		No Data	2:09 PM	7.35													
Relief RCDO-4		No Data	1:33 PM	11.50													
Relief RCDO-5		No Data	1:57 PM	7.29													
Relief RCDO-6		No Data	1:44 PM	8.76													
Relief RCDO-7		No Data	1:47 PM	8.34													
Relief RCDO-8		No Data	2:17 PM	7.47													
Baldwin U	12:26 PM	11.72	3:29 PM	12.46													
Baldwin D	12:27 PM	12.07	3:25 PM	11.44													
Spy Run U	12:11 PM	10.69	3:14 PM	10.47													
Spy Run D	11:59 AM	10.94	3:12 PM	8.10													

No Data for Relief channel DO due to meter problems.
Precipitation 0.00 inches

	Time	Stage	Time	Stage
River Stage	8:00 AM	4.82 ft.	12:00 PM	4.46 ft.
in feet	8:30 AM	4.81 ft.	12:30 PM	4.41 ft.
	9:00 AM	4.77 ft.	1:00 PM	4.36 ft.
	9:30 AM	4.73 ft.	1:30 PM	4.32 ft.
	10:00 AM	4.68 ft.	2:00 PM	4.28 ft.
	10:30 AM	4.62 ft.	2:30 PM	4.25 ft.
	11:00 AM	4.56 ft.	3:00 PM	4.22 ft.
	11:30 AM	4.51 ft.	3:30 PM	4.20 ft.

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 5/16/05
Third day after rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	8:40 AM	11.21	6.93	53.16	1416	65	0.0363	2,560	0.086	3.74	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Baldwin D	8:50 AM	12.93	7.15	52.15	1184	13.5	0.206	4,350	0.041	3.09	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run U	8:20 AM	8.67	7.20	53.91	500	31	0.216	750	0.045	4.57	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	8:30 AM	8.70	7.10	53.78	496	36.5	0.205	740	0.072	5.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RCD-1	10:30 AM	16.77	7.43	53.26	784	14	3.47	1,200	0.121	3.37	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pond 3	7:00 AM	9.40	7.38	62.92	492	3.8	0.142	7	0.28	<1.15	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RC-4	10:10 AM	16.62	7.64	58.67	500	60.5	0.237	520	0.132	5.77	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Lrelief LRC-5	9:50 AM	14.91	7.39	52.24	460	18	1.23	750	0.039	3.4	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.02
River MR-6	10:20 AM	16.04	7.70	58.57	484	42.5	0.0587	520	0.12	5.71	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	9:55 AM	16.20	7.56	58.59	504	35	0.0393	200	0.123	5.37	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
		DO AM	Time	DO PM													
Relief RCDO-1	10:15 AM	16.52	3:25 PM	12.15													
Relief RCDO-2	10:10 AM	16.62	2:50 PM	11.62													
Relief RCDO-3	10:05 AM	16.16	3:23 PM	10.07													
Relief RCDO-4	9:50 AM	14.91	3:31 PM	11.57													
Relief RCDO-5	10:35 AM	15.68	3:53 PM	13.72													
Relief RCDO-6	10:20 AM	16.04	3:09 PM	11.16													
Relief RCDO-7	10:00 AM	16.16	3:13 PM	11.56													
Relief RCDO-8	9:55 AM	16.20	3:35 PM	13.51													
Baldwin U	8:40 AM	11.21	2:02 PM	11.42													
Baldwin D	8:50 AM	12.93	1:55 PM	12.29													
Spy Run U	8:20 AM	8.67	2:25 PM	9.99													
Spy Run D	8:30 AM	8.70	1:38 PM	9.64													

Precipitation 0.00 inches

	Time	Stage	Time	Stage
River Stage	8:00 AM	3.78 ft.	12:00 PM	3.69 ft.
in feet	8:30 AM	3.78 ft.	12:30 PM	3.65 ft.
	9:00 AM	3.77 ft.	1:00 PM	3.61 ft.
	9:30 AM	3.76 ft.	1:30 PM	3.56 ft.
	10:00 AM	3.76 ft.	2:00 PM	3.58 ft.
	10:30 AM	3.74 ft.	2:30 PM	3.58 ft.
	11:00 AM	3.74 ft.	3:00 PM	3.56 ft.
	11:30 AM	3.72 ft.	3:30 PM	3.54 ft.

City of Fort Wayne Indiana
Water Quality Report

Wet Weather monitoring event 5/19/05
Intitial Rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	11:55 AM	11.13	8.08	57.44	132	41.5	1.39	241,960	0.452	33	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.05
Baldwin D	12:05 PM	10.61	8.03	57.36	52	51.2	0.611	72,700	0.253	27.7	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.04
Spy Run U	11:30 AM	10.00	7.67	57.68	388	71.2	0.483	20,980	0.161	36	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.06
Spy Run D	11:19 AM	10.45	7.60	57.93	384	72	0.467	3,880	0.213	19.4	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.06
Relief RCD-1	11:20 AM	9.35	8.09	58.11	56	174	0.86	198,630	0.537	37.8	<0.01	<0.01	0.01	0.03	0.01	<0.01	0.11
Pond 3	12:00 AM	9.63	7.36	64.85	640	2.4	0.137	48	0.28	2.13	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.05
Relief RC-4	11:05 AM	10.04	7.94	60.33	412	48	0.329	548	0.082	12.2	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	0.02
Lrelief LRC-5	10:45 AM	8.70	8.01	55.50	480	49	2.32	4,410	0.07	12.9	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
River MR-6	11:30 AM	10.28	8.03	60.70	400	44	0.19	1,553	0.262	12.3	<0.01	<0.01	<0.01	0.03	<0.01	<0.01	0.02
River MR-7	10:55 AM	10.13	7.92	60.48	372	125.6	0.131	1,733	0.169	13	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.06
Relief RCDO-1	11:10 AM	9.60															
Relief RCDO-2	11:05 AM	10.04															
Relief RCDO-3	11:00 AM	10.25															
Relief RCDO-4	10:45 AM	8.70															
Relief RCDO-5	11:25 AM	10.03															
Relief RCDO-6	11:30 AM	10.28															
Relief RCDO-7	11:40 AM	10.65															
Relief RCDO-8	10:55 AM	10.13															

	Time	Stage	Time	Stage
River Stage	10:00 AM	3.66 ft.	12:30 PM	4.05 ft.
in feet	10:30 AM	3.74 ft.	1:00 PM	4.07 ft.
	11:00 AM	3.86 ft.	1:30 PM	4.08 ft.
	11:30 AM	3.95 ft.	2:00 PM	4.09 ft.
	12:00 PM	4.01 ft.	2:30 PM	4.09 ft.

Precipitation 0.62 inches

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 5/20/05
First day after rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	8:52 AM	6.82	7.45	56.97	1360	7.5	0.0558	3,790	0.027	3.94	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Baldwin D	9:04 AM	7.63	7.43	58.08	828	9	0.942	6,570	<0.006	3.17	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run U	8:32 AM	7.70	7.46	57.09	460	26.5	0.277	12,740	0.014	4.57	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	8:24 AM	7.54	7.36	57.80	440	27.5	0.269	9,590	0.004	5.11	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RCD-1	9:05 AM	7.25	7.71	56.15	668	16.5	2.33	3,500	0.127	3.03	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Pond 3	7:00 AM	9.83	7.18	61.70	648	2.8	0.198	50	0.0335	1.83	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.05
Relief RC-4	8:50 AM	9.49	8.24	60.15	528	46.5	0.0649	7,590	0.12	6.26	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Lrelief LRC-5	8:35 AM	9.45	8.62	56.51	420	11.5	0.542	1,986	<0.006	3.66	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	0.01
River MR-6	9:10 AM	9.40	8.23	60.09	512	32	0.0671	9,590	0.083	6.57	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	8:40 AM	9.59	8.26	60.18	532	32	0.0357	1,986	0.054	6.26	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.03
Pond 2	9:15 AM	7.30	7.96	67.48	752	17	1.85	1	1.14	12.1	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
	Time	DO AM	Time	DO PM													
Relief RCDO-1	8:55 AM	7.00	11:08 AM	9.63													
Relief RCDO-2	8:50 AM	9.49	11:11 AM	8.90													
Relief RCDO-3	8:45 AM	9.88	11:15 AM	9.37													
Relief RCDO-4	8:35 AM	9.45	11:31 AM	11.31													
Relief RCDO-5	9:08 AM	9.55	11:06 AM	9.92													
Relief RCDO-6	9:10 AM	9.40	11:20 AM	10.02													
Relief RCDO-7	9:13 AM	9.53	11:22 AM	10.20													
Relief RCDO-8	8:40 AM	9.59	11:27 AM	10.56													
Baldwin U	8:52 AM	6.82	1:20 PM	8.10													
Baldwin D	9:04 AM	7.63	1:15 PM	9.59													
Spy Run U	8:32 AM	7.70	12:55 PM	7.53													
Spy Run D	8:24 AM	7.54	12:51 PM	7.50													
	Time	Stage	Time	Stage													
River Stage	8:00 AM	4.41 ft.	11:00 AM	4.57													
in feet	8:30 AM	4.43	11:30 AM	4.59													
	9:00 AM	4.44	12:00 PM	4.60													
	9:30 AM	4.47	12:30 PM	4.59													
	10:00 AM	4.52	1:00 PM	4.59													
	10:30 AM	4.55	1:30 PM	4.58													

First day after rain event

Precipitation 0.01 inches

Pond 2 discharge began after the water quality samples were in the relief channel and river for the day.
This discharge ended at 2:30 pm the same day.

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 5/21/05
Second day after rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	^oF	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	7:37 AM	10.18	8.10	54.48	1508	2.4	<0.02	1,733	0.078	<2.86	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Baldwin D	7:47 AM	9.44	7.78	55.03	988	5.4	0	1,203	0.089	<2.86	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Spy Run U	7:21 AM	8.61	8.00	57.33	464	9.6	0	1,203	0.105	<2.86	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	7:12 AM	8.46	8.45	58.17	472	9.2	0	2,430	0.091	<2.86	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RCD-1	9:40 AM	5.65	7.60	55.76	764	12	4	649	0.189	<2.86	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Pond 3	7:00 AM	10.90	7.45	63.77	680	2.6	0	13	0.33	1.61	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.05
Relief RC-4	9:19 AM	12.12	8.33	61.18	540	45	0	517	0.185	4.92	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Lrelief LRC-5	9:01 AM	8.75	7.86	55.97	436	5	1	548	0.095	<2.86	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01
River MR-6	9:53 AM	11.98	8.33	61.30	460	40	0	365	0.172	4.94	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	9:59 AM	12.06	8.35	61.47	468	45.5	<0.02	461	0.166	4.62	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
	Time	DO AM	Time	DO PM													
Relief RCDO-1	9:22 AM	11.69	11:51 AM	11.51													
Relief RCDO-2	9:19 AM	12.12	11:54 AM	12.80													
Relief RCDO-3	9:12 AM	11.63	11:56 AM	11.69													
Relief RCDO-4	9:01 AM	8.75	12:18 PM	8.25													
Relief RCDO-5	9:46 AM	11.66	11:50 AM	8.40													
Relief RCDO-6	9:53 AM	11.98	12:02 PM	12.53													
Relief RCDO-7	9:55 AM	11.80	11:59 AM	12.52													
Relief RCDO-8	9:59 AM	12.06	12:10 PM	12.90													
Baldwin U	7:37 AM	10.18	11:34 AM	7.25													
Baldwin D	7:47 AM	9.44	12:00 AM	10.03													
Spy Run U	7:21 AM	8.61	11:05 AM	10.49													
Spy Run D	7:12 AM	8.46	10:54 AM	10.68													
	Time	Stage	Time	Stage													
River Stage	7:00 AM	4.23 ft.	10:00 AM	4.22													
In Feet	7:30 AM	4.23	10:30 AM	4.19													
	8:00 AM	4.23	11:00 AM	4.15													
	8:30 AM	4.23	11:30 AM	4.1													
	9:00 AM	4.23	12:00 PM	4.06													
	9:30 AM	4.24	12:30 PM	4.02													

Precipitation 0.00 inches

City of Fort Wayne Indiana
Water Quality Report
Wet Weather monitoring event 5/22/05
Third day after rain event

Parameter	Sample	DO	pH	Tep F	TDS	TSS	NH3-N	E.Coli	Phos	CBOD	Ag	Cd	Cr	Cu	Pb	Ni	Zn
	Time	mg/l	mg/l	°F	mg/l	mg/l	mg/l	Col/100ml	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
Site																	
Baldwin U	8:49 AM	9.14	7.76	55.89	1628	5	<0.02	10,460	0.157	3.34	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Baldwin D	8:59 AM	8.76	7.78	57.96	1188	8.4	0.0468	921	0.046	3.2	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Spy Run U	8:27 AM	6.91	7.46	61.41	608	10.2	0.289	228	0.057	3.52	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Spy Run D	8:34 AM	7.61	7.68	59.96	604	10.8	0.279	10,190	0.084	3.8	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.02
Relief RCD-1	10:43 AM	6.04	7.74	57.63	852	9.2	3.69	579	0.129	2.68	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pond 3	7:00 AM	8.74	7.17	62.78	664	2.4	0.0562	3	0.33	1.52	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	0.04
Relief RC-4	10:31 AM	9.24	8.25	62.23	520	36.5	0.289	291	0.174	8.79	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
Lrelief LRC-5	10:14 AM	8.39	8.21	57.92	552	6.2	1.48	112	0.076	2.96	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
River MR-6	11:01 AM	9.79	8.31	63.39	524	35	0.0727	192	0.133	8.66	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
River MR-7	10:18 AM	9.15	8.27	63.31	524	40.5	<0.02	285	0.144	8.53	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01
		DO AM															
Relief RCDO-1	10:35 AM	9.31															
Relief RCDO-2	10:31 AM	9.24															
Relief RCDO-3	10:21 AM	8.99															
Relief RCDO-4	10:14 AM	8.39															
Relief RCDO-5	10:37 AM	9.53															
Relief RCDO-6	11:01 AM	9.79															
Relief RCDO-7	10:55 AM	9.70															
Relief RCDO-8	10:18 AM	9.15															

	Time	Stage	Time	Stage
River Stage	8:00 AM	4.19 ft.	10:00 AM	4.15
in feet	8:30 AM	4.18	10:30 AM	4.13
	9:00 AM	4.17	11:00 AM	4.12
	9:30 AM	4.16	11:30 AM	4.11

Precipitation for 5/22/05 during sampling was 0.00 in.
Precipitation began later in the day after sampling was completed for a total of 0.09 in.

ATTACHMENT 4

City of Fort Wayne
River Survey 2001
St. Marys River @ Ferguson Road

Wk	Dale	ECOLI	Elev(ft)	Depth(ft)	PHOS	NH3-N	TSS
1	4/3/01	440	749.54	1.29	0.14	0.0489	42
2	4/9/01	80	750.17	1.82	0.236	0.169	92
3	4/16/01	1800	755.35	7.00	0.555	0.23	262
4	4/23/01	460	753.09	4.74	0.237	0.108	146
5	4/30/01	30	750.15	1.80	0.181	0.0241	52
6	5/7/01	92	749.83	1.48	0.116	0.0927	52
7	5/14/01	100	749.65	1.30	0.206	0.0316	84
8	5/21/01	512	756.08	7.73	0.444	0.158	124
9	5/29/01	460	753.58	5.23	0.206	0.0992	104
10	6/4/01	920	751.69	3.34	0.253	0.126	112
11	6/11/01	260	750.91	2.56	0.196	0.0336	59
12	6/18/01	110	750.05	1.70	0.158	0.0331	54
13	6/26/01	80	749.85	1.50	0.226	0.047	72
14	7/2/01	76	749.28	0.93	0.267	0.0239	43
15	7/9/01	1200	750.48	2.13	0.43	0.199	160
16	7/16/01	220	749.04	0.69	0.309	0.0205	72
17	7/23/01	1800	751.74	3.39	0.839	0.224	312
18	7/30/01	320	750.32	1.97	0.276	0.0327	80
19	8/6/01	410	749.08	0.73	0.281	0.0107	62
20	8/14/01	150	748.91	0.56	0.284	0.0171	92
21	8/20/01	210	749.53	1.18	0.256	0.0946	45
22	8/27/01	370	750.13	1.78	0.403	0.0432	88
23	9/4/01	400	749.51	1.16	0.308	0.126	172
24	9/10/01	2000	750.13	1.78	0.40	0.0113	104
25	9/17/01	180	749.56	1.21	0.36	0.0435	132
26	9/24/01	610	750.37	2.02	0.39	0.0324	44
27	10/1/01	180	749.48	1.13	0.228	0.0198	28
28	10/9/01	390	752.12	3.77	0.433	0.0454	86
29	10/15/01	2800	756.88	8.53	0.643	0.0879	172
30	10/22/01	420	754.77	6.42	0.541	0.027	136
31	10/29/01	280	754.11	5.76	0.418	0.054	62
	Max	2800	756.88	8.53	0.839	0.23	312
	Min	30	748.91	0.56	0.116	0.0107	28
	Avg		751.14	2.79	0.329	0.074	101

E.coli = colonies per 100 mls, yellow indicates >235
PHOS = Total Phosphorus mg/l, NH3-N = Ammonia-Nitrogen mg/l,
TSS = Total Suspended Solids mg/l

Jim Cornell, Feb. 2002

City of Fort Wayne
River Survey 2001
St. Marys River @ Spy Run Avenue

Wk	Date	ECOLI	Elev(ft)	Depth(ft)	PHOS	NH3-N	TSS
1	4/3/01	1600	739.09	6.09	0.12	0.159	64
2	4/9/01	600	742.45	8.75	0.19	0.165	70
3	4/16/01	1200	743.07	10.07	0.418	0.131	210
4	4/23/01	900	742.70	9.70	0.09	0.124	62
5	4/30/01	70	741.69	8.69	0.091	0.0148	46
6	5/7/01	32	740.07	7.07	0.06	0.0313	52
7	5/14/01	90	739.56	6.56	0.075	0.02	80
8	5/21/01	520	743.37	10.37	0.366	0.204	168
9	5/29/01	600	743.06	10.06	0.155	0.0848	68
10	6/4/01	1450	742.45	9.45	0.214	0.106	104
11	6/11/01	2920	742.76	9.76	0.129	0.0363	34
12	6/18/01	1000	742.07	9.07	0.07	0.0236	16
13	6/26/01	848	742.31	9.31	0.158	0.0596	32
14	7/2/01	450	742.10	9.10	0.402	0.213	36
15	7/9/01	3000	742.35	9.35	0.247	0.0219	56
16	7/16/01	200	741.85	8.85	0.162	0.0196	32
17	7/23/01	3000	742.37	9.37	0.284	0.0839	60
18	7/30/01	1450	742.15	9.15	0.214	0.129	56
19	8/6/01	500	737.81	4.81	0.247	0.20	60
20	8/14/01	360	736.04	3.04	0.34	0.01	176
21	8/20/01	4600	737.43	4.43	0.229	0.115	80
22	8/27/01	4000	738.98	5.98	0.416	0.145	66
23	9/4/01	700	737.22	4.22	0.24	0.0962	172
24	9/10/01	4250	739.63	6.63	0.272	0.192	90
25	9/17/01	1100	737.12	4.12	0.264	0.113	168
26	9/24/01	6000	739.47	6.47	0.319	0.103	72
27	10/1/01	900	737.37	4.37	0.217	0.102	66
28	10/9/01	620	740.40	7.40	0.346	0.0319	56
29	10/15/01	3000	745.14	12.14	0.523	0.0632	100
30	10/22/01	1800	744.79	11.79	0.479	0.148	150
31	10/29/01	380	743.52	10.52	0.472	0.066	72
	Max.	6000	745.14	12.14	0.523	0.213	210
	Min.	32	736.04	3.04	0.06	0.01	16
	Avg.		740.98	7.96	0.252	0.0968	83

E.coli = colonies per 100 mls, yellow indicates >235
PHOS = Total Phosphorus mg/l, NH3-N = Ammonia-Nitrogen mg/l,
TSS = Total Suspended Solids mg/l

Jim Cornell, Feb. 2002

City of Fort Wayne
River Survey 2001
St. Joseph River @ Mayhew Road

Wk	Date	ECOLI	Elev(ft)	Depth(ft)	PHOS	NH3-N	TSS
1	4/3/01	140	753.54	1.24	0.06	0.0104	22
2	4/9/01	280	758.26	5.96	0.344	0.221	134
3	4/16/01	260	754.49	2.19	0.116	0.0697	62
4	4/23/01	80	756.62	4.32	0.096	0.0485	76
5	4/30/01	20	754.97	2.67	0.132	0.0101	42
6	5/7/01	80	754.55	2.25	0.067	0.0523	46
7	5/14/01	70	754.44	2.14	0.063	0.134	28
8	5/21/01	276	756.56	4.26	0.228	0.202	76
9	5/29/01	400	757.41	5.11	0.508	0.111	76
10	6/4/01	540	757.04	4.74	0.168	0.111	68
11	6/11/01	200	756.66	4.36	0.257	0.0439	70
12	6/18/01	150	754.31	2.01	0.083	0.0548	32
13	6/28/01	84	755.07	2.77	0.20	0.122	96
14	7/2/01	104	754.46	2.15	0.168	0.02	51
15	7/9/01	130	754.26	1.96	0.154	0.0613	44
16	7/16/01	130	754.50	2.20	0.239	0.0247	26
17	7/23/01	60	755.56	3.26	0.171	0.0713	30
18	7/30/01	60	755.10	2.66	0.149	0.0651	38
19	8/6/01	30	754.45	2.15	0.152	0.121	32
20	8/14/01	100	754.41	2.11	0.158	0.0137	40
21	8/20/01	98	755.46	3.16	0.075	0.0615	42
22	8/27/01	300	754.75	2.45	0.169	0.03	36
23	9/4/01	100	754.95	2.65	0.173	0.0509	52
24	9/10/01	480	756.34	3.04	0.204	0.0329	66
25	9/17/01	80	755.44	3.14	0.168	0.0238	84
26	9/24/01	470	755.09	2.79	0.173	0.0107	32
27	10/1/01	180	755.11	2.81	0.07	0.0175	24
28	10/9/01	210	756.32	3.02	0.181	0.0327	34
29	10/15/01	2000	761.75	9.45	0.411	0.0371	60
30	10/22/01	170	761.50	9.20	0.317	0.0322	72
31	10/29/01	160	758.08	5.78	0.204	0.022	22
	Max.	2000	761.75	9.45	0.508	0.221	134
	Min.	20	753.54	1.24	0.06	0.0101	22
	Avg.		755.79	3.49	0.183	0.0626	52

E.coli = colonies per 100 mls, yellow indicates >235
PHOS = Total Phosphorus mg/l, NH3-N = Ammonia-Nitrogen mg/l,
TSS = Total Suspended Solids mg/l

Jim Cornell, Feb. 2002

City of Fort Wayne
River Survey 2001
St. Joseph River @ Tennessee Street

Wk	Date	ECOLI	Elev(ft)	Depth(ft)	PHOS	NH3-N	TSS
1	4/3/01	220	739.93	8.43	0.06	0.0042	20
2	4/9/01	280	743.61	12.11	0.365	0.253	152
3	4/16/01	110	743.54	12.04	0.077	0.0504	36
4	4/23/01	140	743.66	12.16	0.06	0.0306	38
5	4/30/01	20	742.33	10.83	0.085	0.0152	34
6	5/7/01	48	740.99	9.49	0.06	0.0414	46
7	5/14/01	32	740.28	8.78	0.06	0.0327	28
8	5/21/01	500	744.06	12.56	0.202	0.259	76
9	5/29/01	540	743.77	12.27	0.594	0.135	80
10	6/4/01	370	742.98	11.48	0.088	0.0316	48
11	6/11/01	100	743.58	12.08	0.136	0.0363	44
12	6/18/01	100	742.72	11.22	0.06	0.0404	36
13	6/26/01	200	743.09	11.59	0.179	0.185	54
14	7/2/01	144	742.85	11.35	0.137	0.02	34
15	7/9/01	100	742.96	11.46	0.127	0.0264	27
16	7/16/01	20	742.72	11.22	0.101	0.0133	38
17	7/23/01	80	742.97	11.47	0.083	0.035	22
18	7/30/01	44	742.74	11.24	0.103	0.0524	14
19	8/6/01	102	738.66	7.16	0.121	0.0324	38
20	8/14/01	102	736.98	5.48	0.136	0.0092	56
21	8/20/01	460	738.20	6.70	0.06	0.0716	36
22	8/27/01	450	739.75	8.25	0.145	0.0535	18
23	9/4/01	210	738.06	6.56	0.159	0.0675	84
24	9/10/01	1120	740.22	8.72	0.144	0.0707	44
25	9/17/01	160	738.02	6.52	0.111	0.041	64
26	9/24/01	350	740.05	8.55	0.151	0.0321	40
27	10/1/01	180	738.22	6.72	0.068	0.0143	20
28	10/9/01	550	741.24	9.74	0.126	0.0087	30
29	10/15/01	3200	745.98	14.48	0.41	0.0241	108
30	10/22/01	270	745.38	13.88	0.302	0.0338	70
31	10/29/01	180	744.21	12.71	0.208	0.023	28
	Max.	3200	745.98	14.48	0.594	0.259	152
	Min.	20	736.98	5.48	0.06	0.0042	14
	Avg.		741.73	10.23	0.152	0.0579	47

E.coli = colonies per 100 mls, yellow indicates >235
PHOS = Total Phosphorus mg/l, NH3-N = Ammonia-Nitrogen mg/l,
TSS = Total Suspended Solids mg/l

Jim Cornell, Feb. 2002

City of Fort Wayne
River Survey 2001
Maumee River @ Anthony Boulevard

Wk	Date	ECOLI	Elev(ft)	Depth(ft)	PHOS	NH3-N	TSS
1	4/3/01	560	732.23	2.16	0.06	0.0153	24
2	4/9/01	340	736.35	6.28	0.384	0.296	146
3	4/16/01	1320	737.23	7.16	0.283	0.107	128
4	4/23/01	1000	736.24	6.17	0.06	0.0595	56
5	4/30/01	20	733.20	3.13	0.089	0.0213	42
6	5/7/01	44	732.08	2.01	0.06	0.0392	62
7	5/14/01	26	731.99	1.92	0.077	0.0176	66
8	5/21/01	432	738.48	6.41	0.308	0.241	144
9	5/29/01	590	737.46	7.39	0.172	0.123	120
10	6/4/01	1000	735.28	5.21	0.122	0.0954	96
11	6/11/01	570	734.49	4.42	0.122	0.0434	44
12	6/18/01	230	732.24	2.17	0.065	0.0271	32
13	6/26/01	1600	732.61	2.54	0.15	0.202	48
14	7/2/01	150	731.94	1.87	0.166	0.03	55
15	7/9/01	980	732.24	2.17	0.175	0.062	49
16	7/16/01	60	731.48	1.41	0.105	0.0416	38
17	7/23/01	980	732.09	2.02	0.16	0.0899	60
18	7/30/01	810	731.93	1.86	0.173	0.119	52
19	8/6/01	330	731.50	1.43	0.193	0.116	48
20	8/14/01	110	730.67	0.60	0.194	0.0134	62
21	8/20/01	6000	731.24	1.17	0.107	0.105	56
22	8/27/01	1060	732.07	2.00	0.275	0.101	62
23	9/4/01	250	731.29	1.22	0.166	0.0704	92
24	9/10/01	2400	732.65	2.58	0.194	0.0825	78
25	9/17/01	8000	731.29	1.22	0.156	0.115	104
26	9/24/01	20000	732.11	2.04	0.252	0.155	72
27	10/1/01	460	731.97	1.90	0.109	0.0468	40
28	10/9/01	440	733.37	3.30	0.268	0.0228	54
29	10/15/01	3200	743.34	13.27	0.472	0.0345	120
30	10/22/01	700	741.67	11.60	0.365	0.0648	100
31	10/29/01	220	738.22	8.15	0.331	0.039	54
	Max.	20000	743.34	13.27	0.472	0.296	146
	Min.	20	730.67	0.60	0.06	0.0134	24
	Avg.		733.90	3.83	0.1685	0.0638	72

E.coli = colonies per 100 mls, yellow indicates >235
PHOS = Total Phosphorus mg/l, NH3-N = Ammonia-Nitrogen mg/l,
TSS = Total Suspended Solids mg/l

Jim Cornell, Feb. 2002

City of Fort Wayne
River Survey 2001
Maumee River @ Landin Road

Wk	Date	ECOLI	Elev(ft)	Depth(ft)	PHOS	NH3-N	TSS
1	4/3/01	600	728.16	3.65	0.06	0.0344	22
2	4/9/01	270	732.20	7.69	0.371	0.292	152
3	4/16/01	390	732.36	7.65	0.309	0.122	168
4	4/23/01	480	734.35	9.84	0.074	0.0734	76
5	4/30/01	10	731.02	0.51	0.11	0.0189	36
6	5/7/01	44	730.30	5.79	0.06	0.034	46
7	5/14/01	64	729.83	5.32	0.093	0.0327	76
8	5/21/01	306	736.21	11.70	0.337	0.245	140
9	5/29/01	650	735.55	11.04	0.152	0.117	106
10	6/4/01	600	732.96	8.47	0.133	0.112	44
11	6/11/01	360	732.86	8.35	0.144	0.0632	58
12	6/18/01	170	730.41	5.90	0.114	0.02	24
13	6/26/01	1024	730.87	6.36	0.196	0.194	68
14	7/2/01	200	730.01	5.50	0.06	0.0259	46
15	7/9/01	600	730.66	6.14	0.222	0.0281	56
16	7/16/01	60	728.68	4.17	0.155	0.0376	30
17	7/23/01	630	730.38	5.87	0.187	0.136	62
18	7/30/01	1020	729.98	5.47	0.174	0.121	72
19	8/6/01	440	729.26	4.75	0.171	0.141	24
20	8/14/01	60	728.63	4.12	0.15	0.17	38
21	8/20/01	3200	730.07	5.56	0.108	0.513	96
22	8/27/01	920	730.82	6.31	0.28	0.108	78
23	9/4/01	200	729.58	5.07	0.10	0.0937	76
24	9/10/01	2240	730.70	6.19	0.202	0.116	68
25	9/17/01	1460	729.41	4.90	0.205	0.188	168
26	9/24/01	6000	730.92	6.41	0.281	0.133	44
27	10/1/01	500	729.79	5.28	0.171	0.109	28
28	10/9/01	1020	730.91	6.40	0.301	0.0298	44
29	10/15/01	4600	740.61	16.10	0.459	0.0516	132
30	10/22/01	620	739.55	15.04	0.336	0.0966	72
31	10/29/01	1020	735.74	11.23	0.346	0.071	44
	Max.	6000	740.61	16.10	0.459	0.513	168
	Min.	10	728.16	3.65	0.06	0.0189	22
	Avg.		731.70	7.19	0.1955	0.1138	71

E.coli = colonies per 100 mls, yellow indicates >235

PHOS = Total Phosphorus mg/l, NH3-N = Ammonia-Nitrogen mg/l,

TSS = Total Suspended Solids mg/l

Jim Cornell, Feb. 2002

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
DEPTH	4/1/02	13.55	13.6	7.71	15.79	15.71	18.73
DEPTH	4/8/02	4.86	9.69	6.47	12.43	8.28	11.63
DEPTH	4/15/02	5.39	10.83	7.89	13.04	9.85	13.19
DEPTH	4/22/02	2.61	9.34	5.27	11.58	5.96	9.32
DEPTH	4/29/02	7.24	9.86	2.68	12.02	8.12	10.64
DEPTH	5/6/02	2.84	7.19	1.55	10.51	3.51	7.2
DEPTH	5/13/02	7.72	11.46	9.08	13.79	13.45	17.68
DEPTH	5/20/02	4.15	9.94	5.69	12.37	8.63	11.12
DEPTH	5/29/02	2.6	8.36	4.42	10.47	4.16	6.98
DEPTH	6/3/02	4.1	8.9	2.84	11.43	4.27	7.84
DEPTH	6/10/02	2.03	7.51	2.41	9.52	3.36	6.75
DEPTH	6/17/02	1.61	8.82	2.73	11.3	1.34	6.25
DEPTH	6/24/02	0.66	9.02	2.57	11.22	1.78	5.22
DEPTH	7/1/02	1.28	8.87	2.09	10.87	1.84	5.8
DEPTH	7/8/02	1.36	9.1	11.08	11.7	2.15	5.87
DEPTH	7/15/02	0.1	8.27	1.51	10.72	1.39	5.27
DEPTH	7/22/02	0.51	8.66	2.66	10.71	1	4.46
DEPTH	7/29/02	0.28	9.31	3.57	11.28	1.94	5.3
DEPTH	8/5/02	0.56	8.16	2.04	10.21	2.46	5.73
DEPTH	8/12/02	0.94	3.19	2.07	5.34	0.96	4.73
DEPTH	8/19/02	0.97	5.35	2.94	7.64	1.74	5.77
DEPTH	8/26/02	1.59	5.05	2.21	7.23	1.48	5.64
DEPTH	9/3/02	0.89	8.69	2.76	10.99	1.23	4.88
DEPTH	9/9/02	1.03	8.59	2.83	10.92	1.1	4.59
DEPTH	9/16/02	0.65	8.63	1.86	10.7	0.98	4.33
DEPTH	9/23/02	1.24	8.77	2.74	11.06	1.31	4.72
DEPTH	9/30/02	1.72	8.94	1.7	11.11	2.01	5.69
DEPTH	10/7/02	1.32	8.83	1.71	11.06	1.72	4.73
DEPTH	10/14/02	0.85	8.69	3	11.08	1.21	4.59
DEPTH	10/21/02	0.74	8.89	1.09	11.17	1.06	4.79
DEPTH	10/28/02	0.64	8.74	0.89	10.85	1.06	4.66
DO	4/1/02	11.26	10.85	11.49	11.94	10.99	11.07
DO	4/8/02	10.99	10.89	11.73	12.52	12.17	12.16
DO	4/15/02	8.69	8.65	9.5	9.92	9.84	9.66
DO	4/22/02	9.78	8.13	9.66	9.96	9.93	9.96
DO	4/29/02	9.06	8.84	11.57	11.47	10.36	10.44
DO	5/6/02	9.13	10.86	10.26	12.19	12.09	10.64
DO	5/13/02	9.35	8.78	9.3	10.3	9.71	9.34
DO	5/20/02	10.21	9.45	10.71	11.21	11.03	11.48
DO	5/29/02	9.01	9.01	11.1	11.72	11.28	10.1
DO	6/3/02	7.03	7.28	9.98	9.34	8.72	8.97
DO	6/10/02	10.2	7.98	8.96	9.72	8.91	8.79
DO	6/17/02	10.79	8.49	9.13	9.66	8.97	9.5
DO	6/24/02	13.74	17.83	6.92	7.79	8.51	6.9
DO	7/1/02	8.95	6.53	6.53	7.27	7.5	6.81

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
DO	7/8/02	9.34	10.95	5.24	7.58	6.84	5.51
DO	7/15/02	15.34	10.32	6.79	9.27	8.25	6.92
DO	7/22/02	9.88	9.73	5.9	11.47	5.47	6.88
DO	7/29/02	7.86	10.51	6.34	5.91	7.67	6.06
DO	8/5/02	10.61	8.74	5.2	5.32	5.87	5.28
DO	8/12/02	8.53	1.9	6.04	8.9	6.44	7.68
DO	8/19/02	7.21	4.04	6.47	6.72	5.36	6.75
DO	8/26/02	5.54	2.69	6.52	6.39	5.51	4.88
DO	9/3/02	7.01	15.77	6.27	11.85	6.65	7.11
DO	9/9/02	10.38	16.56	6.88	8.17	7.31	4.76
DO	9/16/02	9.49	7.81	6.88	5.6	6.29	4.26
DO	9/23/02	5.35	0.77	7.58	7.16	6.53	5.25
DO	9/30/02	8.48	3.21	7.3	10.14	8.17	6.2
DO	10/7/02	8.56	5.61	8.01	13.89	6.74	10.71
DO	10/14/02	11.15	9.01	9.13	8.75	8.45	8.18
DO	10/21/02	15.73	10.69	10.46	10.12	10.18	9.76
DO	10/28/02	11.81	9.67	11.38	10.7	10.81	10.37
ECOLI	4/1/02	396	884	548	544	616	768
ECOLI	4/8/02	800	740	1280	320	1040	440
ECOLI	4/15/02	640	660	200	220	460	400
ECOLI	4/22/02	460	680	620	200	360	300
ECOLI	4/29/02	5660	3740	500	360	4440	5000
ECOLI	5/6/02	200	1000	100	100	300	400
ECOLI	5/13/02	7500	5400	3300	5600	4300	5400
ECOLI	5/20/02	100	500	100	100	100	300
ECOLI	5/29/02	1450	2700	350	100	1100	1800
ECOLI	6/3/02	420	560	180	140	540	200
ECOLI	6/10/02	700	1400	380	290	330	470
ECOLI	6/17/02	350	420	120	140	260	250
ECOLI	6/24/02	2880	360	510	240	430	660
ECOLI	7/1/02	170	220	740	240	540	430
ECOLI	7/8/02	760	300	240	210	290	420
ECOLI	7/15/02	60	380	240	220	70	fail
ECOLI	7/22/02	750	170	80	150	470	400
ECOLI	7/29/02	90	270	240	80	60	130
ECOLI	8/5/02	180	740	20	50	270	160
ECOLI	8/12/02	130	55	265	245	600	65
ECOLI	8/19/02	130	130	360	980	400	620
ECOLI	8/26/02	400	fail	100	210	2400	1480
ECOLI	9/3/02	200	1600	90	70	110	420
ECOLI	9/9/02	240	60	90	50	50	560
ECOLI	9/16/02	100	240	70	30	90	370
ECOLI	9/23/02	350	250	200	320	900	640
ECOLI	9/30/02	385	220	195	415	310	680
ECOLI	10/7/02	230	260	270	100	220	220

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
ECOLI	10/14/02	280	600	110	10	70	130
ECOLI	10/21/02	15	190	80	75	115	105
ECOLI	10/28/02	80	160	35	150	800	270
NH3-N	4/1/02	0.1	0.188	0.206	0.172	0.189	0.173
NH3-N	4/8/02	0.1	0.0493	0.0407	0.0371	0.0387	0.0469
NH3-N	4/15/02	0.1	0.1	0.1	0.1	0.1	0.1
NH3-N	4/22/02	0.0401	0.0283	0.0554	0.0425	0.0399	0.0506
NH3-N	4/29/02	0.804	0.779	0.125	0.0183	0.503	0.495
NH3-N	5/6/02	0.0485	0.0149	0.0202	0.0291	0.015	0.0265
NH3-N	5/13/02	0.25	0.155	0.12	0.0796	0.118	0.115
NH3-N	5/20/02	0.1	0.1	0.1	0.1	0.1	0.1
NH3-N	5/29/02	0.0565	0.0825	0.002	0.002	0.022	0.0416
NH3-N	6/3/02	0.0317	0.0357	0.0189	0.0106	0.0249	0.0452
NH3-N	6/10/02	0.002	0.002	0.002	0.002	0.002	0.002
NH3-N	6/17/02	0.1	0.1	0.1	0.1	0.1	0.1
NH3-N	6/24/02	0.37	0.0135	0.0097	0.0093	0.0657	0.155
NH3-N	7/1/02	0.0415	0.0235	0.0058	0.002	0.0063	0.0439
NH3-N	7/8/02	0.002	0.002	0.002	0.002	0.0557	0.112
NH3-N	7/15/02	0.1	0.2	0.1	0.1	0.1	0.1
NH3-N	7/22/02	0.101	0.0275	0.187	0.0517	0.298	0.114
NH3-N	7/29/02	0.002	0.002	0.002	0.002	0.0053	0.0215
NH3-N	8/5/02	0.0225	0.0216	0.0433	0.0439	0.0353	0.157
NH3-N	8/12/02	0.0189	0.782	0.0322	0.0026	0.179	0.0164
NH3-N	8/19/02	0.1	0.6	N/A	0.1	N/A	0.1
NH3-N	8/26/02	0.0565	0.321	0.0051	0.0546	0.244	0.218
NH3-N	9/3/02	0.0146	0.0172	0.024	0.0038	0.171	0.08
NH3-N	9/9/02	0.19	0.16	0.071	0.14	0.262	0.458
NH3-N	9/16/02	0.1	0.5	0.1	0.1	0.2	0.4
NH3-N	9/23/02	0.173	0.361	0.0583	0.0822	0.195	0.325
NH3-N	9/30/02	0.002	0.324	0.0055	0.002	0.0925	0.241
NH3-N	10/7/02	0.002	0.0697	0.147	0.002	0.186	0.124
NH3-N	10/14/02	0.106	0.117	0.0483	0.0217	0.109	0.258
NH3-N	10/21/02	0.1	0.1	0.1	0.1	0.1	0.1
NH3-N	10/28/02	0.137	0.0979	0.0555	0.0298	0.074	0.127
PH	4/1/02	8.17	7.56	7.69	7.71	7.52	7.64
PH	4/8/02	7.91	7.73	7.87	7.86	7.77	7.82
PH	4/15/02	7.76	7.73	7.76	7.72	7.75	7.74
PH	4/22/02	7.93	7.78	7.91	7.98	7.88	7.95
PH	4/29/02	7.48	7.36	7.87	7.89	7.61	7.71
PH	5/6/02	7.8	7.82	8.14	8.14	7.96	7.96
PH	5/13/02	7.52	7.48	7.61	7.63	7.51	7.6
PH	5/20/02	7.79	7.8	7.89	7.91	7.83	7.86
PH	5/29/02	7.85	7.66	8.06	8.03	7.85	7.88
PH	6/3/02	7.7	7.62	8.1	8.01	7.69	7.87
PH	6/10/02	8.01	7.71	8.04	8.09	7.91	7.9

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
PH	6/17/02	8.33	7.91	8.28	8.31	8.1	8.08
PH	6/24/02	8.34	7.76	7.87	8.2	7.87	7.72
PH	7/1/02	8.32	7.42	7.95	7.99	7.79	7.64
PH	7/8/02	8.35	7.77	7.75	7.89	7.76	7.56
PH	7/15/02	8.77	8.04	8.12	8.24	7.87	7.81
PH	7/22/02	8.46	7.95	7.84	8.23	7.52	7.69
PH	7/29/02	8.1	8.28	7.98	7.94	7.98	7.77
PH	8/5/02	8.7	7.61	7.9	7.72	7.48	7.8
PH	8/12/02	8.28	7.22	7.77	7.65	7.41	7.57
PH	8/19/02	7.8	7.14	7.9	7.77	7.2	7.5
PH	8/26/02	7.47	7.15	7.9	7.71	7.29	7.39
PH	9/3/02	7.82	8.03	7.9	8.04	7.42	7.67
PH	9/9/02	8.41	7.77	8.01	7.94	7.35	7.42
PH	9/16/02	8.21	7.75	7.98	7.66	7.45	7.5
PH	9/23/02	7.29	7.02	7.78	7.7	7.42	7.37
PH	9/30/02	7.24	7	7.71	7.97	7.57	7.3
PH	10/7/02	7.83	7.5	7.65	7.91	7.61	7.66
PH	10/14/02	7.81	7.5	7.88	7.85	7.49	7.36
PH	10/21/02	8.51	7.93	7.88	7.93	7.81	7.68
PH	10/28/02	7.75	7.63	7.95	7.82	7.61	7.73
PHOS	4/1/02	0.1	0.489	0.279	0.261	0.39	0.417
PHOS	4/8/02	0.14	0.308	0.177	0.183	0.205	0.216
PHOS	4/15/02	0.34	0.31	0.28	0.27	0.28	0.29
PHOS	4/22/02	0.212	0.128	0.188	0.141	0.151	0.155
PHOS	4/29/02	0.959	0.994	0.139	0.095	0.643	0.671
PHOS	5/6/02	0.237	0.12	0.072	0.061	0.089	0.099
PHOS	5/13/02	0.714	0.631	0.47	0.526	0.585	0.509
PHOS	5/20/02	0.26	0.31	0.15	0.15	0.19	0.21
PHOS	5/29/02	0.346	0.408	0.156	0.146	0.253	0.291
PHOS	6/3/02	0.411	0.373	0.145	0.104	0.254	0.25
PHOS	6/10/02	0.299	0.304	0.165	0.152	0.236	0.407
PHOS	6/17/02	0.29	0.21	0.13	0.11	0.16	0.2
PHOS	6/24/02	0.239	0.188	0.135	0.089	0.104	0.131
PHOS	7/1/02	0.371	0.249	0.188	0.125	0.174	0.204
PHOS	7/8/02	0.281	0.22	0.191	0.16	0.138	0.179
PHOS	7/15/02	0.29	0.24	0.13	0.12	0.16	0.19
PHOS	7/22/02	0.454	0.298	0.179	0.118	0.229	0.215
PHOS	7/29/02	0.394	0.151	0.21	0.128	0.14	0.201
PHOS	8/5/02	0.35	0.14	0.114	0.072	0.165	0.161
PHOS	8/12/02	0.26	0.369	0.108	0.112	0.146	0.167
PHOS	8/19/02	0.28	0.32	N/A	0.12	N/A	0.21
PHOS	8/26/02	0.447	0.271	0.164	0.116	0.21	0.178
PHOS	9/3/02	0.193	0.082	0.088	0.06	0.016	0.009
PHOS	9/9/02	0.346	0.062	0.139	0.063	0.058	0.198
PHOS	9/16/02	0.32	0.37	0.14	0.11	0.13	0.18

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
PHOS	9/23/02	0.312	0.297	0.158	0.121	0.202	0.206
PHOS	9/30/02	0.186	0.26	0.207	0.183	0.213	0.326
PHOS	10/7/02	0.597	0.245	0.243	0.132	0.399	0.533
PHOS	10/14/02	0.266	0.211	0.102	0.101	0.147	0.263
PHOS	10/21/02	0.22	0.14	0.05	0.08	0.07	0.08
PHOS	10/28/02	0.279	0.06	0.015	0.0.18	0.039	0.073
TDS	4/1/02	538	140	104	124	180	72
TDS	4/8/02	483	276	188	216	216	244
TDS	4/15/02	375	390	300	298	333	339
TDS	4/22/02	376	332	236	240	264	284
TDS	4/29/02	336	328	328	312	320	320
TDS	5/6/02	440	524	352	412	456	456
TDS	5/13/02	388	356	276	280	300	308
TDS	5/20/02	365	347	251	253	275	279
TDS	5/29/02	540	464	392	360	392	416
TDS	6/3/02	504	500	360	332	384	352
TDS	6/10/02	460	412	336	304	388	388
TDS	6/17/02	581	485	398	386	433	447
TDS	6/24/02	544	532	452	460	416	448
TDS	7/1/02	568	432	448	472	364	372
TDS	7/8/02	628	488	384	320	388	432
TDS	7/15/02	691	529	407	402	430	500
TDS	7/22/02	772	572	432	432	448	488
TDS	7/29/02	544	408	324	308	336	456
TDS	8/5/02	144	400	296	324	400	368
TDS	8/12/02	916	840	472	464	628	608
TDS	8/19/02	622	484	397	316	550	579
TDS	8/26/02	444	436	444	380	396	472
TDS	9/3/02	720	532	508	376	400	572
TDS	9/9/02	796	416	404	380	388	492
TDS	9/16/02	784	620	434	485	502	549
TDS	9/23/02	496	440	412	456	552	520
TDS	9/30/02	528	368	428	464	428	460
TDS	10/7/02	688	484	408	328	424	476
TDS	10/14/02	852	560	460	472	488	532
TDS	10/21/02	914	598	463	445	457	508
TDS	10/28/02	884	460	440	424	464	508
TEMPF	4/1/02	36.78	41.69	41.97	42.08	41.85	42.23
TEMPF	4/8/02	43.56	44.94	42.59	42.48	43.29	43.76
TEMPF	4/15/02	59.11	57.62	56.8	56.46	56.85	57.66
TEMPF	4/22/02	56.14	57.38	55.48	57.12	57.77	57.7
TEMPF	4/29/02	50.91	50.43	49.72	50.89	50.57	50.68
TEMPF	5/6/02	58.64	59.2	58.55	59.11	59.54	59.68
TEMPF	5/13/02	55.61	54.92	53.69	57.48	53.99	54.04
TEMPF	5/20/02	52.38	52.68	51.84	52.13	52.45	52.94

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
TEMPF	5/29/02	61.98	61.74	62.2	62.21	62.21	62.24
TEMPF	6/3/02	68.7	68.07	67.96	69.8	69.21	69.36
TEMPF	6/10/02	71.43	71.33	71.55	71.93	70.61	71.02
TEMPF	6/17/02	68.68	69.53	68.55	69.96	69.9	70.24
TEMPF	6/24/02	77.49	79.65	75.44	79.99	77.02	76.29
TEMPF	7/1/02	78.61	78.66	76.89	77.78	78.04	77.14
TEMPF	7/8/02	77.36	80.87	77.12	80.31	80	79.53
TEMPF	7/15/02	78.38	79.02	74.84	77.58	77.69	77.84
TEMPF	7/22/02	81.94	83.48	79.24	82.69	79.98	81.71
TEMPF	7/29/02	79.2	79.81	77.93	78.31	78.61	78.6
TEMPF	8/5/02	81.06	82.47	79.6	80.73	80.85	81.27
TEMPF	8/12/02	75.48	75.82	75.38	77.56	76.83	77.7
TEMPF	8/19/02	74.42	73.38	73.66	74.66	76.38	75.61
TEMPF	8/26/02	73.64	75.35	74.15	75.12	76.25	75.11
TEMPF	9/3/02	75.02	77.2	74.64	77.65	76.39	76.14
TEMPF	9/9/02	73.16	77.48	72.23	77.02	75.63	76.18
TEMPF	9/16/02	69.67	73.25	69.54	73.1	73.29	72.43
TEMPF	9/23/02	61.9	67.29	62.52	68.99	69.33	65.54
TEMPF	9/30/02	64.68	65.72	64.98	65.84	65.26	67.03
TEMPF	10/7/02	58.49	65.19	64.55	65.51	65.46	63.8
TEMPF	10/14/02	52.29	58.85	53.66	59.54	59.4	57.26
TEMPF	10/21/02	48.33	51.51	47.11	51.04	52.63	52.6
TEMPF	10/28/02	47.61	47.82	47.19	48.15	48.51	50.74
TSS	4/1/02	10	112	96	100	144	100
TSS	4/8/02	31	26	64	66	76	84
TSS	4/15/02	131	96	105	109	333	106
TSS	4/22/02	42	260	66	56	46	60
TSS	4/29/02	286	44	176	24	224	224
TSS	5/6/02	94	272	40	38	44	50
TSS	5/13/02	336	59	208	220	260	244
TSS	5/20/02	58	110	41	48	54	55
TSS	5/29/02	112	158	76	42	74	108
TSS	6/3/02	138	76	34	14	58	66
TSS	6/10/02	84	46	36	58	76	74
TSS	6/17/02	88	34	45	26	56	61
TSS	6/24/02	104	36	30	24	48	36
TSS	7/1/02	80	34	60	30	70	66
TSS	7/8/02	56	17	44	37	27	27
TSS	7/15/02	94	20	44	23	27	33
TSS	7/22/02	76	20	32	40	150	210
TSS	7/29/02	60	13	120	25	11	28
TSS	8/5/02	70	62	24	21	36	53
TSS	8/12/02	64	55	42	34	37	32
TSS	8/19/02	69	76	44	46	45	39
TSS	8/26/02	104	28	36	27	52	52

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
TSS	9/3/02	54	11	35	11	17	21
TSS	9/9/02	46	46	25	15	10	20
TSS	9/16/02	61	6	38	16	22	27
TSS	9/23/02	46	11	36	15	17	70
TSS	9/30/02	52	19	23	29	10	13
TSS	10/7/02	20	51	15	10	9	13
TSS	10/14/02	32	23	19	20	27	33
TSS	10/21/02	12	20	15	13	20	27
TSS	10/28/02	60	20	70	10	20	20
DEPTH	04/07/03	7.09	11.48	6.52	13.53	11.24	14.59
DEPTH	04/14/03	3.01	9.54	3.41	11.69	3.63	8.02
DEPTH	04/21/03	2.06	9.27	2.88	11.55	2.84	6.39
DEPTH	04/28/03	1.54	9.15	1.91	11.31	1.98	6.04
DEPTH	05/05/03	11.07	12.04	7.58	14.12	11.45	15.57
DEPTH	05/12/03	15.81	16.53	9.58	18.73	18.41	21.48
DEPTH	05/19/03	3.28	10.46	4.19	12.27	6.35	9.48
DEPTH	05/27/03	1.84	9.08	3.06	11.01	1.66	6.07
DEPTH	06/02/03	2.27	9.19	2.73	11.3	1.97	6.17
DEPTH	06/09/03	2.19	9.15	3.01	11.32	2.19	5.93
DEPTH	06/16/03	9.63	11.01	3.34	13.38	8.96	11.97
DEPTH	06/23/03	5.57	9.43	2.69	11.92	4.79	8.6
DEPTH	06/30/03	2.14	9.38	2.37	11.29	2.2	5.87
DEPTH	07/07/03	17	13.25	12.57	15.36	15.44	18.95
DEPTH	07/15/03	11.35	11.82	2.97	13.91	10.82	14.98
DEPTH	07/21/03	6.03	12.27	5.04	14.37	12.56	17.65
DEPTH	07/28/03	5.55	10.44	5.08	12.95	5.61	9.29
DEPTH	08/04/03	11.27	12.1	6.52	14.46	11.88	15.2
DEPTH	08/11/03	4.24	9.97	3.66	12.01	4.44	8.52
DEPTH	08/18/03	2.25	9.83	2.42	11.51	2.62	6.45
DEPTH	08/25/03	2.11	9.09	3.09	11.2	1.75	5.9
DEPTH	09/02/03	9.03	12.63	10.54	15.51	13.85	16.98
DEPTH	09/08/03	5.09	10.13	3.55	12.16	5.07	8.84
DEPTH	09/15/03	1.88	9.61	3.44	12.07	3.12	7.26
DEPTH	09/22/03	2.18	9.62	3.15	11.93	7.39	7.55
DEPTH	09/29/03	11.42	12.19	5.98	14.3	12.21	15.51
DEPTH	10/06/03	3.06	9.58	3.49	11.96	3.05	7.5
DEPTH	10/13/03	2.19	9.34	1.67	11.58	2.15	6.38
DEPTH	10/20/03						
DEPTH	10/27/03	2.64	9.61	2.38	11.69	2.64	6.49
DO	04/07/03	6.01	5.8	6.26	7.12	7.36	4.9
DO	04/14/03	7.25	8.62	9.05	9.64	10.43	8.46
DO	04/21/03	16.51	15.57	9.91	10.7	10.54	12.28
DO	04/28/03	15.37	20.36	11.72	13.74	13.55	12.52
DO	05/05/03	10.02	9.81	10.67	11.3	10.78	10.03
DO	05/12/03	9.36	8.19	11.14	10.75	8.4	9.41

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
DO	05/19/03	7.9	7.14	9.10	9.29	9.03	8.7
DO	05/27/03	10.49	10.92	10.01	10.33	10.37	9.87
DO	06/02/03	11.78	11.8	9.74	10.36	9.89	9.98
DO	06/09/03	8.7	8.35	9.24	9.84	8.98	9.32
DO	06/16/03	3.11	3.14	4.07	4.22	5.96	3.64
DO	06/23/03	6.75	7.05	7.66	10.25	8.48	8.07
DO	06/30/03	7.56	8.22	5.03	5.68	7.01	5.93
DO	07/07/03	2.78	5.8	4.19	7.12	6.35	2.84
DO	07/15/03	1.38	1.43	4.43	6.13	2.77	2.74
DO	07/21/03	6.03	7.69	7	9.11	7.28	7.92
DO	07/28/03	6.78	6.74	7.32	8.07	8.47	7.12
DO	08/04/03	2.3	9.71	3.32	3.45	6.71	2.66
DO	08/11/03	6.62	6.24	8.02	8.15	8.29	7.6
DO	08/18/03	9.76	11.54	8.49	9.72	9.13	10.4
DO	08/25/03	11.64	13.22	6.47	13.63	8.16	7.07
DO	09/02/03	6.24	5.85	7.19	7.18	6.81	6.9
DO	09/08/03	7.37	7.25	8.63	8.74	9.04	8.5
DO	09/15/03	9.78	8.05	8.08	8.89	8.99	7.88
DO	09/22/03	7.71	10.28	6.55	7.33	9.11	6.78
DO	09/29/03	6.67	7.00	9.16	9.37	8.29	7.62
DO	10/06/03	9.8	9.62	11	10.9	11.06	10.41
DO	10/13/03	8.32	9.33	9.9	9.53	9.8	9.48
DO	10/20/03						
DO	10/27/03	8.8	8.82	10.77	10.11	10.62	10.68
ECOLI	04/07/03	6	32	Failed	8	Failed	32
ECOLI	04/14/03	18	8	16	34	80	36
ECOLI	04/21/03	6	20	9	5	9	7
ECOLI	04/28/03	7	8	4	3	13	48
ECOLI	05/05/03	8	8	8	12	28	28
ECOLI	05/12/03	1200	2000	1300	700	1100	1000
ECOLI	05/19/03	76	249	62	78	146	152
ECOLI	05/27/03	52	88	94	76	84	64
ECOLI	06/02/03	28	36	30	38	40	352
ECOLI	06/09/03	224	20	54	80	44	296
ECOLI	06/16/03	720	300	150	130	495	500
ECOLI	06/23/03	540	260	60	40	320	340
ECOLI	06/30/03	240	620	100	190	400	500
ECOLI	07/07/03	370	250	1040	360	250	200
ECOLI	07/15/03	200	500	<100	500	300	1500
ECOLI	07/21/03	320	200	340	440	140	140
ECOLI	07/28/03	30	20	10	60	10	15
ECOLI	08/04/03	416	800	780	640	760	840
ECOLI	08/11/03	290	340	190	120	230	250
ECOLI	08/18/03	288	29	52	54	42	78
ECOLI	08/25/03	65	67	35	20	26	22

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
ECOLI	09/02/03	4	24	2	8	10	8
ECOLI	09/08/03	38	34	48	96	14	20
ECOLI	09/15/03	120	3	168	92	3	1
ECOLI	09/22/03	116	5	132	92	5	7
ECOLI	09/29/03	80	64	176	184	104	24
ECOLI	10/06/03	30	18	76	104	80	78
ECOLI	10/13/03	70	56	106	20	136	84
ECOLI	10/20/03						
ECOLI	10/27/03	15	1	18	23	15	52
NH3-N	04/07/03	0.239	0.294	0.190	0.181	0.261	0.246
NH3-N	04/14/03	0.221	0.050	0.427	0.081	0.030	0.092
NH3-N	04/21/03	0.2	0.300	<0.1	<0.1	<0.1	0.100
NH3-N	04/28/03	0.003	0.003	<0.003	<0.003	<0.003	<0.003
NH3-N	05/05/03	0.507	0.271	0.219	0.062	0.170	0.242
NH3-N	05/12/03	0.26	0.188	0.174	0.313	0.144	0.156
NH3-N	05/19/03	0.1	0.100	<0.1	<0.1	<0.1	<0.1
NH3-N	05/27/03	0.054	0.011	0.098	0.027	0.005	0.043
NH3-N	06/02/03	0.113	0.003	<0.003	<0.003	<0.003	<0.003
NH3-N	06/09/03	0.0487	0.035	0.007	<0.003	0.082	0.048
NH3-N	06/16/03	0.2	0.300	0.200	<0.1	0.200	0.300
NH3-N	06/23/03	0.0405	0.016	0.037	0.018	0.019	0.035
NH3-N	06/30/03	0.0169	0.036	0.099	0.053	0.030	0.060
NH3-N	07/07/03	0.142	0.072	0.119	0.047	0.070	0.063
NH3-N	07/15/03	0.0237	0.014	0.024	0.011	0.012	0.034
NH3-N	07/21/03	0.1	0.200	0.100	<0.1	0.200	0.200
NH3-N	07/28/03	0.148	0.036	0.063	0.023	0.010	0.047
NH3-N	08/04/03	0.0394	0.068	0.060	0.077	0.071	0.060
NH3-N	08/11/03	0.0234	0.143	0.029	0.012	0.053	0.046
NH3-N	08/18/03	0.1	0.100	<0.1	<0.1	<0.1	<0.1
NH3-N	08/25/03	0.0105	0.035	0.027	0.155	0.039	0.101
NH3-N	09/02/03	0.244	0.174	0.119	0.076	0.082	0.078
NH3-N	09/08/03	0.0892	0.016	0.047	0.029	0.011	0.024
NH3-N	09/15/03	0.0166	0.162	0.022	0.024	0.046	0.133
NH3-N	09/22/03	0.1	0.300	<0.1	<0.1	0.200	0.100
NH3-N	09/29/03	0.0226	0.028	0.052	0.043	0.022	0.023
NH3-N	10/06/03	0.0511	0.037	0.051	0.039	0.031	0.049
NH3-N	10/13/03	0.004	0.004	<0.004	0.009	<0.004	<0.004
NH3-N	10/20/03						
NH3-N	10/27/03	0.0929	0.074	0.018	0.034	0.029	0.111
PH	04/07/03	7.03	6.95	7.06	7.07	6.95	7.01
PH	04/14/03	7.26	7.1	7.3	7.28	6.95	7.27
PH	04/21/03	8.43	8.05	8.02	8	7.81	8.11
PH	04/28/03	8.21	8.14	8.09	8.15	8.15	8.04
PH	05/05/03	7.2	7.24	7.45	7.58	7.24	7.59
PH	05/12/03	7.06	6.95	7.01	7.08	6.69	7.08

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
PH	05/19/03	7.7	7.12	7.18	7.27	7.07	7.70
PH	05/27/03	8.21	7.7	8.05	7.87	7.33	8.05
PH	06/02/03	8.6	8.6	8.5	8.6	8.4	8.4
PH	06/09/03	8	7.80	8.40	8.3	7.6	8.1
PH	06/16/03	6.97	7.03	7.39	7.48	6.87	7.13
PH	06/23/03	6.78	6.99	7.21	7.67	7.37	6.99
PH	06/30/03	7.76	7.72	7.46	7.63	7.7	7.62
PH	07/07/03	6.95	6.95	7.48	7.07	6.94	7.16
PH	07/15/03	7.15	7.03	7.4	7.35	6.92	7.22
PH	07/21/03	7.13	7.13	7.45	7.71	6.93	7.32
PH	07/28/03	7.18	7.09	7.25	7.32	7.06	7.12
PH	08/04/03	7.18	7.11	7.21	7.26	6.85	7.22
PH	08/11/03	7.28	7.07	7.44	7.23	7.01	7.39
PH	08/18/03	8.03	8.04	8.15	8.19	7.76	8.13
PH	08/25/03	7.93	7.83	7.53	7.67	7.49	7.49
PH	09/02/03	7.1	7.21	7.09	7.27	7.02	7.16
PH	09/08/03	7.1	7.12	7.23	7.19	6.91	7.23
PH	09/15/03	7.64	7.37	7.67	7.61	7.4	7.51
PH	09/22/03	8.18	8.08	7.85	7.98	7.73	7.98
PH	09/29/03	6.31	6.24	6.35	6.41	6.2	6.39
PH	10/06/03	7.07	6.89	7.1	7.01	6.89	7.16
PH	10/13/03	7.19	7.16	7.37	7.33	7.08	7.36
PH	10/20/03						
PH	10/27/03	6.92	6.88	7.15	7.13	6.93	7.13
PHOS	04/07/03	0.438	0.499	0.320	0.348	0.337	0.438
PHOS	04/14/03						
PHOS	04/21/03	0.15	0.150	0.110	0.130	0.060	0.140
PHOS	04/28/03	0.027	0.087	0.190	0.079	0.106	0.160
PHOS	05/05/03	1.38	0.573	0.411	0.174	0.421	0.444
PHOS	05/12/03	0.694	0.763	0.263	0.358	0.605	0.620
PHOS	05/19/03	0.33	0.370	0.160	0.140	0.230	0.240
PHOS	05/27/03	0.286	0.145	0.241	0.225	0.215	0.241
PHOS	06/02/03	0.173	0.119	0.219	0.057	0.117	0.094
PHOS	06/09/03	0.03	0.121	< 0.02	0.021	0.075	0.081
PHOS	06/16/03	0.5	0.54	0.16	0.1	0.44	0.500
PHOS	06/23/03	0.265	0.262	0.139	0.120	0.288	0.319
PHOS	06/30/03	0.057	0.175	0.187	0.131	0.153	0.176
PHOS	07/07/03	0.358	0.406	0.124	0.136	0.378	0.382
PHOS	07/15/03	1.904	1.248	1.426	0.793	1.131	1.133
PHOS	07/21/03	0.51	0.420	0.400	0.350	0.390	0.320
PHOS	07/28/03	0.322	0.261	0.494	0.192	0.219	0.238
PHOS	08/04/03	0.501	0.583	0.495	0.316	0.458	0.497
PHOS	08/11/03	0.309	0.255	0.225	0.145	0.190	0.208
PHOS	08/18/03	0.19	0.180	0.110	0.100	0.130	0.140
PHOS	08/25/03	0.252	0.176	0.081	0.126	0.141	0.136

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
PHOS	09/02/03	0.661	0.506	0.518	0.541	0.553	0.644
PHOS	09/08/03	0.197	0.168	0.150	0.110	0.188	0.129
PHOS	09/15/03	0.082	0.072	0.085	0.009	0.041	0.183
PHOS	09/22/03	0.22	0.220	0.120	0.110	0.150	0.180
PHOS	09/29/03	0.337	0.515	0.331	0.279	0.420	0.491
PHOS	10/06/03	0.152	0.203	0.181	0.153	0.208	0.211
PHOS	10/13/03	0.201	0.184	0.132	0.107	0.125	0.169
PHOS	10/20/03						
PHOS	10/27/03	0.207	0.159	0.112	0.062	0.137	0.151
TDS	04/07/03	236	208	272	260	244	284
TDS	04/14/03	428	422	390	370	362	400
TDS	04/21/03	522	508	436	483	448	467
TDS	04/28/03	578	548	426	420	458	480
TDS	05/05/03	320	272	366	394	310	348
TDS	05/12/03	220	224	300	308	272	292
TDS	05/19/03	348	348	355	412	359	373
TDS	05/27/03	452	524	352	372	412	404
TDS	06/02/03	576	536	400	440	440	456
TDS	06/09/03	490	484	474	468	462	488
TDS	06/16/03	319	311	402	408	328	317
TDS	06/23/03	212	228	332	336	220	224
TDS	06/30/03	126	118	98	100	109	115
TDS	07/07/03	104	124	296	212	120	100
TDS	07/15/03	140	128	316	288	152	132
TDS	07/21/03	266	168	257	328	207	218
TDS	07/28/03	336	324	296	392	328	308
TDS	08/04/03	156	204	232	256	180	200
TDS	08/11/03	268	276	340	324	296	312
TDS	08/18/03	473	462	380	366	390	417
TDS	08/25/03	496	400	316	264	332	388
TDS	09/02/03	236	144	176	188	232	272
TDS	09/08/03	272	292	304	316	280	300
TDS	09/15/03	452	340	296	300	288	360
TDS	09/22/03	607	402	411	394	437	497
TDS	09/29/03	192	172	224	244	176	168
TDS	10/06/03	352	352	328	304	308	320
TDS	10/13/03	592	536	472	444	496	504
TDS	10/20/03						
TDS	10/27/03	572	492	436	432	476	468
TEMPF	04/07/03	41.1	41.34	39.73	40.11	40.87	41.04
TEMPF	04/14/03	51.2	50.92	50.22	51.05	50.81	51.19
TEMPF	04/21/03	59.1	60.01	58.49	59.16	59.68	59.67
TEMPF	04/28/03	57.3	56.49	56.52	57.02	56.63	56.28
TEMPF	05/05/03	54.1	54.77	56.52	57.56	55.74	55.07
TEMPF	05/12/03	59.3	59.76	57.34	57.86	59.24	59.4

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
TEMPF	05/19/03	61.3	59.83	59.47	59.84	59.72	61.7
TEMPF	05/27/03	61.0	61.16	60.26	61.7	61.52	62.42
TEMPF	06/02/03	61.5	62.78	62.60	62.78	62.78	63.14
TEMPF	06/09/03	63.7	64.4	64.04	65.12	63.68	65.48
TEMPF	06/16/03	68.6	67.61	69.59	68.95	67.92	68.25
TEMPF	06/23/03	68.2	69.14	70.16	73.33	69.70	69.35
TEMPF	06/30/03	70.8	71.35	71.54	73.58	73.17	72.24
TEMPF	07/07/03	72.9	71.98	75.85	75.27	72.3	72.71
TEMPF	07/15/03	73.9	74.24	72.74	74.3	74.43	74.77
TEMPF	07/21/03	70.4	69.73	70.64	72.58	71.03	71.47
TEMPF	07/28/03	72.0	71.73	71.34	73.3	72.17	72.04
TEMPF	08/04/03	70.9	70.83	69.25	70.63	70.73	70.86
TEMPF	08/11/03	71.5	71.85	72.06	72.5	72.43	72.79
TEMPF	08/18/03	74.3	76.4	75.4	77.29	77.68	77.19
TEMPF	08/25/03	73.0	75.86	73.24	77.35	76.14	75.37
TEMPF	09/02/03	65.8	65.58	63.48	64.04	64.76	65.21
TEMPF	09/08/03	67.0	67.1	66.49	66.36	66.93	67.38
TEMPF	09/15/03	68.1	69.69	68.28	69.37	69.96	69.57
TEMPF	09/22/03	63.3	65.79	63.88	66.24	66.96	66.23
TEMPF	09/29/03	57.7	58.1	56.26	56.96	57.86	58
TEMPF	10/06/03	50.8	52.18	50.38	51.01	51.32	51.80
TEMPF	10/13/03	57.5	60.31	57.39	58.76	60.05	58.85
TEMPF	10/20/03						
TEMPF	10/27/03	48.7	50.25	49.47	50.57	50.73	50.92
TSS	04/07/03	146	166	74	90	108	110
TSS	04/14/03	46	33	30	25	29	34
TSS	04/21/03	38	35	40	9	39	37
TSS	04/28/03	30	24	23	26	30	25
TSS	05/05/03	1220	536	372	124	374	308
TSS	05/12/03	340	392	144	176	356	260
TSS	05/19/03	114	118	57	39	82	82
TSS	05/27/03	43	39	39	28	35	43
TSS	06/02/03	41	35	35	27	40	34
TSS	06/09/03	44	22	18	14	30	34
TSS	06/16/03	202	188	45	22	176	196
TSS	06/23/03	88	92	59	35	64	110
TSS	06/30/03	38	41	29	26	29	35
TSS	07/07/03	134	232	116	54	246	222
TSS	07/15/03	32	33	58	42	36	40
TSS	07/21/03	344	340	246	236	292	216
TSS	07/28/03	80	36	196	72	37	49
TSS	08/04/03	98	136	89	87	139	126
TSS	08/11/03	47	25	35	31	32	40
TSS	08/18/03	45	37	35	28	39	47
TSS	08/25/03	31	26	14	13	17	11

Fort Wayne River Sampling Data

Parameter	Date	St. Marys River @ Ferguson	St. Marys River @ Spy Run	St. Joseph River @ Mayhew	St. Joseph River @ Tennessee	Maumee River @ Anthony	Maumee River @ Landin
TSS	09/02/03	232	100	103	200	216	210
TSS	09/08/03	38	33	26	20	27	40
TSS	09/15/03	27	33	44	38	32	46
TSS	09/22/03	40	30	28	25	31	44
TSS	09/29/03	94	102	65	63	100	73
TSS	10/06/03	18	21	31	22	29	26
TSS	10/13/03	7	14.4	19.2	18.4	20	32.8
TSS	10/20/03						
TSS	10/27/03	6.5	16	17.5	22.4	23.2	21

ATTACHMENT 5

SECTION 3 – IDENTIFICATION OF POLLUTANTS OF INTEREST

The first step of this evaluation was to identify any pollutants of interest in the City of Fort Wayne receiving streams. If pollutants of interest were identified in the City's rivers, they could be traced to CSO (SIU) or upstream (unknown) sources. If pollutants of interest were also identified in the WPCP influent, this would contribute to the theory that the sources of pollutants were from within the City, thus validating further evaluation of the SIUs.

RIVER EVALUATION

The IDEM and Fort Wayne river samples were collected at eight and six (of the eight) stations, respectively, in and near the City of Fort Wayne (Figure 3-1). The station locations are described as follows:

STATION # 1 (IDEM Monitoring Site)
Stream: Cedar Creek
Description: Hursh Road Bridge 2 miles East of SR 427
FSITE: CC-4
LSITE: LEJ090-0026
Latitude: 41°12'54"
Longitude: -85°3'05"
Northing Decimal Degrees: 4564455.163
Easting Decimal Degrees: 663351.7012

STATION # 2 (IDEM & Fort Wayne Monitoring Site)
Stream: St. Joseph River
Description: Mayhew Road Bridge, NE of Fort Wayne
FSITE: STJ-8
LSITE: LEJ100-0002
Latitude: 41°10'05"
Longitude: -85°04'26"
Northing Decimal Degrees: 4559201.274
Easting Decimal Degrees: 661580.866

STATION # 3 (IDEM & Fort Wayne Monitoring Site)
Stream: St. Joseph River
Description: Tennessee Bridge, Fort Wayne
FSITE: STJ-.5
LSITE: LEJ100-0003
Latitude: 41°05'21"
Longitude: -85°07'45"
Northing Decimal Degrees: 4550341.837
Easting Decimal Degrees: 657131.5727

STATION # 4 (IDEM & Fort Wayne Monitoring Site)

Stream: St. Mary's River
Description: Ferguson Road Bridge, West of Winchester Road, Fort Wayne
FSITE: STM-11
LSITE: LES060-0005
Latitude: 40°59'28"
Longitude: -85°07'01"
Northing Decimal Degrees: 4539477.954
Easting Decimal Degrees: 658393.1648

STATION # 5 (IDEM & Fort Wayne Monitoring Site)

Stream: St. Mary's River
Description: Spy Run Bridge, Fort Wayne
FSITE: STM-.2
LSITE: LES060-0004
Latitude: 41°05'02"
Longitude: -85°08'09"
Northing Decimal Degrees: 4549743.903
Easting Decimal Degrees: 656584.1442

STATION # 6 (IDEM & Fort Wayne Monitoring Site)

Stream: Maumee River
Description: Anthony Boulevard, Fort Wayne, Upstream of WPCP
FSITE: M-132
LSITE: LEM010-0012
Latitude: 41°04'55"
Longitude: -85°06'53"
Northing Decimal Degrees: 4549566.177
Easting Decimal Degrees: 658362.1687

STATION # 7 (IDEM & Fort Wayne Monitoring Site)

Stream: Maumee River
Description: Upstream of Landin Road Bridge, Downstream of county boat ramp, Fort Wayne WPCP
FSITE: M-129
LSITE: LEM010-0014
Latitude: 41°05'04"
Longitude: -85°01'14"
Northing Decimal Degrees: 4550019.109
Easting Decimal Degrees: 666266.2313

STATION # 8 (IDEM Monitoring Site)

Stream: Maumee River
Description: SR 101 Bridge, 3 Miles North of Woodburn
FSITE: M-114

IDEM Fort Wayne Rivers - Field Data - Years 2002 and 2003

Station	Sample Date	Sample Time	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	COMMENTS
1	01/14/02	10:30						5.9	
1	02/18/02	11:21	12.18	2.7		8.25	673	6.11	
1	03/18/02	10:53	11.39	538		8	636	12.39	
1	04/15/02	10:31	9.6	13.8		7.8	509	55.19	
1	05/20/02	11:30	10.32	11.5		7.9		20.79	
1	06/17/02	11:30	11.32	17.7		8.14	779	7.96	
1	07/15/02	11:00	8.6	21.7		8.19	800	12.3	
1	08/19/02	12:00	7.6	21.2		7.86	809	18.6	
1	09/16/02	10:31	8.2	18.5		8	891	10.89	
1	10/21/02	11:10	10.77	7.76		7.65	715	6.82	
1	11/18/02	10:42	11.87	3.65		7.82	873	4.63	
1	12/16/02	10:44	12.85	1.6		7.73	940	4.66	
1	01/21/03	10:20							
1	02/18/03	10:31							
1	03/18/03	11:58	9.41	6.94		7.32	672	19.4	
1	04/21/03	12:00	11.7	14.6		7.9		66.7	Time of collection, Specific Conductivity not written down. Weather code incomplete.
1	05/19/03	10:36	8.53	15.3		7.27	651	28.7	
1	06/16/03	10:45	4.26	19.77		7.57	773	15.6	
1	07/21/03	10:09	6.03	20.1		7.52	541	208	
1	08/18/03	11:00	8.99	21.12		7.97	821	11	
1	09/22/03	10:25	6.85	15.53		7.0	794	13.6	
1	10/20/03	9:50	10.02	10.82		7.38	768	5.11	
1	11/17/03	9:40	10.87	7.83		7.56	805	1.6	
1	12/15/03	11:05	12.94	259		7.41	747	9.64	
2	01/14/02	[illegible]						53	
2	02/18/02	10:56	11.8	2.4		8.22	651	13.60	
2	03/18/02	10:33	4.53	6.5		7.96	217	61.7	
2	04/15/02	10:05	9.5	13.66		7.59	395	186	
2	05/20/02	11:27	10.21	11		7.98	369	46.9	
2	06/17/02	11:00	9.13	20.20		8.27	661	38.4	
2	07/15/02	10:30	6.7	23.7		8.1	697	41.2	
2	08/19/02	11:32	6.47	23.13		7.86	674	29.6	
2	09/16/02	9:41	6.8	20.79		7.9	772	32.29	
2	10/21/02	10:42	10.46	8.39		7.88	806	12.8	
2	11/18/02	10:21	11.24	8.6		7.78	790	14.3	
2	12/16/02	10:23	12.98	1.7		7.59	847	6.6	
2	01/21/03	10:00							
2	02/18/03	9:50							
2	03/18/03	11:01	9.65	3.56		7.21	491	42.9	
2	04/21/03	11:35	9.9	14.8		8		34.7	Time of collection, specific conductivity not written down.
2	05/19/03	9:46	9.1	15.2		7.18	577	46.5	
2	06/16/03	10:15	4.07	20.88		7.39	649	43.6	
2	07/21/03	9:46	7	21.4		7.45	419	114	
2	08/18/03	10:25	8.49	24.11		8.15	601	24.7	
2	09/22/03	10:00	6.55	17.71		7.86	607	29.7	
2	10/20/03	9:35	10.4	10.6		7.12	579	30.2	
2	11/17/03	9:20	11.4	8.78		7.89	707	3.9	
2	12/15/03	10:30	13.8	1.40		7.35	607	39.8	
3	01/14/02	9:45						5.09	
3	02/18/02	10:15	12.64	2.59		8.23	577	14.1	

IDEM Fort Wayne Rivers - Field Data - Years 2002 and 2003

Station	Sample Date	Sample Time	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	COMMENTS
3	03/18/02	9:50	11.79	6.66		7.98	505	6.71	
3	04/15/02	8:45	9.9	13.5		7.69	307	161	
3	05/20/02	9:40	11.21	11.1		7.9	388	68.9	
3	06/17/02	10:32	9.66	21		8.31	660	21.39	
3	07/15/02	10:00	9.2	25.29		8.19	696	24.6	
3	07/17/02	10:50	15.3	27.36		8.5	591	28	
3	08/19/02	10:47	6.72	23.7		7.76	554	24.79	
3	09/16/02	9:15	5.6	22.79		7.59	868	11	
3	10/21/02	9:59	10.12	10.56		7.92	788	11.19	
3	11/18/02	9:53	9.81	5.86		7.51	774	8.43	
3	12/16/02	9:48	13.83	0.06		7.57	651	5.84	
3	01/21/03	9:20							
3	02/18/03	9:40							
3	03/18/03	10:12	12.86	3.13		7.26	481	54.9	
3	04/21/03	9:35	10.7	15		8		26.9	Time of collection, Specific conductivity not written down. Weather code incomplete.
3	05/19/03	9:09	9.29	15.4		7.27	578	44.8	
3	06/16/03	9:40	4.22	20.52		7.48	679	20.9	
3	07/21/03	9:15	9.11	22.5		7.71	431	144	
3	08/18/03	10:01	9.72	25.16		8.19	598	21.4	
3	09/22/03	9:30	7.33	19.02		7.98	677	21.3	
3	10/20/03	9:15	10.11	11.18		7.04	557	31.9	
3	11/17/03	8:50	11.47	6.52		7.87	703	6.97	
3	12/15/03	10:00	13.98	1.64		7.32	608	45	
4	01/14/02	12:30						3.79	
4	02/18/02	13:25	11.20	2.7		8.17	815	10.8	
4	03/18/02	12:28	10.99	6.42		7.9	760	56.7	
4	04/15/02	11:15	8.6	15		7.69	519	304	
4	05/20/02	13:15	10.21	11.3		7.78		71.5	
4	06/17/02	13:50	10.79	20.29		8.32	923	79	
4	07/18/02	13:20	15.3	25.7		8.69	1174	70	
4	08/15/02	13:45	7.21	23.66		7.8	1080	80.2	
4	09/16/02	11:38	9.4	20.89		8.19	138	45.2	
4	10/21/02	12:56	15.73	9.06		8.51	1551	16.79	
4	11/18/02	12:16	9.74	4.13		7.55	1047	16.1	
4	12/16/02	12:30	15.75	0.28		7.00	1345	2.74	
4	01/21/03	12:05							
4	02/18/03	11:50							
4	03/18/03	13:27	7.9	6.12		7.15	375	136	
4	04/21/03	13:30	16.5	15		8.4		22.5	Time of collection, specific conductivity not written down. Weather code incomplete.
4	05/19/03	12:47	7.0	16.3		7.7	509	137	
4	06/16/03	12:40	3.11	20.31		6.97	381	334	
4	07/21/03	11:59	6.03	21.3		7.13	368	231	
4	08/18/03	12:20	9.76	23.61		8.03	772	35.3	
4	09/22/03	12:00	7.71	17.37		8.18	1042	34.6	
4	10/20/03	12:00	7.99	11.3		7.06	882	86.6	
4	11/17/03	11:34	9.9	7.62		7.67	728	2.2	
4	12/15/03	12:50	12.83	1.37		7.34	566	76.6	
5	01/14/02	9:15						4.19	
5	02/18/02	9:53	12.18	2.9		8.11	779	17.29	
5	03/18/02	9:36	10.85	685		7.92	750	2.96	

IDEM Fort Wayne Rivers - Field Data - Years 2002 and 2003

Station	Sample Date	Sample Time	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	COMMENTS
5	04/15/02	9:25	8.6	14.19		7.69	542	169	
5	05/20/02	9:32	9.45	11.39		7.5	486	91.4	
5	06/17/02	10:22	8.49	20.79		7.6	771	45.79	
5	07/15/02	9:45	10.3	26.1		8	930	19.2	
5	07/17/02	10:40	5.5	26.89		7.8	1030	22	
5	08/19/02	10:23	4.04	22.67		7.13	602	32.79	
5	09/16/02	9:02	7.5	21.58		7.75	166	20	
5	10/21/02	9:38	10.69	10.82		7.92	1062	20.6	
5	11/18/02	9:30	7.47	5.42		7.26	911	26.69	
5	12/16/02	9:25							
5	01/21/03	9:17							
5	02/18/03	9:35							
5	03/18/03	9:47	9.55	6.5		7.12	382	147	
5	04/21/03	9:20	10.5	15.3		7.8		26.6	Time of collection, Specific Conductivity not written down. Weather code incomplete
5	05/19/03	8:40	7.14	15.4		7.12	539	129	
5	06/16/03	9:20	3.14	19.76		7.03	410	286	
5	07/21/03	8:59	7.69	20.9		7.13	196	254	
5	08/18/03	9:45	11.54	24.66		8.04	755	30.2	
5	09/22/03	9:15	10.28	18.77		8.06	749	30.7	
5	10/20/03	9:00	7.5	11.21		6.84	570	34.8	
5	11/17/03	8:30	10.02	6.66		7.7	751	15.5	
5	12/15/03	9:40	12.65	1.26		7.21	587	79.6	
6	01/14/02	10:30	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	
6	02/18/02	9:34	13.26	2.7		8.11	627	15.5	
6	03/18/02	10:30	11.73	6.9		7.96	581	569	
6	04/15/02	9:09	9.8	13.8		7.59	433	173	
6	05/20/02	8:50	11.03	11.3		7.32	393	65.4	
6	06/17/02	9:56	8.97	21		8.1	685	53	
6	07/15/02	9:30	8.2	25.29		7.8	755	29.89	
6	08/19/02	9:59	5.36	24.04		7.17	945	31.6	
6	09/16/02	8:39	6.9	22.86		7.4	896	12.3	
6	10/21/02	9:01	10.16	11.46		7.8	799	16.39	
6	11/18/02	9:07	10.24	5.88		7.4	788	21	
6	12/16/02	9:25	13.3	1.39		7.28	1038	4.3	
6	01/21/03	8:57	13.36	0.16		7.34	1027	6.68	
6	02/18/03	9:12	9.91	0.21		6.5	969	9.71	
6	03/18/03	9:25	10.59	4.52		7.08	411	127	
6	04/21/03	8:45	10.5	15.3		7.8		303	
6	05/19/03	8:07	9.03	15.4		7.07	556	84.2	
6	06/16/03	8:55	5.96	19.96		6.87	460	238	
6	07/21/03	8:33	7.28	21.6		6.93	342	230	
6	08/18/03	9:15	9.13	25.37		7.76	645	30	
6	09/22/03	8:56	9.11	19.42		7.73	736	20.8	
6	10/20/03	8:40	10.78	11.13		6.59	558	35.1	
6	11/17/03	8:10	11.31	6.69		7.83	726	162.2	
6	12/15/03	9:15	14.5	1.52		7.14	600	63.8	
7	01/14/02	12:00						7.3	
7	02/18/02	12:48	11.46	3.29		8.15	649	15.1	
7	03/18/02	12:02	11.4	7.01		7.92	504	58.79	
7	04/15/02	11:40	8.6	14.19		7.60	441	267	

IDEM Fort Wayne Rivers - Field Data - Years 2002 and 2003

Station	Sample Date	Sample Time	Dissolved Oxygen (mg/L)	Water Temperature (C)	Saturation PerCent (%)	pH (SU)	Specific Conductance (uS/cm)	Turbidity (NTU)	COMMENTS
7	05/20/02	12:35	11.48	11.6		7.86	524	77.59	
7	06/17/02	12:40	9.6	21.2		8.07	721	55.6	
7	07/15/02	13:00	6.9	25.39		7.8	873	27.1	
7	08/19/02	13:17	6.75	24.21		7.48	1025	26.5	
7	09/16/02	11:12	4.2	22.39		7.5	980	17.39	
7	10/21/02	12:22	9.76	11.43		7.97	904	9.77	
7	11/18/02	11:47	9.62	6.3		7.57	824	18.29	
7	12/16/02	11:55	12.28	3.06		7.59	1083	4.09	
7	01/21/03	11:23	13.74	0.11		7.1	1085	6.47	
7	02/18/03	11:11	8.85	0.37		7.1	10.39	9.2	
7	03/18/03	13:01	9.4	4.76		7.21	244	133	
7	04/21/03	13:00	12.2	15.3		8.1		28.0	Time of collection, specific conductivity not written down. Weather code incomplete
7	05/19/03	12:17	8.7	16.5		7.7	548	66.6	
7	06/16/03	11:55	3.84	20.13		7.13	483	239	
7	07/21/03	13:16	7.92	21.6		7.32	351	184	
7	08/18/03	13:00	10.4	25.1		8.13	699	30.4	
7	09/22/03	11:25	6.78	19.02		7.98	860	34.8	
7	10/20/03	10:55	10.05	11.53		7.23	579	35.2	
7	11/17/03	11:00	10.98	7.34		7.82	752	8.4	
7	12/15/03	12:15	13.86	1.74		7.37	614	57.5	
8	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	5.69	
8	02/18/02	12:13	11.76	2.5		8.22	643	13.8	
8	03/18/02	11:38	11.1	7.17		7.94	575	63	
8	04/15/02	11:14	9.2	4.5		7.59	427	211	
8	05/20/02	12:10	9.5	11.36		7.8	405	86.59	
8	06/17/02	12:15	11.27	22.26		8.27	719	46.59	
8	07/15/02	11:30	12	26.6		8.59	786	34.79	
8	08/19/02	12:45	6.97	24.86		7.73	772	22.5	
8	09/16/02	10:44	14	22.1		8.5	910	13.3	
8	10/21/02	11:40	11.63	10		7.94	880	9.85	
8	11/18/02	11:18	10.13	5.32		7.56	840	16.2	
8	12/16/02	11:22	15.16	1.39		7.75	1074	3.31	
8	01/21/03	10:54	14.01	0		7.38	1053	6.28	
8	02/18/03	10:39	9.76	0		7	1014	9.08	
8	03/18/03	12:34	10.3	4.06		7.22	425	124	
8	04/21/03	12:35	14.4	15		8.2		23.1	Time of collection, specific conductivity not written down. Weather code incomplete.
8	05/19/03	11:50	8.5	16		7.7	551	45.4	
8	06/16/03	11:20	3.56	20.05		7.17	418	328	
8	07/21/03	12:49	7.14	21.6		7.15	353	247	
8	08/18/03	11:30	11.7	24.86		8.34	682	26.5	
8	09/22/03	11:00	8.09	19		8.34	757	21.6	
8	10/20/03	10:30	9.59	11.5		7.21	579	32.6	
8	11/17/03	10:35	11.25	7.22		7.85	767	5	
8	12/15/03	11:45	13.82	1.76		7.38	602	62.4	

IDEM Fort Wayne Rivers - Metals - Years 2002 and 2003

Station	Sample Date	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Chromium (Total) (ug/L)	Copper (Dissolved) (ug/L)	Copper (Total) (ug/L)	Iron (Dissolved) (ug/L)	Iron (Total) (ug/L)	Lead (Dissolved) (ug/L)	Lead (Total) (ug/L)	Manganese (Dissolved) (ug/L)	Manganese (Total) (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Zinc (Dissolved) (ug/L)	Zinc (Total) (ug/L)	Hardness (as CaCO3) (mg/L)
1	01/14/02 10:30	1.5	< 1	< 1.2		1.97		407.4056		< 1			< 0.2	2.84		< 6	373
1	02/18/02 11:21	1.7	< 1	< 1.2				414.4965		< 1			< 0.2	2.93		< 6	328
1	03/18/02 10:50	1.35	< 1	< 1.2		2.36		592.1072		< 1			< 0.2	3.11		6.7564 (UJ)	326
1	04/15/02 10:31	2.01	< 1	3.25		4.94		2435.6394		1.84			< 0.2	5.05		13.8803	242
1	05/20/02 11:30	1.93	< 1	1.7		2.84		1230		< 1			< 0.2	3.59		6.41 (UJ)	282
1	06/17/02 11:50	1.84	< 1	< 1.2		1.71		353		< 1			< 0.2	2.74		< 6	359
1	07/15/02 11:00	2.19	< 1	1.61		2.59		827		< 1			< 0.2	3.79		< 6	353
1	08/15/02 12:00	2.88	< 1	1.82		2.77		1300		1.22			< 0.2	3.8		10.1 (UJ)	329
1	09/16/02 10:01	1.9	< 1	1.62		1.66		475		< 1			< 0.2	2.45		< 6	355
1	10/21/02 11:10	1.65	< 1	< 1.2		2.04		381		< 1			< 0.2	2		< 6	300
1	11/18/02 10:42	1.55	< 1	< 1.2		1.63		438		< 1			< 0.2	3.03		< 6	346
1	12/16/02 10:44	1.33	< 1	< 1.2		1.43		489		< 1			< 0.2	3.39		< 6	358
1	03/18/03 11:58	1.46	< 1	1.79				1350		1.48			< 0.2	4.25			294
1	04/21/03 12:00	1.63	< 1	< 1.2		2.33		419		< 1			< 0.2	3.01		< 6	337
1	05/15/03 10:06	2.63	< 1	2.27		4.19		1680		1.54			< 0.2			7.2	316
1	06/16/03 10:40	3.06	< 1	2.14		3.09		794		< 1			< 0.2	3.11		7.42	372
1	07/21/03 10:09	4.79	< 1	8.73		10		9180		0.56			< 0.2	11.8		42.2	340
1	08/18/03 11:00	2.11	< 1	< 1.2		2.67		378		< 1			< 0.2	2.59		7.68	374
2	01/14/02 10:00	1.32	< 1	< 1.2		1.36		3240.0291		< 1			< 0.2	2.25		< 6	306
2	02/18/02 10:35	1.6	< 1	< 1.2				679.6750		< 1			< 0.2	2.47		< 6	275
2	03/18/02 10:33	1.96	< 1	3.12		3.97		2620.7947		1.47			< 0.2	4.49		11.3905 (UJ)	242
2	04/15/02 10:06	2.82	< 1	7.48		8.03		6109.0117		3.95			< 0.2	8.51		24.6042	190
2	05/20/02 11:27	2.15	< 1	3.95		4.21		2560		1.94			< 0.2	11.1		12.9	191
2	06/17/02 11:30	2.43	< 1	2.42		3.25		1740		1.23			< 0.2	4.17		11 (UJ)	317
2	07/15/02 10:30	3.09	< 1	2.88		3.04		1490		1.17			< 0.2	4.38		16.6	339
2	08/14/02 11:32	2.35	< 1	2.3		3.12		1640		1.34			< 0.2	4.01		10.8 (UJ)	260
2	09/16/02 9:41	2.25	< 1	1.88		2.34		1230		1.12			< 0.2	3.96		7.39 (UJ)	321
2	10/21/02 10:42	2.05	< 1	< 1.2		1.89		826		< 1			< 0.2	2.84		< 6	357
2	11/18/02 10:21	1.68	< 1	< 1.2		1.62		617		< 1			< 0.2	2.52		< 6	324
2	12/16/02 10:20	1.57	< 1	< 1.2		1.49		342		< 1			< 0.2	2.99		< 6	348
2	03/18/03 11:01	1.62	< 1	2.9				2200		1.9			< 0.2	4.63			208
2	04/21/03 11:35	2.05	< 1	2.12		2.31		1250		1.46			< 0.2	5.03		8.45	296
2	05/19/03 9:46	2.58	< 1	3.02		4.84		2590		1.78			< 0.2			9.5	269
2	06/16/03 10:15	3.47	< 1	3.04		2.93		1980		1.61			< 0.2	8.72		11.5	307
2	07/21/03 9:46	4.83	< 1	9.24		12.7		9910		6.3			< 0.2	12.6		41.9	228
2	08/18/03 10:25	2.93	< 1	1.86		3.75		1570		1.39			< 0.2	4.04		9.14	206
3	01/14/02 9:45	1.32	< 1	< 1.2	1.29	1.68	17.7714	344.7904	< 1	< 1	45.68	46.07	< 0.2	2.35		< 6	343
3	02/18/02 13:15	1.6	< 1	< 1.2			34.6592	882.1932	< 1	< 1	24.21	37.69	< 0.2	2.83		6.0753 (UJ)	270
3	03/18/02 9:50	1.82	< 1	3.03	1.8	4.56	33.5314	2451.8806	< 1	1.52	23.74	64.17	< 0.2	4.46	< 3	11.4023 (UJ)	244
3	04/15/02 8:45	3.1	< 1	7.38	2.58	8.31	71.2868	6110.4522	< 1	4.17	13.55	109.3	< 0.2	8.68	8.22	24.734	184
3	05/20/02 9:40	2.53	< 1	4.03	2.16	5.16	62.1	3150	< 1	4.3	9.64	74.8	< 0.2	5.43	6.22	12.9	186
3	06/17/02 10:32	2.18	< 1	1.58	1.84	2.51	< 8	809	< 1	< 1	1.3	91.4	< 0.2	3.23	4.73	7.3 (UJ)	321
3	07/15/02 10:00	3.46	< 1	1.89	1.87	2.94	< 8	716	< 1	1.04	4.06	103	< 0.2	4.21	3.82	6.64 (UJ)	298
3	08/19/02 10:47	2.74	< 1	2.48	1.75	3.41	9.18	1350	< 1	2.04	9.56	111	< 0.2	3.58	10.6	12.8	225
3	09/16/02 9:15	3.29	< 1	< 1.2	1.2	1.44	< 8	562	< 1	< 1	6.72	133	< 0.2	2.93	< 3	< 6	315
3	10/21/02 9:59	2.31	< 1	< 1.2	1.03	1.65	< 8	417	< 1	< 1	5.7	95	< 0.2	2.64	7.83	< 6	353
3	11/18/02 9:53	1.61	< 1	< 1.2	1.5	1.93	55.4	402	< 1	< 1	41.4	79.1	< 0.2	2.34		< 6	318
3	12/16/02 9:46	1.39	< 1	< 1.2	1.36	1.67	26.6	367	< 1	< 1	10.3	46.7	< 0.2	2.66	10.1 (UJ)	< 6	356
3	03/18/03 10:12	1.95	< 1	2.77			135	2420	< 1	2.03	44.7	94.2	< 0.2	4.78			197
3	04/21/03 9:35	2.36	< 1	2.01	1.6	3.24	19.9	1220	< 1	1.22	3.11	104	< 0.2	4.89	< 3	9.5	328
3	05/19/03 9:02	2.52	< 1	2.63	2.3	4.52	102	2080	< 1	1.76	17.8	81.7	< 0.2		9.85	9.34	279
3	08/18/03 9:40	4.8	< 1	2.23	1.66	3.05	25.8	520	< 1	< 1	2.95	78.3	< 0.2	4.87	8.71	6.7	322

IDEM Fort Wayne Rivers - Metals - Years 2002 and 2003

Station	Sample Date	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Chromium (Total) (ug/L)	Copper (Dissolved) (ug/L)	Copper (Total) (ug/L)	Iron (Dissolved) (ug/L)	Iron (Total) (ug/L)	Lead (Dissolved) (ug/L)	Lead (Total) (ug/L)	Manganese (Dissolved) (ug/L)	Manganese (Total) (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Zinc (Dissolved) (ug/L)	Zinc (Total) (ug/L)	Hardness (as CaCO3) (mg/L)
3	07/21/03 9:15	4.05	< 1	7.09	2.79	10.9	36.6	6030	< 1	6.58	2.36	178	< 0.2	9.9	11.2	41.3	219
3	08/18/03 10:01	2.2	< 1	1.53	2.22	4.64	18.6	840	< 1	1.56	2.58	96.7	< 0.2	3.53	10.6	9.64	287
4	01/14/02 12:30	1.49	< 1	< 1.2		1.85		170.279		< 1			< 0.2	2.99		< 6	412
4	02/18/02 13:25	1.03	< 1	< 1.2				426.7022		< 1			< 0.2	2.82		< 6	382
4	03/18/02 12:28	1.7	< 1	3.06		3.49		1460.7236		< 1			< 0.2	4.01		9.0430 (UJ)	324
4	04/18/02 11:15	3.23	< 1	7.71		9.21		6936.436		4.42			< 0.2	9.16		27.3163	238
4	05/20/02 13:15	2.57	< 1	4.87		8.85		4050		2.6			< 0.2	6.97		18.2	248
4	07/18/02 13:00	3.87	< 1	3.14		4.27		1750		1.78			< 0.2	6.79		10.3 (UJ)	363
4	08/19/02 13:45	4.03	< 1	7.97		4.03		2120		2.17			< 0.2	5.99		13	329
4	09/16/02 11:59	3.98	< 1	1.93		3.07		1050		1.74			< 0.2	6.07		5.5 (UJ)	396
4	10/21/02 12:56	3.2	< 1	1.23		2.42		515		< 1			< 0.2	5.56		< 6	460
4	11/18/02 12:15	2.31	< 1	< 1.2		2.94		460		< 1			< 0.2	3.98		< 6	304
4	12/16/02 12:39	1.96	< 1	< 1.2		3.37		148		< 1			< 0.2	4.72		< 6	419
4	03/18/03 13:27	2.87	< 1	5.7				6000		4.36			< 0.2	7.74			176
4	04/21/03 13:30	1.77	< 1	1.53		2.85		680		< 1			< 0.2	4.41		11.3	383
4	05/15/03 12:47	3.30	< 1	6.32		7.88		5770		3.99			< 0.2	8.9 (JB)		24	253
4	06/16/03 12:40	5.42	< 1	9.72		11.4		11100		6.58			< 0.2	12.4		47.2	163
4	07/01/03 11:59	5.33	< 1	10.8		13.2		11400		7.82			< 0.2	14.5		44.2	201
4	08/18/03 12:20	3.31	< 1	1.77		4.45		1540		1.36			< 0.2	5.92		8.83	332
5	01/14/02 9:15	1.49	< 1	< 1.2	1.58	2.14	10.7493	351.9405	< 1	< 1	36.88	40.2	< 0.2	3.31		< 6	428
5	02/18/02 9:53	2.01	< 1	1.4			18.7022	720.5372	< 1	< 1	19	29.38	< 0.2	3.42		10.7384 (UJ)	346
5	03/18/02 9:38	1.65	< 1	1.76	1.99	3.53	21.3142	1296.6771	< 1	< 1	16.41	34.67	< 0.2	3.72	4.0437	8.1895 (UJ)	336
5	04/18/02 9:25	3.2	< 1	7.38	2.8	9.31	30.9641	7016.4338	< 1	4.6	12.36	92.62	< 0.2	8.96	3.7156	20.5854	244
5	05/20/02 9:32	2.69	< 1	4.62	3.16	6.9	60.1	4170	< 1	2.81	6.31	67.7	< 0.2	6.8	7.4	17.8	223
5	06/17/02 10:22	2.42	< 1	2.7	2.16	3.93	9.8	2220	< 1	1.56	21.9	76.4	< 0.2	4.05	4.29	11.9	329
5	07/15/02 9:45	3.45	< 1	1.56	1.66	2.31	12.2	506	< 1	< 1	27	104	< 0.2	4.42	5.5	7.56 (UJ)	317
5	08/19/02 10:23	3.79	< 1	2.96	1.48	6.56	46.5	1970	< 1	6.26	123	172	< 0.2	5.7	11.7	26.6	274
5	09/16/02 9:02	3.43	< 1	< 1.2	1.12	3	< 6	604	< 1	1.56	1.17	106	< 0.2	4.36	3.1	7.21 (UJ)	298
5	10/21/02 9:33	2.57	< 1	< 1.2	< 1	2.2	19.4	537	< 1	1.39	5.53	71.4	< 0.2	4.44	< 3	6.46 (UJ)	373
5	11/18/02 9:30	2.19	< 1	1.2	2.03	3.46	115	882	< 1	< 1	46.5	64.6	< 0.2	4.07		7.5 (UJ)	320
5	03/18/03 9:47	2.98	< 1	6.73		9.27 (JB)	97.1	6980	< 1	5.1	13.6	81.3	< 0.2	8.77			157
5	04/21/03 9:23	1.69	< 1	1.79	1.62	2.91	19.4	1080	< 1	1.11	3.17	92.8	< 0.2	4.19	13.3	7.99	330
5	05/19/03 8:43	3.19	< 1	6.21	2.63	7.64	49.3	5740	< 1	4.79	11.6	94.5	< 0.2	8.51 (JB)	12.6	23.8	232
5	06/16/03 9:20	4.52	< 1	9.83	3.23	11.6	59.3	10500	< 1	6.85	3.36	114	< 0.2	13	14.8	44.3	206
5	07/21/03 8:59	5.66	< 1	12.8	2.17	18.7	41.3	11700	< 1	17.5	19.2	199	< 0.2	15.7	17.3	74.4	169
5	08/18/03 9:45	2.93	< 1	< 1.2	2.9	3.94	48.5	827	< 1	1.27	2.76	63	< 0.2	4.36	9.87	6.68	309
6	01/14/02 8:45	1.52	< 1	< 1.2		1.62		325.8821		< 1			< 0.2	2.53		< 6	358
6	02/18/02 9:04	1.7	< 1	< 1.2				716.6975		< 1			< 0.2	3.67		< 6	230
6	03/18/02 10:53	1.94	< 1	3.13		3.91		2306.2692		1.48			< 0.2	4.51		10.9454 (UJ)	266
6	04/15/02 9:02	2.96	< 1	7.01		8.24		9051.8494		3.96			< 0.2	8.34		25.1967	292
6	05/20/02 8:50	2.91	< 1	4.64		5.94		3750		2.49			< 0.2	6.26		15.8	193
6	06/17/02 9:56	2.64	< 1	3.19		4.05		2440		1.78			< 0.2	4.82		26.4	304
6	07/15/02 9:30	3.04	< 1	1.87		2.54		600		< 1			< 0.2	3.77		15.6	296
6	08/19/02 9:56	3.76	< 1	1.80		4.09		1370		3.27			< 0.2	4.89		14.4	323
6	09/16/02 8:39	3.33	< 1	< 1.2		1.84		450		< 1			< 0.2	3.42		< 6	304
6	10/21/02 9:01	2.44	< 1	< 1.2		2.17		604		1.44			< 0.2	3.06		6.32 (UJ)	351
6	11/18/02 9:07	2.3	< 1	1.28		3.18		856		< 1			< 0.2	3.75		13	302
6	12/16/02 9:05	1.95	< 1	< 1.2		2.31		391		< 1			< 0.2	4.29		< 6	300
6	02/18/03 9:12	1.85	< 1	< 1.2		3.13		440		< 1			< 0.2	4.47		8.65	373
6	03/18/03 9:25	3.04	< 1	5.17				5360		3.74			< 0.2	7.17			175
6	04/21/03 8:40	2.36	< 1	2.16		3.52		1760		1.28			< 0.2	5.22		10.2	334
6	05/19/03 8:07	2.07	< 1	4.07		9.61		2890		2.92			< 0.2	7.46 (JB)		16.6	276

IDEM Fort Wayne Rivers - Metals - Years 2002 and 2003

Station	Sample Date	Arsenic (Total) (ug/L)	Cadmium (Total) (ug/L)	Chromium (Total) (ug/L)	Copper (Dissolved) (ug/L)	Copper (Total) (ug/L)	Iron Dissolved (ug/L)	Iron (Total) (ug/L)	Lead (Dissolved) (ug/L)	Lead (Total) (ug/L)	Manganese (Dissolved) (ug/L)	Manganese (Total) (ug/L)	Mercury (Total) (ug/L)	Nickel (Total) (ug/L)	Zinc (Dissolved) (ug/L)	Zinc (Total) (ug/L)	Hardness (as CaCO3) (mg/L)
5	06/16/03 8:56	5.25	< 1	8.74		11.4		9010		6.47			< 0.2	11.9		40.3	217
5	07/21/03 8:39	5.04	< 1	10.4		15.4		11000		15			< 0.2	13		72.2	154
5	08/18/03 8:15	2.96	< 1	1.6		4.43		1100		1.5			< 0.2	4.61		11	305
7	01/14/02 12:30	1.29	< 1	< 1.2	1.21	1.7	15.6972	419.2436	< 1	< 1	44.1	49.31	< 0.2	3.14		< 6	347
7	02/18/02 12:44	1.73	< 1	1.26			27.8411	791.3895	< 1	< 1	27.1	43.19	< 0.2	3.62		6.2601 (UJ)	284
7	03/18/02 12:32	1.81	< 1	2.81	2.4	3.9	203.2131	2100.0681	< 1	1.55	41.39	98.91	< 0.2	4.88	7.6171	11.6509	258
7	04/15/02 11:40	3.02	< 1	7.23	2.49	8.16	55.0708	5640.6872	< 1	4.08	7.72	99.84	< 0.2	8.6	3.0516	37.6613	270
7	05/20/02 12:35	2.85	< 1	4.11	2.42	5.68	61.7	3450	< 1	2.35	14.6	72.7	< 0.2	5.88	16.9	14.8	193
7	06/17/02 12:40	2.39	< 1	3.53	2.18	4.92	6.94	2720	< 1	2.8	4.95	120	< 0.2	8.17	6.46	16.4	309
7	07/15/02 13:00	2.83	< 1	2.25	1.99	3.92	9.97	502	< 1	2.02	31.5	130	< 0.2	7.34	7.93	15.3	302
7	08/19/02 13:17	2.59	< 1	2.2	2.4	5.60	18.1	1250	< 1	3.33	30.1	134	< 0.2	8.7	14.4	21.4	274
7	09/16/02 11:12	2.49	< 1	1.45	1.44	3.55	16.3	762	< 1	2.05	47.2	128	< 0.2	8.42	10.6	17.4	298
7	10/21/02 12:22	1.76	< 1	< 1.2	1.38	2.69	10.8	475	< 1	1.51	41.3	109	< 0.2	11	8.7	15	322
7	11/18/02 11:47	1.89	< 1	< 1.2	1.55	2.93	50.2	735	< 1	1.06	37.9	65.9	< 0.2	6.88		11.7 (UJ)	256
7	12/16/02 11:56	1.49	< 1	< 1.2	1.74	2.28	37.5	324	< 1	< 1	46.3	56.4	< 0.2	8.43	16.3 (UJ)	16.7	365
7	01/21/03 11:20	1.25	< 1	< 1.2	2.2		21	353	< 1	< 1	44.5	46.5	< 0.2			25	390
7	02/18/03 11:11	1.09	< 1	1.22	3.01	2.89	39.4	377	< 1	< 1	57.7	65.2	< 0.2	6.81	35.4	11.8	358
7	03/18/03 13:01	2.88	< 1	6.12	2.41 (JB)		52.8	5850	< 1	5.18	25.2	91.8	< 0.2	8.05			182
7	04/21/03 13:00	2.29	< 1	2.3	1.68	4.01	14.1	1500	< 1	1.06	5.34	97.7	< 0.2	5.79	3.08	12.9	337
7	05/19/03 12:17	3.02	< 1	4.85	2.39	5.5	61.2	4780	< 1	3.37	18.2	97.5	< 0.2	7.75 (JB)	11.8	20.3	276
7	06/16/03 11:55	4.76	< 1	8.24	2.96	10.6	41.8	8810	< 1	6.64	2.85	107	< 0.2	11.4	13.9	41.5	215
7	07/21/03 13:16	4.65	< 1	8.26	2.76	13.8	38.8	8710	< 1	1[illegible].7	5.6	175	< 0.2	11.8	19.2	54.1	139
7	08/18/03 13:00	2.3	< 1	1.91	2.73	4.86	27.8	1590	< 1	2.3	2.96	110	< 0.2	5.18	11.2	13	304
8	01/14/02 11:30	1.64	< 1	< 1.2		1.83		3457.3799		< 1			< 0.2	3.53		< 6	302
8	02/18/02 12:13	1.63	< 1	1.2				673.4157		< 1			< 0.2	3.41		< 6	298
8	03/18/02 11:38	1.92	< 1	3.06		4.11		3455.5657		1.69			< 0.2	5		12.646	272
8	04/15/02 11:14	3.13	< 1	7.83		9.11		4708.609		6.51			< 0.2	9.77		36.6009	198
8	05/20/02 12:10	2.84	< 1	4.30		6.66		3090		2.66			< 0.2	6.53		17.7	191
8	06/17/02 12:16	7.49	< 1	2.67		4.04		1720		1.66			< 0.2	7.93		13.6	300
8	07/15/02 11:30	2.25	< 1	2		4.12		620		1.48			< 0.2	7.17		10.9 (UJ)	296
8	08/19/02 12:45	2.87	< 1	1.76		3.78		761		1.83			< 0.2	7.76		15.5	272
8	09/16/02 10:44	1.8	< 1	< 1.2		4.6		363		1.05			< 0.2	7.41		11.4 (UJ)	254
8	10/21/02 11:40	1.93	< 1	< 1.2		2.6		366		1.15			< 0.2	8.33		6.28 (UJ)	331
8	11/18/02 11:18	1.81	< 1	< 1.2		3.04		666		1.07			< 0.2	6.87		11.6 (UJ)	296
8	12/16/02 11:22	1.45	< 1	< 1.2		2.34		214		< 1			< 0.2	6.31		11.3 (UJ)	360
8	01/21/03 10:54	1.24	< 1	< 1.2				371		< 1			< 0.2			11.4	375
8	02/18/03 10:39	1.56	< 1	< 1.2		3.06		385		< 1			< 0.2	6.87		13	373
8	03/18/03 12:34	3	< 1	5.78				5790		4.59			< 0.2	7.63			179
8	04/21/03 12:35	2.03	< 1	1.87		3.56		698		1.43			< 0.2	5.38		13.5	336
8	05/19/03 11:50	2.84	< 1	4.29		6.19		3940		3.09			< 0.2			17.8	279
8	06/16/03 11:50	5.95	< 1	11.8		13.8		12500		6.9			< 0.2	14.4		55.6	207
8	07/21/03 12:49	6.65	< 1	12.8		26.4		12400		25.6			< 0.2	15.1		87.1	209
8	08/18/03 11:30	2.25	< 1	1.67		4.52		1500		1.89			< 0.2	4.85		9.81	304

IDEM Fort Wayne Rivers - General Chemicals - Years 2002 and 2003

Station	Sample Date & Time	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	COD (mg/L)	Cyanide (Total) (mg/L)	E. Coli MPN/100mL	Fluoride (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	pH (SU)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TBOD5 (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)
1	01/14/02 10:30	231	40.4382	15.5				373	0.1166	1.7791	7.9	0.0481	76.8509		490	0.881	5.607	497	4
1	02/19/02 11:21	245	31.6018	17.7				328	<0.1	1.7796	8.2	0.0479	68.6123		433	0.539	6.875	433	6
1	03/18/02 10:43	222	30.2759	21.3				300	<0.1	2.0297	8.3	0.0604	65.8277		391	0.9324	7.966	421	10
1	04/15/02 10:31	183	22.6211	28.9				242	<0.1	2.4786	8.1	0.1705	41.6565		341	1.3834	8.125	393	45
1	05/20/02 11:30			20.9				282	<0.1	2		0.11				1.2	8.4		
1	06/17/02 11:30	281	36	10.3				369	<0.1	1.4	8.4	0.07	66		463	0.5	6.3	501	6
1	07/15/02 11:00	276	42	14.4				363	<0.1	1	8.6	0.07	75		473	0.4	4.6	500	13
1	08/19/02 12:00	270	49	16				329	<0.1	1.3	8.1	0.14	60		467	0.5	3.8	517	30
1	09/16/02 10:01	296	60	10.6				355	<0.1	1.5	8.2	0.1	72		507	0.3	3.5	532	16
1	10/21/02 11:10	228	46	12				302	0.1	1.2	8	0.07	62		400	0.4 (QJ)	3.8	418	<4
1	11/18/02 10:42	278	59	11.8				346	<0.1	1.2	8	0.07	74		501	0.4	3.8	511	<4
1	12/16/02 10:44	294	65	9.8				368	<0.1	1.3	8.1	<0.03	77		619	0.4	3	332	<4
1	03/18/03 11:56	134	47	32				294	0.2	6.5	7.7	0.2	112		415	1.4	10.3	472	30
1	04/21/03 12:00	294	47	31.3				367	<0.1	2	8.2	0.13	84		483	1	8.3	527	9
1	05/19/03 10:06	179	31	33.6				316	<0.1	4.6	7.9	0.12	63		407	1.4 (QJ)	10.4	476	37
1	06/16/03 10:45	223	47	21.6				372	<0.1	5.7	8	0.11	76		473	0.9	9	516	22
1	07/21/03 10:39	130	38	39.5				240	<0.1	1.4	8.1	0.34	41		324	1.6	8.2	550	240
1	08/18/03 11:00	270	46	20.5				274	<0.1	1.1	8.2	0.06	81		442	0.8	7.6	522	9
2	01/14/02 10:50	263	31.8905	14.7				335	<0.1	1.3176	8	0.0415	41.0905		432	0.5547	4.940	439	5
2	02/19/02 10:56	207	25.1056	16				276	<0.1	1.4914	8.2	0.0563	49.0156		364	0.1889	6.644	356	12
2	03/18/02 10:30	187	22.6650	22.7				242	<0.1	1.5727	8.2	0.1225	39.6352		309	1.1128	7.768	396	42
2	04/15/02 10:06	143	16.7336	21.6				180	<0.1	1.7299	8	0.281	28.7959		300	1.5665	9.241	289	108
2	05/20/02 11:27	147	13	22.4				191	<0.1	1.1	8.1	0.15	22		251	1.1	8.3	303	41
2	06/17/02 11:00	240	29	22.8				317	<0.1	0.8	8.6	0.13	46		268	0.9	7	484	45
2	07/15/02 10:30	236	30	20.1				309	<0.1	0.5	8.6	0.13	53		407	0.8	6.2	454	44
2	08/19/02 11:32	225	38		<0.005			280			8.2		53		387			448	44
2	09/16/02 9:41	261	46	18.6				321	<0.1	0.5	8.2	0.14	61		404	0.6	4.6	480	36
2	10/21/02 10:42	265	54	14.7				367	<0.1	0.6	8.3	0.05	67		463	0.5 (QJ)	4.5	487	15
2	11/18/02 10:21	155	50	16.6				324	<0.1	0.6	8	0.07	60		443	0.5	5.2	465	10
2	12/16/02 10:23	282	52	12	<0.005			348	<0.1	0.7	8.1	0.04	73		472	0.5	4.3	492	4
2	03/18/03 11:01	96	34	36.8				208	0.3	4.2	7.6	0.28	54		303	1.6	10.8	390	35
2	04/21/03 11:05	207	39	30.5				336	<0.1	3.4	8.3	0.11	60		436	1.1	7.2	484	40
2	05/19/03 9:48	163	29	38.6				269	<0.1	3.3	7.9	0.16	61		305	1.5	10.2	428	87
2	06/16/03 10:15	181	35	37				307	0.2	5.7	7.8	0.16	56		462	1.5	9	462	48
2	07/21/03 9:46	107	25	44				228	0.1	1.2	7.9	0.4	37		257	1.9	9	519	246
2	08/18/03 10:26	210	29	31.5				306	<0.1	0.4	8.4	0.11	60		380	1.3	9.4	425	136
3	01/14/02 9:45	259	33.9024	14.7	<0.005		0.2963	343	<0.1		7.9	0.0414	57.5199		432	0.4262	5.162	441	5
3	02/18/02 10:15	205	25.0799	19.2	<0.005		0.2331	270	<0.1	1.4931	8.2	0.0501	43.9513	<1	367	0.680	6.062	355	12
3	03/18/02 9:50	185	22.5803	24.3			0.2303	244	<0.1	1.6007	8.3	0.1195	35.9492		313	1.2116	7.871	363	43
3	04/15/02 8:45	141	16.0940	23.1	<0.005		0.1887	164	<0.1	1.723	8.1	0.2744	27.0358	1.9	298	1.6576	9.219	389	139
3	05/20/02 9:40	139	13	22.8	<0.005			185	<0.1	1.1	8.1	0.15	21		253	1.2	7.7	367	48
3	06/17/02 10:30	257	28	20.9	<0.005		0.3	321	<0.1	0.7	8.6	0.11	52	2.6	396	0.9	6.6	425	26
3	07/15/02 10:30	230	38	39.9			0.4	256	<0.1	0.4	8.7	0.13	55		402	1	6.3	439	23
3	08/19/02 10:47	180	30	25.1	<0.005		0.4	225	<0.1	0.2	8	0.12	46	3.7 (QJ)	316	0.9	5	367	45
3	09/16/02 9:16	225	74	22.8	<0.005		0.5	315	<0.1	<0.1	8	0.11	67		405	1	6.1	511	16
3	10/21/02 9:59	262	51	15.9	<0.005		0.6	353	<0.1	0.2	8.2	0.08	65	2	445	0.5 (QJ)	4.6	470	13
3	11/18/02 9:53	248	47	13.7	<0.005		0.5	318	<0.1	0.3	7.9	0.05	61		432	0.5	4.6	457	9
3	12/16/02 9:48	276	60	15.4	<0.005		0.6	366	<0.1	1	8.1	0.09	69		468	0.6	5	491	9
3	03/18/03 13:12	92	35	37.2	<0.005		0.2	161	0.4	3.6	7.6	0.27	48		297	2.2	10.8	354	42
3	04/21/03 8:38	206	38	22.5	<0.005		0.2	328	<0.1	2.2	8.3	0.03	77	3.6	422	0.9	8.1	474	35
3	05/19/03 8:02	161	29	38.6	<0.005		0.2	279	<0.1	3.4	7.9	0.14	55		360	1.5	10.1	421	66
3	06/16/03 9:40	201	37	32.9	<0.005		0.3	323	<0.1	4.4	7.9	0.1	62	2.1	408	1	8.2	444	22
3	07/21/03 9:15	118	24	33.5	<0.005		0.2	219	<0.1	1.4	8.1	0.24	36		269	1.8	7.2	439	176

IDEM Fort Wayne Rivers - General Chemicals - Years 2002 and 2003

Station	Sample Date & Time	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	COD (mg/L)	Cyanide (Total) (mg/L)	E. Coli (MPN/100mL)	Fluoride (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	pH (SU)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TBOD5 (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)
3	08/18/03 10:01	205	28	30.4	< 0.005		0.3	287	< 0.1	0.5	8.4	0.1	47	3.9	366	1.4	9.4	403	26
4	01/14/02 12:30	230	68.1207	12.8	< 0.005			412	0.1619	3.7408	7.9	0.1138	161.0924		660	0.8602	4.164	679	5
4	02/18/02 13:25	213	65.2656	14.2	< 0.005			362	< 0.1	5.6744	8.2	0.1019	109.9339	< 1	538	0.5524	4.921	642	10
4	03/18/02 12:30	195	50.4839	16.9	< 0.005			324	< 0.1	5.6017	8.3	0.1428	83.2081		483	1.1802	5.119	530	31
4	04/15/02 11:15	149	27.277	26.1	< 0.005			236	< 0.1	5.5288	8	0.3378	52.6546	1.9	375	1.6075	7.23	601	131
4	05/20/02 13:15	153	36	20.2	< 0.005			246	< 0.1	6.5	8	0.26	50		365	1.5	7.3	444	58
4	06/17/02 13:50	228	71	29.3	< 0.005			366	< 0.1	3.7	8.7	0.29	121	5	581	1.8	5.9	584	68
4	07/15/02 13:20	137	125	49.4	< 0.005			363	< 0.1	< 0.1	9.1	0.29	193		601	3	10.1	812	94
4	08/19/02 13:45	179	127	28.9	< 0.005			323	< 0.1	1.4	8.1	0.28	124	3.6 (QJ)	622	1.4	7.2	745	69
4	09/16/02 11:39	201	176	30.4	< 0.005			368	< 0.1	0.4	8.3	0.32	220		764	1.6	8	869	61
4	10/21/02 12:56	203	214	31.4	< 0.005			460	0.1	0.6	8.7	0.22	234	7.3	914	1.6 (QJ)	7.6	970	12
4	11/18/02 12:16	154	111	25.8	< 0.005			334	< 0.1	9.6	7.8	0.2	138		593	1.6	9.1	967	11
4	12/16/02 12:39	213	149	20.3				418	< 0.1	3.7	8.2	0.14	200	1.1	779	0.8	7.1	813	< 4
4	03/18/03 13:27	67	25	26.4	< 0.005			179	0.2	8	7.6	0.42	34		290	1.3	7.1	385	84
4	04/21/03 13:50	130	66	46.1	< 0.005			361	0.2	5.3	8.7	0.15	104	6.2	522	1.7	5.6	803	39
4	05/19/03 12:47	114	28	27.7	< 0.005			253	< 0.1	8	7.8	0.33 (QJ)	44		348	1.6	5.2	476	114
4	06/16/03 12:40	67	16	39.5	< 0.005			183	0.2	11	7.5	0.5	26	2.3	319	1.9	7.7	510	202
4	07/21/03 11:50	92	23	49.3	< 0.005			201	0.1	1.8	7.7	0.61	35		266	2.1	11.4	605	344
4	08/18/03 13:20	210	46	35	< 0.005			332	< 0.1	1.3	8.3	0.19	101	3.6	473	1.8	10.8	592	45
4	08/22/03 12:30																3		
5	01/14/02 9:16	243	96.5652	13.2	< 0.005			429	0.1592	3.3549	7.6	0.1103	147.4126		673	0.7408	4.213	595	5
5	02/18/02 9:53	321	52.9883	14.7	< 0.005			346	< 0.1	5.4481	8.1	0.1094	99.2796	< 1	612	0.7025	4.7	521	14
5	03/18/02 9:36	209	51.3001	18	< 0.005			336	< 0.1	5.3801	8.2	0.1397	93.1994		475	0.0883	5.133	522	26
5	04/15/02 9:25	153	26.5758	27.4	< 0.005			244	< 0.1	5.9769	8	0.3159	53.6047	1.6	390	1.5347	6.595	479	96
5	05/20/02 9:32	146	23	23.2	< 0.005			223	< 0.1	6.5	7.9	0.31	42		347	1.6	8	427	59
5	06/17/02 10:22	262	48	23.9	< 0.005			309	< 0.1	6.6	8.3	0.21	67	7	455	1.6	6.1	566	46
5	07/15/02 9:45	179	85	28.1	< 0.005			317	0.2	0.1	8.5	0.24	121		529	1.9	8	577	17
5	08/19/02 10:23	170	84	36.4	< 0.005			274	0.6	0.3	7.4	0.32	95	7.3 (QJ)	464	2.2	7.6	584	56
5	09/16/02 9:02	218	120	37.2	< 0.005			299	0.5	< 0.1	8	0.37	145		626	2.3	9.4	677	46
5	10/21/02 9:36	201	112	32.6	< 0.005			373	0.1	< 0.1	8.3	0.14	152	5.5	598	1.7 (QJ)	6.1	644	22
5	11/18/02 9:30	147	84	27	< 0.005			303	0.2	12	7.6	0.22	108		521	1.9	6.8	600	18
5	03/18/03 9:47	53	25	33.5	< 0.005			157	0.2	8	7.5	0.46	30		203	2.3	6.4	389	96
5	04/21/03 9:20	182	65	27.2	< 0.005			330	0.3	0.7	8.4	0.15	113	6.6	508	1.8	5.2	593	35
5	05/19/03 8:40	110	28	28.6	< 0.005			232	0.1	7.5	7.8	0.37	50		348	1.9	6.2	476	119
5	06/16/03 9:20	74	16	39.1	< 0.005			206	0.3	12	7.5	0.54	27	2.6	311	2.2	7.4	525	161
5	07/21/03 8:59	53	12	6.0	< 0.005			159	0.2	1	7.7	0.42	21		108	2.1	7.4	475	340
5	08/18/03 9:45	220	42	39.9	< 0.005			338	< 0.1	0.8	8.4	0.18	101	5.5	462	2.2	10.6	516	37
6	01/14/02 8:45	259	42.6739	13.6				355	< 0.1	1.6453	8	0.0605	75.6276		481	0.491	4.862	492	< 4
6	02/18/02 9:04	205	33.8131	15.1				290	< 0.1	2.6527	8.2	0.0693	63.8187		400	0.5212	5.44	410	12
6	03/18/02 10:55	195	31.3903	21.2				208	< 0.1	2.6572	8.3	0.1337	52.6476		366	1.4362	7.095	416	40
6	04/15/02 9:09	146	20.6687	31.2				202	< 0.1	3.0044	8	0.276	35.3279		332	1.0348	8.695	419	105
6	05/20/02 10:53	143	16	23.6				193	< 0.1	2.7	8.1	0.19	26		175	1.4	7.7	343	64
6	06/17/02 9:56	220	34	27.4				304	< 0.1	2.6	8.5	0.16	60		433	1.2	7	494	56
6	07/15/02 9:30	212	49	23.2				296	0.1	0.2	8.0	0.16	73		430	1.3	0.6	466	27
6	08/19/02 9:59	215	91		< 0.005			323			7.7		106		550			617	45
6	09/16/02 8:59	206	61	23.6				304	0.2	< 0.1	7.9	0.13	106		502	1.2	6.8	505	22
6	10/21/02 9:01	218	68	19				351	< 0.1	0.1	8.3	0.07	78		457	0.7 (QJ)	4.8	488	20
6	11/18/02 9:07	133	60	21.7				302	0.1	7.2	7.8	0.15	60		457	1.3	7.1	504	18
6	12/16/02 9:05	235	68	16.9				360	< 0.1	3.8	8	0.08	119		596	0.9	6.6	614	< 4
6	01/21/03 8:57	218	60	18.4				409	0.1	10	7.8	0.1	112		627	1	5.8	649	5
6	02/18/03 9:12	216	68	20.9				373	0.3	4.4	7.7	0.14	114		558	1.1	6.5	592	8
6	03/10/03 9:22	62	29	33.9				175	0.3	5.6	7.6	0.4	36		289	1.0	6.7	372	76
6	04/21/03 8:45	195	47	28.8				334	< 0.1	2.5	8.3	0.06	83		448	0.7	8.5	515	30

IDEM Fort Wayne Rivers - General Chemicals - Years 2002 and 2003

Station	Sample Date & Time	Alkalinity (as CaCO3) (mg/L)	Chloride (mg/L)	COD (mg/L)	Cyanide (Total) (mg/L)	E. Coli (MPN/100mL)	Fluoride (mg/L)	Hardness (as CaCO3) (mg/L)	Nitrogen, Ammonia (mg/L)	Nitrogen, Nitrate+Nitrite (mg/L)	pH (SU)	Phosphorus, Total (mg/L)	Sulfate (mg/L)	TBOD5 (mg/L)	TDS (mg/L)	TKN (mg/L)	TOC (mg/L)	TS (mg/L)	TSS (mg/L)
6	05/19/03 8:07	140	29	24.9				276	<0.1	5.7	7.9	0.23	53		319	1.6	6.6	445	62
6	06/16/03 8:55	104	20	36.8				217	0.2	11	7.6	0.44	33		328	2	7.8	554	176
6	07/21/03 8:33	82	19	40.6				194	0.2	1.1	7.9	0.39	32		207	1.9	5.5	506	230
6	08/18/03 9:15	209	33	31.9				305	<0.1	0.6	8.4	0.19	65		390	5	9.7	443	39
7	01/14/02 12:00	265	45.2815	15.1	0.0052			347			7.9	0.0659	72.6763		468	0.7559	6.376	481	6
7	02/18/02 12:48	207	38.1459	17.7	< 0.005			294	<0.1	2.7979	8.2	0.08	60.6273	< 1	410	0.6729	6.139	418	15
7	03/18/02 12:02	185	34.516	20.8	< 0.005			266	0.1076	2.6558	8.2	0.1391	54.0424		366	1.2728	7.214	425	40
7	04/15/02 11:40	145	21.811	33.8	< 0.005			262	<0.1	3.0153	8	0.2918	36.6474	1.9	339	1.8606	8.685	428	106
7	05/20/02 12:35	143	16	24.3	< 0.005			193	<0.1	2.8	8.1	0.21	25		279	1.2	9	349	55
7	06/17/02 12:40	220	44	23.2	< 0.005			309	<0.1	3.5	8.4	0.2	65	3.3	447	1.3	6.9	529	61
7	07/15/02 13:00	204	76	25.1	< 0.005			302	0.1	1.4	8.4	0.19	91		500	1.4	6.9	559	33
7	08/19/02 13:17	172	139	25.8	< 0.005			274	0.1	2.5	7.8	0.91	91	3.8 (QJ)	679	1.5	7.1	636	39
7	09/16/02 11:12	197	106	20.9	< 0.005			298	0.4	2.9	7.7	0.18	102		549	1.6	6.9	587	27
7	10/21/02 12:22	210	94	21.7	< 0.005			322	<0.1	3.1	8	0.08	81	2.3	508	1 (QJ)	5.6	535	27
7	11/18/02 11:47	174	74	20.6	< 0.005			288	0.2	7.3	7.8	0.19	84		474	1.4	7.3	512	86
7	12/16/02 11:56	225	110	17.7	< 0.005			296	0.2	6.2	7.9	0.15	129	1.4	614	1	6.1	636	< 4
7	01/21/03 11:29	204	106	18.8	< 0.005			290	0.2	11	7.8	0.12	113		650	1.1	6.1	690	5
7	02/18/03 11:11	188	113	18.8	< 0.005			256	0.3	5	7.7	0.17	119	< 1	602	1.1	6.9	628	8
7	03/18/03 13:01	60	31	32	< 0.005			182	0.3	5.8	7.5	0.38	37		290	1.5	8.6	377	74
7	04/21/03 13:00	195	55	30.9	< 0.005	57		337	0.1	4.1	8.3	0.14	87	4.6	467	1.2	7.9	539	27
7	05/19/03 12:17	141	30	45.6	< 0.005			279	<0.1	5.8	7.9	0.24 (QJ)	54		373	1.6 (QJ)	8.4	469	82
7	06/16/03 11:55	132	21	39.9	< 0.005			219	0.3	11	7.6	0.5	32	2.7	317	2	7.6	519	196
7	07/21/03 13:16	87	20	36.5	< 0.005			189	0.2	1.2	7.8	0.32	34		219	1.7	6.7	435	216
7	08/18/03 13:00	210	42	31.5	< 0.005			303	<0.1	1.1	8.4	0.14	71	4.2	417	1.6	9.3	476	47
8	01/14/02 11:30	[illegible]	57.6559	14.7	< 0.005			305	[illegible]	2.4235	7.9	0.077	67.6496		524	0.6309	6.003	531	6
8	02/18/02 12:13	226	37.2758	16.1	< 0.005			298	<0.1	2.8423	8.3	0.0776	62.1850	< 1	411	0.5928	5.846	417	13
8	03/18/02 11:38	159	33.4138	23.5	< 0.005			272	<0.1	2.9133	8.2	0.1515	54.8104		360	1.2672	7.03	422	48
8	04/15/02 11:14	139	21.2029	34.2	< 0.005			198	<0.1	3.0206	8	0.3118	34.3184		322	2.0296	8.745	427	107
8	05/20/02 12:10	141	16	23.6	< 0.005			191	<0.1	2.9	8.1	0.24	28		273	1.4	8.3	354	64
8	06/17/02 12:15	218	44	26.6	< 0.005			300	<0.1	3	8.6	0.19	56	3	435	1.2	6.9	495	52
8	07/15/02 11:30	130	64	31.9	< 0.005			298	<0.1	0.6	8.8	0.14	80		438	1.5	6.5	512	42
8	08/19/02 12:45	176	72	27.4	< 0.005			272	<0.1	1.8	8	0.19	80	2.7 (QJ)	445	1.1	7	507	37
8	09/16/02 10:44	154	110	31.2	< 0.005			284	<0.1	2.0	8.6	0.12	98		502	1.5	7.8	543	32
8	10/21/02 11:49	213	69	19.4	< 0.005			331	<0.1	1.4	8.3	0.06	86	2.9	494	0.9 (QJ)	6.6	527	17
8	11/18/02 11:15	156	74	20.9	< 0.005			296	0.2	9.2	7.9	0.16	66		469	1.3	7.3	530	14
8	12/16/02 11:20	220	107	18	< 0.005			350	<0.1	5.1	8.1	0.11	112	1.2	604	0.7	6.2	625	< 4
8	01/21/03 10:54	206	101	18	< 0.005			376	0.1	11	7.8	0.10	107		625	1	6.2	634	7
8	02/18/03 10:39	159	106	22.9	< 0.005			372	0.3	5.8	7.8	0.17	101	1.4	667	1.2	6.8	520	8
8	03/18/03 12:34	89	32	33.1	< 0.005			179	0.3	6.1	7.6	0.4	36		295	1.6	8.5	386	102
8	04/21/03 12:35	136	54	28	< 0.005			306	<0.1	3.8	8.5	0.14	96	4.8	465	1.2	7.3	526	21
8	05/19/03 11:50	142	31	36.5	< 0.005			279	<0.1	6	7.9	0.34	66		394	1.6	8.2	434	66
8	06/16/03 11:20	90	16	42	< 0.005			207	0.2	10	7.6	0.5	29	2.5	299	2.1	7.6	565	202
8	07/21/03 12:49	87	27	40.0	< 0.005			209	0.2	1.5	7.8	0.54	34		228	2.2	7.6	574	344
8	08/18/03 11:30	209	40	30.8	< 0.005			304	<0.1	1	8.5	0.12	71	4.5	409	1.7	9.3	460	41

ATTACHMENT 6

DO INVESTIGATION

The analysis of the 2002 and 2003 river data, done as part of Donohue's July 16, 2004 report, identifies some dissolved oxygen (DO) excursions. The 2003 excursions can be linked to flooding, upstream sources, or faulty instrument calibration. The 2002 excursions are most significant at the Spy Run Bridge on the St. Mary's River. See Figure 1.

Donohue and Associates attempted to identify the cause of the low DO measurements while preparing their July 16, 2004 report. They assembled "Table 5-1 Dissolved Oxygen Excursions". This is located in Appendix A. The Spy Run Creek enters the St. Mary's River just upstream of the Spy Run Bridge. See Figure 1. Therefore, Spy Run Creek data was also included in this table.

Table 5-1 tabulates the DO excursion data and corresponding records for temperature, precipitation, river levels, and other parameters for comparison (E. Coli, Ammonia, pH, Phosphorus, TDS, and TSS). Each DO excursion (shown in **bold)** is sectioned in to its own table with details relating to the week prior to and after the excursion date. Daily high and low water levels and rainfall recorded at the Spy Run Creek gauge are indicated in the last two columns of Table 5-1. Rainfall and temperature information as recorded at the airport (approximately seven miles southeast of the Spy Run creek and St. Mary's confluence) are shown in their respective columns. This information was used to track wet vs. dry days and river levels. The flood stage for the Spy Run Creek is eight (8) feet.

No flooding occurred on the Spy Run Creek or the St. Mary's River during the week prior or after any of the 2002 recorded DO excursions. No rain fall was recorded 48 hours prior to any of the 2002 DO excursions. The DO excursions occurred during relative low E Coli readings. These findings indicate that the DO excursions did not occur during CSO events.

In August 2004 the City of Fort Wayne initiated an effort to locate the cause of DO excursions at the Spy Run Bridge on the St. Mary's River. This was accomplished by sampling DO at 4 locations that bracketed the site of previous excursions. See Figure 1 for the location of the sampling sites.

Samples were taken from the Harrison St. Bridge on the St. Mary's River to isolate causes on the St. Mary's River upstream of the Spy Run Creek. Samples were taken from the Lawton Park Footbridge on the Spy Run Creek to isolate causes on the Spy Run Creek. Samples were taken from the Spy Run Bridge on the St. Mary's River to isolate causes downstream of the Harrison St. Bridge and Lawton Park Footbridge. Samples were taken from the Tecumseh St. Bridge on the Maumee River to isolate causes on the St Joseph River and downstream of the Spy Run Bridge.

Between 8/23/04 and 11/18/04 each site was sampled every work day. These results are in appendix B. The only reading below 5.0 was a 4.9 reading at the Lawton Park Footbridge on 11/1/04. Upon seeing the low reading additional samples were immediately taken at several locations on the Spy Run Creed upstream of the original sampling location. The results of these samples were:

Location	Reading
Lawton Park Footbridge	4.8
Elizabeth Street Bridge	6.0
Clinton St. Bridge	7.4
State Street Bridge	7.8
Oakridge Bridge	7.9

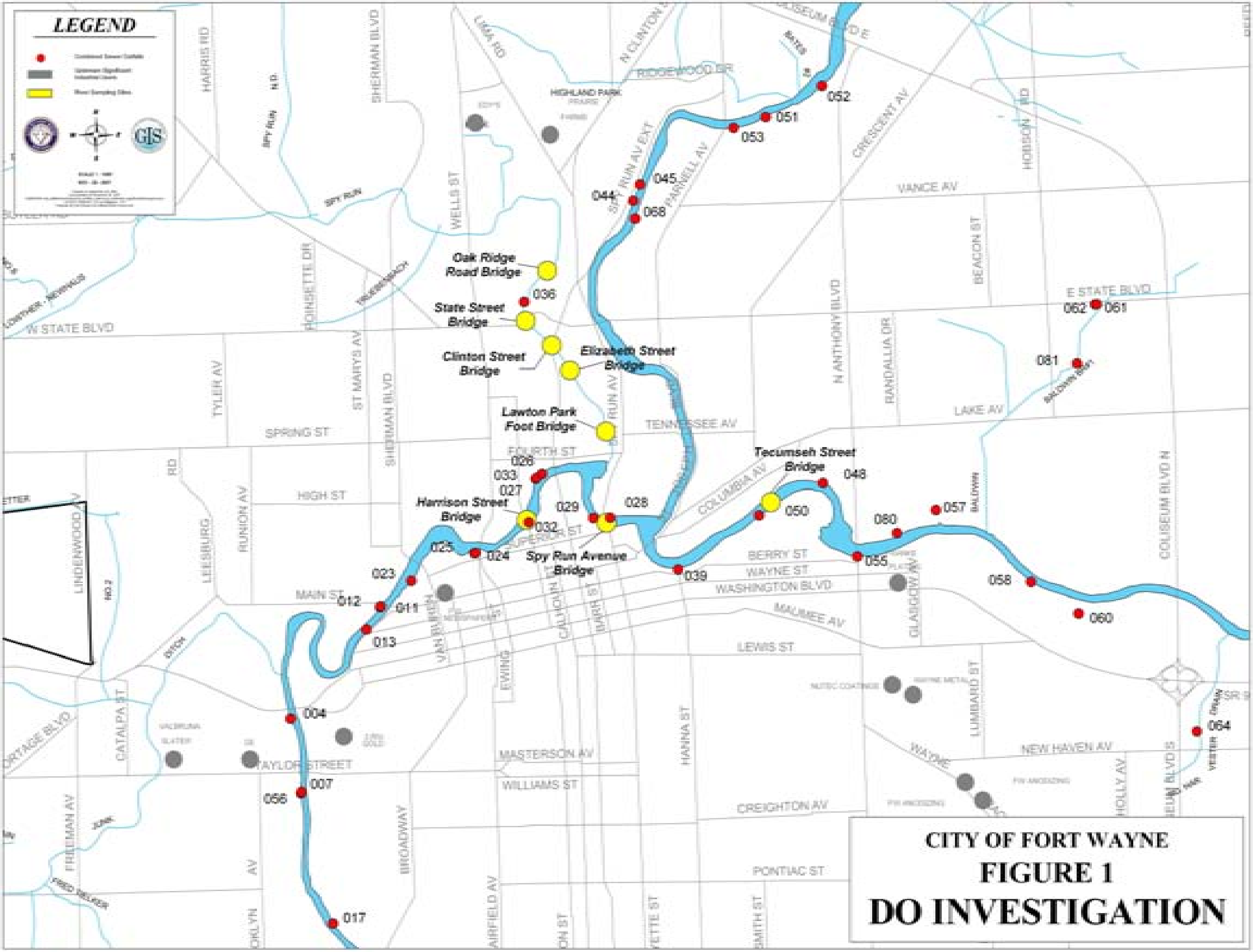
In addition to the daily sampling the City installed continuous DO monitoring equipment at the same sites on 10/28/04. The equipment at the Harrison St. Bridge was stolen on 11/9/04. The equipment at the Lawton Park site was stolen 11/18/04. The remaining equipment was removed by the City on 11/18/04.

While operating, this equipment sampled the DO every hour. These results are in appendix C. The only readings below 5.0 were at the Lawton Park Footbridge on the Spy Run Creek between 10/29/05 and 11/1/05. This is consistent with the results of the daily grab samples.

No CSOs were observed by the City's CSO inspectors along the Spy Run Creek during the entire month of October. The Little Turtle rain gauge reported the following rain totals:

Date	Amount
10/24/04	0.00"
10/24/04	0.00"
10/26/04	0.00"
10/27/04	0.01"
10/28/04	0.00"
10/29/04	0.04"
10/30/04	0.34"
10/31/04	0.00"
11/1/04	0.40"

An hourly distribution of the rein is shown in Appendix D.



CITY OF FORT WAYNE
FIGURE 1
DO INVESTIGATION

Table 5-1: Dissolved Oxygen Excursions

Date	Airport Temperature High	Airport Temperature Low	Temperature at River (F)	River / Sample Point / Station	Rain Recorded at Airport (in)	River Depth (ft)	DO	Ecoli	NH_3-N	pH	Phosphorus	TDS	TSS	Spy Run High/Low Depth	Spy Run Rain
Excursion: 08/12/02															
08/05/02	85	72	82.47	St. Mary's / Spy Run / Station 5	0.05	8.16	8.74	740	0.0216	7.61	0.14	400	62	3.53 / 3.53	0.00
08/06/02	75	58		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
08/07/02	76	54		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
08/08/02	78	53		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
08/09/02	83	53		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
08/10/02	87	55		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
08/11/02	90	62		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
08/12/02	**87**	**66**	**75.82**	St. Mary's / Spy Run / Station 5	**0.11**	**3.19**	**1.9**	**55**	**0.782**	**7.22**	**0.369**	840	55	**3.54 / 3.53**	**0.08**
08/13/02	89	70		St. Mary's / Spy Run / Station 5	0.12									3.84 / 3.53	0.15
08/14/02	75	64		St. Mary's / Spy Run / Station 5	0.34									4.23 / 3.56	0.36
08/15/02	84	65		St. Mary's / Spy Run / Station 5	Trace									3.87 / 3.56	0.00
08/16/02	82	70		St. Mary's / Spy Run / Station 5	Trace									3.82 / 3.54	0.15
08/17/02	85	69		St. Mary's / Spy Run / Station 5	0.00									3.64 / 3.54	0.00
08/18/02	80	66		St. Mary's / Spy Run / Station 5	0.00									3.54 / 3.53	0.00
08/19/02	75	58	73.38	St. Mary's / Spy Run / Station 5	0.92	5.35	4.04	130	0.6	7.14	0.32	484	76	4.77 / 3.53	0.80
Excursion: 08/26/02															
08/19/02	75	58	73.38	St. Mary's / Spy Run / Station 5	0.92	5.35	4.04	130	0.6	7.14	0.32	484	76	4.77 / 3.53	0.80
08/20/02	75	53		St. Mary's / Spy Run / Station 5	0.00									3.84 / 3.59	0.00
08/21/02	84	55		St. Mary's / Spy Run / Station 5	0.00									3.59 / 3.54	0.00
08/22/02	85	72		St. Mary's / Spy Run / Station 5	0.78									7.08 / 3.53	2.16
08/23/02	83	69		St. Mary's / Spy Run / Station 5	0.44									5.44 / 3.97	0.32
08/24/02	81	62		St. Mary's / Spy Run / Station 5	0.00									3.95 / 3.72	0.00
08/25/02	81	60		St. Mary's / Spy Run / Station 5	0.00									3.71 / 3.59	0.00
08/26/02	**82**	**61**	**75.35**	St. Mary's / Spy Run / Station 5	**0.00**	**5.05**	**2.69**	**test fail**	**0.321**	**7.15**	**0.271**	436	28	**3.59 / 3.56**	**0.00**
08/27/02	81	58		St. Mary's / Spy Run / Station 5	0.00									3.56 / 3.56	0.00
08/28/02	79	61		St. Mary's / Spy Run / Station 5	0.00									3.54 / 3.53	0.00
08/29/02	79	61		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
08/30/02	81	58		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.51	0.00
08/31/02	84	59		St. Mary's / Spy Run / Station 5	0.00									3.49 / 3.48	0.00
09/01/02	85	60		St. Mary's / Spy Run / Station 5	0.00									3.48 / 3.48	0.00
09/02/02	87	64		St. Mary's / Spy Run / Station 5	Trace									3.48 / 3.48	0.00
09/03/02	83	57	77.2	St. Mary's / Spy Run / Station 5	0.00	8.69	15.77	1600	0.0172	8.03	0.082	532	11	3.48 / 3.48	0.00

Table 5-1: Dissolved Oxygen Excursions

Date	Airport Temperature High	Airport Temperature Low	Temperature at River (F)	River / Sample Point / Station	Rain Recorded at Airport (in)	River Depth (ft)	DO	Ecoli	NH_3-N	pH	Phosphorus	TDS	TSS	Spy Run High/Low Depth	Spy Run Rain
Excursion: 09/23/02															
09/16/02	75	54	73.25	St. Mary's / Spy Run / Station 5	0.00	8.63	7.81	240	0.5	7.75	0.37	784	6	3.48 / 3.43	0.00
09/17/02	80	49		St. Mary's / Spy Run / Station 5	0.00									3.48 / 3.48	0.00
09/18/02	84	59		St. Mary's / Spy Run / Station 5	0.02									3.48 / 3.48	0.00
09/19/02	89	67		St. Mary's / Spy Run / Station 5	0.12									3.72 / 3.48	0.24
09/20/02	71	53		St. Mary's / Spy Run / Station 5	1.31									4.64 / 3.67	0.84
09/21/02	79	59		St. Mary's / Spy Run / Station 5	0.00									4.2 / 3.61	0.00
09/22/02	63	45		St. Mary's / Spy Run / Station 5	0.01									3.59 / 3.54	0.00
09/23/02	**68**	**40**	**67.29**	St. Mary's / Spy Run / Station 5	**0.00**	**8.77**	**0.77**	**250**	**0.361**	**7.02**	**0.312**	**496**	**11**	**3.54 / 3.51**	**0.00**
09/24/02	67	42		St. Mary's / Spy Run / Station 5	0.00									3.51 / 3.51	0.00
09/25/02	73	43		St. Mary's / Spy Run / Station 5	0.00									3.51 / 3.51	0.00
09/26/02	74	50		St. Mary's / Spy Run / Station 5	0.00									3.51 / 3.51	0.00
09/27/02	76	57		St. Mary's / Spy Run / Station 5	0.73									4.71 / 3.53	0.84
09/28/02	73	54		St. Mary's / Spy Run / Station 5	0.00									3.8 / 3.58	0.00
09/29/02	81	53		St. Mary's / Spy Run / Station 5	0.00									3.56 / 3.53	0.00
09/30/02	83	57	65.72	St. Mary's / Spy Run / Station 5	0.00	8.94	3.21	220	0.324	7	0.186	528	19	3.53 / 3.53	0.00
Excursion: 09/30/02															
09/23/02	68	40	65.72	St. Mary's / Spy Run / Station 5	0.00	8.77	0.77	250	0.361	7.02	0.312	496	11	3.54 / 3.51	0.00
09/24/02	67	42		St. Mary's / Spy Run / Station 5	0.00									3.51 / 3.51	0.00
09/25/02	73	43		St. Mary's / Spy Run / Station 5	0.00									3.51 / 3.51	0.00
09/26/02	74	50		St. Mary's / Spy Run / Station 5	0.00									3.51 / 3.51	0.00
09/27/02	76	57		St. Mary's / Spy Run / Station 5	0.73									4.71 / 3.53	0.84
09/28/02	73	54		St. Mary's / Spy Run / Station 5	0.00									3.8 / 3.58	0.00
09/29/02	81	53		St. Mary's / Spy Run / Station 5	0.00									3.56 / 3.53	0.00
09/30/02	**83**	**57**	**65.72**	St. Mary's / Spy Run / Station 5	**0.00**	**8.94**	**3.21**	**220**	**0.324**	**7**	**0.186**	**528**	**19**	**3.53 / 3.53**	**0.00**
10/01/02	84	54		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
10/02/02	84	65		St. Mary's / Spy Run / Station 5	0.00									3.53 / 3.53	0.00
10/03/02	75	61		St. Mary's / Spy Run / Station 5	Trace									3.53 / 3.53	0.00
10/04/02	76	56		St. Mary's / Spy Run / Station 5	0.47									4.18 / 3.53	0.40
10/05/02	66	47		St. Mary's / Spy Run / Station 5	0.00									3.92 / 3.56	0.00
10/06/02	69	42		St. Mary's / Spy Run / Station 5	0.01									3.54 / 3.51	0.00
10/07/02	58	39	65.19	St. Mary's / Spy Run / Station 5	0.00	8.83	5.61	260	0.0597	7.5	0.597	638	51	3.51 / 3.51	0.00

DONOHUE & ASSOCIATES

Harrison Bridge on the St. Marys
Daily Grab Sampling

Wk	Date	D.O.	Temp F	Depth
1	08/23/04	6.74		
	08/24/04	6.68	68	
	08/25/04	7.18	72	7.8
	08/26/04	7.02	73	8.3
	08/27/04	7.38	74	8.1
2	08/30/04	6.33	70	10.0
	08/31/04	6.22	70	10.1
	09/01/04	6.02	70	10.2
	09/02/04	5.80	69	9.7
	09/03/04	6.05	69	10.1
3	09/07/04	5.45	72	8.8
	09/08/04	6.11	70	8.4
	09/09/04	6.17	68	7.7
	09/10/04	6.32	68	7.7
4	09/13/04	9.70	73	7.5
	09/14/04	8.10	73	7.8
	09/15/04	11.25	73	5.3
	09/16/04	8.92	71	3.5
	09/17/04	13.13	70	2.6
5	09/20/04	14.43	65	2.8
	09/21/04	17.30	66	3.1
	09/22/04	14.13	65	2.8
	09/23/04	15.73	66	3.7
	09/24/04	15.28	68	2.8
6	09/27/04	14.32	66	3.1
	09/28/04	10.94	64	3.5
	09/29/04	9.63	61	3.5
	09/30/04	10.33	59	2.8
	10/01/04	13.06	61	3.5
7	10/04/04	13.46	58	3.5
	10/05/04	12.75	56	4.5
	10/06/04	16.44	56	6.5
	10/07/04	19.44	60	8.2
	10/08/04	20.68	58	8.0
8	10/11/04	17.04	58	7.9
	10/12/04	15.30	60	8.0
	10/13/04	14.42	58	8.1
	10/14/04	13.49	59	8.2
	10/15/04	11.63	56	7.9
9	10/18/04	8.25	50	8.2
	10/19/04	7.90	48	8.0
	10/20/04	7.16	49	9.0
	10/21/04	6.22	51	8.6
	10/22/04	8.61	52	7.2
10	10/25/04	6.50	54	5.6
	10/26/04	7.70	55	5.2
	10/27/04	8.60	57	5.0
	10/28/04	7.54	56	4.8

Harrison Bridge on the St. Marys
Daily Grab Sampling

Wk	Date	D.O.	Temp F	Depth
	10/29/04	7.25	58	4.8
11	11/01/04	6.36	55	4.8
	11/02/04	5.50	56	4.9
	11/03/04	6.90	53	5.0
	11/05/04	8.00	50	8.1
12	11/08/04	na	na	na
	11/09/04	9.50	47	6.0
	11/10/04	9.91	46	5.7
	11/12/04	10.48	44	4.6
13	11/15/04	na	na	na
	11/16/04	10.25	43	4.9
	11/18/04	9.47	49	4.3

Lawton Park Footbridge on the Spy Run Creek
Daily Grab Sampling

Wk	Date	D.O.	Temp F	Depth
1	08/23/04	8.38		
	08/24/04	7.12	70	
	08/25/04	7.45	74	2.7
	08/26/04	8.40	73	3.4
	08/27/04	6.72	72	2.9
2	08/30/04	9.36	71	3.4
	08/31/04	10.10	71	2.9
	09/01/04	10.10	72	2.7
	09/02/04	9.04	69	3.0
	09/03/04	7.92	69	3.4
3	09/07/04	7.56	72	4.1
	09/08/04	8.30	68	3.1
	09/09/04	7.88	69	2.7
	09/10/04	8.17	69	2.7
4	09/13/04	9.82	72	2.6
	09/14/04	10.20	73	2.8
	09/15/04	10.89	74	2.6
	09/16/04	6.21	70	3.1
	09/17/04	12.19	68	2.7
5	09/20/04	11.23	6.5	2.7
	09/21/04	11.4	68	2.7
	09/22/04	9.99	67	2.7
	09/23/04	8.45	65	2.6
	09/24/04	9.29	68	2.7
6	09/27/04	10.52	67	2.5
	09/28/04	8.14	62	2.8
	09/29/04	7.22	61	2.6
	09/30/04	8.00	59	2.7
	10/01/04	9.67	62	2.6
7	10/04/04	9.56	58	2.5
	10/05/04	8.45	52	2.8
	10/06/04	8.86	52	2.5
	10/07/04	9.95	56	2.6
	10/08/04	10.15	60	2.6
8	10/11/04	7.75	57	2.4
	10/12/04	10.21	56	2.7
	10/13/04	8.81	55	2.5
	10/14/04	7.75	58	2.7
	10/15/04	7.28	54	2.8
9	10/18/04	6.53	47	3.7
	10/19/04	6.22	48	2.8
	10/20/04	6.54	51	2.8
	10/21/04	6.26	54	2.6
	10/22/04	7.43	53	2.6
10	10/25/04	6.08	57	3.0
	10/26/04	7.38	56	2.9
	10/27/04	8.03	5.9	2.8
	10/28/04	6.57	58	2.7
	10/29/04	5.69	60	2.8

Lawton Park Footbridge on the Spy Run Creek
Daily Grab Sampling

Wk	Date	D.O.	Temp F	Depth
11	11/01/04	4.90	54	2.7
	11/02/04	7.53	55	4.3
	11/03/04	7.46	51	3.1
	11/05/04	9.10	47	3.0
12	11/08/04	8.60	49	2.8
	11/09/04	8.76	46	2.7
	11/10/04	9.52	45	2.7
	11/12/04	9.52	42	2.5
13	11/15/04	9.59	43	2.4
	11/16/04	8.98	42	2.6
	11/18/04	8.08	53	3.1

Spy Run Bridge on the St. Marys River
Daily Grab Sampling

Wk	Date	D.O.	Temp F	Depth
1	08/23/04	6.74		
	08/24/04	6.40	68	
	08/25/04	7.45	74	8.9
	08/26/04	6.87	73	9.4
	08/27/04	6.29	74	9.1
2	08/30/04	6.25	69	10.9
	08/31/04	6.22	70	10.3
	09/01/04	6.02	70	10.6
	09/02/04	5.90	68	10.0
	09/03/04	5.90	69	10.1
3	09/07/04	5.77	71	10.4
	09/08/04	6.06	70	9.5
	09/09/04	6.14	68	8.7
	09/10/04	6.06	69	8.9
4	09/13/04	6.23	68	9.9
	09/14/04	16.12	76	8.9
	09/15/04	9.36	72	6.5
	09/16/04	8.94	71	4.4
	09/17/04	12.62	70	3.9
5	09/20/04	16.50	66	4.0
	09/21/04	13.23	64	3.9
	09/22/04	16.63	67	3.2
	09/23/04	13.75	66	4.1
	09/24/04	16.51	69	3.3
6	09/27/04	10.56	65	3.5
	09/28/04	11.00	64	4.0
	09/29/04	10.46	63	4.2
	09/30/04	10.04	60	3.5
	10/01/04	12.53	61	3.8
7	10/04/04	12.21	57	4.2
	10/05/04	11.89	56	4.0
	10/06/04	13.48	58	7.1
	10/07/04	13.65	60	8.7
	10/08/04	18.13	60	8.6
8	10/11/04	14.70	58	9.0
	10/12/04	14.03	59	8.4
	10/13/04	13.25	58	8.5
	10/14/04	13.66	58	8.6
	10/15/04	10.52	57	8.4
9	10/18/04	8.42	51	9.0
	10/19/04	7.87	48	8.4
	10/20/04	7.16	48	9.4
	10/21/04	6.10	51	9.0
	10/22/04	7.66	52	7.7
10	10/25/04	6.89	54	6.0
	10/26/04	7.40	55	5.7
	10/27/04	8.31	57	5.3

Tecumseh Bridge on the Maumee River
Daily grab Sample Data

Wk	Date	D.O.	Temp F	Depth
1	08/23/04			
	08/24/04			
	08/25/04	9.86	74	12.7
	08/26/04	11.37	73	13.2
	08/27/04	8.49	74	12.1
2	08/30/04	6.70	71	14.2
	08/31/04	6.38	70	14.2
	09/01/04	6.60	71	14.3
	09/02/04	6.02	69	14.2
	09/03/04	7.14	71	13.3
3	09/07/04	6.30	73	13.6
	09/08/04	6.55	71	13.4
	09/09/04	6.66	70	12.9
	09/10/04	6.75	70	12.6
4	09/13/04	15.10	77	12.6
	09/14/04	15.50	75	12.9
	09/15/04	8.50	73	10.3
	09/16/04	8.46	72	8.7
	09/17/04	11.59	72	7.9
5	09/20/04	16.60	72	7.8
	09/21/04	19.21	73	7.1
	09/22/04	18.49	77	7.0
	09/23/04	13.15	68	7.9
	09/24/04	18.75	71	7.0
6	09/27/04	16.91	71	7.5
	09/28/04	9.34	66	7.8
	09/29/04	11.58	65	8.0
	09/30/04	11.79	65	7.1
	10/01/04	10.52	63	7.9
7	10/04/04	14.56	62	8.0
	10/05/04	11.87	60	8.3
	10/06/04	13.52	59	10.9
	10/07/04	15.48	63	12.6
	10/08/04	13.11	60	12.4
8	10/11/04	14.08	60	12.4
	10/12/04	13.12	59	12.5
	10/13/04	12.59	58	12.5
	10/14/04	12.41	59	12.6
	10/15/04	9.84	57	12.7
9	10/18/04	6.59	52	13.0
	10/19/04	7.16	51	12.5
	10/20/04	7.15	49	13.5
	10/21/04	6.27	52	13.1
	10/22/04	8.27	52	11.5
10	10/25/04	6.87	55	10.0
	10/26/04	7.96	55	9.7
	10/27/04	9.37	57	9.5
	10/28/04	8.80	57	9.3
	10/29/04	8.29	58	9.2

Tecumseh Bridge on the Maumee River
Daily grab Sample Data

Wk	Date	D.O.	Temp F	Depth
11	11/01/04	8.70	56	9.4
	11/02/04	7.13	56	9.5
	11/03/04	6.76	54	9.7
	11/05/04	8.00	51	12.5
12	11/08/04	na	na	na
	11/09/04	9.54	47	10.3
	11/10/04	9.86	46	9.9
	11/12/04	10.61	44	9.3
13	11/15/04	na	na	na
	11/16/04	10.72	45	8.9
	11/18/04	10.38	47	8.8

Harrison St. Bridge on the St. Marys
YSI Sonde Data

Date/time	Temp	DO mg/l	pH
10/28/2004 13:00	55.87	8.17	7.79
10/28/2004 14:00	56.24	8.21	7.8
10/28/2004 15:00	56.45	8.27	7.8
10/28/2004 16:00	56.63	8.36	7.81
10/28/2004 17:00	56.74	8.43	7.8
10/28/2004 18:00	56.8	8.45	7.8
10/28/2004 19:00	56.84	8.46	7.8
10/28/2004 20:00	56.86	8.54	7.8
10/28/2004 21:00	56.91	8.48	7.8
10/28/2004 22:00	56.98	8.56	7.81
10/28/2004 23:00	57.01	8.55	7.81
10/29/2004 0:00	57.02	8.55	7.81
10/29/2004 1:00	57	8.55	7.81
10/29/2004 2:00	56.97	8.48	7.8
10/29/2004 3:00	56.95	8.45	7.8
10/29/2004 4:00	56.93	8.38	7.8
10/29/2004 5:00	56.93	8.35	7.8
10/29/2004 6:00	56.94	8.29	7.8
10/29/2004 7:00	56.97	8.27	7.8
10/29/2004 8:00	57.03	8.24	7.8
10/29/2004 9:00	57.09	8.21	7.79
10/29/2004 10:00	57.19	8.01	7.79
10/29/2004 11:00	57.33	8.21	7.79
10/29/2004 12:00	57.48	8.01	7.79
10/29/2004 13:00	57.67	8.00	7.79
10/29/2004 14:00	57.93	8.01	7.79
10/29/2004 15:00	58.13	7.98	7.78
10/29/2004 16:00	58.31	7.94	7.78
10/29/2004 17:00	58.52	7.94	7.78
10/29/2004 18:00	58.65	7.89	7.77
10/29/2004 19:00	58.73	7.76	7.77
10/29/2004 20:00	58.9	7.09	7.73
10/29/2004 21:00	59.11	6.24	7.69
10/29/2004 22:00	59.21	6.12	7.68
10/29/2004 23:00	59.25	6.26	7.69
10/30/2004 0:00	59.31	6.45	7.7
10/30/2004 1:00	59.41	6.64	7.7
10/30/2004 2:00	59.47	6.75	7.71
10/30/2004 3:00	59.53	6.92	7.72
10/30/2004 4:00	59.6	6.95	7.72
10/30/2004 5:00	59.64	7.03	7.72
10/30/2004 6:00	59.7	7.09	7.73
10/30/2004 7:00	59.78	7.07	7.72
10/30/2004 8:00	59.75	7.08	7.73
10/30/2004 9:00	59.79	6.99	7.72
10/30/2004 10:00	59.92	6.95	7.72
10/30/2004 11:00	60.19	6.95	7.72
10/30/2004 12:00	60.58	6.47	7.69

Harrison St. Bridge on the St. Marys
YSI Sonde Data

Date/time	Temp	DO mg/l	pH
10/30/2004 13:00	60.95	6.07	7.67
10/30/2004 14:00	61.22	6.26	7.67
10/30/2004 15:00	61.45	6.01	7.65
10/30/2004 16:00	61.67	5.73	7.64
10/30/2004 17:00	61.68	5.62	7.63
10/30/2004 18:00	61.61	5.58	7.64
10/30/2004 19:00	61.46	5.61	7.65
10/30/2004 20:00	61.35	5.59	7.65
10/30/2004 21:00	61.21	5.58	7.65
10/30/2004 22:00	61.07	5.58	7.66
10/30/2004 23:00	60.93	5.57	7.66
10/31/2004 0:00	60.74	5.74	7.67
10/31/2004 1:00	60.5	5.80	7.68
10/31/2004 2:00	60.19	5.82	7.68
10/31/2004 3:00	58.46	6.98	8.01
10/31/2004 4:00	52.08	11.38	8.42
10/31/2004 5:00	50.71	11.66	8.44
10/31/2004 6:00	49.85	11.92	8.43
10/31/2004 7:00	48.89	11.87	8.43
10/31/2004 8:00	49.69	12.01	8.42
10/31/2004 9:00	51.76	11.70	8.37
10/31/2004 10:00	59.22	10.62	8.29
10/31/2004 11:00	63.73	10.18	8.09
10/31/2004 12:00	57.51	10.93	8.28
10/31/2004 13:00	56.16	11.17	8.25
10/31/2004 14:00	57.7	10.86	8.22
10/31/2004 15:00	60.14	10.54	8.18
10/31/2004 16:00	61.37	10.29	8.16
10/31/2004 17:00	59.79	10.54	8.15
10/31/2004 18:00	56.27	10.97	8.15
10/31/2004 19:00	53.16	11.43	8.14
10/31/2004 20:00	50.81	11.64	8.13
10/31/2004 21:00	49.4	11.90	8.11
10/31/2004 22:00	48.64	11.83	8.09
10/31/2004 23:00	48.87	11.77	8.08
11/1/2004 0:00	49.09	11.70	8.06
11/1/2004 1:00	48.81	11.63	8.05
11/1/2004 2:00	56.92	8.21	7.79
11/1/2004 3:00	56.67	8.08	7.79
11/1/2004 4:00	56.4	8.05	7.79
11/1/2004 5:00	56.15	8.01	7.79
11/1/2004 6:00	55.92	7.98	7.79
11/1/2004 7:00	55.69	7.96	7.79
11/1/2004 8:00	55.49	7.94	7.79
11/1/2004 9:00	55.35	8.14	7.79
11/1/2004 10:00	55.33	9.80	7.8
11/1/2004 11:00	55.32	9.77	7.8
11/1/2004 12:00	55.31	9.85	7.8

Harrison St. Bridge on the St. Marys
YSI Sonde Data

Date/time	Temp	DO mg/l	pH
11/1/2004 13:00	55.33	9.87	7.8
11/1/2004 14:00	55.37	10.18	7.8
11/1/2004 15:00	55.34	10.26	7.8
11/1/2004 16:00	55.32	10.33	7.8
11/1/2004 17:00	55.32	10.34	7.8
11/1/2004 18:00	55.31	10.31	7.8
11/1/2004 19:00	55.29	10.29	7.8
11/1/2004 20:00	55.29	10.27	7.8
11/1/2004 21:00	55.32	10.25	7.8
11/1/2004 22:00	55.33	10.25	7.8
11/1/2004 23:00	55.32	10.39	7.8
11/2/2004 0:00	55.32	10.39	7.8
11/2/2004 1:00	55.32	10.31	7.8
11/2/2004 2:00	55.31	10.31	7.8
11/2/2004 3:00	55.31	10.28	7.8
11/2/2004 4:00	55.32	10.26	7.8
11/2/2004 5:00	55.34	10.20	7.79
11/2/2004 6:00	55.35	10.10	7.79
11/2/2004 7:00	55.39	9.82	7.77
11/2/2004 8:00	55.5	8.92	7.75
11/2/2004 9:00	55.65	8.38	7.72
11/2/2004 10:00	55.72	8.28	7.72
11/2/2004 11:00	55.73	8.19	7.71
11/2/2004 12:00	55.72	8.50	7.73
11/2/2004 13:00	55.72	8.71	7.73
11/2/2004 14:00	55.72	8.78	7.73
11/2/2004 15:00	55.72	8.79	7.73
11/2/2004 16:00	55.76	8.68	7.72
11/2/2004 17:00	55.76	8.58	7.71
11/2/2004 18:00	55.71	8.56	7.71
11/2/2004 19:00	55.62	9.26	7.71
11/2/2004 20:00	55.5	9.28	7.71
11/2/2004 21:00	55.39	9.22	7.72
11/2/2004 22:00	55.3	9.37	7.71
11/2/2004 23:00	55.17	9.32	7.72
11/3/2004 0:00	55.03	9.34	7.72
11/3/2004 1:00	54.86	9.36	7.72
11/3/2004 2:00	54.7	9.37	7.72
11/3/2004 3:00	54.49	9.40	7.73
11/3/2004 4:00	54.24	9.43	7.73
11/3/2004 5:00	54	9.49	7.74
11/3/2004 6:00	53.7	9.50	7.74
11/3/2004 7:00	53.44	9.73	7.75
11/3/2004 8:00	53.19	9.79	7.75
11/3/2004 9:00	53.01	9.90	7.76
11/3/2004 10:00	52.84	10.05	7.78
11/3/2004 11:00	52.67	10.32	7.8
11/3/2004 12:00	52.54	10.68	7.82

Harrison St. Bridge on the St. Marys
YSI Sonde Data

Date/time	Temp	DO mg/l	pH
11/3/2004 13:00	52.44	10.99	7.85
11/3/2004 14:00	46.48	16.35	8.48
11/3/2004 15:00	52.57	11.11	7.88
11/3/2004 16:00	52.77	11.17	7.89
11/3/2004 17:00	52.88	12.86	7.89
11/3/2004 18:00	52.96	10.90	7.89
11/3/2004 19:00	53.09	10.58	7.87
11/3/2004 20:00	53.19	10.39	7.86
11/3/2004 21:00	53.2	10.29	7.84
11/3/2004 22:00	53.22	10.03	7.82
11/3/2004 23:00	53.3	9.59	7.77
11/4/2004 0:00	53.38	9.23	7.73
11/4/2004 1:00	53.44	9.13	7.7
11/4/2004 2:00	53.46	9.21	7.69
11/4/2004 3:00	53.46	9.35	7.69
11/4/2004 4:00	53.43	9.27	7.68
11/4/2004 5:00	53.36	9.32	7.67
11/4/2004 6:00	53.36	9.27	7.66
11/4/2004 7:00	53.31	9.20	7.65
11/4/2004 8:00	47.93	13.70	8.44
11/4/2004 9:00	53.13	8.60	7.62
11/4/2004 10:00	53.13	8.52	7.61
11/4/2004 11:00	53.14	8.56	7.62
11/4/2004 12:00	53.14	8.47	7.62
11/4/2004 13:00	53.09	8.59	7.63
11/4/2004 14:00	53.03	8.50	7.64
11/4/2004 15:00	53	8.55	7.65
11/4/2004 16:00	52.96	8.61	7.65
11/4/2004 17:00	52.91	8.64	7.66
11/4/2004 18:00	52.82	8.66	7.67
11/4/2004 19:00	52.71	8.71	7.67
11/4/2004 20:00	52.59	8.76	7.68
11/4/2004 21:00	52.42	8.80	7.69
11/4/2004 22:00	52.25	8.81	7.69
11/4/2004 23:00	52.06	8.85	7.7
11/5/2004 0:00	51.88	8.87	7.71
11/5/2004 1:00	51.69	9.13	7.71
11/5/2004 2:00	51.48	9.16	7.72
11/5/2004 3:00	51.29	9.21	7.73
11/5/2004 4:00	51.12	9.30	7.74
11/5/2004 5:00	50.94	9.33	7.76
11/5/2004 6:00	50.76	9.43	7.77
11/5/2004 7:00	50.6	9.45	7.78
11/5/2004 8:00	50.43	9.53	7.79
11/5/2004 9:00	50.32	9.57	7.79
11/5/2004 10:00	50.29	9.62	7.8
11/5/2004 11:00	50.34	9.73	7.81
11/5/2004 12:00	50.49	9.89	7.82

Harrison St. Bridge on the St. Marys
YSI Sonde Data

Date/time	Temp	DO mg/l	pH
11/5/2004 13:00	50.71	9.95	7.83
11/5/2004 14:00	50.95	10.04	7.84
11/5/2004 15:00	51.15	10.07	7.84
11/5/2004 16:00	51.34	10.10	7.84
11/5/2004 17:00	51.34	10.10	7.83
11/5/2004 18:00	51.22	10.07	7.82
11/5/2004 19:00	51.04	10.01	7.81
11/5/2004 20:00	50.88	9.97	7.8
11/5/2004 21:00	50.7	9.97	7.78
11/5/2004 22:00	50.54	9.91	7.78
11/5/2004 23:00	50.42	9.87	7.77
11/6/2004 0:00	50.32	9.87	7.77
11/6/2004 1:00	50.2	9.82	7.77
11/6/2004 2:00	50.09	9.82	7.77
11/6/2004 3:00	50	9.79	7.77
11/6/2004 4:00	49.92	10.01	7.78
11/6/2004 5:00	49.83	10.02	7.78
11/6/2004 6:00	49.73	9.99	7.78
11/6/2004 7:00	49.63	9.98	7.79
11/6/2004 8:00	49.51	10.00	7.79
11/6/2004 9:00	49.41	10.03	7.79
11/6/2004 10:00	49.39	9.95	7.8
11/6/2004 11:00	49.46	9.95	7.8
11/6/2004 12:00	49.63	10.02	7.8
11/6/2004 13:00	49.89	10.08	7.8
11/6/2004 14:00	50.17	9.84	7.8
11/6/2004 15:00	50.46	9.91	7.81
11/6/2004 16:00	50.68	9.94	7.81
11/6/2004 17:00	50.73	9.95	7.81
11/6/2004 18:00	50.68	9.92	7.81
11/6/2004 19:00	50.59	9.92	7.82
11/6/2004 20:00	50.48	9.94	7.82
11/6/2004 21:00	50.34	9.97	7.82
11/6/2004 22:00	50.17	9.97	7.82
11/6/2004 23:00	50.02	9.95	7.83
11/7/2004 0:00	49.9	10.17	7.83
11/7/2004 1:00	49.83	10.17	7.83
11/7/2004 2:00	49.76	10.16	7.83
11/7/2004 3:00	49.69	10.14	7.83
11/7/2004 4:00	49.61	10.14	7.83
11/7/2004 5:00	49.53	10.12	7.84
11/7/2004 6:00	49.45	10.12	7.84
11/7/2004 7:00	49.39	10.07	7.84
11/7/2004 8:00	49.33	10.09	7.84
11/7/2004 9:00	49.31	10.12	7.85
11/7/2004 10:00	49.35	10.13	7.85
11/7/2004 11:00	49.48	10.14	7.85
11/7/2004 12:00	49.69	10.17	7.86

Harrison St. Bridge on the St. Marys
YSI Sonde Data

Date/time	Temp	DO mg/l	pH
11/7/2004 13:00	50	9.99	7.86
11/7/2004 14:00	50.36	10.08	7.86
11/7/2004 15:00	50.67	10.17	7.87
11/7/2004 16:00	50.88	10.25	7.88
11/7/2004 17:00	50.91	10.25	7.88
11/7/2004 18:00	50.83	10.24	7.89
11/7/2004 19:00	50.69	10.23	7.89
11/7/2004 20:00	50.53	10.22	7.9
11/7/2004 21:00	50.34	10.21	7.9
11/7/2004 22:00	50.11	10.17	7.9
11/7/2004 23:00	49.85	10.38	7.91
11/8/2004 0:00	49.63	10.36	7.91
11/8/2004 1:00	49.45	10.32	7.91
11/8/2004 2:00	49.3	10.28	7.92
11/8/2004 3:00	49.15	10.24	7.92
11/8/2004 4:00	49.01	10.21	7.92
11/8/2004 5:00	48.83	10.17	7.92
11/8/2004 6:00	48.66	10.15	7.92
11/8/2004 7:00	48.48	10.14	7.92
11/8/2004 8:00	48.31	10.13	7.92
11/8/2004 9:00	48.18	10.38	7.92
11/8/2004 10:00	48.13	10.42	7.92
11/8/2004 11:00	48.1	10.45	7.93
11/8/2004 12:00	48.18	10.53	7.93
11/8/2004 13:00	48.33	10.37	7.93
11/8/2004 14:00	48.56	10.45	7.93
11/8/2004 15:00	48.8	10.52	7.94
11/8/2004 16:00	48.96	10.57	7.94
11/8/2004 17:00	49.01	10.55	7.94
11/8/2004 18:00	48.91	10.52	7.94
11/8/2004 19:00	48.77	10.51	7.94
11/8/2004 20:00	48.64	10.46	7.94
11/8/2004 21:00	48.51	10.45	7.93
11/8/2004 22:00	48.34	10.42	7.93
11/8/2004 23:00	48.14	10.61	7.93
11/9/2004 0:00	47.94	10.58	7.93
11/9/2004 1:00	47.77	10.55	7.93
11/9/2004 2:00	47.64	10.53	7.93
11/9/2004 3:00	47.53	10.50	7.92
11/9/2004 4:00	47.44	10.47	7.92
11/9/2004 5:00	47.33	10.45	7.92
11/9/2004 6:00	47.23	10.43	7.92
11/9/2004 7:00	47.13	10.41	7.92
11/9/2004 8:00	47.02	10.40	7.92
11/9/2004 9:00	46.94	10.36	7.92
11/9/2004 10:00	66.85		8.49

Sonde Stolen

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
10/28/2004 13:00	57.07	6.56	7.66
10/28/2004 14:00	58.27	6.83	7.68
10/28/2004 15:00	58.23	6.95	7.68
10/28/2004 16:00	58.46	7.09	7.68
10/28/2004 17:00	58.25	6.97	7.68
10/28/2004 18:00	58.08	6.75	7.68
10/28/2004 19:00	57.91	6.53	7.67
10/28/2004 20:00	57.7	6.19	7.66
10/28/2004 21:00	57.62	5.92	7.66
10/28/2004 22:00	57.54	5.66	7.65
10/28/2004 23:00	57.45	5.42	7.65
10/29/2004 0:00	57.35	5.18	7.64
10/29/2004 1:00	57.29	5.08	7.64
10/29/2004 2:00	57.2	4.99	7.64
10/29/2004 3:00	57.17	4.97	7.63
10/29/2004 4:00	57.3	4.87	7.63
10/29/2004 5:00	57.28	4.76	7.63
10/29/2004 6:00	57.32	4.68	7.62
10/29/2004 7:00	57.75	4.83	7.63
10/29/2004 8:00	57.75	4.75	7.62
10/29/2004 9:00	57.86	4.63	7.62
10/29/2004 10:00	58.19	4.66	7.63
10/29/2004 11:00	60.52	4.83	7.86
10/29/2004 12:00	58.67	4.91	7.63
10/29/2004 13:00	59.63	5.06	7.65
10/29/2004 14:00	59.56	4.96	7.64
10/29/2004 15:00	59.79	4.91	7.64
10/29/2004 16:00	60.02	4.79	7.63
10/29/2004 17:00	60.19	4.73	7.62
10/29/2004 18:00	60.52	4.56	7.62
10/29/2004 19:00	60.61	4.45	7.61
10/29/2004 20:00	60.89	4.47	7.61
10/29/2004 21:00	60.76	4.10	7.6
10/29/2004 22:00	60.59	4.08	7.6
10/29/2004 23:00	60.79	4.17	7.6
10/30/2004 0:00	60.86	4.05	7.6
10/30/2004 1:00	60.94	3.93	7.61
10/30/2004 2:00	60.65	3.72	7.59
10/30/2004 3:00	61.01	3.83	7.62
10/30/2004 4:00	60.98	3.95	7.62
10/30/2004 5:00	60.98	3.80	7.61
10/30/2004 6:00	60.98	3.87	7.61
10/30/2004 7:00	60.99	4.08	7.61
10/30/2004 8:00	61	4.44	7.61
10/30/2004 9:00	61.24	5.35	7.64
10/30/2004 10:00	61.38	5.09	7.61
10/30/2004 11:00	61.79	4.83	7.59
10/30/2004 12:00	62.04	5.23	7.58
10/30/2004 13:00	62.06	5.41	7.59

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
10/30/2004 14:00	62.05	5.91	7.63
10/30/2004 15:00	61.9	6.05	7.68
10/30/2004 16:00	61.76	6.11	7.68
10/30/2004 17:00	61.62	5.93	7.66
10/30/2004 18:00	61.36	5.66	7.62
10/30/2004 19:00	61.07	5.38	7.58
10/30/2004 20:00	60.74	5.31	7.57
10/30/2004 21:00	60.36	5.27	7.58
10/30/2004 22:00	59.92	5.11	7.57
10/30/2004 23:00	59.5	5.04	7.58
10/31/2004 0:00	59.12	4.92	7.58
10/31/2004 1:00	58.67	4.90	7.58
10/31/2004 2:00	58.27	4.77	7.59
10/31/2004 3:00	57.9	4.75	7.59
10/31/2004 4:00	57.52	4.67	7.59
10/31/2004 5:00	57.12	4.70	7.59
10/31/2004 6:00	56.71	4.70	7.58
10/31/2004 7:00	56.31	4.67	7.58
10/31/2004 8:00	55.91	4.70	7.58
10/31/2004 9:00	55.71	4.71	7.58
10/31/2004 10:00	55.78	4.87	7.58
10/31/2004 11:00	56.38	5.01	7.58
10/31/2004 12:00	57.37	5.11	7.59
10/31/2004 13:00	58.17	5.34	7.6
10/31/2004 14:00	58.52	5.54	7.61
10/31/2004 15:00	58.55	5.67	7.61
10/31/2004 16:00	57.95	5.66	7.62
10/31/2004 17:00	57.58	5.46	7.61
10/31/2004 18:00	57.14	5.44	7.61
10/31/2004 19:00	56.69	5.34	7.61
10/31/2004 20:00	56.24	5.15	7.61
10/31/2004 21:00	55.84	5.05	7.6
10/31/2004 22:00	55.44	4.93	7.59
10/31/2004 23:00	55.23	4.94	7.59
11/1/2004 0:00	55.01	5.10	7.6
11/1/2004 1:00	54.84	5.15	7.61
11/1/2004 2:00	54.61	5.14	7.61
11/1/2004 3:00	54.35	5.02	7.61
11/1/2004 4:00	54.13	4.87	7.6
11/1/2004 5:00	53.88	4.75	7.6
11/1/2004 6:00	53.67	4.58	7.6
11/1/2004 7:00	53.41	4.53	7.59
11/1/2004 8:00	53.1	4.42	7.59
11/1/2004 9:00	53.12	4.37	7.59
11/1/2004 10:00	53.16	4.54	7.6
11/1/2004 11:00	53.2	4.68	7.6
11/1/2004 12:00	53.33	4.86	7.61
11/1/2004 13:00	53.55	5.00	7.61
11/1/2004 14:00	53.68	5.05	7.61

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/1/2004 15:00	53.7	5.22	7.62
11/1/2004 16:00	53.7	5.19	7.61
11/1/2004 17:00	53.68	5.05	7.6
11/1/2004 18:00	53.58	5.15	7.6
11/1/2004 19:00	53.51	5.07	7.6
11/1/2004 20:00	53.42	5.05	7.59
11/1/2004 21:00	53.39	5.08	7.59
11/1/2004 22:00	53.42	5.23	7.6
11/1/2004 23:00	53.45	5.80	7.62
11/2/2004 0:00	53.55	6.18	7.61
11/2/2004 1:00	53.7	6.67	7.64
11/2/2004 2:00	53.82	7.14	7.65
11/2/2004 3:00	53.99	6.75	7.61
11/2/2004 4:00	54.09	6.79	7.57
11/2/2004 5:00	54.25	6.78	7.57
11/2/2004 6:00	54.08	7.15	7.62
11/2/2004 7:00	54.29	7.77	7.63
11/2/2004 8:00	54.63	7.84	7.61
11/2/2004 9:00	54.83	7.58	7.61
11/2/2004 10:00	55.01	7.71	7.64
11/2/2004 11:00	55	8.09	7.66
11/2/2004 12:00	54.99	8.02	7.66
11/2/2004 13:00	54.96	8.07	7.66
11/2/2004 14:00	55	8.09	7.66
11/2/2004 15:00	55.01	8.02	7.66
11/2/2004 16:00	55	7.97	7.66
11/2/2004 17:00	54.94	8.02	7.67
11/2/2004 18:00	54.82	7.94	7.67
11/2/2004 19:00	54.66	7.88	7.66
11/2/2004 20:00	54.49	7.87	7.66
11/2/2004 21:00	54.26	7.75	7.66
11/2/2004 22:00	54.07	7.63	7.65
11/2/2004 23:00	53.85	7.65	7.65
11/3/2004 0:00	53.58	7.84	7.65
11/3/2004 1:00	53.3	7.85	7.65
11/3/2004 2:00	53.05	7.78	7.64
11/3/2004 3:00	52.83	7.79	7.64
11/3/2004 4:00	52.48	7.72	7.64
11/3/2004 5:00	52.09	7.65	7.64
11/3/2004 6:00	51.73	7.78	7.64
11/3/2004 7:00	51.41	7.74	7.64
11/3/2004 8:00	51.18	7.69	7.64
11/3/2004 9:00	51.04	7.73	7.63
11/3/2004 10:00	51.04	7.79	7.63
11/3/2004 11:00	51.11	7.89	7.64
11/3/2004 12:00	51.25	8.06	7.64
11/3/2004 13:00	51.43	8.21	7.64
11/3/2004 14:00	51.67	8.43	7.65
11/3/2004 15:00	51.84	8.39	7.65

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/3/2004 16:00	51.91	8.47	7.65
11/3/2004 17:00	51.72	8.77	7.66
11/3/2004 18:00	51.49	8.76	7.66
11/3/2004 19:00	51.15	8.69	7.66
11/3/2004 20:00	50.86	8.63	7.66
11/3/2004 21:00	50.59	8.52	7.66
11/3/2004 22:00	50.37	8.47	7.66
11/3/2004 23:00	50.25	8.37	7.66
11/4/2004 0:00	50.18	8.30	7.66
11/4/2004 1:00	50.15	8.15	7.66
11/4/2004 2:00	50.08	7.95	7.65
11/4/2004 3:00	50.03	7.79	7.64
11/4/2004 4:00	49.95	7.85	7.64
11/4/2004 5:00	49.8	8.12	7.65
11/4/2004 6:00	49.69	8.25	7.67
11/4/2004 7:00	49.16	8.94	7.72
11/4/2004 8:00	49.11	9.01	7.7
11/4/2004 9:00	48.89	9.10	7.71
11/4/2004 10:00	49.4	8.72	7.66
11/4/2004 11:00	49.36	9.02	7.69
11/4/2004 12:00	48.92	9.50	7.72
11/4/2004 13:00	48.76	9.79	7.76
11/4/2004 14:00	48.84	9.61	7.76
11/4/2004 15:00	48.92	9.51	7.75
11/4/2004 16:00	48.98	9.56	7.74
11/4/2004 17:00	49.06	9.61	7.74
11/4/2004 18:00	49.01	9.65	7.75
11/4/2004 19:00	48.93	9.64	7.75
11/4/2004 20:00	48.8	9.57	7.74
11/4/2004 21:00	48.6	9.51	7.74
11/4/2004 22:00	48.41	9.43	7.73
11/4/2004 23:00	48.22	9.22	7.71
11/5/2004 0:00	48	9.47	7.71
11/5/2004 1:00	47.78	9.51	7.71
11/5/2004 2:00	47.54	9.53	7.71
11/5/2004 3:00	47.28	9.52	7.71
11/5/2004 4:00	47.05	9.50	7.71
11/5/2004 5:00	46.8	9.41	7.7
11/5/2004 6:00	46.54	9.37	7.7
11/5/2004 7:00	46.28	9.66	7.71
11/5/2004 8:00	46.02	9.65	7.71
11/5/2004 9:00	45.86	9.64	7.72
11/5/2004 10:00	46.07	9.72	7.72
11/5/2004 11:00	46.68	9.65	7.71
11/5/2004 12:00	47.49	10.58	7.81
11/5/2004 13:00	48.08	10.82	7.82
11/5/2004 14:00	48.49	10.76	7.83
11/5/2004 15:00	48.68	10.92	7.84
11/5/2004 16:00	48.8	11.03	7.85

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/5/2004 17:00	48.64	11.07	7.86
11/5/2004 18:00	48.29	10.99	7.86
11/5/2004 19:00	47.99	11.12	7.85
11/5/2004 20:00	47.7	11.01	7.85
11/5/2004 21:00	47.38	10.87	7.86
11/5/2004 22:00	47.05	10.74	7.86
11/5/2004 23:00	46.71	10.57	7.86
11/6/2004 0:00	46.43	10.37	7.86
11/6/2004 1:00	46.13	10.43	7.85
11/6/2004 2:00	45.88	10.23	7.84
11/6/2004 3:00	45.63	10.04	7.83
11/6/2004 4:00	45.4	9.88	7.82
11/6/2004 5:00	45.17	9.72	7.81
11/6/2004 6:00	44.98	9.66	7.81
11/6/2004 7:00	44.83	9.61	7.8
11/6/2004 8:00	44.67	9.61	7.8
11/6/2004 9:00	44.62	9.65	7.81
11/6/2004 10:00	45.05	9.74	7.79
11/6/2004 11:00	46.06	9.97	7.84
11/6/2004 12:00	47.31	10.00	7.79
11/6/2004 13:00	48.43	10.16	7.81
11/6/2004 14:00	49.26	10.42	7.82
11/6/2004 15:00	49.62	10.54	7.83
11/6/2004 16:00	49.72	10.54	7.83
11/6/2004 17:00	49.68	10.48	7.83
11/6/2004 18:00	49.46	10.95	7.84
11/6/2004 19:00	49.22	10.81	7.84
11/6/2004 20:00	49.06	10.70	7.83
11/6/2004 21:00	48.92	10.64	7.84
11/6/2004 22:00	48.79	10.54	7.85
11/6/2004 23:00	48.66	10.43	7.85
11/7/2004 0:00	48.52	10.31	7.85
11/7/2004 1:00	48.34	10.05	7.84
11/7/2004 2:00	48.15	10.04	7.83
11/7/2004 3:00	47.95	9.78	7.82
11/7/2004 4:00	47.77	9.53	7.81
11/7/2004 5:00	47.63	9.33	7.8
11/7/2004 6:00	47.49	9.18	7.8
11/7/2004 7:00	47.36	9.06	7.79
11/7/2004 8:00	47.28	8.99	7.79
11/7/2004 9:00	47.37	9.15	7.98
11/7/2004 10:00	47.54	9.15	7.84
11/7/2004 11:00	48.26	9.02	7.82
11/7/2004 12:00	49.54	9.22	7.81
11/7/2004 13:00	50.81	9.30	7.81
11/7/2004 14:00	51.87	9.35	7.82
11/7/2004 15:00	52.01	9.44	7.82
11/7/2004 16:00	51.59	9.57	7.83
11/7/2004 17:00	51.16	9.59	7.84

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/7/2004 18:00	50.76	9.61	7.84
11/7/2004 19:00	50.21	9.51	7.84
11/7/2004 20:00	49.76	9.61	7.84
11/7/2004 21:00	49.39	9.40	7.83
11/7/2004 22:00	49.05	9.29	7.82
11/7/2004 23:00	48.76	9.27	7.83
11/8/2004 0:00	48.43	9.27	7.83
11/8/2004 1:00	48.11	9.48	7.84
11/8/2004 2:00	47.78	9.41	7.84
11/8/2004 3:00	47.36	9.29	7.84
11/8/2004 4:00	46.97	9.10	7.84
11/8/2004 5:00	46.49	8.86	7.83
11/8/2004 6:00	46.05	8.92	7.83
11/8/2004 7:00	45.62	8.73	7.82
11/8/2004 8:00	45.22	8.56	7.81
11/8/2004 9:00	44.88	8.46	7.81
11/8/2004 10:00	44.9	8.51	7.81
11/8/2004 11:00	45.44	8.77	7.81
11/8/2004 12:00	46.26	8.92	7.81
11/8/2004 13:00	47.37	9.03	7.8
11/8/2004 14:00	48.24	9.13	7.81
11/8/2004 15:00	48.59	9.41	7.82
11/8/2004 16:00	48.17	9.67	7.83
11/8/2004 17:00	47.33	9.50	7.84
11/8/2004 18:00	46.82	9.41	7.84
11/8/2004 19:00	46.43	9.33	7.84
11/8/2004 20:00	46.05	9.47	7.83
11/8/2004 21:00	45.78	9.34	7.83
11/8/2004 22:00	45.53	9.27	7.83
11/8/2004 23:00	45.27	9.27	7.83
11/9/2004 0:00	44.98	9.26	7.83
11/9/2004 1:00	44.71	9.40	7.83
11/9/2004 2:00	44.42	9.76	7.84
11/9/2004 3:00	44.15	9.94	7.86
11/9/2004 4:00	43.98	10.00	7.86
11/9/2004 5:00	43.71	10.00	7.87
11/9/2004 6:00	43.45	9.90	7.87
11/9/2004 7:00	43.25	9.77	7.86
11/9/2004 8:00	43.04	9.64	7.86
11/9/2004 9:00	42.88	9.51	7.86
11/9/2004 10:00	42.86	9.50	7.86
11/9/2004 11:00	43.05	9.56	7.85
11/9/2004 12:00	43.74	9.72	7.84
11/9/2004 13:00	44.8	9.64	7.82
11/9/2004 14:00	45.71	9.82	7.81
11/9/2004 15:00	46.52	9.83	7.8
11/9/2004 16:00	46.67	9.91	7.8
11/9/2004 17:00	46.23	10.04	7.8
11/9/2004 18:00	45.67	9.89	7.8

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/9/2004 19:00	45.12	9.78	7.81
11/9/2004 20:00	44.69	9.74	7.82
11/9/2004 21:00	44.33	9.90	7.83
11/9/2004 22:00	44.01	9.80	7.83
11/9/2004 23:00	43.73	9.74	7.82
11/10/2004 0:00	43.44	9.72	7.83
11/10/2004 1:00	43.12	9.71	7.84
11/10/2004 2:00	42.87	9.77	7.85
11/10/2004 3:00	42.56	10.16	7.85
11/10/2004 4:00	42.39	10.39	7.88
11/10/2004 5:00	42.33	10.46	7.88
11/10/2004 6:00	42.24	10.56	7.89
11/10/2004 7:00	42.19	10.68	7.91
11/10/2004 8:00	42.11	10.59	7.9
11/10/2004 9:00	42.17	10.54	7.9
11/10/2004 10:00	42.35	10.57	7.91
11/10/2004 11:00	43.16	10.47	7.9
11/10/2004 12:00	44.56	10.67	7.88
11/10/2004 13:00	45.81	10.59	7.86
11/10/2004 14:00	46.74	10.41	7.85
11/10/2004 15:00	47.11	10.43	7.84
11/10/2004 16:00	47.38	10.47	7.84
11/10/2004 17:00	47.51	10.36	7.84
11/10/2004 18:00	47.34	10.21	7.85
11/10/2004 19:00	47.2	10.03	7.85
11/10/2004 20:00	47.05	9.90	7.85
11/10/2004 21:00	46.9	9.74	7.85
11/10/2004 22:00	46.71	9.66	7.85
11/10/2004 23:00	46.58	9.55	7.85
11/11/2004 0:00	46.47	9.52	7.85
11/11/2004 1:00	46.39	9.45	7.84
11/11/2004 2:00	46.31	9.77	7.84
11/11/2004 3:00	46.25	9.78	7.85
11/11/2004 4:00	46.29	9.92	7.86
11/11/2004 5:00	46.36	9.99	7.86
11/11/2004 6:00	46.38	10.00	7.86
11/11/2004 7:00	46.41	9.70	7.86
11/11/2004 8:00	46.43	9.58	7.87
11/11/2004 9:00	46.35	9.54	7.86
11/11/2004 10:00	46.2	9.53	7.86
11/11/2004 11:00	46.01	9.55	7.87
11/11/2004 12:00	45.85	9.47	7.87
11/11/2004 13:00	45.89	9.57	7.87
11/11/2004 14:00	45.97	9.61	7.86
11/11/2004 15:00	46.06	9.65	7.85
11/11/2004 16:00	46.1	9.57	7.85
11/11/2004 17:00	45.96	9.49	7.84
11/11/2004 18:00	45.82	9.13	7.84
11/11/2004 19:00	45.56	9.14	7.85

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/11/2004 20:00	45.23	8.92	7.85
11/11/2004 21:00	44.98	8.74	7.85
11/11/2004 22:00	44.75	8.52	7.85
11/11/2004 23:00	44.56	8.75	7.85
11/12/2004 0:00	44.38	8.65	7.85
11/12/2004 1:00	44.21	8.73	7.84
11/12/2004 2:00	44.01	8.68	7.83
11/12/2004 3:00	43.71	8.64	7.83
11/12/2004 4:00	43.44	8.55	7.83
11/12/2004 5:00	43.04	8.59	7.84
11/12/2004 6:00	42.6	8.88	7.85
11/12/2004 7:00	42.22	8.88	7.85
11/12/2004 8:00	41.78	8.94	7.86
11/12/2004 9:00	41.36	9.05	7.87
11/12/2004 10:00	41.12	9.27	7.89
11/12/2004 11:00	41.45	9.55	7.9
11/12/2004 12:00	42.22	9.87	7.9
11/12/2004 13:00	43.5	9.86	7.91
11/12/2004 14:00	44.4	10.07	7.9
11/12/2004 15:00	44.58	9.94	7.89
11/12/2004 16:00	45.13	9.85	7.88
11/12/2004 17:00	44.43	10.22	7.89
11/12/2004 18:00	43.85	10.07	7.89
11/12/2004 19:00	43.59	9.79	7.88
11/12/2004 20:00	43.29	9.60	7.87
11/12/2004 21:00	42.93	9.45	7.86
11/12/2004 22:00	42.6	9.51	7.86
11/12/2004 23:00	42.22	9.39	7.86
11/13/2004 0:00	41.8	9.33	7.85
11/13/2004 1:00	41.39	9.37	7.86
11/13/2004 2:00	41.04	9.39	7.86
11/13/2004 3:00	40.8	9.68	7.86
11/13/2004 4:00	40.51	9.69	7.86
11/13/2004 5:00	40.43	9.77	7.86
11/13/2004 6:00	40.15	9.92	7.87
11/13/2004 7:00	39.83	10.08	7.88
11/13/2004 8:00	39.57	10.19	7.89
11/13/2004 9:00	39.36	10.27	7.91
11/13/2004 10:00	39.36	10.50	7.93
11/13/2004 11:00	39.88	10.79	7.95
11/13/2004 12:00	40.94	11.17	7.97
11/13/2004 13:00	41.63	11.03	7.97
11/13/2004 14:00	42.85	10.99	7.97
11/13/2004 15:00	42.7	11.37	7.94
11/13/2004 16:00	43.16	11.01	7.93
11/13/2004 17:00	43.33	11.23	7.94
11/13/2004 18:00	42.79	10.94	7.93
11/13/2004 19:00	42.32	10.88	7.93
11/13/2004 20:00	41.98	10.61	7.92

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/13/2004 21:00	41.7	10.42	7.91
11/13/2004 22:00	41.38	10.16	7.9
11/13/2004 23:00	41.03	9.99	7.89
11/14/2004 0:00	40.68	10.16	7.89
11/14/2004 1:00	40.24	10.25	7.9
11/14/2004 2:00	39.89	10.36	7.9
11/14/2004 3:00	39.67	10.30	7.9
11/14/2004 4:00	39.54	10.29	7.89
11/14/2004 5:00	39.37	10.29	7.89
11/14/2004 6:00	39.19	10.65	7.89
11/14/2004 7:00	38.9	10.75	7.9
11/14/2004 8:00	38.69	10.78	7.91
11/14/2004 9:00	38.51	10.93	7.92
11/14/2004 10:00	38.47	11.17	7.93
11/14/2004 11:00	38.74	11.49	7.95
11/14/2004 12:00	39.57	11.68	7.96
11/14/2004 13:00	40.51	11.93	7.96
11/14/2004 14:00	41.61	11.83	7.96
11/14/2004 15:00	42.64	12.16	7.97
11/14/2004 16:00	43.13	12.03	7.97
11/14/2004 17:00	42.95	17.64	8.06
11/14/2004 18:00	35.69	12.39	7.72
11/14/2004 19:00	42.07	6.27	7.95
11/14/2004 20:00	41.79	5.86	7.91
11/14/2004 21:00	41.56	5.68	7.89
11/14/2004 22:00	41.23	5.40	7.89
11/14/2004 23:00	41.08	5.08	7.88
11/15/2004 0:00	40.79	5.14	7.88
11/15/2004 1:00	40.53	4.88	7.89
11/15/2004 2:00	40.19	4.84	7.89
11/15/2004 3:00	40.04	4.67	7.89
11/15/2004 4:00	39.64	4.60	7.9
11/15/2004 5:00	39.4	4.56	7.9
11/15/2004 6:00	39.01	4.71	7.91
11/15/2004 7:00	38.81	4.72	7.91
11/15/2004 8:00	38.73	4.68	7.92
11/15/2004 9:00	38.59	4.78	7.94
11/15/2004 10:00	38.81	4.79	7.95
11/15/2004 11:00	39.22	4.82	7.97
11/15/2004 12:00	40	4.86	7.97
11/15/2004 13:00	40.96	4.81	7.96
11/15/2004 14:00	41.77	4.80	7.94
11/15/2004 15:00	42.47	4.80	7.94
11/15/2004 16:00	42.94	5.40	5.56
11/15/2004 17:00	43.21	4.82	4.93
11/15/2004 18:00	43.35	4.63	4.34
11/15/2004 19:00	43.33	4.52	4.36
11/15/2004 20:00	43.18	3.46	4.39
11/15/2004 21:00	42.99	3.14	4.21

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/15/2004 22:00	42.81	4.03	4.23
11/15/2004 23:00	42.69	3.97	4.11
11/16/2004 0:00	42.58	3.82	4.08
11/16/2004 1:00	42.46	3.83	4.07
11/16/2004 2:00	42.38	3.77	4.06
11/16/2004 3:00	42.36	3.79	4.05
11/16/2004 4:00	42.29	3.84	4.05
11/16/2004 5:00	42.33	3.83	4.04
11/16/2004 6:00	42.32	3.83	4.04
11/16/2004 7:00	42.36	3.89	4.04
11/16/2004 8:00	42.42	3.95	4.04
11/16/2004 9:00	42.53	4.05	4.04
11/16/2004 10:00	42.78	4.12	4.04
11/16/2004 11:00	43.09	4.11	4.04
11/16/2004 12:00	43.58	4.17	4.04
11/16/2004 13:00	44.14	4.17	4.03
11/16/2004 14:00	44.81	4.07	4.02
11/16/2004 15:00	45.53	3.96	4.01
11/16/2004 16:00	46.13	7.36	4.17
11/16/2004 17:00	46.46	9.67	4.15
11/16/2004 18:00	46.35	7.50	4.11
11/16/2004 19:00	46.2	6.60	4.1
11/16/2004 20:00	46.22	6.09	4.09
11/16/2004 21:00	46.2	5.84	4.09
11/16/2004 22:00	46.12	5.57	4.1
11/16/2004 23:00	45.99	5.41	4.1
11/17/2004 0:00	45.95	5.40	4.1
11/17/2004 1:00	45.86	5.22	4.1
11/17/2004 2:00	45.87	5.12	4.1
11/17/2004 3:00	45.86	5.26	4.1
11/17/2004 4:00	45.94	5.20	4.11
11/17/2004 5:00	46	5.17	4.11
11/17/2004 6:00	46.11	5.23	4.11
11/17/2004 7:00	46.19	5.20	4.11
11/17/2004 8:00	46.33	5.16	4.11
11/17/2004 9:00	46.45	4.91	4.11
11/17/2004 10:00	46.63	5.08	4.11
11/17/2004 11:00	46.88	4.96	4.11
11/17/2004 12:00	47.26	5.07	4.11
11/17/2004 13:00	48.06	4.84	4.1
11/17/2004 14:00	48.6	4.44	4.1
11/17/2004 15:00	48.74	4.25	4.1
11/17/2004 16:00	49.02	4.34	4.09
11/17/2004 17:00	49.34	6.64	4.07
11/17/2004 18:00	49.58	5.98	4
11/17/2004 19:00	49.74	4.70	4
11/17/2004 20:00	50.05	4.26	4.02
11/17/2004 21:00	50.14	4.27	4
11/17/2004 22:00	50.16	4.26	4.01

Lawton Park Footbridge on the Spy Run Creek
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/17/2004 23:00	50.06	4.43	4.03
11/18/2004 0:00	49.99	4.67	4.06
11/18/2004 1:00	50.03	4.60	4.09
11/18/2004 2:00	50.24	4.76	4.09
11/18/2004 3:00	50.52	4.85	4.08
11/18/2004 4:00	50.78	4.91	4.06
11/18/2004 5:00	51	4.97	4.03
11/18/2004 6:00	51.19	5.16	4.01
11/18/2004 7:00	51.34	5.16	3.98
11/18/2004 8:00	51.49	5.15	3.95
11/18/2004 9:00	51.6	4.99	3.94
11/18/2004 10:00	59.2	2.01	4.04

Sonde Stolen

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
10/28/2004 13:00	55.7	8.12	7.77
10/28/2004 14:00	55.98	8.30	7.78
10/28/2004 15:00	56.13	8.34	7.79
10/28/2004 16:00	56.3	8.42	7.79
10/28/2004 17:00	56.42	8.44	7.79
10/28/2004 18:00	56.46	8.43	7.79
10/28/2004 19:00	56.52	8.41	7.79
10/28/2004 20:00	56.59	8.40	7.79
10/28/2004 21:00	56.65	8.38	7.78
10/28/2004 22:00	56.7	8.36	7.78
10/28/2004 23:00	56.75	8.34	7.78
10/29/2004 0:00	56.81	8.32	7.78
10/29/2004 1:00	56.87	8.31	7.78
10/29/2004 2:00	56.91	8.28	7.78
10/29/2004 3:00	56.94	8.25	7.78
10/29/2004 4:00	56.96	8.21	7.78
10/29/2004 5:00	56.95	8.15	7.78
10/29/2004 6:00	56.95	8.10	7.78
10/29/2004 7:00	56.97	8.05	7.78
10/29/2004 8:00	57	8.01	7.78
10/29/2004 9:00	57.03	7.96	7.78
10/29/2004 10:00	57.11	7.94	7.78
10/29/2004 11:00	57.21	7.83	7.78
10/29/2004 12:00	57.3	7.76	7.78
10/29/2004 13:00	57.44	7.76	7.77
10/29/2004 14:00	57.62	7.74	7.77
10/29/2004 15:00	57.79	7.62	7.77
10/29/2004 16:00	57.98	7.59	7.77
10/29/2004 17:00	58.18	7.55	7.77
10/29/2004 18:00	58.3	7.42	7.76
10/29/2004 19:00	58.38	7.35	7.76
10/29/2004 20:00	58.49	7.29	7.76
10/29/2004 21:00	58.59	7.23	7.75
10/29/2004 22:00	58.68	7.10	7.74
10/29/2004 23:00	58.83	6.62	7.72
10/30/2004 0:00	59.02	6.01	7.69
10/30/2004 1:00	59.18	5.73	7.67
10/30/2004 2:00	59.25	5.74	7.67
10/30/2004 3:00	59.34	5.91	7.67
10/30/2004 4:00	59.42	6.08	7.68
10/30/2004 5:00	59.49	6.23	7.69
10/30/2004 6:00	59.78	6.37	7.68
10/30/2004 7:00	59.65	6.51	7.7
10/30/2004 8:00	59.67	6.49	7.7
10/30/2004 9:00	59.85	6.50	7.69
10/30/2004 10:00	59.91	6.51	7.7
10/30/2004 11:00	60.07	6.53	7.7
10/30/2004 12:00	60.32	6.57	7.7
10/30/2004 13:00	60.61	6.73	7.71

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
10/30/2004 14:00	60.83	6.75	7.71
10/30/2004 15:00	61.01	6.43	7.69
10/30/2004 16:00	61.17	6.04	7.66
10/30/2004 17:00	61.15	5.89	7.66
10/30/2004 18:00	61.1	5.67	7.64
10/30/2004 19:00	61.1	5.34	7.62
10/30/2004 20:00	61.12	5.10	7.6
10/30/2004 21:00	61.06	5.05	7.6
10/30/2004 22:00	60.93	5.07	7.61
10/30/2004 23:00	60.78	5.14	7.62
10/31/2004 0:00	60.62	5.14	7.62
10/31/2004 1:00	60.46	5.12	7.63
10/31/2004 2:00	60.3	5.17	7.63
10/31/2004 3:00	60.11	5.14	7.63
10/31/2004 4:00	59.9	5.18	7.64
10/31/2004 5:00	59.65	5.26	7.65
10/31/2004 6:00	59.34	5.30	7.66
10/31/2004 7:00	59.02	5.32	7.66
10/31/2004 8:00	58.68	5.38	7.67
10/31/2004 9:00	58.42	5.47	7.68
10/31/2004 10:00	58.22	5.59	7.69
10/31/2004 11:00	58.18	5.75	7.7
10/31/2004 12:00	58.19	5.85	7.7
10/31/2004 13:00	58.16	5.96	7.71
10/31/2004 14:00	58.2	6.04	7.71
10/31/2004 15:00	58.18	6.12	7.72
10/31/2004 16:00	58.11	6.27	7.72
10/31/2004 17:00	58.02	6.22	7.73
10/31/2004 18:00	57.93	6.16	7.73
10/31/2004 19:00	57.88	6.16	7.73
10/31/2004 20:00	57.83	6.12	7.73
10/31/2004 21:00	57.71	6.17	7.73
10/31/2004 22:00	57.58	6.16	7.73
10/31/2004 23:00	57.47	6.13	7.73
11/1/2004 0:00	57.4	6.13	7.73
11/1/2004 1:00	57.31	6.18	7.74
11/1/2004 2:00	57.17	6.26	7.74
11/1/2004 3:00	57	6.26	7.74
11/1/2004 4:00	56.8	6.27	7.75
11/1/2004 5:00	56.56	6.27	7.75
11/1/2004 6:00	56.32	6.27	7.76
11/1/2004 7:00	56.07	6.32	7.76
11/1/2004 8:00	55.82	6.31	7.76
11/1/2004 9:00	55.65	6.31	7.76
11/1/2004 10:00	55.5	6.33	7.76
11/1/2004 11:00	55.35	6.36	7.77
11/1/2004 12:00	55.28	6.36	7.77
11/1/2004 13:00	55.25	6.38	7.77
11/1/2004 14:00	55.23	6.39	7.77

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/1/2004 15:00	55.2	6.44	7.77
11/1/2004 16:00	55.18	6.49	7.77
11/1/2004 17:00	55.15	6.49	7.77
11/1/2004 18:00	55.13	6.50	7.77
11/1/2004 19:00	55.09	6.50	7.77
11/1/2004 20:00	55.08	6.50	7.77
11/1/2004 21:00	55.09	6.48	7.77
11/1/2004 22:00	55.09	6.46	7.77
11/1/2004 23:00	55.1	6.56	7.77
11/2/2004 0:00	55.11	6.50	7.77
11/2/2004 1:00	55.23	6.36	7.75
11/2/2004 2:00	55.21	6.43	7.75
11/2/2004 3:00	55.2	6.44	7.75
11/2/2004 4:00	55.11	6.51	7.74
11/2/2004 5:00	55.09	6.58	7.74
11/2/2004 6:00	55.16	6.55	7.74
11/2/2004 7:00	55.17	6.54	7.74
11/2/2004 8:00	55.16	6.58	7.74
11/2/2004 9:00	55.23	6.56	7.74
11/2/2004 10:00	55.31	6.50	7.74
11/2/2004 11:00	55.39	6.24	7.72
11/2/2004 12:00	55.48	5.95	7.7
11/2/2004 13:00	55.55	5.75	7.69
11/2/2004 14:00	55.56	5.55	7.68
11/2/2004 15:00	55.51	5.53	7.68
11/2/2004 16:00	55.46	5.64	7.69
11/2/2004 17:00	55.41	5.72	7.69
11/2/2004 18:00	55.37	5.71	7.69
11/2/2004 19:00	55.33	5.71	7.69
11/2/2004 20:00	55.31	5.63	7.68
11/2/2004 21:00	55.25	5.58	7.68
11/2/2004 22:00	55.18	5.57	7.68
11/2/2004 23:00	55.09	5.55	7.68
11/3/2004 0:00	54.94	5.53	7.68
11/3/2004 1:00	54.82	5.52	7.68
11/3/2004 2:00	54.72	5.49	7.68
11/3/2004 3:00	54.56	5.48	7.68
11/3/2004 4:00	54.39	5.64	7.68
11/3/2004 5:00	54.21	5.64	7.69
11/3/2004 6:00	53.99	5.64	7.69
11/3/2004 7:00	53.76	5.66	7.69
11/3/2004 8:00	53.56	5.80	7.7
11/3/2004 9:00	53.35	5.86	7.7
11/3/2004 10:00	53.16	5.91	7.71
11/3/2004 11:00	52.97	5.99	7.73
11/3/2004 12:00	52.79	6.14	7.75
11/3/2004 13:00	52.6	6.35	7.77
11/3/2004 14:00	52.47	6.63	7.81
11/3/2004 15:00	52.38	6.81	7.83

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/3/2004 16:00	52.44	6.89	7.85
11/3/2004 17:00	52.56	6.95	7.86
11/3/2004 18:00	52.67	6.96	7.87
11/3/2004 19:00	52.73	7.10	7.87
11/3/2004 20:00	52.84	6.78	7.86
11/3/2004 21:00	52.95	6.68	7.84
11/3/2004 22:00	52.99	6.61	7.83
11/3/2004 23:00	53.03	6.55	7.8
11/4/2004 0:00	53.09	6.33	7.76
11/4/2004 1:00	53.18	6.11	7.72
11/4/2004 2:00	53.24	6.03	7.69
11/4/2004 3:00	53.27	6.10	7.67
11/4/2004 4:00	53.27	6.14	7.67
11/4/2004 5:00	53.22	6.24	7.67
11/4/2004 6:00	53.17	6.25	7.65
11/4/2004 7:00	53.16	6.22	7.64
11/4/2004 8:00	53.12	6.22	7.63
11/4/2004 9:00	52.99	6.19	7.62
11/4/2004 10:00	52.91	5.91	7.6
11/4/2004 11:00	52.91	5.83	7.59
11/4/2004 12:00	52.9	5.99	7.61
11/4/2004 13:00	52.87	5.91	7.6
11/4/2004 14:00	52.83	6.00	7.61
11/4/2004 15:00	52.78	6.08	7.62
11/4/2004 16:00	52.77	6.04	7.62
11/4/2004 17:00	52.71	6.06	7.63
11/4/2004 18:00	52.66	6.07	7.64
11/4/2004 19:00	52.59	6.09	7.64
11/4/2004 20:00	52.48	6.12	7.65
11/4/2004 21:00	52.31	6.11	7.66
11/4/2004 22:00	52.17	6.03	7.66
11/4/2004 23:00	52.01	6.11	7.67
11/5/2004 0:00	51.86	6.13	7.67
11/5/2004 1:00	51.65	6.29	7.68
11/5/2004 2:00	51.44	6.32	7.69
11/5/2004 3:00	51.26	6.37	7.7
11/5/2004 4:00	51.06	6.39	7.71
11/5/2004 5:00	50.89	6.42	7.72
11/5/2004 6:00	50.7	6.46	7.73
11/5/2004 7:00	50.54	6.46	7.74
11/5/2004 8:00	50.37	6.48	7.75
11/5/2004 9:00	50.24	6.51	7.76
11/5/2004 10:00	50.21	6.53	7.77
11/5/2004 11:00	50.25	6.56	7.78
11/5/2004 12:00	50.37	6.66	7.79
11/5/2004 13:00	50.51	6.69	7.8
11/5/2004 14:00	50.69	6.75	7.81
11/5/2004 15:00	50.86	6.79	7.82
11/5/2004 16:00	51.07	6.82	7.82

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/5/2004 17:00	51.16	6.84	7.82
11/5/2004 18:00	51.14	6.80	7.82
11/5/2004 19:00	51.03	6.74	7.8
11/5/2004 20:00	50.87	6.69	7.79
11/5/2004 21:00	50.67	6.69	7.78
11/5/2004 22:00	50.51	6.59	7.77
11/5/2004 23:00	50.34	6.51	7.76
11/6/2004 0:00	50.22	6.46	7.75
11/6/2004 1:00	50.11	6.44	7.75
11/6/2004 2:00	50.01	6.40	7.75
11/6/2004 3:00	49.9	6.54	7.75
11/6/2004 4:00	49.78	6.53	7.75
11/6/2004 5:00	49.7	6.52	7.75
11/6/2004 6:00	49.62	6.50	7.76
11/6/2004 7:00	49.55	6.47	7.76
11/6/2004 8:00	49.44	6.45	7.76
11/6/2004 9:00	49.36	6.46	7.77
11/6/2004 10:00	49.34	6.46	7.77
11/6/2004 11:00	49.41	6.50	7.77
11/6/2004 12:00	49.54	6.42	7.78
11/6/2004 13:00	49.72	6.25	7.78
11/6/2004 14:00	49.96	6.29	7.78
11/6/2004 15:00	50.17	6.27	7.78
11/6/2004 16:00	50.38	6.40	7.78
11/6/2004 17:00	50.53	6.47	7.78
11/6/2004 18:00	50.58	6.51	7.79
11/6/2004 19:00	50.54	6.53	7.79
11/6/2004 20:00	50.46	6.53	7.79
11/6/2004 21:00	50.36	6.54	7.79
11/6/2004 22:00	50.24	6.53	7.8
11/6/2004 23:00	50.09	6.51	7.8
11/7/2004 0:00	49.93	6.66	7.8
11/7/2004 1:00	49.79	6.64	7.8
11/7/2004 2:00	49.7	6.62	7.81
11/7/2004 3:00	49.63	6.61	7.81
11/7/2004 4:00	49.55	6.60	7.81
11/7/2004 5:00	49.48	6.59	7.81
11/7/2004 6:00	49.4	6.58	7.81
11/7/2004 7:00	49.32	6.55	7.81
11/7/2004 8:00	49.27	6.57	7.82
11/7/2004 9:00	49.25	6.57	7.82
11/7/2004 10:00	49.29	6.60	7.82
11/7/2004 11:00	49.41	6.66	7.83
11/7/2004 12:00	49.62	6.65	7.83
11/7/2004 13:00	49.83	6.58	7.83
11/7/2004 14:00	50.1	6.53	7.84
11/7/2004 15:00	50.34	6.67	7.84
11/7/2004 16:00	50.54	6.76	7.85
11/7/2004 17:00	50.66	6.82	7.85

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/7/2004 18:00	50.69	6.86	7.85
11/7/2004 19:00	50.63	6.88	7.86
11/7/2004 20:00	50.52	6.86	7.86
11/7/2004 21:00	50.39	6.84	7.87
11/7/2004 22:00	50.23	6.82	7.87
11/7/2004 23:00	50.01	6.81	7.87
11/8/2004 0:00	49.77	6.91	7.88
11/8/2004 1:00	49.52	6.89	7.88
11/8/2004 2:00	49.3	6.84	7.88
11/8/2004 3:00	49.12	6.81	7.89
11/8/2004 4:00	48.98	6.76	7.89
11/8/2004 5:00	48.83	6.75	7.89
11/8/2004 6:00	48.66	6.70	7.89
11/8/2004 7:00	48.49	6.68	7.89
11/8/2004 8:00	48.32	6.65	7.89
11/8/2004 9:00	48.18	6.64	7.89
11/8/2004 10:00	48.15	6.64	7.9
11/8/2004 11:00	48.14	6.62	7.9
11/8/2004 12:00	48.2	6.57	7.9
11/8/2004 13:00	48.28	6.49	7.9
11/8/2004 14:00	48.4	6.51	7.91
11/8/2004 15:00	48.51	6.59	7.91
11/8/2004 16:00	48.64	6.69	7.91
11/8/2004 17:00	48.72	6.74	7.91
11/8/2004 18:00	48.74	6.76	7.91
11/8/2004 19:00	48.7	6.75	7.91
11/8/2004 20:00	48.61	6.73	7.91
11/8/2004 21:00	48.5	6.69	7.91
11/8/2004 22:00	48.38	6.66	7.91
11/8/2004 23:00	48.23	6.62	7.91
11/9/2004 0:00	48.05	6.58	7.9
11/9/2004 1:00	47.85	6.69	7.9
11/9/2004 2:00	47.65	6.64	7.9
11/9/2004 3:00	47.49	6.59	7.9
11/9/2004 4:00	47.36	6.56	7.9
11/9/2004 5:00	47.26	6.52	7.9
11/9/2004 6:00	47.15	6.49	7.89
11/9/2004 7:00	47.05	6.46	7.89
11/9/2004 8:00	46.94	6.44	7.89
11/9/2004 9:00	46.87	6.43	7.89
Sonde reprogrammed for DO mg/l			
11/10/2004 9:00	66.04	8.3	7.43
11/10/2004 10:00	45.31	9.69	7.92
11/10/2004 11:00	45.41	9.71	7.93
11/10/2004 12:00	45.58	9.74	7.94
11/10/2004 13:00	45.8	9.77	7.94
11/10/2004 14:00	45.96	9.82	7.95
11/10/2004 15:00	46.1	9.86	7.95
11/10/2004 16:00	46.25	9.88	7.95

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/10/2004 17:00	46.37	9.9	7.96
11/10/2004 18:00	46.48	9.89	7.95
11/10/2004 19:00	46.61	9.89	7.95
11/10/2004 20:00	46.74	9.9	7.95
11/10/2004 21:00	46.84	9.88	7.95
11/10/2004 22:00	46.94	9.87	7.95
11/10/2004 23:00	47.02	9.86	7.95
11/11/2004 0:00	47.05	9.84	7.95
11/11/2004 1:00	47.04	9.82	7.95
11/11/2004 2:00	47	9.79	7.95
11/11/2004 3:00	46.94	9.75	7.95
11/11/2004 4:00	46.88	9.7	7.95
11/11/2004 5:00	46.83	9.65	7.95
11/11/2004 6:00	46.76	9.6	7.94
11/11/2004 7:00	46.7	9.57	7.94
11/11/2004 8:00	46.64	9.49	7.94
11/11/2004 9:00	46.54	9.42	7.94
11/11/2004 10:00	46.47	9.43	7.95
11/11/2004 11:00	46.41	9.41	7.94
11/11/2004 12:00	46.35	9.43	7.95
11/11/2004 13:00	46.31	9.42	7.95
11/11/2004 14:00	46.29	9.43	7.96
11/11/2004 15:00	46.26	9.46	7.96
11/11/2004 16:00	46.21	9.47	7.96
11/11/2004 17:00	46.17	9.46	7.96
11/11/2004 18:00	46.12	9.46	7.97
11/11/2004 19:00	46.06	9.43	7.96
11/11/2004 20:00	45.97	9.39	7.96
11/11/2004 21:00	45.91	9.37	7.96
11/11/2004 22:00	45.84	9.35	7.97
11/11/2004 23:00	45.75	9.33	7.97
11/12/2004 0:00	45.65	9.31	7.97
11/12/2004 1:00	45.52	9.3	7.97
11/12/2004 2:00	45.36	9.28	7.98
11/12/2004 3:00	45.22	9.27	7.98
11/12/2004 4:00	45.04	9.24	7.98
11/12/2004 5:00	44.83	9.21	7.98
11/12/2004 6:00	44.64	9.17	7.98
11/12/2004 7:00	44.43	9.12	7.98
11/12/2004 8:00	44.21	9.09	7.98
11/12/2004 9:00	44.02	9.07	7.98
11/12/2004 10:00	43.94	9.05	7.98
11/12/2004 11:00	43.93	9.05	7.99
11/12/2004 12:00	43.97	9.08	7.99
11/12/2004 13:00	44.08	9.12	8
11/12/2004 14:00	44.17	9.16	8
11/12/2004 15:00	44.23	9.23	8.01
11/12/2004 16:00	44.25	9.25	8.01
11/12/2004 17:00	44.19	9.28	8.02

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/12/2004 18:00	44.15	9.3	8.02
11/12/2004 19:00	44.09	9.27	8.02
11/12/2004 20:00	44.07	9.25	8.01
11/12/2004 21:00	44.01	9.24	8.01
11/12/2004 22:00	43.93	9.22	8.01
11/12/2004 23:00	43.81	9.2	8.01
11/13/2004 0:00	43.69	9.15	8.01
11/13/2004 1:00	43.59	9.13	8.02
11/13/2004 2:00	43.49	9.11	8.02
11/13/2004 3:00	43.38	9.09	8.02
11/13/2004 4:00	43.25	9.07	8.02
11/13/2004 5:00	43.07	9.03	8.02
11/13/2004 6:00	42.87	8.99	8.02
11/13/2004 7:00	42.68	8.95	8.02
11/13/2004 8:00	42.45	8.93	8.03
11/13/2004 9:00	42.26	8.91	8.02
11/13/2004 10:00	42.15	8.88	8.03
11/13/2004 11:00	42.14	8.86	8.03
11/13/2004 12:00	42.17	8.85	8.03
11/13/2004 13:00	42.27	8.9	8.03
11/13/2004 14:00	42.39	8.94	8.04
11/13/2004 15:00	42.48	8.98	8.04
11/13/2004 16:00	42.52	8.99	8.04
11/13/2004 17:00	42.51	9	8.04
11/13/2004 18:00	42.5	9.01	8.04
11/13/2004 19:00	42.45	9.01	8.04
11/13/2004 20:00	42.44	8.98	8.04
11/13/2004 21:00	42.45	8.97	8.03
11/13/2004 22:00	42.41	8.96	8.03
11/13/2004 23:00	42.34	8.95	8.03
11/14/2004 0:00	42.28	8.93	8.03
11/14/2004 1:00	42.15	8.9	8.03
11/14/2004 2:00	42.04	8.9	8.04
11/14/2004 3:00	41.94	8.89	8.04
11/14/2004 4:00	41.89	8.87	8.04
11/14/2004 5:00	41.78	8.85	8.04
11/14/2004 6:00	41.69	8.83	8.04
11/14/2004 7:00	41.54	8.8	8.04
11/14/2004 8:00	41.38	8.77	8.04
11/14/2004 9:00	41.23	8.75	8.04
11/14/2004 10:00	41.15	8.76	8.05
11/14/2004 11:00	41.15	8.76	8.05
11/14/2004 12:00	41.2	8.76	8.05
11/14/2004 13:00	41.27	8.77	8.05
11/14/2004 14:00	41.43	8.82	8.05
11/14/2004 15:00	41.56	8.84	8.05
11/14/2004 16:00	41.59	8.85	8.05
11/14/2004 17:00	41.61	8.85	8.05
11/14/2004 18:00	41.55	8.84	8.05

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/14/2004 19:00	41.48	8.83	8.05
11/14/2004 20:00	41.41	8.8	8.05
11/14/2004 21:00	41.4	8.79	8.04
11/14/2004 22:00	41.36	8.77	8.04
11/14/2004 23:00	41.34	8.76	8.04
11/15/2004 0:00	41.32	8.73	8.04
11/15/2004 1:00	41.29	8.71	8.04
11/15/2004 2:00	41.24	8.68	8.04
11/15/2004 3:00	41.16	8.66	8.04
11/15/2004 4:00	41.08	8.64	8.04
11/15/2004 5:00	41.06	8.63	8.04
11/15/2004 6:00	41.03	8.61	8.04
11/15/2004 7:00	40.99	8.59	8.04
11/15/2004 8:00	40.93	8.58	8.05
11/15/2004 9:00	40.88	8.57	8.05
11/15/2004 10:00	40.88	8.57	8.05
11/15/2004 11:00	40.94	8.58	8.05
11/15/2004 12:00	40.99	8.59	8.06
11/15/2004 13:00	41.09	8.6	8.06
11/15/2004 14:00	41.17	8.62	8.06
11/15/2004 15:00	41.22	8.61	8.06
11/15/2004 16:00	41.27	8.62	8.06
11/15/2004 17:00	41.28	8.62	8.06
11/15/2004 18:00	41.29	8.61	8.06
11/15/2004 19:00	41.27	8.59	8.05
11/15/2004 20:00	41.23	8.57	8.05
11/15/2004 21:00	41.2	8.54	8.05
11/15/2004 22:00	41.17	8.52	8.05
11/15/2004 23:00	41.15	8.5	8.04
11/16/2004 0:00	41.12	8.48	8.04
11/16/2004 1:00	41.11	8.46	8.04
11/16/2004 2:00	41.14	8.45	8.04
11/16/2004 3:00	41.18	8.43	8.03
11/16/2004 4:00	41.24	8.42	8.03
11/16/2004 5:00	41.3	8.4	8.03
11/16/2004 6:00	41.39	8.39	8.03
11/16/2004 7:00	41.49	8.39	8.03
11/16/2004 8:00	41.59	8.41	8.03
11/16/2004 9:00	41.71	8.4	8.03
11/16/2004 10:00	41.86	8.4	8.03
11/16/2004 11:00	41.99	8.41	8.04
11/16/2004 12:00	42.16	8.42	8.04
11/16/2004 13:00	42.3	8.43	8.04
11/16/2004 14:00	42.53	8.44	8.04
11/16/2004 15:00	42.73	8.45	8.04
11/16/2004 16:00	42.91	8.45	8.04
11/16/2004 17:00	43.05	8.45	8.04
11/16/2004 18:00	43.13	8.42	8.03
11/16/2004 19:00	43.23	8.39	8.03

Spy Run Bridge on the St. Marys River
YSI Sond Data

Date/time	Temp F	DO mg/l	pH
11/16/2004 20:00	43.3	8.36	8.03
11/16/2004 21:00	43.41	8.34	8.03
11/16/2004 22:00	43.52	8.31	8.02
11/16/2004 23:00	43.6	8.29	8.02
11/17/2004 0:00	43.65	8.25	8.02
11/17/2004 1:00	43.7	8.21	8.01
11/17/2004 2:00	43.75	8.19	8.01
11/17/2004 3:00	43.82	8.16	8.01
11/17/2004 4:00	43.91	8.12	8
11/17/2004 5:00	43.99	8.1	8
11/17/2004 6:00	44.06	8.07	8
11/17/2004 7:00	44.15	8.06	8
11/17/2004 8:00	44.26	8.04	8
11/17/2004 9:00	44.37	8.03	8
11/17/2004 10:00	44.51	8.03	8
11/17/2004 11:00	44.65	8.04	8
11/17/2004 12:00	44.83	8.03	8
11/17/2004 13:00	45.06	8.05	8
11/17/2004 14:00	45.29	8.04	8
11/17/2004 15:00	45.49	8.06	8
11/17/2004 16:00	45.76	8.01	8
11/17/2004 17:00	45.97	7.97	7.99
11/17/2004 18:00	46.06	7.92	7.98
11/17/2004 19:00	46.27	7.88	7.98
11/17/2004 20:00	46.43	7.85	7.97
11/17/2004 21:00	46.47	7.78	7.97
11/17/2004 22:00	46.53	7.74	7.97
11/17/2004 23:00	46.56	7.72	7.97
11/18/2004 0:00	46.72	7.7	7.96
11/18/2004 1:00	46.81	7.67	7.96
11/18/2004 2:00	46.91	7.66	7.96
11/18/2004 3:00	47.03	7.64	7.96
11/18/2004 4:00	47.14	7.5	7.95
11/18/2004 5:00	47.42	7.31	7.93
11/18/2004 6:00	47.63	7.18	7.92
11/18/2004 7:00	47.77	7.16	7.92
11/18/2004 8:00	47.87	7.17	7.92
11/18/2004 9:00	47.92	7.17	7.92
11/18/2004 10:00	48.03	7.2	7.92
11/18/2004 11:00	48.19	7.2	7.92
11/18/2004 12:00	48.34	7.17	7.91
11/18/2004 13:00	48.56	7.15	7.91
11/18/2004 14:00	48.82	7.14	7.91
11/18/2004 15:00	49.04	7.1	7.9

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
10/28/2004 13:00	55.77	9.29	7.84
10/28/2004 14:00	55.82	9.37	7.86
10/28/2004 15:00	55.9	9.33	7.86
10/28/2004 16:00	56.09	9.20	7.87
10/28/2004 17:00	56.25	9.11	7.87
10/28/2004 18:00	56.34	9.13	7.89
10/28/2004 19:00	56.25	9.14	7.89
10/28/2004 20:00	56.27	9.27	7.89
10/28/2004 21:00	56.33	9.26	7.88
10/28/2004 22:00	56.41	9.31	7.88
10/28/2004 23:00	56.51	9.19	7.87
10/29/2004 0:00	56.62	9.17	7.88
10/29/2004 1:00	56.69	9.09	7.88
10/29/2004 2:00	56.77	9.07	7.88
10/29/2004 3:00	56.8	9.12	7.88
10/29/2004 4:00	56.84	9.11	7.88
10/29/2004 5:00	56.89	9.06	7.87
10/29/2004 6:00	56.95	8.96	7.87
10/29/2004 7:00	57.05	8.84	7.87
10/29/2004 8:00	57.1	8.78	7.87
10/29/2004 9:00	57.12	8.78	7.87
10/29/2004 10:00	57.14	8.78	7.86
10/29/2004 11:00	57.17	8.79	7.86
10/29/2004 12:00	57.21	8.67	7.86
10/29/2004 13:00	57.27	8.52	7.86
10/29/2004 14:00	57.36	8.35	7.86
10/29/2004 15:00	57.49	8.30	7.87
10/29/2004 16:00	57.52	8.34	7.86
10/29/2004 17:00	57.57	8.32	7.85
10/29/2004 18:00	57.68	8.29	7.84
10/29/2004 19:00	57.78	8.40	7.84
10/29/2004 20:00	57.87	8.39	7.84
10/29/2004 21:00	57.95	8.38	7.84
10/29/2004 22:00	58.05	8.33	7.83
10/29/2004 23:00	58.18	8.21	7.85
10/30/2004 0:00	58.31	7.93	7.85
10/30/2004 1:00	58.43	7.60	7.85
10/30/2004 2:00	58.56	7.43	7.85
10/30/2004 3:00	58.62	7.38	7.83
10/30/2004 4:00	58.79	7.61	7.82
10/30/2004 5:00	58.98	7.50	7.8
10/30/2004 6:00	59.28	7.54	7.79
10/30/2004 7:00	59.31	8.03	7.79
10/30/2004 8:00	59.29	8.30	7.8
10/30/2004 9:00	59.39	8.46	7.79
10/30/2004 10:00	59.42	8.56	7.79
10/30/2004 11:00	59.53	8.53	7.83
10/30/2004 12:00	59.76	8.59	7.84
10/30/2004 13:00	60	8.57	7.84

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
10/30/2004 14:00	60.21	8.51	7.86
10/30/2004 15:00	60.38	8.37	7.85
10/30/2004 16:00	60.41	8.07	7.86
10/30/2004 17:00	60.38	7.93	7.86
10/30/2004 18:00	60.32	7.78	7.86
10/30/2004 19:00	60.29	7.60	7.85
10/30/2004 20:00	60.31	7.36	7.83
10/30/2004 21:00	60.35	7.28	7.82
10/30/2004 22:00	60.32	7.47	7.81
10/30/2004 23:00	60.28	7.63	7.8
10/31/2004 0:00	60.26	7.65	7.78
10/31/2004 1:00	60.19	7.68	7.78
10/31/2004 2:00	60.04	7.55	7.79
10/31/2004 3:00	59.83	7.43	7.81
10/31/2004 4:00	59.63	7.38	7.82
10/31/2004 5:00	59.42	7.30	7.82
10/31/2004 6:00	59.22	7.24	7.81
10/31/2004 7:00	59.07	7.36	7.81
10/31/2004 8:00	58.79	7.36	7.81
10/31/2004 9:00	58.61	7.38	7.8
10/31/2004 10:00	58.42	7.51	7.8
10/31/2004 11:00	58.27	7.65	7.81
10/31/2004 12:00	58.18	7.73	7.8
10/31/2004 13:00	58.16	7.85	7.8
10/31/2004 14:00	58.23	8.06	7.8
10/31/2004 15:00	58.29	8.11	7.81
10/31/2004 16:00	58.25	8.22	7.81
10/31/2004 17:00	58.14	8.39	7.83
10/31/2004 18:00	57.99	8.29	7.84
10/31/2004 19:00	57.91	8.47	7.84
10/31/2004 20:00	57.8	8.28	7.84
10/31/2004 21:00	57.71	8.17	7.85
10/31/2004 22:00	57.63	8.15	7.84
10/31/2004 23:00	57.55	8.23	7.86
11/1/2004 0:00	57.47	8.16	7.84
11/1/2004 1:00	57.43	8.37	7.83
11/1/2004 2:00	57.35	8.14	7.83
11/1/2004 3:00	57.26	8.33	7.83
11/1/2004 4:00	57.19	8.48	7.82
11/1/2004 5:00	57.13	8.37	7.84
11/1/2004 6:00	57.05	8.43	7.82
11/1/2004 7:00	56.95	8.47	7.83
11/1/2004 8:00	56.81	8.48	7.85
11/1/2004 9:00	56.67	8.46	7.84
11/1/2004 10:00	56.5	8.43	7.85
11/1/2004 11:00	56.27	8.24	7.85
11/1/2004 12:00	56.12	8.39	7.86
11/1/2004 13:00	55.98	8.38	7.86
11/1/2004 14:00	55.82	8.34	7.85

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/1/2004 15:00	55.65	8.33	7.83
11/1/2004 16:00	55.58	8.30	7.85
11/1/2004 17:00	55.5	8.26	7.85
11/1/2004 18:00	55.43	8.25	7.85
11/1/2004 19:00	55.39	8.25	7.85
11/1/2004 20:00	55.37	8.28	7.85
11/1/2004 21:00	55.34	8.27	7.85
11/1/2004 22:00	55.33	8.49	7.84
11/1/2004 23:00	55.33	8.53	7.84
11/2/2004 0:00	55.34	8.53	7.84
11/2/2004 1:00	55.35	8.32	7.84
11/2/2004 2:00	55.4	8.23	7.84
11/2/2004 3:00	55.5	8.43	7.85
11/2/2004 4:00	55.54	8.55	7.85
11/2/2004 5:00	55.57	8.66	7.83
11/2/2004 6:00	55.64	8.55	7.82
11/2/2004 7:00	55.67	8.44	7.83
11/2/2004 8:00	55.71	8.35	7.83
11/2/2004 9:00	55.75	8.30	7.84
11/2/2004 10:00	55.76	8.23	7.83
11/2/2004 11:00	55.78	8.16	7.82
11/2/2004 12:00	55.76	8.07	7.81
11/2/2004 13:00	55.8	7.85	7.81
11/2/2004 14:00	55.84	7.65	7.8
11/2/2004 15:00	55.89	7.60	7.8
11/2/2004 16:00	55.97	7.74	7.8
11/2/2004 17:00	55.98	7.86	7.78
11/2/2004 18:00	55.98	7.90	7.77
11/2/2004 19:00	55.96	7.94	7.77
11/2/2004 20:00	55.93	7.96	7.78
11/2/2004 21:00	55.88	8.02	7.79
11/2/2004 22:00	55.81	8.00	7.78
11/2/2004 23:00	55.75	8.03	7.78
11/3/2004 0:00	55.68	8.20	7.78
11/3/2004 1:00	55.6	8.23	7.79
11/3/2004 2:00	55.44	8.15	7.79
11/3/2004 3:00	55.27	8.16	7.79
11/3/2004 4:00	55.07	8.26	7.79
11/3/2004 5:00	54.94	8.29	7.79
11/3/2004 6:00	54.75	8.33	7.79
11/3/2004 7:00	54.6	8.32	7.79
11/3/2004 8:00	54.38	8.27	7.78
11/3/2004 9:00	54.32	8.18	7.8
11/3/2004 10:00	54.13	8.08	7.8
11/3/2004 11:00	53.96	8.29	7.8
11/3/2004 12:00	53.79	8.61	7.79
11/3/2004 13:00	53.52	8.93	7.76
11/3/2004 14:00	53.24	9.09	7.75
11/3/2004 15:00	52.97	9.07	7.76

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/3/2004 16:00	52.75	9.07	7.78
11/3/2004 17:00	52.55	9.01	7.81
11/3/2004 18:00	52.49	8.90	7.83
11/3/2004 19:00	52.52	8.80	7.84
11/3/2004 20:00	52.6	8.76	7.85
11/3/2004 21:00	52.65	8.63	7.85
11/3/2004 22:00	52.75	8.37	7.84
11/3/2004 23:00	52.88	8.13	7.83
11/4/2004 0:00	52.93	8.13	7.81
11/4/2004 1:00	53	8.27	7.79
11/4/2004 2:00	53.07	8.63	7.76
11/4/2004 3:00	53.14	8.55	7.72
11/4/2004 4:00	53.19	8.57	7.7
11/4/2004 5:00	53.21	8.69	7.69
11/4/2004 6:00	53.03	8.79	7.69
11/4/2004 7:00	53.19	8.85	7.7
11/4/2004 8:00	53.16	8.69	7.7
11/4/2004 9:00	53.14	8.61	7.7
11/4/2004 10:00	53.11	8.75	7.71
11/4/2004 11:00	53.02	8.75	7.7
11/4/2004 12:00	52.95	8.80	7.7
11/4/2004 13:00	52.93	8.87	7.69
11/4/2004 14:00	52.88	8.87	7.71
11/4/2004 15:00	52.83	8.92	7.71
11/4/2004 16:00	52.77	8.93	7.72
11/4/2004 17:00	52.71	8.95	7.73
11/4/2004 18:00	52.64	8.99	7.73
11/4/2004 19:00	52.59	9.01	7.74
11/4/2004 20:00	52.51	9.04	7.74
11/4/2004 21:00	52.38	9.25	7.73
11/4/2004 22:00	52.24	9.26	7.74
11/4/2004 23:00	52.14	9.26	7.74
11/5/2004 0:00	51.99	9.28	7.75
11/5/2004 1:00	51.86	9.28	7.75
11/5/2004 2:00	51.68	9.31	7.75
11/5/2004 3:00	51.5	9.35	7.75
11/5/2004 4:00	51.33	9.40	7.75
11/5/2004 5:00	51.14	9.46	7.75
11/5/2004 6:00	50.96	9.52	7.76
11/5/2004 7:00	50.79	9.60	7.76
11/5/2004 8:00	50.61	10.88	7.77
11/5/2004 9:00	50.47	9.77	7.78
11/5/2004 10:00	50.38	9.84	7.78
11/5/2004 11:00	50.38	9.94	7.79
11/5/2004 12:00	45.89	10.04	8.13
11/5/2004 13:00	50.55	10.08	7.82
11/5/2004 14:00	50.63	10.12	7.82
11/5/2004 15:00	50.73	10.17	7.83
11/5/2004 16:00	50.88	10.15	7.85

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/5/2004 17:00	50.98	10.10	7.85
11/5/2004 18:00	51.04	10.06	7.86
11/5/2004 19:00	51.09	10.04	7.87
11/5/2004 20:00	51.03	10.01	7.86
11/5/2004 21:00	50.91	10.03	7.85
11/5/2004 22:00	50.74	10.03	7.84
11/5/2004 23:00	50.57	10.25	7.83
11/6/2004 0:00	50.4	10.22	7.82
11/6/2004 1:00	50.23	10.22	7.82
11/6/2004 2:00	50.1	10.23	7.82
11/6/2004 3:00	50.01	10.23	7.82
11/6/2004 4:00	49.89	10.20	7.82
11/6/2004 5:00	49.78	10.20	7.82
11/6/2004 6:00	49.7	10.20	7.83
11/6/2004 7:00	49.62	10.22	7.84
11/6/2004 8:00	49.52	10.27	7.84
11/6/2004 9:00	49.42	10.30	7.84
11/6/2004 10:00	49.37	10.37	7.84
11/6/2004 11:00	49.39	10.17	7.85
11/6/2004 12:00	49.47	10.23	7.86
11/6/2004 13:00	49.61	10.26	7.85
11/6/2004 14:00	49.78	10.31	7.86
11/6/2004 15:00	49.93	10.33	7.86
11/6/2004 16:00	50.06	10.33	7.86
11/6/2004 17:00	50.14	10.32	7.87
11/6/2004 18:00	50.25	10.29	7.87
11/6/2004 19:00	50.36	10.30	7.87
11/6/2004 20:00	50.41	10.54	7.88
11/6/2004 21:00	50.37	10.54	7.88
11/6/2004 22:00	50.31	10.55	7.87
11/6/2004 23:00	50.22	10.53	7.88
11/7/2004 0:00	50.14	10.50	7.88
11/7/2004 1:00	50	10.45	7.89
11/7/2004 2:00	49.87	10.43	7.89
11/7/2004 3:00	49.75	10.43	7.89
11/7/2004 4:00	49.68	10.40	7.89
11/7/2004 5:00	49.63	10.37	7.89
11/7/2004 6:00	49.57	10.32	7.89
11/7/2004 7:00	49.48	10.33	7.89
11/7/2004 8:00	49.4	10.33	7.89
11/7/2004 9:00	49.34	10.40	7.9
11/7/2004 10:00	49.3	10.26	7.89
11/7/2004 11:00	49.33	10.34	7.9
11/7/2004 12:00	49.48	10.41	7.9
11/7/2004 13:00	49.65	10.47	7.9
11/7/2004 14:00	49.89	10.49	7.91
11/7/2004 15:00	50.14	10.50	7.92
11/7/2004 16:00	50.24	10.47	7.92
11/7/2004 17:00	50.26	10.49	7.93

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/7/2004 18:00	50.3	10.45	7.93
11/7/2004 19:00	50.3	10.47	7.93
11/7/2004 20:00	50.32	10.68	7.93
11/7/2004 21:00	50.29	10.69	7.94
11/7/2004 22:00	50.26	10.66	7.94
11/7/2004 23:00	50.17	10.60	7.94
11/8/2004 0:00	50.05	10.55	7.94
11/8/2004 1:00	49.88	10.52	7.96
11/8/2004 2:00	49.67	10.46	7.96
11/8/2004 3:00	49.45	10.40	7.96
11/8/2004 4:00	49.26	10.35	7.96
11/8/2004 5:00	49.12	10.29	7.96
11/8/2004 6:00	48.99	10.24	7.96
11/8/2004 7:00	48.82	10.21	7.96
11/8/2004 8:00	48.66	10.22	7.96
11/8/2004 9:00	48.51	10.24	7.96
11/8/2004 10:00	48.37	10.29	7.96
11/8/2004 11:00	48.33	10.35	7.96
11/8/2004 12:00	48.34	10.36	7.96
11/8/2004 13:00	48.39	10.37	7.96
11/8/2004 14:00	48.47	10.37	7.97
11/8/2004 15:00	48.53	10.38	7.97
11/8/2004 16:00	48.56	10.35	7.97
11/8/2004 17:00	48.49	10.33	7.97
11/8/2004 18:00	48.47	10.32	7.97
11/8/2004 19:00	48.47	10.29	7.97
11/8/2004 20:00	48.47	10.28	7.97
11/8/2004 21:00	48.47	10.48	7.97
11/8/2004 22:00	48.42	10.44	7.97
11/8/2004 23:00	48.34	10.38	7.97
11/9/2004 0:00	48.25	10.40	7.97
11/9/2004 1:00	48.15	10.36	7.97
11/9/2004 2:00	48.03	10.32	7.97
11/9/2004 3:00	47.9	10.25	7.97
11/9/2004 4:00	47.76	10.18	7.98
11/9/2004 5:00	47.66	10.06	7.98
11/9/2004 6:00	47.55	0.00	7.98
11/9/2004 7:00	47.43	0.00	7.97
11/9/2004 8:00	47.31	0.00	7.97
11/9/2004 9:00	47.18	0.00	7.96
Sonde reprogrammed for DO mg/l			
11/10/2004 9:00	66.14	7.41	7.42
11/10/2004 10:00	45.89	10.51	7.98
11/10/2004 11:00	45.85	10.48	7.98
11/10/2004 12:00	45.98	10.55	8
11/10/2004 13:00	46.12	10.57	8.01
11/10/2004 14:00	46.25	10.61	8.01
11/10/2004 15:00	46.37	10.65	8.02
11/10/2004 16:00	46.47	10.71	8.03

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/10/2004 17:00	46.56	10.74	8.03
11/10/2004 18:00	46.61	10.75	8.03
11/10/2004 19:00	46.69	10.76	8.03
11/10/2004 20:00	46.74	10.74	8.03
11/10/2004 21:00	46.86	10.8	8.04
11/10/2004 22:00	46.92	10.78	8.04
11/10/2004 23:00	47.01	10.76	8.03
11/11/2004 0:00	47.08	10.74	8.03
11/11/2004 1:00	47.16	10.73	8.04
11/11/2004 2:00	47.2	10.7	8.04
11/11/2004 3:00	47.2	10.64	8.03
11/11/2004 4:00	47.19	10.59	8.03
11/11/2004 5:00	47.15	10.52	8.03
11/11/2004 6:00	47.08	10.47	8.03
11/11/2004 7:00	47.03	10.37	8.02
11/11/2004 8:00	46.96	10.31	8.02
11/11/2004 9:00	46.87	10.24	8.02
11/11/2004 10:00	46.77	10.18	8.01
11/11/2004 11:00	46.67	10.18	8.01
11/11/2004 12:00	46.56	10.18	8.02
11/11/2004 13:00	46.47	10.2	8.03
11/11/2004 14:00	46.41	10.22	8.04
11/11/2004 15:00	46.38	10.21	8.03
11/11/2004 16:00	46.3	10.24	8.04
11/11/2004 17:00	46.26	10.24	8.04
11/11/2004 18:00	46.2	10.25	8.05
11/11/2004 19:00	46.12	10.23	8.05
11/11/2004 20:00	46.06	10.23	8.05
11/11/2004 21:00	45.97	10.23	8.05
11/11/2004 22:00	45.91	10.21	8.05
11/11/2004 23:00	45.84	10.21	8.05
11/12/2004 0:00	45.76	10.24	8.06
11/12/2004 1:00	45.65	10.19	8.05
11/12/2004 2:00	45.54	10.2	8.05
11/12/2004 3:00	45.45	10.19	8.06
11/12/2004 4:00	45.3	10.2	8.06
11/12/2004 5:00	45.15	10.19	8.06
11/12/2004 6:00	45.03	10.15	8.06
11/12/2004 7:00	44.83	10.11	8.06
11/12/2004 8:00	44.67	10.08	8.06
11/12/2004 9:00	44.52	10.04	8.06
11/12/2004 10:00	44.33	10.03	8.07
11/12/2004 11:00	44.2	9.99	8.06
11/12/2004 12:00	44.2	10.03	8.06
11/12/2004 13:00	44.3	10.06	8.07
11/12/2004 14:00	44.44	10.19	8.09
11/12/2004 15:00	44.54	10.21	8.09
11/12/2004 16:00	44.56	10.23	8.1
11/12/2004 17:00	44.51	10.23	8.1

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/12/2004 18:00	44.41	10.18	8.09
11/12/2004 19:00	44.35	10.2	8.09
11/12/2004 20:00	44.31	10.23	8.09
11/12/2004 21:00	44.23	10.23	8.09
11/12/2004 22:00	44.17	10.2	8.09
11/12/2004 23:00	44.11	10.19	8.09
11/13/2004 0:00	44.06	10.18	8.09
11/13/2004 1:00	44.05	10.17	8.08
11/13/2004 2:00	43.99	10.19	8.09
11/13/2004 3:00	43.93	10.23	8.09
11/13/2004 4:00	43.8	10.16	8.09
11/13/2004 5:00	43.65	10.15	8.09
11/13/2004 6:00	43.56	10.14	8.1
11/13/2004 7:00	43.36	10.06	8.09
11/13/2004 8:00	43.23	10.03	8.09
11/13/2004 9:00	43.07	9.97	8.09
11/13/2004 10:00	43	10.01	8.11
11/13/2004 11:00	42.91	9.94	8.1
11/13/2004 12:00	42.9	9.9	8.09
11/13/2004 13:00	43.05	9.95	8.1
11/13/2004 14:00	43.19	9.96	8.1
11/13/2004 15:00	43.32	9.96	8.1
11/13/2004 16:00	43.26	9.9	8.08
11/13/2004 17:00	43.4	10.01	8.11
11/13/2004 18:00	43.33	9.98	8.1
11/13/2004 19:00	43.26	9.96	8.1
11/13/2004 20:00	43.13	9.93	8.09
11/13/2004 21:00	43.08	9.91	8.09
11/13/2004 22:00	43.12	9.94	8.1
11/13/2004 23:00	43.11	9.9	8.09
11/14/2004 0:00	42.99	9.87	8.08
11/14/2004 1:00	43.05	9.88	8.09
11/14/2004 2:00	43.04	9.9	8.09
11/14/2004 3:00	42.97	9.86	8.09
11/14/2004 4:00	42.96	9.88	8.1
11/14/2004 5:00	42.91	9.91	8.1
11/14/2004 6:00	42.71	9.87	8.1
11/14/2004 7:00	42.47	9.83	8.1
11/14/2004 8:00	42.42	9.81	8.1
11/14/2004 9:00	42.27	9.75	8.1
11/14/2004 10:00	42.2	9.72	8.1
11/14/2004 11:00	42.08	9.62	8.09
11/14/2004 12:00	42.14	9.63	8.09
11/14/2004 13:00	42.21	9.6	8.09
11/14/2004 14:00	42.32	9.58	8.08
11/14/2004 15:00	42.49	9.59	8.09
11/14/2004 16:00	42.63	9.6	8.09
11/14/2004 17:00	42.71	9.63	8.1
11/14/2004 18:00	42.52	9.58	8.09

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/14/2004 19:00	42.56	9.59	8.1
11/14/2004 20:00	42.42	9.57	8.1
11/14/2004 21:00	42.38	9.56	8.1
11/14/2004 22:00	42.35	9.54	8.1
11/14/2004 23:00	42.32	9.53	8.09
11/15/2004 0:00	42.35	9.53	8.09
11/15/2004 1:00	42.4	9.53	8.09
11/15/2004 2:00	42.41	9.54	8.09
11/15/2004 3:00	42.4	9.55	8.09
11/15/2004 4:00	42.39	9.56	8.1
11/15/2004 5:00	42.36	9.59	8.1
11/15/2004 6:00	42.24	9.59	8.11
11/15/2004 7:00	42.15	9.58	8.11
11/15/2004 8:00	42.01	9.54	8.11
11/15/2004 9:00	41.81	9.49	8.11
11/15/2004 10:00	41.84	9.46	8.11
11/15/2004 11:00	41.81	9.42	8.11
11/15/2004 12:00	41.82	9.36	8.11
11/15/2004 13:00	41.92	9.33	8.11
11/15/2004 14:00	42	9.31	8.11
11/15/2004 15:00	42.1	9.3	8.11
11/15/2004 16:00	42.12	9.29	8.11
11/15/2004 17:00	42.07	9.26	8.11
11/15/2004 18:00	42.04	9.24	8.11
11/15/2004 19:00	42.02	9.21	8.11
11/15/2004 20:00	42	9.2	8.11
11/15/2004 21:00	41.96	9.17	8.11
11/15/2004 22:00	41.96	9.16	8.11
11/15/2004 23:00	42	9.16	8.11
11/16/2004 0:00	42.08	9.18	8.11
11/16/2004 1:00	42.13	9.17	8.11
11/16/2004 2:00	42.2	9.2	8.12
11/16/2004 3:00	42.28	9.23	8.12
11/16/2004 4:00	42.31	9.26	8.12
11/16/2004 5:00	42.34	9.29	8.13
11/16/2004 6:00	42.33	9.27	8.13
11/16/2004 7:00	42.33	9.24	8.13
11/16/2004 8:00	42.29	9.19	8.13
11/16/2004 9:00	42.29	9.12	8.12
11/16/2004 10:00	42.27	9.04	8.11
11/16/2004 11:00	42.31	8.97	8.11
11/16/2004 12:00	42.4	8.94	8.11
11/16/2004 13:00	42.47	8.89	8.11
11/16/2004 14:00	42.58	8.87	8.11
11/16/2004 15:00	42.77	8.87	8.11
11/16/2004 16:00	42.91	8.87	8.11
11/16/2004 17:00	43.03	8.86	8.11
11/16/2004 18:00	43.09	8.84	8.11
11/16/2004 19:00	43.16	8.82	8.11

Tecumseh Bridge on the Maumee River
YSI Sonde Data

Date/time	Temp F	DO mg/l	pH
11/16/2004 20:00	43.22	8.79	8.1
11/16/2004 21:00	43.28	8.78	8.11
11/16/2004 22:00	43.36	8.77	8.11
11/16/2004 23:00	43.43	8.75	8.1
11/17/2004 0:00	43.51	8.74	8.11
11/17/2004 1:00	43.59	8.73	8.1
11/17/2004 2:00	43.68	8.72	8.1
11/17/2004 3:00	43.76	8.72	8.11
11/17/2004 4:00	43.84	8.73	8.11
11/17/2004 5:00	43.88	8.69	8.1
11/17/2004 6:00	43.92	8.69	8.11
11/17/2004 7:00	43.93	8.64	8.11
11/17/2004 8:00	43.94	8.61	8.11
11/17/2004 9:00	43.95	8.56	8.1
11/17/2004 10:00	43.96	8.5	8.1
11/17/2004 11:00	44.01	8.44	8.09
11/17/2004 12:00	44.09	8.41	8.1
11/17/2004 13:00	44.24	8.37	8.1
11/17/2004 14:00	44.37	8.33	8.09
11/17/2004 15:00	44.52	8.3	8.09
11/17/2004 16:00	44.67	8.23	8.08
11/17/2004 17:00	44.74	8.21	8.08
11/17/2004 18:00	44.82	8.2	8.09
11/17/2004 19:00	44.87	8.18	8.09
11/17/2004 20:00	44.99	8.14	8.08
11/17/2004 21:00	45.11	8.12	8.08
11/17/2004 22:00	45.29	8.06	8.07
11/17/2004 23:00	45.42	8.04	8.07
11/18/2004 0:00	45.58	8.01	8.07
11/18/2004 1:00	45.7	8	8.07
11/18/2004 2:00	45.83	8.98	8.07
11/18/2004 3:00	45.93	8.95	8.07
11/18/2004 4:00	46.04	8.92	8.07
11/18/2004 5:00	46.15	8.88	8.06
11/18/2004 6:00	46.27	8.83	8.06
11/18/2004 7:00	46.34	8.81	8.06
11/18/2004 8:00	46.35	8.74	8.06
11/18/2004 9:00	46.34	8.65	8.05
11/18/2004 10:00	46.43	8.77	8.05
11/18/2004 11:00	46.61	7.42	8.03
11/18/2004 12:00	46.75	7.37	8.03
11/18/2004 13:00	46.86	7.34	8.03
11/18/2004 14:00	46.97	7.37	8.03
11/18/2004 15:00	47.08	7.38	8.04

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23-Oct-04 11:51a.m.	0.01
	0.03
23-Oct-04 12:06p.m.	0.01
23-Oct-04 12:31p.m.	0.01
23-Oct-04 12:36p.m.	0
23-Oct-04 12:41p.m.	0.01
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	0.06
23-Oct-04 01:16p.m.	0.01
	0.01
23-Oct-04 03:01p.m.	0.04
23-Oct-04 03:06p.m.	0.04
23-Oct-04 03:11p.m.	0.02
23-Oct-04 03:16p.m.	0.02
23-Oct-04 03:21p.m.	0
23-Oct-04 03:26p.m.	0
23-Oct-04 03:31p.m.	0.01
	0.13
23-Oct-04 09:21p.m.	0.01
23-Oct-04 09:26p.m.	0.05
	0.06
	.29
27-Oct-04 03:16a.m.	0.01
	0.01
	.01
29-Oct-04 09:46a.m.	0.01
	0.01
29-Oct-04 10:01a.m.	0.01
29-Oct-04 10:06a.m.	0.01
	0.02
29-Oct-04 11:36a.m.	0.01
	0.01
	.04
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30-Oct-04 02:56a.m.	0.01
	0.11
30-Oct-04 03:01a.m.	0.01
30-Oct-04 03:06a.m.	0.01
	0.02
30-Oct-04 05:41a.m.	0.13
30-Oct-04 05:46a.m.	0.01
30-Oct-04 05:51a.m.	0.02
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30-Oct-04 06:01a.m.	0.01
30-Oct-04 06:16a.m.	0.02
30-Oct-04 06:51a.m.	0.01
	0.04

30-Oct-04 07:36a.m.	0.01	
	0.01	
30-Oct-04 10:26a.m.	0.01	
	0.01	
		.36
1-Nov-04 02:16p.m.	0.01	
1-Nov-04 02:21p.m.	0.01	
1-Nov-04 02:26p.m.	0.01	
	0.03	
1-Nov-04 03:01p.m.	0.01	
1-Nov-04 03:06p.m.	0	
1-Nov-04 03:11p.m.	0.01	
1-Nov-04 03:21p.m.	0.01	
1-Nov-04 03:51p.m.	0.01	
1-Nov-04 03:56p.m.	0.01	
	0.05	
1-Nov-04 04:36p.m.	0.01	
	0.01	
1-Nov-04 09:16p.m.	0.01	
1-Nov-04 09:21p.m.	0	
1-Nov-04 09:26p.m.	0.01	
1-Nov-04 09:41p.m.	0.01	
1-Nov-04 09:51p.m.	0.01	
1-Nov-04 09:56p.m.	0.02	
	0.06	
1-Nov-04 10:01p.m.	0.01	
1-Nov-04 10:06p.m.	0.01	
1-Nov-04 10:11p.m.	0.02	
1-Nov-04 10:16p.m.	0.03	
1-Nov-04 10:21p.m.	0.02	
1-Nov-04 10:26p.m.	0.02	
1-Nov-04 10:31p.m.	0.01	
1-Nov-04 10:36p.m.	0.01	
1-Nov-04 10:41p.m.	0.01	
1-Nov-04 10:46p.m.	0.02	
1-Nov-04 10:51p.m.	0.06	
1-Nov-04 10:56p.m.	0.01	
	0.23	
1-Nov-04 11:01p.m.	0.01	
1-Nov-04 11:26p.m.	0.01	
	0.02	
		.40
2-Nov-04 03:51a.m.	0.01	
	0.01	
2-Nov-04 04:16a.m.	0.01	
2-Nov-04 04:31a.m.	0.01	
2-Nov-04 04:36a.m.	0.01	
2-Nov-04 04:41a.m.	0.01	
2-Nov-04 04:46a.m.	0	
2-Nov-04 04:51a.m.	0.01	
	0.05	

ATTACHMENT 7

St. Joseph River at Mayhew Road

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	150.5	61.3
DO	6.4	8.75
NH_3-N	0.01445	0.135
Total Phosphorus	0.13	0.20335
E. Coli	0.2	950
Hg	0.0000425	0.000025
Cu	0.0125	0.03125
Cd	0.0035	0.005625
Cyanide	0.02015 mg	0.006375 mg
Cis-1,2-Dichloroethene	N/A	0.00025
tetrachloroethene	N/A	0.00025
Cr	0.00375	0.01275
Zn	0.0085	0.03875
Pb	0.0065	0.01688
Ni	0.0155	0.01688
Ag	0.00175	0.005625

St. Joseph River at Tennessee Avenue

Parameter	**Dry Weather Concentration mg/l**	**Wet Weather Concentration mg/l**
TSS	32	61.225
DO	7	9.855
NH_3-N	0.03665	0.25
Total Phosphorus	0.1262	0.0925
E. Coli	130	3,470.25
Hg	0.000015	0.000025
Cu	0.00425	0.039375
Cd	0.0035	0.005625
Cyanide	0.00015 mg	0.0053875 mg
Cis-1,2-Dichloroethene	N/A	0.00025
tetrachloroethene	N/A	0.00025
Cr	0.00325	0.012
Zn	0.0065	0.02
Pb	0.0065	0.01875
Ni	0.00625	0.0125
Ag	0.00175	0.005

St. Mary's at Ferguson Road

Parameter	**Dry Weather Concentration mg/l**	**Wet Weather Concentration mg/l**
TSS	65	67.175
DO	11.9	8.2275
NH_3-N	0.03875	0.195
Total Phosphorus	0.349	0.325
E. Coli	220	3,088
Hg	0.000015	0.000025
Cu	0.0115	0.03125
Cd	0.0015	0.005
Cyanide	0.00025 mg	0.0038875 mg
Cis-1,2-Dichloroethene	N/A	0.00025
tetrachloroethene	N/A	0.00025
Cr	0.0065	0.0125
Zn	0.0115	0.02625
Pb	0.0065	0.01186
Ni	0.005	0.01438
Ag	0.0035	0.0075

St. Mary's at Harrison Street

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	63.5	31.175
DO	10.6	8.585
NH_3-N	0.02195	0.32
Total Phosphorus	0.2905	0.28
E. Coli	270	14,206.25
Hg	0.000015	0.000025
Cu	0.0065	0.01125
Cd	0.00125	0.005
Cyanide	0.0003 mg	0.006875 mg
Cis-1,2-Dichloroethene	N/A	0.000375
tetrachloroethene	N/A	0.013625
Cr	0.00375	0.015
Zn	0.0145	0.0375
Pb	0.0065	0.03
Ni	0.014	0.0125
Ag	0.00175	0.005

Maumee River at Anthony Boulevard

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	52.5	37.225
DO	8.3	9.425
NH_3-N	0.0373	0.17
Total Phosphorus	0.203	0.2075
E. Coli	210	19,666.75
Hg	0.000015	0.000023125
Cu	0.0055	0.01875
Cd	0.00125	0.005
Cyanide	0.0003 mg	0.0042 mg
Cis-1,2-Dichloroethene	N/A	0.00025
tetrachloroethene	N/A	0.00025
Cr	0.00425	0.01625
Zn	0.014	0.025
Pb	0.008	0.024375
Ni	0.00675	0.041875
Ag	0.00175	0.005

Maumee River at Landin Road

Parameter	**Dry Weather Concentration mg/l**	**Wet Weather Concentration mg/l**
TSS	49.5	37.625
DO	7.1	8.3825
NH_3-N	0.16345	0.2475
Total Phosphorus	0.286	0.6825
E. Coli	110	8,883.5
Hg	0.000042	0.000025
Cu	0.007	0.01688
Cd	0.00125	0.005
Cyanide	0.00015 mg	0.00375 mg
Cis-1,2-Dichloroethene	N/A	0.00025
tetrachloroethene	N/A	0.00025
Cr	0.006	0.0145
Zn	0.022	0.03375
Pb	0.0065	0.02563
Ni	0.00725	0.02063
Ag	0.04775	0.005

Spy Run Creek Upstream

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	6.6	36.5
DO	12.78	8.82
NH_3-N	0.0527	0.321
Total Phosphorus	0.053	0.1405
E. Coli	207	6,281.5
CBOD	3.33	14.44
Cu	0.005	0.00875
Cd	0.005	0.005
Cr	0.005	0.006875
Zn	0.015	0.0425
Pb	0.005	0.008125
Ni	0.005	0.006875
Ag	0.005	0.005

Spy Run Creek Downstream

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	7.4	63.65
DO	12.55	8.71
NH_3-N	0.0599	0.321
Total Phosphorus	0.058	0.201
E. Coli	175	9744
CBOD	3.75	13.615
Cu	0.005	0.01875
Cd	0.005	0.005
Cr	0.005	0.006875
Zn	0.02	0.06625
Pb	0.005	0.009375
Ni	0.005	0.006875
Ag	0.005	0.005

Baldwin Ditch Upstream

Parameter	**Dry Weather Concentration mg/l**	**Wet Weather Concentration mg/l**
TSS	6.2	17.25
DO	13.03	9.765
NH_3-N	0.1025	0.199
Total Phosphorus	0.091	0.1945
E. Coli	2077	56,607
CBOD	3.03	14.7
Cu	0.005	0.016875
Cd	0.005	0.005
Cr	0.005	0.006875
Zn	0.045	0.1025
Pb	0.005	0.006875
Ni	0.005	0.00625
Ag	0.005	0.005

Baldwin Ditch Downstream

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	9	19.45
DO	13.58	10.09
NH_3-N	0.1505	0.42
Total Phosphorus	0.106	0.1021
E. Coli	547	37,167
CBOD	2.21	14.56
Cu	0.005	0.018125
Cd	0.005	0.005
Cr	0.005	0.005625
Zn	0.015	0.06125
Pb	0.005	0.009375
Ni	0.005	0.00625
Ag	0.005	0.005

Relief RCD1

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	9.2	38.9
DO	12.25	7.765
NH_3-N	3.075	2.541
Total Phosphorus	.138	0.611
E. Coli	189	60,724
CBOD	2.47	22.83
Cu	0.005	0.013125
Cd	0.005	0.005
Cr	0.005	0.005
Zn	0.0125	0.049375
Pb	0.005	0.006875
Ni	0.005	0.005
Ag	0.005	0.005

Relief RC4

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	34.2	64.95
DO	12.25	7.765
NH_3-N	3.075	2.541
Total Phosphorus	0.132	0.1975
E. Coli	160	6,190
CBOD	4.47	10.465
Cu	0.005	0.013125
Cd	0.005	0.005
Cr	0.005	0.005
Zn	0.01	0.02
Pb	0.005	0.005
Ni	0.005	0.005
Ag	0.005	0.005

River MR6

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	35.6	45.3
DO	N/A	N/A
NH_3-N	0.1135	0.0855
Total Phosphorus	0.118	0.175
E. Coli	101	3,329.5
CBOD	4.17	18.71
Cu	0.005	0.005
Cd	0.005	0.005
Cr	0.005	0.005
Zn	0.01	0.01625
Pb	0.005	0.005
Ni	0.005	0.005
Ag	0.005	0.005

Lower Relief LRC5

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	5.6	19.6
DO	N/A	N/A
NH_3-N	1.415	1.017
Total Phosphorus	0.078	0.1025
E. Coli	22	2,587
CBOD	2.23	8.13
Cu	0.005	0.005625
Cd	0.005	0.005
Cr	0.005	0.005
Zn	0.0075	0.015
Pb	0.005	0.005
Ni	0.005	0.005
Ag	0.005	0.005

River MR7

Parameter	Dry Weather Concentration mg/l	Wet Weather Concentration mg/l
TSS	39.2	51.65
DO	N/A	N/A
NH_3-N	0.202	0.05
Total Phosphorus	0.119	0.1535
E. Coli	191	1,714
CBOD	4.23	10.44
Cu	0.005	0.005
Cd	0.005	0.005
Cr	0.005	0.005
Zn	0.0075	0.01875
Pb	0.005	0.005
Ni	0.005	0.005
Ag	0.005	0.005

CHAPTER 3

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3 DEVELOPMENT AND EVALUATION OF ALTERNATIVES FOR CSO CONTROL

3.1 *PUBLIC PARTICIPATION AND AGENCY INTERACTION*

The City has made a strong commitment to public participation and agency interaction during development of their LTCP, and will continue to do so during implementation of the plan. The following subsections summarize the City's demonstrated commitment in these areas.

3.1.1 Public Participation

The City has emphasized community and stakeholder involvement in the development of its wet-weather control plans. This effort was initiated during the early development of the "*Combined Sewer System Operational Plan*" and its ongoing strategy to involve the public. This strategy served as a foundation for the public involvement requirements of the LTCP development process by pursuing the following five objectives:

- Educating the public on the various aspects of the collection system so they will become familiar with its terminology and function.
- Educating the public on what goes into the nation's waters through CSOs.
- Involving the public in deciding how pollution reduction will be accomplished.
- Ensuring that water quality issues important to the public are addressed.
- Gaining public confidence.

Two of the focused efforts used to achieve these objectives were:

- An ongoing schedule of public meetings through the LTCP development process
- A public process to establish community-based water quality goals for the City's receiving waters.

3.1.1.1 Public Meetings

The City organized and facilitated approximately 26 meetings with the general public, neighborhood groups, environmental advocacy groups, and business organizations during 2000 and 2001. The purpose of these meetings was to convey information to and receive input from local stakeholders regarding the City's CSO control objectives and approach.

A listing of the meetings held in addition to the workshops described later in Sections 3.3.4 and 3.4 is provided in Table 3.1.1.1.

3.1.1.2 Establishing Community-Based Water Quality Goals

In order to further define public goals and objectives regarding community-based water quality goals, the City solicited the input from a group of 75 stakeholders (comprised of neighborhood leaders, environmental advocates, business leaders, and other citizens) through one-on-one interviews and three formal workshops. This effort resulted in the summary document "*Community-Based Water Quality Goals for the Upper Maumee Watershed*," completed in May, 1998. A summary of the conclusions from the stakeholder interviews is presented in Table 3.1.1.2. These community views have been incorporated in the LTCP decision-making process to the extent consistent with applicable law.

Table 3.1.1.2
Community-Based Water Quality Goals - Conclusions from Stakeholder Interviews

TOPIC	MAJORITY OPINION
Most important objective for regional watershed management	Drinking water protection Aquatic life protection
Most desired improvement in Fort Wayne's rivers	Overall recreation: • Improved use of Greenway and parks. • Improved boating • Improved fishing
Concerns with current rivers	Aesthetics: • Silt • Debris and litter
Priority steps necessary to achieve improvement	Public education

3.1.2 Regulatory Interaction

The City has regularly engaged the regulatory agencies as part of their CSO planning efforts, as summarized below:

- Beginning in the late 1990s, the City regularly submitted their CSO planning documents to IDEM and U.S. EPA. All submitted documents presented background information relevant to the LTCP, e.g. model development reports or public involvement summaries.
- During the formative stages of developing their LTCP strategy, the City had early discussions with IDEM (Mr. Reggie Baker) and U.S. EPA (Mr. Howard Duckman) in 1999.

- The City submitted a draft of the technical component of their LTCP in December, 1999, in an effort to obtain agency feedback on their LTCP development approach.
- The City submitted a full draft of their LTCP in July 2001.
- Following Agency review of and comment on the 2001 LTCP, the City has held regular negotiation sessions with U.S. EPA and IDEM in the period from 2003 to 2006. These sessions resulted in the agreed-upon LTCP presented in this document.

3.2 LONG-TERM CONTROL PLAN APPROACH

3.2.1 Water Quality Goals

The CSO Control Policy states that the ultimate goal of the LTCP is "*Compliance with the requirements of the CWA*" (Part II.c).[1] One of the primary CWA requirements on which the CSO Control Policy focuses is that municipalities develop and implement CSO controls which will result in compliance with applicable water quality standards (WQS) in waters receiving CSO discharges. At the same time, the CSO Control Policy recognizes that existing WQS might not be appropriate in all cases for a given receiving water and allows CSO communities and permitting authorities to consider the possible need for review of applicable WQS concurrently with the development of CSO control plans. (Part II.E). Congress added emphasis to this point with its 2000 amendment to the CWA[2] that required EPA to issue guidance to facilitate the conduct of water quality and designated use reviews for CSO-impacted receiving waters. 33 U.S.C. § 1342(q)(2).

Given the provisions of the Policy and CWA requirements, the City concluded that the initial water quality goal for its CSO controls should be compliance with the current WQS at all times. The City also sought to integrate the local community water quality goals, as described in Section 3.1.1.2, in the LTCP decision-making process to the extent consistent with applicable law.

As discussed in more detail in Chapter 2 and elsewhere in this LTCP, this initial water quality goal was tempered by the City's conclusion, based on the characterization of the City's CSS and its receiving water that complete elimination of CSOs will not result in the attainment of the current WQS – particularly those applying to recreational use – because of pollution sources other than CSOs. [3] Its initial water quality goal was further tempered by the tentative conclusion reached by the City as it engaged in the

[1] Interestingly, the Clean Water Act was amended in late 2000, at 33 U.S.C. §1342(q), to require permits, orders and other enforcement documents to conform to the CSO Control Policy.
[2] Pub.L. 106-554, § 1(a)(4).
[3] The receiving waters for the City's CSOs are designated by the State of Indiana for full-body contact recreation at all times during the recreational season.

identification and development of CSO control alternatives, as discussed later in this chapter, that full control of all CSO discharges so as to not preclude the attainment of WQS or designated uses of the receiving waters would not be feasible due to the inordinate expense.

These factors have led the City to the conclusion that it will be necessary to seek a revision of the designated recreational use and associated water quality criteria in order to develop an affordable LTCP. Such revisions to WQSs are possible, as alluded to in the CWA provisions referenced above, when attainment of an existing WQS is not feasible as demonstrated through a Use Attainability Analysis (UAA) in accordance with 40 CFR 131.10(g). The UAA provides the scientific, technical and economic support for a state's determination that a designated use is not attainable based on one or more of the factors listed in 40 CFR 131.10(g). These federal regulations provide the legal basis for revising or removing a designated use.[4]

As discussed in more detail later in this LTCP, the City is seeking a revision of the currently applicable recreational designated use to the CSO Wet Weather Limited Use Subcategory, as established under Ind. Code § 13-18-3-2.5. If this use subcategory is approved by IDEM (and the Indiana Water Pollution Control Board) for application to the City's CSO-impacted waters and the revision to the designated use is approved by EPA pursuant to federal regulations, then the current designated recreational use will not apply during wet weather conditions causing CSO discharges that exceed the capability of the CSO control measures implemented by the City under its LTCP.

Consequently, the water quality goal ultimately guiding the City's development and anticipated implementation of the LTCP is to comply with the designated use for recreation as requested by the City to be revised in accordance with the applicable state and federal law and the draft UAA prepared by the City.

3.2.2 General Approach to Long-Term Control Plan Development

The CSO Control Policy provides two potential approaches for determining acceptable CSO control. Both of these general approaches are intended to lead to attainment of water quality standards (WQS), including designated uses, and compliance with the Clean Water Act.

The **demonstration approach** relies on data collection and simulation to demonstrate that the proposed LTCP results in meeting water quality standards and considers all factors that are likely to influence success; there is no formal reliance on end-of-pipe criteria governing how much CSOs must be reduced. The guidance states, "Under the

[4] However, a revision of a current designated use is not permissible if that use is being or has been attained in the water body so as to be "existing use."

demonstration approach, the municipality would be required to successfully demonstrate compliance with each of the following criteria (II.C.4b)":

i. *the planned control program is adequate to meet WQS and protect designated uses, unless WQS or uses cannot be met as a result of natural background conditions or pollution sources other than CSOs;*

ii. *the CSO discharges remaining after implementation of the planned control program will not preclude the attainment of WQS or the receiving waters' designated uses or contribute to their impairment. Where WQS and designated uses are not met in part because of natural background conditions or pollution sources other than CSOs, a total maximum daily load, including a wasteload allocation, a load allocation or other means should be used to apportion pollutant loads;*

iii. *the planned control program will provide the maximum pollution reduction benefits reasonably attainable; and*

iv. *the planned control program is designed to allow cost-effective expansion or cost-effective retrofitting if additional controls are subsequently determined to be necessary to meet WQS or designated uses.*

The **presumption approach** is based on the assumption that a LTCP meeting certain minimum defined performance criteria "*…would be presumed to provide an adequate level of control to meet the water quality-based requirements of the CWA, provided the permitting authority determines that such presumption is reasonable in light of the data and analysis conducted in the characterization, monitoring, and modeling of the system and the consideration of sensitive areas…*"(II.C.4a).

Under the presumption approach, controls adopted in the LTCP are required to meet one of the following criteria (II.C.4.a):

i. *No more than an average of four overflow events per year, provided that the permitting authority may allow up to two additional overflow events per year. For the purpose of this criterion, an overflow event is one or more overflows from a CSS as the result of a precipitation event that does not receive the minimum treatment specified…[see definition of minimum treatment, below]; or*

ii. *The elimination or the capture for treatment of no less than 85% by volume of the combined sewage collected in the CSS during precipitation events on a system-wide annual average basis; or*

iii. *The elimination or removal of no less than the mass of the pollutants identified as causing water quality impairment through the sewer system characterization, monitoring, and modeling effort for the volumes that would be eliminated or captured for treatment under paragraph ii above.*

From the results of its characterization of the CSS and receiving waters, the City has concluded that complete elimination of CSOs will not result in the attainment of the current WQS because of pollution sources other than CSOs. The demonstration approach is particularly appropriate where attainment of WQS cannot be achieved through CSO control alone, due to the impacts of non-CSO sources of pollution. In such cases, an appropriate level of CSO control cannot be dictated directly by existing WQS but must be defined based on water quality data, system performance modeling, and economic factors. Further, the Policy recognizes that these factors might ultimately support the revision of existing WQS as the City now proposes.

Because of this the City has selected the demonstration approach as the guiding strategy for their Long-Term Control Plan.

3.3 DEVELOPMENT OF ALTERNATIVES FOR CSO CONTROL

3.3.1 General Approach

Certain concepts should be considered when developing CSO control alternatives. The general approaches and concepts incorporated in the City's evaluative process included the following:

- Examining a range of control levels, from minimum control measures to full control of CSOs.
- Incorporating other collection and treatment system objectives, e.g. combined sewer capacity issues and separate sanitary improvements, where supportive of or closely related to the City's CSO control goals.
- Considering other point and nonpoint sources and associated control activities, while recognizing that the City does not have a mandate for control of these sources in their CSO program. Further, in most cases, the City has no jurisdictional mechanism for such control.

3.3.2 Definition of CSO Control Goals

To facilitate examination of cost and affordability issues, the City developed 12 systemwide Long-Term Control Plan options and conducted an evaluation of each option's cost and benefits. As explained in detail in Section 3.3.5 below, the following alternatives were developed:

1. Storage Tunnel
2. Satellite Disinfection Basins
3. Conveyance to CSO Ponds with Treatment/Storage at Ponds
    - 3A: Enhanced High-Rate Clarification/High-Rate Treatment at CSO Ponds 1&2
    - 3B: Flow Equalization and Enhanced High-Rate Clarification/High Rate Treatment at CSO Ponds 1&2

- 3C: Wet-Weather Storage at CSO Ponds 1&2 with Dewatering to WPCP
- 3D: High-Rate Disinfection at CSO Pond 1
- 3E: Wet-Weather Storage at CSO Ponds 1&2 with Dewatering to WPCP, Combined with EHRC/HRT for Flows Exceeding Pond Storage Capacity

4. Conveyance to CSO Ponds with EHRC/HRT Facilities at Ponds, Satellite Treatment at Rudisill Subbasin
    - 4A: Enhanced High-Rate Clarification/High-Rate Treatment with Disinfection at Rudisill
    - 4B: Satellite Disinfection Basin at Rudisill
5. Partial Sewer Separation
6. Conveyance to CSO Ponds with EHRC/HRT Facilities at Ponds, Local Complete Separation in Subbasin K11010 (Rudisill)
7. Complete Separation

Section 3.4 (Evaluation of Alternatives for CSO Control) discusses the alternative selection process in further detail. Section 3.5 (Financial Capability) discusses the cost implications of implementing the selected alternative in terms of the local community's ability to fund improvements through rate increases.

3.3.2.1 CSO Control Goals

CSO control goals refer to specific level of pollution control for CSO sources only. The process for determining level of control is based on the City's water quality goals. As noted above, the City established early in the LTCP development process that current WQS (specifically bacteria) would be violated even with complete elimination of CSOs. Therefore, under the Policy, the City must demonstrate the CSO discharges remaining after implementation of the planned control program will not preclude the attainment of appropriate WQS, as they may be revised, or contribute to their impairment.

The City developed and evaluated a full range of CSO control levels, for a wide range of alternatives, to define associated cost/benefit relationships. These relationships provide the basis for identifying one of two CSO control scenarios for the City to proceeed with:

- Scenario 1: A CSO control goal **can** be defined that is both affordable and limits CSO discharges to a level that will not preclude the attainment of current WQS or contribute to their impairment.
- Scenario 2: A CSO control goal **cannot** be defined that is both affordable and limits CSO discharges to a level that will not preclude the attainment of current WQS or contribute to their impairment. Under this scenario, the City would proceed with a UAA and seek relief from current WQS through SEA 431.

3.3.3 Approaches to Structuring CSO Control Alternatives

The process used to structure CSO control alternatives for the City of Fort Wayne began with a preliminary screening of potential control technologies. Technologies were screened based on performance factors, implementation and operation factors, and environmental impacts. The technology screening process is explained in Section 3.3.5.1 below.

Once viable control technologies for Fort Wayne were identified through the screening process, they were assembled into functional system-wide alternatives to address every CSO in the City's system. Seven system-wide alternatives were developed, as described in Section 3.3.5.2 below. Each system-wide alternative is based on a different core technology, allowing the City to assess a full range of options as part of their alternative selection process.

3.3.4 Goals of Initial Alternatives Development

As noted in the CSO Guidance documents (*Guidance for Long-Term Control Planning*, page 3-29), the goal of the initial alternatives development process is to develop specific candidate alternatives to achieve various CSO control goals. The Guidance explains that this is a flexible, iterative process that relies on judgment to develop a "*manageable array of alternatives*."

In order to develop their manageable array of alternatives, the City worked through each of the steps recommended in the Guidance:

1. Identification of control alternatives
2. Preliminary sizing of control alternatives
3. Preliminary development of cost/performance relationships
4. Identification of preliminary site options and issues
5. Identification of preliminary operating strategies

While the alternatives development process was flexible and iterative, one fundamental criterion incorporated in all of the City's alternatives was the ability to control CSOs over a wide range of control levels, up to and including full control in an average, or typical, year. This criterion was necessary given the identification of bacteria as the primary pollutant of concern. If the City is required to ensure that CSOs do not preclude the attainment of current water quality standards for bacteria, full control of CSOs may be necessary.

Key City staff were directly involved in the alternatives development process on a day-to-day basis. In addition, a number of workshops were held with focus groups to explain the direction of the alternatives development effort, and obtain feedback on stakeholder priorities and concerns. These workshops included the following:

- Several presentations to the Sewer Advisory Group (SAG). The SAG was developed as part of the City's Combined Sewer Capacity Improvement Program, and provides consistent stakeholder oversight of the City's collection system programs. In particular, the SAG provides a mechanism for disseminating information to neighborhood groups.
- A workshop with local business representatives, to present the purpose and likely configuration of the LTCP and obtain feedback on rate sensitivity.
- An Alternatives Selection Workshop, held with City personnel on July 6, 1999, during the preliminary screening process for system-wide alternatives. The purpose of the workshop was to obtain input from City decision-makers on CSO control options during the formative stages of the alternative development process. Participants in the workshop included representatives from City Utilities, personnel from City planning programs, WPCP staff, and consultants involved in the City's WPCP Program.

3.3.5 Identification of Control Alternatives

Section 3.3.5 of the *Guidance for Long-Term Control Planning* uses the term "control alternative" and "control measure" interchangeably. In addition, while "control measures" can include non-technological components (such as public policy and regulations), much of the control measure discussion in the Guidance focuses on technology solutions. Specifically, the Guidance states "*Control measures* (i.e., control alternatives) *can generally be classified under one of the following categories:*

- *Source controls*
- *Collection system controls*
- *Storage technologies*
- *Treatment technologies"*

As noted above, the first step in developing alternatives for Fort Wayne's LTCP was to screen potential control technologies in terms of performance, implementation and operational issues, and cost factors. A full discussion of the technology screening process is described in detail in Section 3.3.5.1.

Following the screening of technologies, the second step in developing alternatives for Fort Wayne's LTCP was to combine applicable technologies into integrated system-wide alternatives. The resulting candidate alternatives are presented in Section 3.3.5.2.

3.3.5.1 Screening of Wet-Weather Technologies

A full set of potential control technologies was subjected to a preliminary screening in order to assess advantages and disadvantages in LTCP applications. Technologies were screened based on the following factors:

- *Performance Factors*: including the ability to reduce overflow volume and/or frequency, reduce bacteria, BOD, and/or suspended solids, reduce litter or first flush effects, or otherwise provide any pollution control.
- *Implementation and Operation Factors*: including potential for disruption and environmental impacts during construction, ease of implementation, facility O&M burden, whether operation of the facility requires specialized equipment, is labor intensive, has the potential to increase risk of street or yard flooding, improves system capacity, can be implemented in modules and/or stages, or can be integrated with other City programs, etc.
- *Cost Factors*: including the relative capital costs of facilities and the long-term O&M costs.

Each potential control technology was screened against these factors, resulting in documentation of qualitative advantages and disadvantages associated with each. A summary matrix was developed to show the identified technologies versus the screening factors, and is shown in Table 3.3.5.1.

3.3.5.1.1 Source Controls

Source controls are methods of reducing overflow volumes, floatables and/or pollutant loads by controlling wet weather flows and loadings at their source. Source control methods include street sweeping, catch basin cleaning, sewer flushing, and surface storage, e.g. via catch basin inlet flow control or installation of street humps. Community programs such as public education and conservation programs are other source control methods.

The primary advantage of source controls is their low capital cost. The primary disadvantage of this technology is its inability to achieve compliance with WQSs for bacteria, BOD, and suspended solids. Additional disadvantages include increased O&M costs for additional efforts to clean streets and inlets and increased risk of street and yard flooding associated with surface storage technologies.

Source control methods are typically used to help reduce overflow volumes, floatables and first flush effects. However, these methods are typically considered to be insufficient on their own for total CSO control. Due to their inability to achieve compliance with WQSs, source controls were not considered as an alternative for complete CSO control. However, source controls may be recommended as part of an overall solution set.

3.3.5.1.2 Collection System Controls

Collection system controls are methods of reducing overflow volume and frequency by implementing changes to the system, e.g. through flow controls or an increase in system capacity. Methods of collection system control include pump station modifications, regulator modifications, sewer separation, flow diversion, and other transport options.

The primary advantage of the use of collection system controls is their potential for significant control of wet-weather flows. These technologies can lead to substantive improvement at reasonable control levels and have the capacity to achieve full control of CSOs, e.g., through sewer separation, if extreme control is warranted for water quality reasons and affordable to the community.

The primary disadvantage of this technology is its high capital cost when compared to lower impact options, e.g., source control technologies. Additional disadvantages include increased operation and maintenance costs resulting from pump station and regulator modifications, increased potential for street and yard flooding associated with regulator modification, and potential for disruption during construction,.

Because collection system controls may, in whole or in part, provide the City with the ability to achieve significant improvement and comply with WQSs, collection system controls were considered for further analysis. Collection system controls were evaluated in a range of configurations, e.g., partial or complete separation, increase in conveyance capacity, pump station upgrades, and redirection of overflows.

3.3.5.1.3 Storage Technologies

Storage control is a method of reducing overflow volume and frequency by increasing a system's storage capacity. Once stored, wet weather flows may be released back to a wastewater treatment plant for treatment after system capacity becomes available. Storage control methods include in-line storage (in pipes), off-line storage (in storage basins), and deep tunnel storage.

The primary advantage of the use of storage controls is their potential for significant control of wet-weather flows. These technologies can lead to substantive improvement at reasonable control levels and have the capacity to achieve significant control of CSOs, if a high control level is warranted for water quality reasons and affordable to the community.

As with collection system controls, the primary disadvantage of this technology is its high capital cost when compared to lower impact options, e.g., source control technologies. Additional disadvantages include increased O&M costs for satellite facilities, potential for disruption during construction, and siting requirements associated with off-line storage basin alternatives.

Because storage control may, in whole or in part, provide the City with the ability to achieve significant improvement and comply with WQSs, storage control methods were considered for further analysis. Storage control methods evaluated included surface storage basins and deep-rock storage tunnels.

3.3.5.1.4 Treatment Technologies

Treatment control is a method of reducing untreated overflow volume and frequency by increasing a system's treatment capacity. Referred to as wet-weather treatment, these technologies typically involve a minimum of disinfection, and can include some form of solids (and associated BOD) removal. Wet-weather treatment systems may be located adjacent to a local regulator or at a downstream wastewater treatment plant. Treatment control methods include simple satellite disinfection basins, swirl concentrators or vortex separators, and high-rate treatment (Enhanced High-Rate Clarification) systems, often referred to using the trade names DensaDeg or ACTIFLO..

The primary advantage of the use of treatment controls is their potential for significant control of wet-weather flows. These technologies can lead to substantive improvement at reasonable control levels and have the capacity to achieve significant control of CSOs, if a high control level is warranted for water quality reasons and affordable to the community.

As with collection system and storage controls, the primary disadvantage of this technology is its high capital cost when compared to lower impact options, e.g., source control technologies. Additional disadvantages include increased O&M costs for satellite facilities, the need for transportation and storage of chemical additives, potential for disruption during construction, and siting requirements associated with satellite treatment facilities.

Because treatment control may, in whole or in part, provide the City with the ability to achieve significant improvement and comply with WQSs, treatment control methods were considered for further analysis.

3.3.5.1.5 Floatables Control

While fundamentally a form of treatment technology, floatables control has a distinct place in CSO control plans given its identification as a Nine Minimum Control. Floatables control is a method of reducing floatables (e.g., trash, rags, etc.) locally at a regulator or at the end of a CSO outfall. Methods of controlling floatables include continuous deflective separators, netting traps and automatic or manually cleaned screening.

The primary advantage of the use of floatables control is its ability to improve stream aesthetics at a relatively low capital cost.

The primary disadvantage of this technology is its inability to meet WQSs for E. Coli, BOD, or suspended solids on its own. Additional disadvantages include increased O&M costs required for maintaining screening facilities and replacement of netting.

Floatables control is not considered an alternative for complete CSO control. However, some level of floatables control will be provided at every overflow as part of the LTCP.

3.3.5.1.6 Non-Traditional Alternatives

Non-traditional technologies include both direct and indirect methods of mitigating the impact of CSO discharges on water quality. These methods include wetland treatment, stormwater detention, stream restoration, channel modification, stream aeration, and habitat modification.

The primary advantage of the use of non-traditional alternatives is their relatively low implementation and O&M costs as compared to traditional structural technologies. Furthermore, these technologies are often based on natural processes and have a high aesthetic value, which is a combination that can lead to strong public support.

The primary disadvantages of these technologies include the requirement for large tracts of land (e.g., for wetland treatment) and the difficulty in quantitatively measuring benefit (e.g., from stream restoration). Furthermore, while these technologies are often based on natural processes, they still require structural disinfection facilties to meet *E. Coli* standards.

Non-traditional technologies are typically used in site-specific applications (i.e., where limited flow and loadings are involved). However, these methods are generally considered to be insufficient for total CSO control on their own. Therefore, non-traditional alternatives were not evaluated as an alternative for complete CSO control. However, non-traditional alternatives remain an option in the City’s overall wet-weather control planning, and have already proven viable in local applications (e.g., the Camp Scott Wetlands project).

3.3.5.1.7 Non-CSO Source Alternatives

Non-CSO source technologies are methods that contribute to CSO control objectives by reducing the volume of flow in the existing CSO system. Methods include express sewers for upstream separate sanitary areas and infiltration and inflow (I/I) reduction in the separate sanitary sewer system.

The primary advantage of the non-CSO source alternatives is the relatively low O&M costs of certain technologies (e.g., I/I reduction will typically result in a decrease in O&M).

The primary disadvantages of this alternative are its high capital costs associated with express sewers and the uncertain effectiveness of I/I reduction efforts. Furthermore, both methods can require high-impact construction in residential and commercial areas.

Non-CSO source technologies are typically used in site-specific applications,but are insufficient for total CSO control on their own given the large combined sewer portion of the City's system. The City is actively implementing non-CSO source technologies through their separate sanitary sewer improvement program, which included I/I reduction efforts, capacity improvement planning and implementation, and equalization planning and implementation.

3.3.5.2 Identification of Candidate System-Wide Alternatives

Following the screening of general technologies, potential system-wide CSO control alternatives were configured to meet, at a minimum, the following goals:

- Control all overflows in the system
- Reduce overflow volume and frequency via capture of wet weather flows.
- Integrate with other City programs (i.e., Combined Sewer System Capacity Improvement Program, WPCP Program, and separate sanitary sewer improvement program).
- Be cost effective.
- Provide floatables control.

This process resulted in seven candidate integrated system-wide improvement alternatives that have the potential to serve as Fort Wayne's CSO LTCP. These seven integrated improvement alternatives represent realistic possible combinations of control technologies applicable to the Fort Wayne collection system.

Table 3.3.5.2 presents a summary of the seven candidate integrated system-wide improvement alternatives, in terms of the major technology components that make up each one. Note that Integrated Alternatives No. 3 and 4 each include subalternatives; therefore, while there are 7 overall integrated improvement alternatives, the City actually developed 12 distinct options from which to select their CSO LTCP.

Table 3.3.5.3 provides details on the configuration of Integrated Alternatives 1, 2, 3, 4, 6, and 7. These six alternatives (eleven including subalternatives) incorporate wet-weather control technologies to capture all overflows in the system. Alternative 5 is not included in this table because it is not capable of controlling all overflows (see Section 3.3.5.2.6); however, partial separation remains viable as part of an overall solution set.

The following discussion begins with a summary of the qualitative considerations that guided the City's development of system-wide alternatives. Each of the individual integrated system-wide alternatives is then described, in terms of its configuration, facilities, and operational concept. Note that the descriptions of the integrated alternatives focus on the backbone, or dominant, technologies that define each alternative. For information on the specific technologies included in each alternative at every regulator, the reader should consistently refer to Table 3.3.5.3.

3.3.5.2.1 Qualitative Considerations

The process of identifying candidate system-wide alternatives began with a qualitative consideration of the characteristics of wet-weather control technologies and the features of Fort Wayne's collection system. This process led to the identification of several conceptual configurations for the City's LTCP. These included satellite treatment or storage basins at regulators, conveyance options using parallel interceptor(s), tunnel storage, partial or complete sewer separation, and various treatment scenarios at the CSO Ponds. Considerations important to this qualitative process are summarized below.

As explained in Section 2.6.1, 15 regulators in the City's system dominate annual overflow volume. While all regulators are targeted for control in the LTCP, these dominant regulators control certain characteristics of several alternatives, e.g., the alignment of parallel interceptors or deep-rock storage tunnels. Furthermore, all alternatives require some control mechanism to be placed within a reasonable distance of these dominant regulators.

Particular attention was focused on Regulator K11163 in developing conceptual alternative configurations, given that this regulator is the single highest-volume discharger in Fort Wayne's system. Satellite disinfection basins and Enhanced High-Rate Clarification/High Rate Treatment (EHRC/HRT), typically referred to by the trade names DensaDegor ACTIFLO, were among local technologies evaluated at K11163. Complete sewer separation was also evaluated for this drainage basin.

Preliminary siting of the storage tunnel and parallel interceptor technologies was based on right-of-way considerations, providing a direct route for transport to the WPCP, and locating the facilities at a close proximity to the regulators being served. Since the majority of Fort Wayne's regulators and its existing combined sewer interceptors are located along the St. Marys and Maumee Rivers, a general route along the rivers was selected for consideration. The selected route begins south of Regulator K11163 and proceeds north along the St. Marys River and St. Marys Interceptor (SMI) to the Wayne Street Interceptor (WSI), and then east along the WSI to the WPCP.

When considering the storage tunnel concept, the City found that a tunnel could be constructed beneath roadways or existing interceptors with access shafts at ground level to connect regulator overflows to the tunnel. The only land requirements, along with disruption during construction, would be at entrance, exit and access shafts. A parallel interceptor could be constructed below grade parallel to existing interceptors (east of the SMI and north of the WSI) in existing right-of-ways. The construction of parallel interceptors would, however, be very disruptive and would likely cause the temporary closing of roadways along its route. The storage tunnel option was identified as a system-wide alternative and the parallel interceptor was evaluated as a component of several other alternatives.

Siting of satellite storage or treatment basins was evaluated based on available surface space within close proximity to the regulators being served. Recent aerial photographs were used where available to determine if enough open land was available near a particular regulator. In some cases, the improvement alternative was sited reasonable distances from the regulator, if open land did not appear to be available nearer the regulator. Further discussion of preliminary siting issues is presented in Section 3.3.8.

Preliminary sizing evaluations along with preliminary cost estimates determined that satellite disinfection basins (using 30-minutes of detention) would be smaller and less costly than storage basins for the same level of hydraulic control at satellite facilities. Therefore, given that a storage scenario was already represented in the tunnel alternative, satellite disinfection basins were the selected technology for the satellite facility scenario.

Other improvement alternatives required siting facilities at or near the CSO Ponds. All CSO Pond technologies considered would require a parallel interceptor for transport of additional wet-weather flows to the Ponds along with upgrades to the CSO Pond Pump Station. Among the Pond technologies that survived the qualitative screening were:

- High Rate Treatment/Enhanced High Rate Clarification (HRT/EHRC), typically referred to by the trade names DensaDegor ACTIFLO. These facilities would be combined with disinfection, and were assessed with and without flow equalization.
- Storage with dewatering to the WPCP, including first flush facilities and disinfection.
- High rate mixing with disinfection at Pond 1.

Some of the advantages of these Pond technologies include the high level of treatment that can be achieved, the potential for regulatory acceptance, and very little disruption (to the general public) during construction and operation (except with regards to the parallel interceptor). Given these advantages, these combinations of technologies were evaluated further.

The CSO Ponds are recognized as a significant existing resource in the City's wet-weather control program, capable of serving a primary role in CSO abatement. Therefore, CSO-specific options were also pursued and examined to take advantage of the CSO Ponds. One option considered was direct transport of CSO from Basin O10101 to the CSO ponds. This option would eliminate local discharge of CSO to the Maumee River during the typical year, as well as mitigate flooding problems in the O10101 basin, but would require rehabilitation of the Morton Street Pump Station.

Both partial and complete system-wide sewer separation were examined. One advantage of partial separation is that it integrates naturally with the ongoing CSCI Program; in fact, the CSCI Program already includes the partial separation of several subbasins. Complete sewer separation provides full CSO control, but has several disadvantages: its cost is usually prohibitively high, implementation would be very disruptive, and it does not guarantee that WQSs will be met due to the increased impact of stormwater loads. Despite these potential disadvantages, system-wide complete separation was evaluated as a “complete control” alternative to allow for a full comparison of options.

3.3.5.2.2 Alternative 1: Tunnel Storage

Alternative No. 1 consists of the construction of one or more tunnels to provide storage for combined sewer overflow. The mining of tunnels below grade is a proven method of providing off-line storage in congested urban areas. A storage tunnel for Fort Wayne’s system would be mined at a depth of approximately 50 to 150 feet below grade using tunnel-boring machines (TBMs). The design depth would depend on several factors, including the results of a geotechnical investigation to determine the depth of bedrock along the proposed route. The tunnel alignment would likely be well below ground water for its entire length.

An entrance shaft would be required to provide a platform at the tunnel invert elevation to start the advance of the tunnel. Work shafts would be constructed along the tunnel route to provide a connection to the regulators that would overflow to the tunnel. For regulators that are distant from the tunnel alignment, microtunnels would be constructed to connect the overflow pipes to the tunnel drop shafts. An exit shaft would then be required at the end of the tunnel.

To minimize drawdown of the groundwater table due to leakage into the entrance and exit shafts, slurry walls would be used for the sides of the entrance and exit shafts with a grout plug at the bottom of each shaft. The tunnel would be constructed with a lining system consisting of reinforced concrete, precast concrete, shotcrete, contact grout, or other materials.

The proposed tunnel would provide storage for overflow volume for the captured regulators along its alignment. During a storm event, CSO currently directed to a receiving stream from a regulator would flow to the tunnel up to the selected control level. Ventilation and odor control would be included with the facility. Solids handling dewatering pumps would be used to return the contents of the tunnel to the interceptor or the WPCP after the storm event.

Two possible tunnel alignments were considered in this analysis. Both alignments are shown in Figure 3.3.5.1:

- The first alignment, “A”, would begin at the intersection of Rudisill Boulevard and Broadway/Old Mill Road, and follow a path north along Thompson Avenue to Wayne Street. The tunnel would then proceed east along Wayne Street to the WPCP. The entire tunnel length for this alignment would be 21,900 feet, with the diameter varying by control level.

- The second alignment, “B”, would consist of a tunnel along Wayne Street (i.e., include only the East/West route shown in Figure 3.3.5.1), between Nelson Street and the WPCP, and would be constructed in conjunction with a parallel interceptor along the St. Marys Interceptor (SMI). The parallel interceptor would transport overflow from captured regulators along the SMI directly to the tunnel. The proposed parallel interceptor would be designed for wet-weather conveyance of overflow from regulators along the SMI and follow a route very near the SMI. The existing interceptor would remain in service**.** Tunnel “B” would be 12,600 feet long, with the diameter varying by control level.

An initial comparison of unit costs (dollars/gallon) between the two alignments indicated that the unit costs were approximately equal. Therefore, alignment A was carried forward as the preferred option given that it represents a true tunnel configuration, not requiring a parallel interceptor along the SMI.

3.3.5.2.3 Alternative 2: Satellite Disinfection Basins

Alternative No. 2 consists of the construction of satellite disinfection basins to provide flow-through treatment for combined sewer overflow (CSO). The disinfection basins would be constructed at or near each regulator in Fort Wayne’s system, with consolidation of regulators where cost effective. The disinfection basins would be connected to the overflow of each regulator, collecting CSO during wet-weather events up to the desired level of control.

The disinfection basins would be sized to provide 30 minutes of detention time to the peak overflow rate associated with the desired control level. Previous studies and industry literature indicate that a detention time of 30 minutes can be expected to provide a sufficient kill rate to treat combined sewer overflows. When the regulator activates, flow rates up to the peak overflow rate would be routed to the basin, detained for 30 minutes with disinfection, and then discharged to the river. Flow rates above this level would bypass the basin and be discharged to the river. This untreated discharge would be considered a CSO event in the new system. After the storm, the small volume of overflow retained in the basin would be dewatered to the interceptor. Many of the treatment basins would have to be dewatered with pumps. Dewatering rates could be set to empty these basins in less than 24 hours. Treatment basins would treat all of the flow associated with overflow events up to the desired control level, and a portion of the flow throughout the duration of larger events.

The disinfection basins would be covered, concrete, underground tanks. The basin would include a bar screen in the influent channel to provide floatables control for the overflow. A shunt channel would be provided for flow rates exceeding the design capacity of the basin. Odor control would also be included with each facility. A fan/blower system would be designed to provide six air changes per hour for the two feet of headspace in the basin, and would operate when CSO volume collected in the basin. Solids handling dewatering pumps would be used to return the contents of the basin to the interceptor after the storm event. The pumps would be sized to empty the basin volume based on the available capacity at the WPCP, with dewatering time set at a maximum of 24 hours. The proposed disinfection system would use sodium hypochlorite as the means of CSO treatment because of reduced residual effects and relative safety of on-site storage. Sodium bisulfite would be used for dechlorination. A control building would be designed to house all facilities associated with treatment at the basin.

3.3.5.2.4 Alternative 3: Conveyance to CSO Ponds with Treatment/Storage at Ponds

Alternative 3 includes 5 options, or subalternatives. Before describing each option in detail, the following summarizes the overall alternative.

Alternative No. 3 examines the scenario in which CSO control is obtained by transporting additional wet-weather flows to the WPCP for treatment. This alternative provides a contrast to Alternatives No. 1 and 2, in which CSO control is obtained through storage or treatment in the collection system, upstream of the WPCP.

This Alternative No. 3 is especially applicable to Fort Wayne's combined sewer system given the existence of CSO Ponds 1 and 2. These in-place pond facilities give the City a strong basis for examining additional wet-weather treatment scenarios at the WPCP. Given the current system, Alternative No. 3 is made up of various combinations of two key components:

- Parallel interceptors to convey additional wet-weather flow to the WPCP, as outlined in Section 3.3.5.2.9.
- Some form of wet-weather high-rate treatment at the CSO ponds, and/or utilization of WPCP treatment capacity to treat wet-weather flows stored in the CSO ponds.

The high-rate treatment technologies incorporated in Alternative No. 3 have the capability to exceed the treatment level of the satellite disinfection basins presented in Alternative No. 2. The high-rate treatment technology in Alternative No. 3 is attractive to the City given the uncertainty regarding future effluent limits for the CSO ponds. In addition, Alternative No. 3 incorporates flexibility in the level of control required at the CSO ponds. This is beneficial, as pond control level is not as straightforward as the level of control established for upstream regulators, given that the ponds are existing facilities and future effluent limits have not been established for discharge from the proposed high-rate treatment facility.

Alternative No. 3 assumes that wet-weather flows can be conveyed to the CSO Ponds and the WPCP. Therefore, it must be considered in conjunction with additional wet-weather flow conveyance provided by parallel interceptors (see Section 3.3.5.2.9). The five subalternatives developed under Alternative 3 are:

- Alternative No. 3A – High Rate Treatment/Enhanced High-rate Clarification (HRT/EHRC) at CSO Ponds 1 & 2.
- Alternative No. 3B - Flow equalization (using CSO Pond 1) and HRT/EHRC at CSO Ponds 1 & 2.
- Alternative No. 3C - Wet-weather storage at CSO Ponds 1 & 2 (with bleed-back to the WPCP).
- Alternative No. 3D - High-rate disinfection at CSO Pond 1.
- Alternative No. 3E - Wet-weather storage at CSO Ponds 1 & 2 (with bleed-back to the WPCP), combined with HRT/EHRC for flows exceeding storage capacity.

The following subsections first present relevant background characteristics of the WPCP and CSO Ponds, then describe each the subalternatives in greater detail.

3.3.5.2.4.1 WPCP and Pond Characteristics

The City of Fort Wayne's WPCP is currently rated for a design flow of 60 million gallons per day (mgd) with the largest pump off-line (firm capacity), and can treat peak flows of up to of 71 mgd with all pumps operating (peak capacity). Treatment capacity at the existing WPCP is currently limited by the pumping capacity of the headworks (i.e., 60 to 71 mgd) and the hydraulic capacity of the existing primary clarifiers. The City is in the final stages of completing a major headworks and preliminary treatment upgrade as part of their WPCP program, which will allow for a future increase of the plant's firm capacity to 74 mgd and peak capacity to 85 mgd.

When wet-weather flows observed at the headworks exceed the capacity of the WPCP, combined sewer overflow is diverted from the Wayne Street Interceptor across the Maumee River to a CSO pump station where it is pumped to the two CSO Ponds. Currently, the Ponds, which are normally operated half full and in series, have specific NPDES effluent limits for TSS, BOD, and bacteria. Pond 1 is approximately 36 acres in area, 7.5 feet deep, and can retain up to 87.5 million gallons of CSO flow as currently operated. Pond 2 is approximately 33 acres in area, 8.5 feet deep, and can retain up to 90.6 million gallons of CSO flow as currently operated. The CSO pump station also receives wet-weather flows directly from the Glasgow regulator (Regulator P06014), which services CSO Subbasin P06014 on the south side of the Maumee River.

The CSO pump station houses a large mechanically cleaned trash rack (44-ft wide by 43-ft deep), two large pumps (150 mgd) that discharge to Pond 1 and two small pumps (25 mgd and 50 mgd) that previously discharged to a former demonstration screening facility. Originally designed to operate with adjustable speed drives, the 150 mgd pumps have historically been operated (individually) as constant speed pumps at an operational flow of approximately 94 mgd. In 1999, the two large 150 mgd pumps were rehabilitated and the adjustable speed drives are currently being utilized, but remain in need of additional improvements. Also in 1999, the demonstration screening facility was decommissioned due to its difficult operation and poor performance. All pumps and associated facilities have been identified for rehabilitation. Pump station rehabilitation will be conducted as part of the LTCP, with the specific nature of the rehabilitation dependent on the selected alternative.

Currently, the CSO ponds are operated partially full to maintain a water layer above the settled solids. The ponds currently have a combined usable (for CSO retention) volume of about 178 mg and a combined total volume of about 280 mg. During CSO events, excess flow is pumped into the two CSO Ponds where settling occurs and solids are retained. Once the ponds are filled, flow-through operation is initiated and the discharge flow rate is equal to that of the influent pumping rate. A more detailed discussion of the existing facilities is provided in the report *"City of Fort Wayne Water Pollution Control Plant – Facilities Planning Study,"* dated May 1998. Pond improvements will be conducted as part of the LTCP that may allow the useable volume of the ponds to be increased, with the specific nature of the improvements dependent on the selected alternative.

3.3.5.2.4.2 Alternative No. 3A – Enhanced High-Rate Clarification/High-Rate Treatment at CSO Ponds 1 & 2

Alternative No. 3A involves the addition of enhanced high-rate clarification/high rate treatment (EHRC/HRT, typically referred to by the trade names DensaDegor ACTIFLO) and disinfection facilities upstream of the CSO Ponds for treatment of wet-weather flows. The EHRC/HRT facilities would be used to treat wet-weather flows in excess of the future plant capacity of 85 mgd. More specifically, this option involves the rehabilitation of the existing CSO pump station, the construction of EHRC/HRT facilities, and the addition of disinfection facilities on the property between CSO Pond 1 and the Maumee River.

The EHRC/HRT facilities could be constructed as modular units to allow for pilot testing of the initial installation and to allow for phased construction. A schematic illustrating the flow path required for Alternative No. 3A is shown on Figure 3.3.5.2.

All of the Alternative 3 configurations require an integrated set of components to be added to the existing CSO Pond facilities. The components of Alternative No. 3A are as follows:

CSO Pump Station – In order to consistently convey flows in excess of 150 mgd, it is necessary to upgrade the existing CSO pump station. Required improvements include the reconstruction of the two existing 150 mgd pumps. Conveyance of wet-weather flows at or above 300 mgd would require the addition of a new 150 mgd pump to be provided as a standby. Since the existing pump station was originally constructed to accommodate four additional pumps, the construction of an additional wet well would not be necessary. In addition to rehabilitation of the pumps, it has been recommended that the existing pre-engineered pump building be replaced with a new concrete block building, and that a flood control levee be constructed to protect the pumping facilities. The assumed configuration for this alternative includes the addition of a new 150 mgd pump; rehabilitation of the existing pre-engineered pump building; rehabilitation of the mechanically cleaned trash rack; and, the addition of new electrical and instrumentation and control (I&C) equipment.

Enhanced High-rate Clarification/High-Rate Treatment Facilities – EHRC/HRT would be used to remove suspended solids and allow treated CSO flows to be disinfected. Pilot testing in other cities has shown that EHRC/HRT can achieve TSS removal rates comparable to those of primary removal while utilizing a much smaller footprint. A mechanically cleaned fine screen would be provided to prevent plugging of the lamella type settling plates in the clarification system. The assumed configuration for this alternative includes concrete tankage for chemical (e.g., polymer, coagulants, and ballast sand or biological solids) addition, flash mixing, gentle mixing and sedimentation; chemical feed and pumping facilities and associated building; settling facilities; self cleaning fine screens; yard piping; and electrical and I&C equipment.

Disinfection – In order to meet anticipated *E. coli* standards, treated effluent from the EHRC/HRT facilities would need to be disinfected. Because sodium hypochlorite has been recommended for disinfection at the upgraded WPCP, it is recommended that sodium hypochlorite also be used for the EHRC/HRT facilities. Sodium bisulfite may be used for dechlorination. Disinfection would require the construction of a new chemical storage facility, but could take advantage of the CSO Ponds for the required chlorine contact time. Sodium hypochlorite could be fed immediately downstream of the EHRC facility while sodium bisulfite could be fed downstream of CSO Pond 1. It is recommended that baffles be added to CSO Pond 1 to provide the required detention time. The assumed configuration for this alternative includes a new chemical storage and feed building, chemical storage tanks (for sodium hypochlorite and sodium bisulfite for chlorination/dechlorination), chemical feed and pumping facilities, and electrical and I&C equipment.

3.3.5.2.4.3 Alternative No. 3B – Flow Equalization and Enhanced High-Rate Clarification/High Rate Treatment at CSO Ponds 1 & 2

Alternative No. 3B involves the use of a portion of CSO Pond 1 for flow equalization and the addition of EHRC/HRT and disinfection for treatment of wet-weather flows. Like Alternative No. 3A, this alternative assumes that wet-weather flows can be conveyed to the CSO Ponds and WPCP. The proposed facilities would be used to treat wet-weather flows in excess of the future plant peak capacity of 85 mgd. Therefore, this option would require the rehabilitation of the existing CSO pump station, the construction of enhanced high-rate clarification facilities, and the addition of disinfection facilities on the property between CSO Pond 1 and the Maumee River. Additionally, Alternative No. 3B would require the rehabilitation of a portion of CSO Pond 1 to prevent solids from settling during flow equalization. Flow equalization, provided at CSO Pond 1, would be used to reduce the peak flow observed at the EHRC/HRT facilities. The EHRC/HRT facilities could be constructed as modular units to allow for pilot testing of the initial installation and to allow for phased construction. A schematic illustrating the flow path required for Alternative No. 3B is shown on Figure 3.3.5.3.

All of the Alternative 3 configurations require an integrated set of components to be added to the existing CSO Pond facilities. The components of Alternative No. 3B are as follows:

CSO Pump Station – The improvements for the CSO pump station for this alternative are the same as those required for Alternative No. 3A.

Equalization Basin – Under Alternative No. 3B it is proposed that a portion of CSO Pond 1 be used for flow equalization. Therefore, modifications would need to be made which would prevent solids from settling and which would allow the equalization basin to be drained and cleaned after use. In order to facilitate cleaning, a lining would be required in the portion of CSO Pond 1 used for equalization. It is recommended that this be accomplished through the installation of an 80-mil high-density polyethylene (or similar material) liner. Complete mixing of the equalization basin portion of Pond 1 would require the installation of floating surface mixers.

Enhanced High-rate Clarification/High-Rate Treatment Facilities – Like Alternative No. 3A, EHRC/HRT would be used to remove suspended solids and allow treated CSO flows to be disinfected. However, because the equalization basin would provide a means to store the peak of the influent hydrograph, the peak flow requiring treatment would be reduced and the EHRC/HRT facilities would be smaller than in Alternative No. 3A for the same level of control.

Disinfection – The disinfection facilities would be similar to those described for Alternative No. 3A.

3.3.5.2.4.4 Alternative No. 3C – Wet-Weather Storage at CSO Ponds 1 & 2 with Dewatering to WPCP

Alternative No. 3C involves storage of CSO overflows at CSO Ponds 1 & 2 with subsequent dewatering to the WPCP. These overflows would be conveyed to the Ponds through the parallel interceptor described in Section 3.3.5.2.9.. Wet-weather flows in excess of the future plant capacity of 85-mgd would be directed to the CSO ponds for storage. Once the rain event ceases, stored flow would be returned to the plant for treatment. CSO flows in excess of the total storage capacity of the two ponds (i.e., approximately 280 mg) would overflow to the Maumee River at the outlet of Pond 2. Specifically, this option involves the reconstruction of the two existing 150-mgd pumps, the addition of a new 150-mgd pump (to be provided as a standby), the addition of a first flush facility, the installation of aeration units in both Ponds and the addition of disinfection facilities on the property between CSO Pond 1 and the Maumee River. A schematic illustrating the flow path required for Alternative No. 3C is shown on Figure 3.3.5.4.

All of the Alternative 3 configurations require an integrated set of components to be added to the existing CSO Pond facilities. The components of Alternative No. 3C are as follows:

CSO Pump Station – The improvements for the CSO pump station for this alternative are the same as those required for Alternative No. 3A.

First Flush Facilities – With an emphasis on storage of wet-weather flows, implementation of Alternative No. 3C would require some means of removing solids from the waste stream or the storage basins. Therefore, it is recommended that a first flush facility, as described in the report entitled "*City of Fort Wayne Water Pollution Control Plant – Facilities Planning Study,*" be constructed to provide solids removal. As noted in the report, the facilities would include concrete first flush and sedimentation tanks, overflow weirs, and solids pumping facilities.

Storage Basins – Under Alternative No. 3C it is proposed that both CSO Ponds 1 and 2 be used as storage basins. It is anticipated that the existing Ponds would be cleaned so that the full volume of both Ponds could be used. This results in a total storage volume of approximately 280-mg. Dewatering facilities would be added south of the Ponds to allow for dewatering of stored volume to the WPCP. Additionally, the basins must be provided with some means of preventing stored CSO flows from becoming anaerobic. For the purpose of developing costs, it was assumed that both basins would be provided with floating surface aerators. The assumed configuration for this alternative includes regrading of the existing ponds (to allow for complete draining), the addition of floating aerators, and the addition of floating baffles (to provide the required chlorine contact time).

Disinfection – The disinfection facilities would be similar to those described for Alternative No. 3A.

3.3.5.2.4.5 Alternative No. 3D – High-Rate Disinfection at CSO Pond 1

Alternative No. 3D involves the use of a portion of CSO Pond 1 for high-rate disinfection of wet-weather flows. Like all other subalternatives under Alternative No. 3, this alternative assumes that wet-weather flows can be conveyed to the CSO Ponds and the WPCP. The proposed facilities would be used to treat wet-weather flows in excess of the future plant capacity of 85-mgd. Therefore, this option would require the rehabilitation of the existing CSO pump station, the construction of high-rate mixing facilities and the addition of disinfection facilities on the property between CSO Pond 1 and the Maumee

River. Additionally, Alternative No. 3D would require the rehabilitation of CSO Pond 1 to prevent solids from settling during the required 30-minute detention time. A schematic illustrating the flow path required for Alternative No. 3D is shown on Figure 3.3.5.5.

All of the Alternative 3 configurations require an integrated set of components to be added to the existing CSO Pond facilities. The components of Alternative No. 3D are as follows:

CSO Pump Station – The improvements for the CSO pump station for this alternative are the same as those required for Alternative No. 3A.

High-rate Mixing Facilities – Unlike Alternatives No. 3A, B and C, Alternative No. 3D would require the use of high-rate mixing to provide energy sufficient to break apart biological solids and to provide homogeneous mixing of sodium hypochlorite. High-rate mixing facilities would require the addition concrete tankage and mechanical mixers for flash mixing.

Disinfection – The disinfection facilities would be similar to those described for Alternative No. 3A.

Detention (Contact) Basin – Under Alternative No. 3D it is proposed that a portion of CSO Pond 1 be used for flow detention, i.e., chlorine contact time. Therefore, modifications would need to be made which would prevent solids from settling and which would allow the basin to be drained after use. These modifications would require lining a portion of CSO Pond 1. It is recommended that this be accomplished through the installation of an 80-mil high-density polyethylene (or similar material) liner. Complete mixing of the detention basin portion of Pond 1 would require the installation of floating surface mixers

3.3.5.2.4.6 Alternative No. 3E - Wet-Weather Storage at CSO Ponds 1 & 2 with Dewatering to WPCP, Combined With EHRC/HRT for Flows Exceeding Pond Storage Capacity

Alternative No. 3E involves storage of CSO overflows at CSO Ponds 1 & 2 with subsequent dewatering to the WPCP, in combination with an EHRC/HRT facility for flows exceeding the storage capacity of the Ponds and the level of control for Pond discharges. As with other Alternative 3 configurations, the overflows would be conveyed to the Ponds through the parallel interceptor described in Section 3.3.5.2.9. Wet-weather flows in excess of the future plant capacity of 85-mgd would be directed to the CSO ponds for storage. Once the rain event ceases, stored flow would be returned to the plant for treatment. CSO flows in excess of the storage capacity of the ponds (i.e., when the ponds are full) would be diverted to the EHRC/HRT facility for wet-weather treatment as necessary to meet the level of control. Diverted flows in excess of the EHRC/HRT capacity would overflow to the Maumee River. Specifically, this option involves the reconstruction of the two existing 150-mgd pumps, the addition of a new 150-mgd pump (to be provided as a standby), the addition of a first flush facility, the installation of aeration units in both Ponds, the installation of an EHRC/HRT facility, and the addition of disinfection facilities on the property between CSO Pond 1 and the Maumee River. A schematic illustrating the flow path required for Alternative No. 3E is shown on Figure 3.3.5.6.

As can be noted, Alternative 3E is an enhanced version of Alternative 3C, with the enhancement being the addition of the EHRC/HRT technology. This enhancement significantly increases the flexibility associated with operation of the Ponds and the resulting wet-weather control level. The EHRC/HRT facility allows Alternative 3E to overcome several disadvantages associated with Alternative 3C, specifically:

- Under Alternative 3C, achieving a high control level at the Ponds requires use of the full Pond storage volume, approximately 280 mg. This volume of storage in turn requires significant dewatering time, and will result in the need to run the WPCP at full capacity (85 mgd) for extended periods.
- Under Alternative 3C, there is no wet-weather treatment mechanism available when the Ponds are full. This creates the possibility that even small wet-weather events can cause a Pond overflow, if they occur when the Ponds are full.

The addition of the EHRC/HRT facility under Alternative 3E creates the opportunity to overcome these disadvantages, as it allows for an optimal combination of storage and wet-weather treatment capable of achieving a wide range of control levels.

All of the Alternative 3 configurations require an integrated set of components to be added to the existing CSO Pond facilities. The components of Alternative No. 3E are as follows:

CSO Pump Station – The improvements for the CSO pump station for this alternative are the same as those required for Alternative No. 3A.

First Flush Facilities – The first flush facilities for this alternative are the same as those required for Alternative 3C.

Storage Basins – The storage basin configuration and improvements under this alternative are similar to those required for Alternative 3C. However, under this alternative, only a portion of the CSO Ponds would be used for storage, rather than the full combined pond volume. The volume of required storage will vary by control level, and is established in combination with the EHRC/HRT capacity. As with Alternative 3C, dewatering facilities would be added south of the Ponds to allow for dewatering of stored volume to the WPCP. Additionally, the basins would be provided with some means of preventing stored CSO flows from becoming anaerobic. For the purpose of developing costs, it was assumed that the basins would be provided with floating surface aerators. The assumed configuration for this alternative includes regrading of the existing ponds (to allow for complete draining), the addition of floating aerators, and the addition of floating baffles (to provide the required chlorine contact time).

Disinfection – The disinfection facilities would be similar to those described for Alternative No. 3A.

3.3.5.2.5 Alternative 4: Conveyance to CSO Ponds with EHRC/HRT Facilities at Ponds, Satellite Treatment at Rudisill Subbasin

Alternative No. 4 presents a logical combination of satellite facilities and CSO treatment at the CSO Ponds. This alternative combines the concept of a satellite treatment facility at Regulator K11163, a parallel interceptor to capture additional overflows, and high-rate treatment at the CSO ponds.

Regulator K11163, at Rudisill Boulevard, is singled out for satellite treatment in this alternative for a two reasons:

- First, it is the most active regulators in Fort Wayne's combined sewer system for both the predicted number of annual overflow events and the predicted annual overflow volume. Under existing conditions, this regulator is ranked first for annual overflow volume at approximately 390 million gallons and first for the number of annual overflow events at approximately 71 events.
- Second, the regulator is a geographical outlier compared to other highly active regulators. This characteristic makes it difficult to include Regulator K11163 in centralized CSO control facilities such as the Alternative No. 1 tunnel or the Alternative No. 3 treatment facility at the CSO Ponds.

This alternative consists of constructing satellite treatment facilities at Rudisill to treat overflows from Basin K11010, constructing Parallel Interceptor Configuration B (presented in Section 3.3.5.2.9.2), and constructing EHRC/HRT facilities at the CSO Ponds to treat wet-weather flow from other regulators. Given its proximity to Regulator K11163, Regulator K11162 is also controlled in the satellite treatment facility included in this alternative.

At the Rudisill regulators, treatment facilities would be provided on the north side of Foster Park near the access road, downstream of the existing CSO diversion structure. The wet-weather treatment facilities at the CSO Ponds are as described in Alternative No. 3B, with the use of a portion of CSO Pond 1 for flow equalization and the addition of enhanced high-rate clarification/high rate treatment and disinfection. This is the lowest cost advanced CSO Pond treatment option discussed in Section 3.3.5.2.4. However, under this Alternative No. 4, the equalization and EHRC/HRT facilities at the CSO Ponds would be designed for lower peak flows than the analogous control level in Alternative No. 3B, given that the K11163 overflows would not be routed to the WPCP.

Two alternatives were considered for high-rate treatment at Rudisill. These alternatives include Alternative No. 4.A – EHRC/HRT Facilities and Alternative No. 4.B – Satellite Disnfection Basin. These alternatives are described in greater detail in the following sections.

3.3.5.2.5.1 Alternative No. 4A – Enhanced High-Rate Clarification/High Rate Treatment with Disinfection

A flow schematic of the facilities for Alternative 4A is shown in Figure 3.3.5.7.

Nets would be provided downstream of the existing CSO diversion structure to capture at least 90% of the floatables. Individual EHRC/HRT facilities would be installed to operate in parallel, with the required number determined by the combined Regulators K11163 and K11162 flow rates at each desired control level. The top of the facilities would be at ground surface. Hatches would be provided around the perimeter for washdown with hoses.

3.3.5.2.5.2 Alternative No. 4B – Satellite Disinfection Basin

A flow schematic of the facilities for Alternative 4B is shown in Figure 3.3.5.7.

Nets would be provided between the existing CSO diversion structure and the new treatment basin to capture floatables. The treatment basin would be sized to provide a 30 minutes contact time at the peak flow rate associated with the desired level of control. The basin would be buried with approximately 10-foot cover. The proposed disinfection system would use sodium hypochlorite as the means of CSO treatment because of reduced residual effects and relative safety of on-site storage. Sodium bisulfite would be used for dechlorination. A submersible pumping station would be provided to pump the contents of the basin back to the interceptor for complete treatment at the WPCP after the storm. Three pumps would be provided. Each pump would be sized to pump the sewage back to the interceptor over 24 to 48 hours. Operating 2 pumps would pump the contents back over 12 to 24 hours. The treatment basin would be provided with an automatic flushing system and odor control facilities.

3.3.5.2.6 Alternative 5: Partial Sewer Separation

Partial sewer separation in the combined sewer subbasins can reduce combined sewer overflow activity by reducing the amount of wet-weather flow reaching the regulators. This alternative presents a direct opportunity to merge the goals of Fort Wayne's CSO Program with the City's ongoing Combined Sewer System Capacity Improvement Program (CSSCIP). Under Fort Wayne's CSSCIP, which began in 1999, sewer separation projects are typically assessed for the purpose of capacity improvement, and in fact have already been implemented in nine combined sewer subbasins. This Alternative No. 5 evaluates partial separation in the context of CSO control, which would provide a concurrent benefit in terms of capacity improvements.

Because sewer separation is already included as a core solution in the City's CSSCIP, Alternative 5 examines a narrow definition of partial separation for the purpose of LTCP alternatives analysis. In essence, Alternative 5 identifies areas within combined sewer subbasins in which partial separation has a high likelihood of being a cost-effective component of CSO control. This provides the City with an early, qualitative indication of how partial sewer separation may fit into a CSO control program, with the understanding that final decisions on the degree of sewer separation in any single subbasin will be based on cost-benefit analyses conducted under the CSSCIP.

This section first defines partial separation as included in Alternative 5, and explains the criteria used to identify its applicability. The definition is then applied across the combined sewer system, in order to identify applicable subbasins where partial sewer separation is a potential cost-effective component of CSO control. Finally, the relationship between partial sewer separation for CSO control and sewer separation in general under the CSSCIP is discussed, along with the City's approach to identifying and pursuing separation projects during LTCP implementation.

3.3.5.2.6.1 Partial Separation as Included in the LTCP Alternatives Development

Partial sewer separation under Alternative 5 is defined as installing new storm sewer in local, discrete areas within combined sewer subbasins. For this alternative, partial sewer separation projects are considered viable in areas where gravity discharge of collected stormwater would be feasible through relatively short outfalls. This requirement was established to identify areas within the combined sewer system where partial separation is most likely to be cost-effective in pursuing purely CSO control goals. A broader definition of partial sewer separation is included in the CSSCIP solution development process, as explained below in Section 3.3.5.2.6.3.

This alternative relies on new storm sewers constructed for local discharge to the receiving streams, or routed through stormwater detention basins and connected to the existing storm sewer system. For the purpose of developing preliminary cost estimates as presented in Section 3.3.5.2.6.2 below, the following is assumed in implementing partial sewer separation as defined for this alternative:

- The existing combined sewers would remain in service to convey sanitary flows.
- Storm sewers would be sized to convey stormwater produced from the 10-year design storm event, consistent with City Storm Sewer design standards.
- The local collector sewers would be a minimum of 12-inches in diameter.

3.3.5.2.6.2 Candidate Areas for Partial Sewer Separation as Part of CSO Control

As part of this alternative, potential viable partial sewer separation areas have been identified for all subbasins in the system, based on the feasibility of short gravity outfalls or connection to the existing storm sewer system. Table 3.3.5.4 shows the preliminary list of sewer separation areas by subbasin where partial separation is a potential cost-effective component of CSO control. Note the following:

- The partial sewer separation concept has been examined for all combined sewer subbasins not already addressed under the CSSCIP.
- Very few subbasins present the opportunity for complete separation targeted exclusively at CSO control, based on the requirement for short gravity outfalls or available connection to the existing storm sewer system. Some subbasins present no opportunity for partial separation (as defined in this alternative).

In summary, up to approximately 1117 acres are candidates for CSO-related partial separation, at an estimated cost of $80M. The 1117 acres represents approximately 30 percent of the combined sewer area in the subbasins where partial separation is seen as viable. The degree of partial sewer separation in these subbasins ultimately incorporated in the CSO LTCP will depend on the cost-effectiveness of partial separation in reducing regulator activity. As explained below, this decision process is programatically incorporated in the City's CSSCIP.

3.3.5.2.6.3 Relationship between CSSCIP and CSO Control Decisions

Based on the results presented in above in Section 3.3.5.2.6.2, the City concluded that partial sewer separation targeted at CSO control is a viable component of the LTCP solution. From a programmatic point of view, the City's in-place CSSCIP will be the framework for identifying sewer separation projects in the combined sewer area, and it is included as such in the City's overall LTCP Program. The CSSCIP is the logical mechanism for this process, due to the following:

- The CSSCIP is a proven program for identifying and implementing wet-weather solutions, with a number of CSO-related improvements already completed.
- The CSSCIP accounts for the inherent overlap between capacity solutions and CSO solutions, allowing cost-benefit decisions on sewer separation to incorporate all necessary issues within each subbasin.
- Given a broader set of goals, the CSSCIP examines additional partial separation opportunities beyond those identified in Table 3.3.5.4. The CSSCIP process often identifies separation projects that are cost-effective for capacity improvement purposes; any such projects will also benefit CSO control by reducing the amount of wet-weather flow reaching regulators.

- Moving forward, the CSSCIP will incorporate future stormwater control requirements in the decision process, which may have a significant impact on the cost-effectiveness of separation projects.

As part of the final LTCP, the CSSCIP program schedule is projected to address two to three combined sewer subbasins per calendar year. The City will review the potential CSO-control related sewer separation identified in Table 3.3.5.4 as part of each subbasin analysis, and identify the full set of partial sewer separation improvements that are justified for either capacity improvements or CSO control. Once identified and implemented, these partial separation projects will have the effect of reducing local CSO activity and potentially reducing the size of the subsequent CSO solution under the LTCP. Note that all CSO control alternatives discussed elsewhere in this chapter assume no sewer separation in the combined sewer system; therefore, the City's facility sizing and costing for a given CSO control level are not dependent on achieving an assumed level of sewer separation under the CSSCIP.

The general process outlined above has been implemented in the nine subbasins addressed to date under the CSSCIP. Table 3.3.5.5 lists these nine subbasins, along with the total project costs associated with the improvements. As part of these solutions, several categories of sewer separation and/or related stormwater control have been implemented. The decision on what type of separation to apply in each subbasin was determined during the preliminary design phase based on a combination of cost-effectiveness and other factors. Implemented solutions include the following:
:

- Stormwater detention: Detaining separate stormwater in up system storage areas reduces the magnitude of peak flows at downstream regulators during wet weather.
- Sewer rehabilitation: While not a separation technology, sewer rehabilitation reduces the amount of rainfall-dependent infiltration and inflow entering the system, thus reducing wet-weather flows in the downstream combined sewer system.
- Storm sewer construction: Full separation of local areas.
- Stormwater pump station construction: In some subbasins, construction of new storm sewers requires a new stormwater pump station to dewater the system over flood protection levees.
- Inflow removal: Partial separation of local areas, targeting obvious inflow sources for which an alternate conveyance mechanism can be provided. This solution reduces wet-weather flows in the downstream combined sewer system.
- Wetland treatment systems: Given potential future stormwater regulations, the City has piloted wetland treatment systems for stormwater discharges at its Camp Scott Wetland facility.
- Subbasin-wide complete separation: In one of the nine subbasins addressed to date in the CSSCIP, the City determined that complete separation was the appropriate solution for the combination of CSSCIP and CSO LTCP objectives. While complete separation of entire subbasins will not be a widespread solution

for CSO control, the CSSCIP provides a mechanism to identify special circumstances where it is the City's preferred option.

Table 3.3.5.6 provides an example of the CSSCIP improvement projects implemented in an individual subbasin, Subbasin K11010. As can be seen, many of the CSSCIP improvements also provide direct benefit to CSO control objectives.

3.3.5.2.7 Alternative 6: Conveyance to CSO Ponds with EHRC/HRT Facilities at Ponds, Local Complete Separation in Subbasin K11010 (Rudisill)

As explained under Alternative No. 4, Regulator K11163 and its tributary subbasin (K11010) are geographically distant from the other high volume regulators in Fort Wayne's system and from the WPCP. This characteristic creates the opportunity to address Regulator K11163 locally, which may result in cost savings for the associated integrated alternative. Alternative No. 6 combines local complete separation in Subbasin K11010 (to address Regulator K11163), a parallel interceptor to capture additional overflows, and EHRC/HRT treatment at the CSO Ponds. Because this alternative completely eliminates Regulators K11162 and K11163, it exceeds the level of control examined in any of the other integrated alternatives at these regulators.

Under this alternative, new sanitary sewers would be installed to collect all sanitary flows from the subbasin in areas where new storm sewers are not currently planned under the CSCI Program. The new storm sewer areas under the CSCI Program are the McMillen Park and South Gate Plaza areas. The combination of the new sanitary sewers under this alternative and the new storm sewers under CSCI Program would provide complete sewer separation for the subbasin. In the CSCI areas where storm sewers are being installed, the existing combined sewers will be converted to sanitary sewers.

The other two components of this Integrated Alternative are as presented under Alternative No. 4. Parallel Interceptor Configuration B (Section 3.3.5.2.9.2) would need to be constructed to capture overflows from designated regulators. The wet-weather treatment facilities at the CSO Ponds are as described in Alternative No. 3B, with the use of CSO Pond 1 for flow equalization and the addition of EHRC/HRT facilities and disinfection. This is the lowest cost advanced CSO Pond treatment option discussed in Section 3.3.5.2.4. However, as with Alternative No. 4, the equalization and EHRC/HRT facilities at the CSO Ponds would be designed for lower peak flows than the analogous control level in Alternative No. 3B, given that the K11163 overflows would not be routed to the WPCP.

In areas not already covered by the CSCI Program, new sanitary sewers would be built and the existing combined sewers would be converted to storm sewers. The primary reason for installing new sanitary sewers in lieu of using the existing combined sewers for sanitary flow and installing new storm sewers is the configuration of Subbasin K11010. This subbasin is a relatively long (approximately 2.5 miles) basin with no surface water discharge locations in the interior of the basin. It was determined through the CSCI Program that stormwater pump stations would be needed to lift stormwater out of the basin, and that the installation of pump stations was not cost effective.

The only areas where new storm sewers were deemed cost effective under the CSCI Program were the McMillen Park and South Gate Plaza areas. The stormwater collected from the McMillen Park area will be pumped to the Camp Scott Wetlands for treatment and reuse while the stormwater collected from the South Gate Plaza area will be routed through a detention basin prior to discharge to the existing stormwater drainage system. The existing stormwater drainage system ultimately discharges to the St. Marys River.

The sanitary sewers would be sized to convey sanitary flows only. The collector sewers would be 8-inch diameter. As the system picks up more flows, the size would be progressively increased. The new sanitary sewer system would require reconnection of individual sanitary laterals that are currently connected to the existing combined sewer system. It was assumed that the sanitary sewers would continue to provide basement level gravity service. The storm inlets would remain connected to the combined sewers. As part of the sewer separation, existing 8" and 10" diameter combined sewers would be replaced with 12" diameter storm sewers.

Land use and population information for the basin were used to develop per acre wastewater flows in order to size the larger diameter sanitary sewer pipes required to convey flow to the St. Marys Interceptor. Full flow pipe capacities were calculated for progressively larger diameters using the minimum slopes given in the Recommended Standards for Wastewater Facilities, 1997 Edition. Using the minimum slopes and the highest peaking factors produced the most conservative estimate of the pipes' required capacities. The assumptions and resulting pipe capacities are listed in Table 3.3.5.7.

In summary, the proposed sanitary sewer system would consist of approximately 176,500 LF of 8" through 36" diameter pipe, and 580 4- and 5-foot diameter manholes. The proposed additions to the storm drainage system consist of approximately 8,000 LF of 12" diameter pipe and 26 4-foot diameter manholes.

3.3.5.2.8 Alternative 7: Complete Separation

Complete separation applied on a system-wide basis provides a mechanism to eliminate combined sewer overflows. The disadvantages of complete separation are that it is typically extremely expensive, and that it results in a net increase in the discharge of stormwater pollutants. While rarely implemented on a system-wide basis, it is often analyzed to provide a benchmark for the effort required to eliminate CSOs.

The concept used to develop the complete separation alternative in Fort Wayne is to provide new storm sewers alongside or nearby existing combined sewers, but to route the new storm sewers to the rivers for discharge. Sanitary sewage can then be transported to the plant, as always, through the existing combined sewer system, without overflow conditions occurring during wet-weather events. Local collector storm sewers would be a minimum of 12-inches in diameter. Three or four inlets or catch basins would be installed at most intersections; it is anticipated that some existing inlets currently connected to the combined system would be reused and connected to the new storm sewer system.

3.3.5.2.9 Parallel Interceptor Component

As discussed above, several of the candidate integrated system-wide alternatives include the concept of transporting captured CSO flows to the CSO Ponds for subsequent storage, dewatering, and/or treatment. In order to implement this concept, additional conveyance is required, as both flow monitoring and hydraulic modeling indicate that the St. Marys Interceptor and the Wayne Street Interceptor are already at capacity during relatively minor wet-weather events .

The existing St. Marys Interceptor is 24" in diameter and collects sanitary and rainfall-generated wet-weather flows from a relatively large area of the collection system. The modeling analysis confirmed that this interceptor is surcharged even during small rainfall events. During the hydraulic modeling analysis, it was also predicted that during large events some regulators (i.e., K11162) may act as a relief point for interceptor flows. The modeling analysis also revealed that the upper portion of the Wayne Street Interceptor, at 5' in diameter, has no additional wet-weather capacity; however, the lower portion, at 7' in diameter, has some additional capacity to convey more wet-weather flows to the CSO Ponds and WPCP under certain conditions.

Given these conclusions, it became clear that additional conveyance would be required to transport captured CSO flows to the CSO Ponds. Therefore, two parallel interceptor configurations were developed: Configuration A to support Alternative 3, and Configuration B to support Alternative 4.

3.3.5.2.9.1 Configuration A – Parallel Interceptor from Outfall 21 to the CSO Ponds

Configuration A of the parallel interceptor involves the construction of new interceptors parallel to the St. Marys and Wayne Street Interceptors to convey wet-weather flows to the CSO Ponds. The parallel interceptor would start near CSO Outfall 21, associated with Regulator L19018.

Parallel interceptor Configuration A assumes that the WPCP peak capacity is at 85 mgd and that the CSO Ponds can treat excess wet-weather flows (through one of the Alternative No. 3 options). The operational concept for the parallel interceptor would be to use the new parallel interceptor only as a wet-weather conveyance interceptor and keep the existing SMI and WSI as the primary interceptors to convey both dry weather sanitary and a portion of wet-weather combined flows. The existing interceptor system would remain in service with minimal changes. The peak inlet flows to the new parallel interceptor would be restricted to the desired control level for individual regulators. This process would require a connection between the existing regulator structures and the new parallel interceptor.

The availability of easements and cost effective placement were the main factors for selecting the route of the proposed new parallel interceptor. The route for the upstream end of the parallel interceptor, along the Saint Marys Interceptor, was selected based upon a field investigation performed by Malcolm Pirnie staff under the CSCI Program. The sewer route for the downstream end of the parallel interceptor was selected north of the existing Wayne Street Interceptor along the riverbank, in order to capture wet-weather flows from the necessary regulators. Figure 3.3.5.8 shows the proposed route for Parallel Interceptor Configuration A.

3.3.5.2.9.2 Configuration B - Parallel Interceptor from Outfall 21 to the CSO Ponds with Satellite Treatment Or Separation At Rudisill

Parallel Interceptor Configuration B is required in conjunction with either the construction of a satellite treatment facility at Regulators K11162 and K11163 (Alternative No. 4) or elimination of Regulators K11162 and K11163 through sewer separation (Alternative No. 6). Configuration B includes a smaller parallel interceptor along the St. Marys Interceptor, as flows from the two Rudisill regulators do not have to be conveyed. The new parallel interceptor conveys wet-weather flows from captured regulators to the CSO Ponds.

Parallel Interceptor Configuration B assumes that the WPCP peak capacity is at 85 mgd and that the CSO Ponds can treat excess wet-weather flows (through one of the Alternative No. 3 options). Apart from not capturing overflows from Regulators K11162 and K11163, all other operational concepts are similar to Parallel Interceptor Configuration A.

The new interceptor route was established for Configuration B based on the same factors used for Configuration A. Therefore, apart from smaller pipe sizes, the routing under Configuration B would be the same as under Configuration A (as shown previously in Figure 3.3.5.8).

3.3.6 Preliminary Sizing Considerations

Section 3.3.6 of the *Guidance for Long-Term Control Plan* explains that “*the preliminary sizing of CSO control alternatives will likely depend on the following factors:*

- *Predicted CSO flow rates, volumes, and pollutant loads under selected hydraulic conditions*
- *Level of abatement of predicted CSO volumes and pollutant loads necessary to meet CSO control goals*
- *Design criteria for achieving the desired level of abatement with the selected control measure or technology"*

The City investigated these factors in the preliminary stage by using the collection system model to simulate design storms ranging from a 1-month return period storm to a 12-month return period storm. Each design storm simulation provides estimates of the CSO flow rates and volumes at every regulator for the associated return period. Peak flow rate is the typical design parameter for treatment technologies, and total overflow volume is the typical design parameter for storage technologies. At the preliminary level, it can be assumed that controlling each overflow to its predicted response under a given design storm will reduce annual activations at that overflow to the return period of the design storm. As a result, the simulations provide preliminary estimates of "design criteria" for storage and treatment technologies encompassing a wide range of control, or abatement, levels. For example, if the satellite disinfection basins in Alternative 2 were sized for the predicted peak overflow rate from a 3-month design storm, the associated control level would be approximately one overflow every 3 months, i.e., 4 untreated overflows in an average year. The relationship between the design storm return periods and assumed control levels is shown in Table 3.3.6.1.

The full set of design storm results in terms of overflow rates and volumes are shown in Tables 3.3.6.2 and 3.3.6.3, with results presented for each individual regulator. Note that in several cases multiple regulators discharge through a single downstream CSO; these cases are identified in Table 3.3.5.3 presented previously.

The results presented in Tables 3.3.6.2 and 3.3.6.3 were used to develop preliminary sizes for each of Integrated Alternatives 1, 2, 3, 4, and 6. Six sizing configuration were developed for each alternative, representing the sizes necessary to achieve 12-month, 6-month, 4-month, 3-month, 2-month, and 1-month control levels, equivalent to 1, 2, 3, 4, 6, and 12 activations per year, respectively. The resulting preliminary estimates of sizes were used in subsequent costing and siting assessments, as described below in Section 3.3.7 and 3.3.8.

The City's preliminary sizing approach as described above is an enhanced version of an approach outlined in the Guidance:

"Sizing to meet goals of providing storage for 1 to 3, 4 to 7, and 8 to 12 overflows per year can be estimated initially by capturing the volumes from the l-year, 3-month, and l-month storms, respectively. Similarly, sizing to provide treatment over that range can be estimated using the peak flow rates from the range of storms, in conjunction with sizing criteria for treatment, which are usually based on flow rates." Pages 3-40 to 3-41, *Guidance for Long-Term Control Plan*.

The City's enhancement was to use six design storms, rather than the three suggested in the Guidance, to develop estimates of the relevant design parameters. This allowed a more refined representation of the increase in size associated with increasing control level.

3.3.7 Cost/Performance Considerations

With preliminary sizes for each alternative, for a range of control levels, developed as described above, the next step in the City's process was to develop cost estimates for each alternative configuration. Because the preliminary size estimates are directly related to a performance measure (activations per year), adding costs allows for development of cost/performance curves for each alternative.

Capital costs were used as the cost parameter in the preliminary cost/performance assessment. The capital costs associated with each alternative, for each of the six analyzed control levels, is shown in Table 3.3.7.1. The basis of costs used to price each technology is presented in Attachment 1. Note that at the preliminary Stage 1 level, the capital costs presented in Table 3.3.7.1 represent the cost of collection system and CSO Pond improvements. They do not include the WPCP and CSSCIP components of the LTCP, which are added into the evaluation as part of the Stage 2 advanced rating and ranking process described in Section 3.4.5.2.

Cost/performance curves were developed directly from the information shown in Table 3.3.7.1. The resulting curves, one for each alternative, are shown on Figure 3.3.7.1.

3.3.8 Preliminary Siting Issues

As explained in Section 3.3.8 of *Guidance for Long-Term Control Plan*,

"One of the key considerations in assessing the overall feasibility of a CSO control alternative is the identification of an appropriate site. Siting issues can overshadow technical and even financial issues in the process of gaining public acceptance of a CSO control program."

The City's approach investigated preliminary siting issues in several ways:

- First, a general screening of the applicability of a technology (e.g., a storage facility) at a particular regulator was done by comparing estimates of required size (from Section 3.3.6) to available land area.
- Second, potential sites with adequate land area were reviewed by City planning staff using aerial photographs to screen out undesirable locations (and the associated technology) based on institutional, social, and/or political constraints.

One forum for assessment of siting issues was the Alternative Selection Workshop conducted with City staff. This workshop led to the following conclusions regarding siting:

- In general, land is available for siting of CSO control facilities in close proximity to the collection system. Fort Wayne has an older, fully developed urban area, but the location of most regulators and CSOs by the rivers provides open land in parks and/or industrial areas.
- Despite the general availability of land, there are certain situations where siting a satellite CSO facility will be difficult to impossible:
  - Some regulators are near historical sites in Fort Wayne. Constructing a CSO facility in these areas would be very difficult.
  - Certain parks in Fort Wayne have a high level of local resident use and support. While occasional engineering projects have been successfully sited in parks in certain areas, there are also examples of proposed facilities being rejected. For example, a proposed facility in Foster Park was rejected during a past project.

The City's historical experience in Foster Park is especially relevant; as noted in the Guidance, *"In some areas, however, a municipality might have specific knowledge of the history or existing plans for a particular site, which would preclude that site for consideration as a location for a CSO control facility."* Page 3-48, *Guidance for Long-Term Control Plan*.

3.3.9 Preliminary Operating Strategies

Section 3.3.9 of the *Guidance for Long-Term Control Plan* suggests that

"Once a preliminary size and location have been identified for an alternative, the municipality should develop conceptual operating considerations to ensure that the alternative can function reasonably in the context of its geographic location and relationship to the collection system."

Given the geographical extent and complexity of Fort Wayne's candidate system-wide alternatives, no alternative had a single "location" for which simple integration into the operation of the overall system could be assessed. However, during the alternatives development process, system operational issues were constantly considered to ensure that the proposed alternatives could function in the system. An important part of this effort was to identify potential constraints imposed on the alternatives by system operational issues.

Specific opportunities and constraints regarding the operation of alternatives within the City's system were summarized and documented during the Alternative Selection

Workshop. These operational issues were organized into three categories, System Issues, WPCP Issues, and Operation and Maintenance Issues, as summarized below.

3.3.9.1 System Issues

The workshop identified four system issues that impact the selection of CSO control alternatives:

- Upstream separate sanitary basins impact the response of the combined sewer system. Although separate sanitary, many of these basins currently exhibit a wet-weather response. These basins are tributary to either separate sanitary interceptors or the upstream end of combined sewer interceptors, and so do not flow through one of the City's 50 system regulators. However, because these separate sanitary flows do impact the hydraulics of the combined sewer interceptors and ultimately share treatment capacity at the WPCP with combined sewer flows, the separate sanitary areas do need to be considered in combined sewer system planning. In addition, the City wants to maintain an infiltration and inflow (I/I) reserve capacity at the plant for expansion of these tributary areas.
- There are currently capacity issues in the combined sewer subbasins. Therefore, there is a strong emphasis on integrating and balancing CSO abatement with capacity improvements. For example, the LTCP will need to account for the potential increase in combined sewer flows in subbasins where local bottlenecks are removed.
- There are currently capacity issues on the main interceptors. The Saint Marys Interceptor has existing capacity limitations. The Wayne Street and Clinton Street Interceptors are currently impacted by the WPCP raw pumping capacity; when WPCP inflows exceed the pumping capacity, flows back up in these interceptors until the Wayne Street Interceptor overflows to the CSO Ponds. The St. Joseph Interceptor has the greatest reserve capacity, but it is ultimately impacted by the WPCP raw water pumps during high flow conditions.
- The CSO Ponds are an important system feature at the downstream end of the interceptor system. The Ponds provide both advantages and disadvantages:
  - Advantage: The Ponds represent a significant existing resource for wet-weather storage and/or treatment.
  - Disadvantage: The Ponds present a potential permitting complication in terms of effluent limitations.
- The WPCP is an important hydraulic control at the downstream end of the interceptor system.

3.3.9.2 WPCP Issues

The Workshop identified several important plant characteristics and plant issues:

- The WPCP has an existing Average Daily Flow (ADF) of approximately 48 mgd.
- City planning projections estimate that the ADF will increase by 7 mgd over the next 20 years.
- The WPCP's current peak capacity and planned capacity are as follows:

Table 3.3.9.1
Projected WPCP Peak Capacities

	CURRENT	PLANNED
Primary	60 mgd	85 mgd
Secondary	85 mgd	85 mgd

- As noted above, the City's current planning projections estimate that the ADF will increase by 7 mgd over the next 20 years. In order to conservatively assess the wet-weather treatment capacity of the WPCP for the purpose of LTCP development, this CSO analysis assumed that the planned increase in WPCP capacity will be used by a combination of:
  - Planned residential/commercial growth, with an ADF of **up to** 7 mgd.
  - Additional industrial users, with an ADF of **up to** 7 mgd.
  - Potential contract service areas, with an ADF of **up to** 4 mgd.
  - Capacity needs for dewatering of potential CSO storage and sanitary sewer equalization. Given the above projections, dewatering capacity will range between the following:

Table 3.3.9.2
Range in Dewatering Capacity for CSO Storage and Separate Sanitary EQ

GROWTH PROJECTION	CALCULATION	APPROXIMATE DEWATERING CAPACITY
Zero growth	85 mgd – 48 mgd	37 mgd
Full projection[(1)]	85 mgd – 7 mgd – 7 mgd – 4 mgd – 48 mgd	19 mgd

Notes:
(1) Full projection is presented as an extreme reference point, as it is a very conservative assessment of potential flows. The sum of these potential flows is greater than the City's current planning projections, and it is unlikely that all of the potential flow sources (residential/commercial growth, industrial users, contract service areas) will reach their full projections.

- According to WPCP personnel, the WPCP has the ability to operate at approximately maximum capacity (60 mgd) for an extended period of time, without causing an upset of the treatment process. This is based on observations that certain seasonal hydrologic and groundwater conditions currently cause the WPCP to operate at its maximum capacity for extended periods.
- It is City's intent of WPCP planned condition to be able to maintain peak 85 mgd capacity for extended periods of time with all operational units in service, but firm capacity will be approximately 74 mgd.

3.3.9.3 Future Operation and Maintenance Issues

The workshop also provided information to City decision-makers on the operational issues associated with the CSO control technologies included in the City's integrated system-wide alternatives. This information, summarized in Table 3.3.9.3, provided the basis for subsequent discussions of O&M issues during the detailed alternatives evaluation and ranking discussed in Section 3.4.

3.4 EVALUATION OF ALTERNATIVES FOR CSO CONTROL

Following the development of the 12 integrated system-wide alternatives presented in Section 3.3, the City further evaluated and compared the alternatives through a rating and ranking process. This process was made up of several interrelated activities, as follows:

- Conducting a series of Alternative Selection Workshops with various stakeholder groups.
  - An initial comprehensive selection workshop was held with key City staff in 1999. Participants were made up of experienced decision makers responsible for administration, management and operation of the WPCP and the collection system.
  - A Peer Review Workshop was held in 2000 to obtain outside input and objective review of the City's planning and selection process. Working with City staff, a team of independent consultants confirmed the soundness of the City's process.
  - Following a transition in City administration, two additional workshops were held in 2001 to confirm the selection of the preferred alternative.
  - A series of meetings were held with regulatory official from 2003 to 2006 to achieve consensus on the selected alternative.
- Development of a selection framework, made up of criteria important to the City with assignment of relative weights.

- A Stage 1 scoring of all 12 integrated system-wide alternatives by a cross-section of City staff.
- Identification of 2 short-listed alternatives based on Stage 1 results, with a subsequent Stage 2 evaluation of these alternatives using expanded cost and performance measures.

These activities are described in the following sections. The first four subsections describe the criteria important to the City's selection process: costs, performance, and non-monetary factors. The final subsection presents and describes the initial Stage 1 and final Stage 2 alternative rating and ranking process.

3.4.1 Project Costs

The Stage 1 rating and ranking process used estimates of capital costs to characterize the alternatives. These costs are as presented previously in Section 3.3.7, with details on the basis of costs for each technology presented in Attachment 1.

The Stage 2 rating and ranking process used a present worth analysis for a refined characterization of the two short-listed alternatives that emerged from Stage 1. Details on the present worth costs are presented below in the discussion of Stage 2 (Subsection 3.4.5.2).

3.4.2 Performance

The Stage 1 rating and ranking process used estimates of annual activations to characterize the performance of the alternatives. These annual activation estimates were developed using the approach recommended in the Guidance, i.e., assume that control of a design storm of a certain return period will result in activations occurring at that same return period. This approach and the resulting activation estimates were presented previously in Section 3.3.6.

The Stage 2 rating and ranking process expanded both the analysis technique and range of performance metrics. The Stage 2 performance metrics were made up of annual activations, annual overflow volume, and annual number of days exceeding instream bacteria WQS. Details on the expanded analysis technique and performance metrics are presented below in the discussion of Stage 2 (Subsection 3.4.5.2).

3.4.3 Cost/Performance Evaluations

The preliminary cost/performance curves (used in the Stage 1 evaluation) for the integrated alternatives in terms of capital costs and annual activations are as presented previously in Figure 3.3.7.1.

The Stage 2 cost-performance curves are presented below in the discussion of Stage 2 (Subsection 3.4.5.2)

3.4.4 Non-Monetary Factors

The non-monetary factors, or criteria, identified as important to the City in selection of a CSO control alternative are presented in Table 3.4.4.1 and discussed in the following subsections.

3.4.4.1 Environmental Issues/Impacts

3.4.4.1.1 Level of Treatment

Although 10 of the 12 integrated alternatives provide the opportunity to scale the level of CSO control to meet water quality objectives (Alternative 5 and Alternative 7 are the exceptions), the level of treatment for captured flow can vary between alternatives. For example, alternatives that provide storage achieve secondary treatment levels for captured flow because the stored flow is dewatered to the WPCP for treatment, whereas alternatives that rely on end-of-pipe treatment may provide only preliminary or primary treatment. While primary treatment is sufficient to meet the technology-based requirements of CSO control, degrees of treatment can influence the decision on a preferred alternative. This criterion reflects the importance of additional treatment in the decision process.

3.4.4.1.2 Adaptability to Future Regulatory Requirements

Each alternative varies in its ability to adapt to possible future regulatory requirements, e.g., more stringent future treatment requirements. For example, Alternative 2, tunnel storage, cannot be easily increased in size once it is built, whereas end-of-pipe treatment basins can be expanded (if space is currently available and reserved for future use). This criterion is a measure of overall flexibility in this regard, as it represents the degree and importance of the alternative’s adaptability to possible future regulatory requirements.

3.4.4.2 Technical Issues

3.4.4.2.1 Inconvenience during Operation

Each alternative will require varying levels and frequencies of operator attention during normal operation. This requirement will typically increase as the technical complexity of a facility and associated process increases. The amount and frequency of this operator attention is inherent in the nature of the alternative and the degree to which it can be considered practical to automate the operation. Generally, satellite facilities, such as end-of-pipe treatment facilities, can present more challenges in operation given that they are remote from the operators. In addition, each alternative will have some level of impact in areas where the physical facilities are located (e.g., the need to operate and maintain a treatment basin in a local park). This criterion represents the degree and importance of minimizing the operational aspect and local impact aspect in Fort Wayne.

3.4.4.2.2 Operation and Maintenance Staff Requirements

Each alternative will require varying levels of staff to properly maintain and operate the facilities. This requirement will typically increase as the technical complexity of a facility and associated process increases. The number and skill requirements of this staff are inherent in the nature of the alternative and the degree to which it can be considered practical to automate the operation. Generally, satellite facilities, such as end-of-pipe treatment facilities, will require greater numbers of mobile field staff, able to respond to operational needs across the system. This criterion represents the degree and importance of minimizing operation and maintenance staffing requirements in Fort Wayne.

3.4.4.3 Implementation Issues

3.4.4.3.1 Inconvenience during Construction

Each alternative will cause a degree of short-term inconvenience to the public during construction due to disruption of traffic, increased construction traffic, noise, and dust. This criterion represents the degree and importance of minimizing this inconvenience in Fort Wayne.

3.4.4.3.2 Coordination with Other City Programs

Other City programs, such as the ongoing CSCI Program, may coordinate with certain alternatives by having common or mutually supporting goals, the potential for the sharing of resources, and the potential for minimizing inconvenience during construction through concurrent scheduling. This criterion represents the degree and importance of the alternative's potential for coordination with other City programs.

3.4.4.3.3 Potential for Regulatory Support

Due to factors such as familiarity with certain control measures or reduced need to modify existing permits, regulatory agencies such as USEPA or IDEM may view certain alternatives as more favorable, making the task of obtaining final approval of Fort Wayne's LTCP easier or more rapid. This criterion represents the degree and importance of the alternative's potential for easy and rapid approval.

3.4.4.3.4 Smoothness of Rate Impact

While rate increases are a quantitative cost factor, the smoothness of rate impact is best viewed as a non-cost factor, as it represents a measure of societal impact on the City's at-risk ratepayers. Certain of the alternatives, such as end-of-pipe treatment basins, may be broken into many small projects which might be implemented over a period of time, smoothing the impact to sewer rates. Other alternatives, such as the storage tunnel, will have to be implemented as a few large projects, which will necessarily cause abrupt rate increases. This criterion represents the degree and importance of the alternative's potential for a smooth rate impact.

3.4.5 Rating and Ranking of Alternatives

This section describes the two-stage process used by the City to rate and rank their candidate integrated system-wide alternatives. Stage 1 evaluated all 12 alternatives, using the cost, performance, and non-monetary factors described above. Stage 2 expanded the evaluation to focus on two short-listed alternatives that emerged from Stage 1.

The City's two-stage process is consistent with the approach to rating and ranking recommended in the Guidance:

"Rating and ranking systems should be viewed as a tool in the evaluation process and not necessarily as the final determinant of a recommended plan. Once a series of alternatives has been rated and/or ranked, it is sometimes necessary to "step back" from the evaluation process to ensure that the recommendations make sense and that program goals are being met." Pages 3-65 to 3-66, *Guidance for Long-Term Control Plan*.

The City's Stage 1 effort provided a consistent initial assessment of all candidate alternatives. Following Stage 1, the City "stepped back" and, building on the results of Stage 1, conducted a more refined Stage 2 to ensure their LTCP control objectives were met.

3.4.5.1 Stage 1: Rating and Ranking of All Alternatives

3.4.5.1.1 Weighting of Selection Criteria

To reflect the relative importance of each of the selection criteria described in Sections 3.4.1 to 3.4.4 to the City, the criteria were assigned relative weights in the Alternative Selection Workshop. The weight assigned to each criterion is shown in Table 3.4.5.1. It should be noted that the absolute numerical value of the assigned weight is of no significance; the relative importance of the criteria are instead reflected in the ratio of one weight to another. For example, as shown in Table 3.4.5.1, the assigned weight of 20 to "Level of Treatment" means that this criterion is twice as important to Fort Wayne as is "Potential For Regulatory Support", which has an assigned weight of 10. Likewise, since both "Level of Treatment" and "Smoothness of Rate Impact" have an assigned weight of 20, both are considered of equal importance to Fort Wayne in choosing an LTCP. The least important criterion is seen to be "Inconvenience During Construction" with a weight of 7.5, and the most important criterion is "Capital Cost" with an assigned weight of 25.

3.4.5.1.2 Scoring of Alternatives

Following the Alternative Selection Workshop, each attendee from the City was asked to assign scores for each alternative reflecting how well it was perceived to meet each desired selection criterion. Individuals were asked to provide scores according to the following rules:

- Award 10 points if the alternative met the criterion completely or nearly completely, or was “good” at providing the desired outcome.
- Award 5 points if the alternative met the criterion only partially or was “fair” at providing the desired outcome.
- Award zero points if the alternative did not meet the criterion or met the criterion only slightly, or was “poor” at providing the desired outcome.

The averages of these unweighterd scores are shown in Table 3.4.5.2. These scores were obtained by averaging scores provided by each individual in attendance at the Alternative Selection Workshop.

It should be noted that Alternative 5 (Partial Separation) and Alternative 7 (Complete Separation) are not included in Table 3.4.5.2 because both were eliminated from further consideration as integrated system-wide alternatives by the City prior to the detailed alternative scoring step. Alternative 7 was eliminated because its capital cost burden (543 $M, at least 40% higher than all other alternatives), widespread disruption during construction, and potential water quality concerns with stormwater loads could not be offset by other positive criteria. Alternative 5 was eliminated because it is not capable of achieving a high enough level of control on a system-wide basis; however, partial separation will still be considered as part of local solutions in other alternatives.

Alternative 3E, made up of wet-weather storage at the CSO Ponds with dewatering to the WPCP, combined with HRT/EHRC for flows exceeding Pond storage capacity, was configured by the City after the initial scoring process. Because this alternative is simply an optimized combination of Alternative 3A and Alternative 3C, representative scores for Alternative 3E came directly from scores for these component alternatives.

After the individual scores by criteria were averaged, these average scores were multiplied by the selection criteria weight. The total weighted score for each alternative was then obtained by summation, as shown in Table 3.4.5.3. Finally, for ease of comprehension and comparison, these total scores were normalized to a basis of 100, also as shown in Table 3.4.5.3.

3.4.5.1.3 Ranking of Alternatives

The normalized total scores for each alternative are presented graphically on Figure 3.4.5.1.

The highest-ranking alternative, with a score of 100, is Alternative 3E, Wet-Weather Storage at CSO Ponds with Dewatering to WPCP, Combined with EHRC/HRT for Flows Exceeding Pond Storage Capacity. This is closely followed by Alternative 3C, Wet Weather Storage at CSO Ponds with Dewatering to WPCP, with a score of 98. The next two alternatives are Alternative 1, Storage Tunnel, with a score of 97, and Alternative 3D, High Rate Treatment at Pond 1, with a score of 96. The only other alternative with a score above 90 was Alternative 3B, Flow Equalization at Pond 1 and Enhanced High Rate Treatment at CSO Ponds 1 and 2, with a score of 92.

The lowest ranking alternative is Alternative 2, Treatment Basins, with a score of 60. Although capital cost was the most important selection criterion (with a weight of 25) and this alternative had the least capital cost, this advantage was more than offset by the poor rating of this alternative in "Level of Treatment", "Operations Staffing" and "Operation and Maintenance Cost". Also ranked low are Alternative 4A, High Rate Treatment at WPCP with EHRC/HRT at Rudisill, with a score of 67, and Alternative 4B, High Rate Treatment at WPCP with Treatment Basin at Rudisill, with a score of 63.

Alternatives which received a middle ranking are Alternative 3A, Enhanced High-Rate Clarification/High-Rate Treatment at CSO Ponds 1 and 2, with a score of 84, and Alternative 6, Local Complete Separation in the Rudisill Subbasin with High Rate Treatment at WPCP, with a score of 81.

3.4.5.1.4 Discussion of Rankings

As indicated above, Alternative 3E, Alternative 3C, Alternative 1, Alternative 3D, and Alternative 3B stood out as the highest ranking alternatives, all having scores above 90. The top four of these alternatives were very closely ranked with scores of 100, 98, 97, and 96, respectively. The relative closeness of these alternatives does not allow any one to be distinguished from the others based on total score. These four alternatives do, however, clearly stand out as ranking above the other alternatives.

To obtain and utilize additional background to distinguish between these four alternatives, the City proceeded as follows:

- The four Alternative 3 configurations (3E, 3C, and 3D, and 3B) were compared to select one as the preferred version of Alternative 3.
- The detailed scores of the individual selection criteria were examined to more fully assess the desirability of Alternative 1.

3.4.5.1.5 Selection of an Alternative 3 Configuration

Four of the five highest-ranking candidates (Alternative 3E, 3C, 3D, and 3B) present similar control concepts in that they involve use of the existing CSO Ponds. All four of these alternatives also require an increase in the conveyance capacity of the combined sewer interceptor system and improvements to the CSO Pond Pump Station. Therefore, once the parallel interceptor is constructed and the Pump Station is improved, the distinguishing factor between these configurations is the method for treating the wet-weather flows that reach the CSO Ponds.

Each of these four alternatives incorporates some combination of three wet-weather treatment technologies at the CSO Ponds: storage/dewatering, disinfection, and EHRC/HRT. Each of these technologies provides a benefit, and they are not mutually exclusive. Therefore, Alternative 3E, which is the only configuration that incorporates all three of these technologies, was selected as the preferred Alternative 3 configuration. The storage/dewatering, disinfection, and EHRC/HRT components of Alternative 3E can be phased as part of an overall improvement plan that is flexible to future regulatory requirements.

3.4.5.1.6 Detailed Examination of Criteria Scores for Alternative 1

In examining the detailed scores of the individual selection criteria for Alternative 1, the following characteristics were noted. Alternative 1 scores very high in “Level of Treatment”, “Operations Staff”, “Inconvenience during Operation”, and “O&M Cost”, but it scores the lowest of all alternatives in “Capital Cost” and “Smoothness of Rate Impact”. Of the five highest-ranked alternatives, this alternative is the only one with very poor ratings in any one criterion.

Therefore, despite its relatively high overall score, Alternative 1 was seen as less desirable than Alternative 3E due to poor ratings on certain key criteria. Another factor in eliminating this alternative is the fact that the tunnel in essence duplicates the storage already available at the CSO ponds.

3.4.5.1.7 Conclusions from Rating and Ranking of the Full Set of Alternatives

Alternative 3E, Storage/Dewatering with EHRC/HRT at CSO Ponds, emerged as the highest ranked alternative in the Stage 1 process. The only non-Alternative 3 configuration to be highly ranked in Stage 1 was Alternative 1, Storage Tunnel; however, despite its relatively high overall score, this alternative was eliminated due to very low scores in several key criteria.

After reviewing the quantitative Stage 1 results, the City made the decision to carry more than Alternative 3E forward into Stage 2 for further evaluation. In particular, the City decided not to eliminate the category of alternative that addressed the Rudisill basin (K11010) with a local solution. Despite the relatively low scores of alternatives in this category (Alternatives 4A, 4B, and 6), this configuration has an attractive logic and provides a juxtaposition to the Alternative 3 configuration. As a result, the City felt that maintaining one of these alternatives would facilitate a full evaluation of Alternative 3E and confirm its selection as the preferred alternative. Therefore, Alternative 4A, Conveyance to CSO Ponds with EHRC/HRT Facilities at Ponds, EHRC/HRT at Rudisill, was included along with Alternative 3E on the short-list that was carried into the Stage 2 evaluation.

3.4.5.2 Stage 2: Advanced Rating and Ranking of Two Short-Listed Alternatives

During Stage 2, the two short-listed alternatives that emerged from Stage 1 (Alternative 3E and Alternative 4A) were subjected to a more refined and advanced rating and ranking process. This involved four steps:

- Expansion of the metrics used to assess performance
- Use of continuous annual simulations to assess the performance of alternatives
- Analysis of the costs of the alternatives in terms of present worth
- Cost/performance evaluations using the expanded performance metrics and present-worth costs

3.4.5.2.1 Expansion of Performance Metrics

The Stage 2 process expanded beyond the simple Stage 1 annual activation estimate to use three metrics to assess the performance of alternatives, all based on continuous annual simulations:

- Annual activations, a measure of the frequency of CSO discharges
- Annual overflow volume, a measure of the gross pollutant load from CSO discharges
- Annual number of days exceeding in-stream bacteria standards, a measure of potential recreational impact

The performance of each of the two shortlisted alternatives was assessed against each of these metrics, for control levels ranging from 1 month (12 activations in a typical year) to full control (0 activations in the typical year).

3.4.5.2.2 Continuous Annual Simulations

The Stage 2 effort used full continuous annual simulations to estimate the annual performance of each alternative. This expanded on the simple Stage 1 methodology, which used the return period of captured design storms to estimate annual performance. Continuous annual simulations provide a refined estimate of the performance associated with a specific control size, as explained in the *Guidance for Long-Term Control Plan,* page 3-41:

"As CSO control alternatives are further developed, the basis for sizing should be evaluated against a long-term simulation, which would incorporate the impacts of dewatering rates and antecedent storms, particularly if the CSO control goals are tied to average annual overflow frequencies."

Given that both short listed alternatives include a significant storage/dewatering component at the CSO Ponds, incorporating the impacts of dewatering rates and antecedent storms in the Stage 2 analysis methodology was important.

The continuous annual simulations used the typical, or average, year developed for the City's LTCP. The typical year is presented in Attachment 2. Each of the short listed alternatives was assessed under seven different sizing configurations, with the sizes based on achieving the following control levels:

- 1 month, or 12 activations in a typical year
- 2 month, or 6 activations in a typical year
- 3 month, or 4 activations in a typical year
- 4 month, or 3 activations in a typical year
- 6 month, or 2 activations in a typical year
- 12 month, or 1 activation in a typical year
- Full control, or 0 activations in a typical year

3.4.5.2.3 Present Worth Analysis

As noted in the *Guidance for Long-Term Control Plan*, use of total present worth costs can be a useful component of the alternatives evaluation process:

"Life-cycle costs refer to the total capital and O&M costs projected to be incurred over the design life of the project. Life-cycle costs can be conveniently expressed in terms of total present worth (TPW), which is the sum of money that, if invested now, would provide the funds necessary to cover all present and future costs of a project over the design life of the project." Page 3-50, *Guidance for Long-Term Control Plan*.

As part of the Stage 2 effort, present worth values were developed for each of the alternative sizing configurations presented above (seven sizes per short-listed alternative). The components of the present worth analysis - capital cost estimates, O&M cost estimates, and additional assumptions – are presented below.

3.4.5.2.3.1 Capital Cost Estimates

A total present worth calculation begins with an estimate of the capital costs of the proposed alternatives. The capital cost estimates for each of the sizing configurations for each to the two short listed alternatives were developed using the same basis of costs as the Stage 1 effort. This basis of costs, including cost models for all proposed technologies, is presented in Attachment 1. For the Stage 2 analysis, the capital cost estimate was developed to represent the full CSO program, and so includes the costs of the WPCP and CSSCIP programs.

The resulting capital cost estimates are presented in Table 3.4.5.4.

3.4.5.2.3.2 O&M Cost Estimates

Calculation of total present worth requires an estimate of the O&M cost associated with operating and maintaining an in-place facility. For the purpose of this analysis, annual O&M for each facility in each alternative was estimated as a percentage of total capital cost, as follows:

- 0.5% for predominantly pipeline projects
- 1.65% for typical civil mix of equipment, structures, and pipe.
- 6% for pure satellite treatment facilities

3.4.5.2.3.3 Additional Assumptions

A number of scheduling and financing assumptions are necessary to develop present worth estimates for an LTCP implementation program. The following assumptions were incorporated in the City's analysis:

- A 20 year LTCP implementation period. NOTE: The ultimate implementation schedule for the City's LTCP depends on a number of factors, including to-be-selected level of control and affordability considerations. However, a standardized implementation period is required for relative present worth comparisons, and 20 years has been selected solely for the purpose of these comparisons.
- Staged construction during the 20 year period.
  - WPCP and CSSCIP programs remain on their current schedule (as identified in 2001).
  - Additional grouped LTCP components are built in five-year stages
  - Constructed components go online at end of each 5-year stage, and construction of subsequent group begins.
- Construction financed through 20-year bonds.
- 40-year time horizon: allows retirement of all debt initiated during 20-year implementation period. Note that a single, simple "design life" as referenced in the Guidance for present worth analyses is not applicable to an LTCP of the scale proposed by the City, as components of differing design lives will become operational in stages over the 20 year implementation period. In these situations, standard engineering present worth methods require use of a fixed time horizon for all alternatives being considered.
- 5% interest rate

- Salvage value at end of time horizon proportional to remaining design life.
- Design life durations:
  - Pipelines 80 years
  - Tankage 75 years
  - Buildings 40 years
  - Equipment 20 years

3.4.5.2.3.4 Resulting Total Present Worth Values

The resulting present worth values for each sizing configuration of each of the two short listed alternatives are summarized in Table 3.4.5.5.

3.4.5.2.4 Cost/Performance Evaluation

Table 3.4.5.6 summarizes the present worth values for each sizing configuration under Alternative 3E, along with the performance associated with each configuration in terms of the metrics explained previously. Table 3.4.5.7 summarizes the same information for Alternative 4A.

The information in these two tables forms the basis of cost/performance curves for each of the two short listed alternatives. The resulting cost/performance curves are shown on Figure 3.4.5.2 (annual activations), Figure 3.4.5.3 (annual volume), and Figure 3.4.5.4 (annual days exceeding instream bacteria standards).

3.4.5.2.5 Final Rating and Ranking

The refined information developed for each of the short-listed alternatives (presented above) formed the basis for a final comparison between Alternative 3E and Alternative 4A. This comparison is summarized in the following sections.

3.4.5.2.5.1 Performance

Both Alternative 3E and Alternative 4A can be scaled to meet a wide range of performance requirements. Each alternative can achieve a control level associated with full control, defined as no activations during a typical year. Therefore, the two alternatives are seen as equal in terms of potential performance.

3.4.5.2.5.2 Capital Cost

As can be seen in Figure 3.4.5.5, Alternative 4A is nominally less expensive than Alternative 3E in terms of capital cost. This is true for all control levels, up to and including full control, and is due primarily to the fact that Alternative 4A allows for a significant reduction in the size of the parallel interceptor.

3.4.5.2.5.3 Present Worth

As can be seen in Figure 3.4.5.2, Alternative 3E becomes nominally less expensive than Alternative 4A when costs are characterized in terms of total present worth. This is true for most control levels up to and including full control. The only exception is a 6-month control level, i.e. 2 activations per year, where Alternative 4A has a slightly lower total present worth; this one exception is due to nonlinear cost escalation in certain size ranges with certain technologies. Alternative 4A becomes generally more expensive in terms of total present worth because it has a significant O&M burden associated with the large satellite treatment facility in the Rudisill basin.

3.4.5.2.5.4 Cost/Performance

Cost/performance curves are often used to identify the "knee-of-the curve," or the point where incremental performance starts decreasing more rapidly than the associated incremental increase in cost. As noted in the guidance,

"The optimal point, or "knee of the curve," is identified as the point where the incremental change in cost per change in performance changes most rapidly, indicating that the slope of the curve is changing from shallow to steep, or vice versa." page 3-55, *Guidance for Long-Term Control Plan.*

Figures 3.4.5.2 through 3.4.5.4 show that for all of the metrics, the knee-of-the-curve for Alternative 3E is at approximately the 3-month control level, or 4 activations per year. For both annual activations and annual volume, the knee-of-the-curve for Alternative 4A is at approximately this same 3-month control level. For number of days exceeding instream bacteria standards, the curves suggest that the Alternative 4A knee could be at a slightly higher control level (i.e., fewer than 4 activations per year).

Note that although the knee of the curve is at a similar control level between the two alternatives, Alternative 4A requires a higher present worth cost than Alternative 3E to meet that control level. This means that in terms of relative cost/performance between the two alternatives, Alternative 3E is more cost effective than Alternative 4A.

3.4.5.2.5.5 Water Quality Benefit

Both Alternative 3E and Alternative 4A meet the treatment requirements of the CSO Policy, i.e., provide a minimum of primary treatment to captured flow. Given the storage (in CSO Ponds) and dewatering (to WPCP) component of both alternatives, they in fact exceed the treatment level requirements by providing secondary treatment to a large portion of the captured CSO flow.

In comparing the two alternatives relative to one another, however, Alternative 3E has a greater water quality benefit than Alternative 4A. This is because Alternative 3E captures overflows from Regulators K11162 and K11163 (the most active and highest volume regulator group in the system) and conveys them to the CSO Ponds, where the operating protocol will be to provide secondary treatment via storage/dewatering whenever possible, with EHRC/HRT treatment used only when the storage capacity of the Ponds is exceeded. Alternative 4A, on the other hand, treats all overflows from Regulators K11162 and K11163 locally at a satellite EHRC/HRT facility. This means that under Alternative 4A, the overflow from these two high-volume regulators will receive a lower level of treatment than under Alternative 3E (although Alternative 4A will still treat overflows to a level that satisfies the CSO Policy).

3.4.5.2.5.6 Distinguishing Non-Monetary Considerations

Both Alternative 3E and Alternative 4A were graded in terms of non-monetary factors in Stage 1, with the results presented in Section 3.4.5.2. In many regards, the two alternatives are similar - they both make use of a parallel interceptor, and they both make use of the CSO Ponds. Therefore, they scored similarly with respect to many of the non-monetary criteria. However, because of the presence of a large satellite EHRC/HRT facility for Regulators K11162 and K11163 under Alternative 4A, there are several distinguishing non-monetary considerations that are relevant in comparing the two alternatives:

- First, siting issues. As noted in Section 3.3.8, a previous effort to site wet-weather facilities in Foster Park was resisted by local residents strongly enough for the project to be abandoned. Foster Park would be the location for the large satellite EHRC/HRT facility under Alternative 4A.
- Second, impact on O&M program. The City is fully aware that any CSO LTCP program will require a significant increase in O&M activity. Further, they are aware that by definition O&M in a collection system requires a distributed program, able to maintain facilities across the system. However, the City would prefer, and sees it as an advantage, to consolidate major wet-weather control facilities at or near the CSO Ponds where possible. Given this, the large satellite EHRC/HRT facility in the Rudisill basin under Alternative 4A is seen as a disadvantage compared to Alternative 3E. The greater consolidation of wet-weather control facilities at the CSO Ponds under Alternative 3E is considered an advantage.

3.4.5.2.5.7 Conclusion and Selection

As explained in Section 3.4.5.1, Alternative 3E emerged as the highest-ranked alternative during Stage 1 of the rating and ranking process. The purpose of the refined Stage 2 evaluation was to confirm this ranking by comparing Alternative 3E directly to an alternate control configuration represented by Alternative 4A. This comparison was intended to determine if any important characteristics had been overlooked in Stage 1, i.e., whether Alternative 3E had any hidden flaws or Alternative 4A had any hidden advantages that would change the relative ranking.

A qualitative summary of the Stage 2 comparison is shown in Table 3.4.5.8. The only measure where Alternative 4A rates more highly than Alternative 3E is in capital costs; however, this apparent advantage is eliminated when present worth costs are considered. Alternative 3E exceeds Alternative 4A in terms of cost/performance, water quality benefits, and non-monetary factors. Given this, Alternative 3E is confirmed as the preferred alternative for the City's LTCP.

Following selection of Alternative 3E as the preferred alternative, the City initiated additional dialogue with U.S. EPA and IDEM to discuss the relationship between control levels, affordability, and implementation schedule. The results of these discussions, including the agreed-upon control levels and associated final technologies incorporated in Alternative 3E, are presented in Section 4.2.

3.5 FINANCIAL CAPABILITY

3.5.1 Introduction

One of the most fundamental and practical concerns in any planning process is to ensure that the plan can be implemented. To address this concern for the Wet Weather Management Plan (WWMP), Fort Wayne City Utilities (FWCU) performed this detailed affordability analysis, which was conducted in collaboration with the Community Research Institute (CRI) at Indiana University – Purdue University, Fort Wayne. The United States' Environmental Protection Agency's (EPA's) document, *Combined Sewer Overflows - Guidance for Financial Capability and Assessment* (hereinafter referred to as "guidance document") was generally relied upon in preparing the affordability analysis. However, certain limited modifications to the guidance document's methodologies were found to be necessary to accurately develop or present data as discussed later in this section. Additionally, according to the EPA's 1994 *CSO Guidance for Long-Term Control Plan* (LTCP).

> As part of LTCP development, the ability of the municipality to finance the final recommendations should be considered. The CSO Control Policy[5] "...recognizesthat financial considerations are a major factor affecting the implementation of CSO controls...[and]...allows consideration of...financial capability in connection with the [LTCP] effort...and negotiation of enforceable schedules." The CSO Control Policy also specifically states that "...schedules for

[5] 59 Fed Register, 18688

> implementation of the CSO controls may be phased based on...financial capability."[6]

This section describes the methodology and results of applying EPA's financial capability process. The focus of this effort is to estimate the cost per household for Fort Wayne's customers, assess how that cost will compare to future household income, and then determine and discuss financial capability factors set forth in the guidance document. This guidance document is not binding and the resulting analysis may not fully capture the fiscal stress and/or ability of Fort Wayne residents to fund CSO controls. The City has projected future revenue requirements and associated rates, taking into account current costs to operate the City's system, how those costs will change over time, existing debt service, and future debt service resulting from anticipated and identified capital improvements. The City's planning horizon for evaluating the impacts of the LTCP exceeds 18 years.

The City has developed its financial projections consistent with the way it will develop rate projections, with expenses, revenues and capital costs stated in future year dollar terms. Thus, household bills in 2015 reflect what the City estimates households will actually pay in that year. For purposes of the affordability analysis, these future household rates are compared to the projected household incomes in those specific years. This is consistent with the approach used by a number of other municipal sewer agencies. The approach keeps all cost figures on a consistent basis and gives the City a realistic picture of actions required to raise needed revenue.

In developing these projections, the City has sought to estimate the future burden of the CSO program in addition to the wastewater system's overall long-term needs, as currently understood by the City. The City has evaluated the impact of the long-term control plan and other wastewater needs by estimating long-term revenue requirements and then estimating typical household sanitary sewer costs based on estimated rates. The residential indicator is based on that average annual cost per household relative to projected median household income for each year over the forecast period.

3.5.2 Key Assumptions

The key assumptions used to develop these projections are:

- 1999 Median Household Income (MHI) was calculated by identifying each census tract in the service area and weighting it by population according to the formula prescribed by the guidance document. MHI was then inflated to 2005 by using the countywide rate of change from 1999 MHI, as reported in the 2000 census, to 2005 MHI, as reported in the 2005 American Community Survey (ACS). For future projections, MHI is forecasted to grow by 2.2% per year.

[6] U.S. EPA, Office of Water, EPA 832-B-95-002, September 1995, p. 3-66

- Some of FWCU's customers are served by wholesale agreements that limit its ability to pass on CSO costs. In fact, FWCU's largest wholesale customer, the City of New Haven, has its own CSO LTCP that it is in the process of implementing. It is unreasonable to expect contract customers to fully share the cost of our CSO program.

- Based upon historical flow data, the City does not anticipate increases in billable flows over the forecast period due to the historic trend of industrial and commercial conservation measures being implemented as rates increase. However, the City does anticipate that the number of households connected to the system will increase slowly as the City moves forward with septic conversions, and experiences limited infill of undeveloped areas.

- O&M costs for the existing system are projected to increase at an average annual rate of 2.5 percent.

- Capital costs are projected to increase at an average annual rate of 3.5 percent.

- The City's repair, replacement, and capital maintenance activities are assumed to increase over time, reflecting the increased attention the systems will require as they age.

- The City's capital improvement program assumes that the City will move forward during the forecast period with the following plans and projects: the Repair and Replacement Program, the North Area Master Plan, the South Area Master Plan, as well as other projected wastewater improvements and maintenance needs within the collection system and at the City's treatment plant. The current estimated cost of this capital improvement program (CIP) is approximately $927.7 million (inflated dollars) at the time of construction, including LTCP costs.

- FWCU has assumed that incomes in the service area will grow at a rate slightly lower than that national rate of inflation. FWCU believes this is a realistic assumption, given that historical trends indicate this is the case, and that local incomes and wages have steadily declined relative to the national average.

- Consistent with revenue bond requirements, it is assumed that that the City will set rates to comply with a debt service coverage of 130 percent. This has no impact on future rates, since the revenues generated through coverage are used to fund pay-as-you-go capital and other system expenses.

- Operating and maintenance costs for new infrastructure were incorporated based on projects that would directly result in new system components or improved performance. The indexed annual costs were synchronized with the capital program implementation schedule and were compared to historical expenses and published rates for accuracy and consistency.

- Revenue projections for this Financial Capability Assessment rely on the City's current rate policy and structure and assume that the share of revenues derived from industrial and commercial customers remains stable, despite a history of declines in base flow over time.

- Although FWCU will pursue available grant programs, its financial analysis does not rely on significant grants to fund CSO controls. The amount of grant funding that may become available is expected to be relatively minor in comparison to the projected capital expenditures for the program. The City encourages the State of Indiana to issue substantial grants for CSO abatement projects, as has been the practice in other states. We will also be supporting municipal efforts to seek a reinstitution of congressional support for grants for public wastewater projects.

3.5.3 Current Rate Structure

The City's current rate structure includes both a minimum charge per month and a volume-based charge. The volume-based charge is allocated among retail customers based on metered water consumption (a small number of retail customers do not have centralized water service, and therefore pay a flat rate). Each contract customer's agreement has been negotiated on a case-by-case basis, over time; and has a different rate, rate structure methodology, and process for adjusting those contract customer charges to reflect changes in the cost of service. Furthermore, the City does not control how retail rates are set inside the contract customer's service area. While the City has assumed that wholesale customers will incur rate increases at 50% of those rates assessed to retail customers, this assumption may prove to be optimistic.

The 2007 baseline City retail rate consists of a monthly billing charge of $2.78 and a commodity rate of $2.4265 per 100 cubic feet (unit). For the typical residential customer using approximately 112.3 units per year, the annual bill in 2007 will be approximately $305.86.

3.5.4 Projected Revenue Requirements, Financing, and Rate Impacts

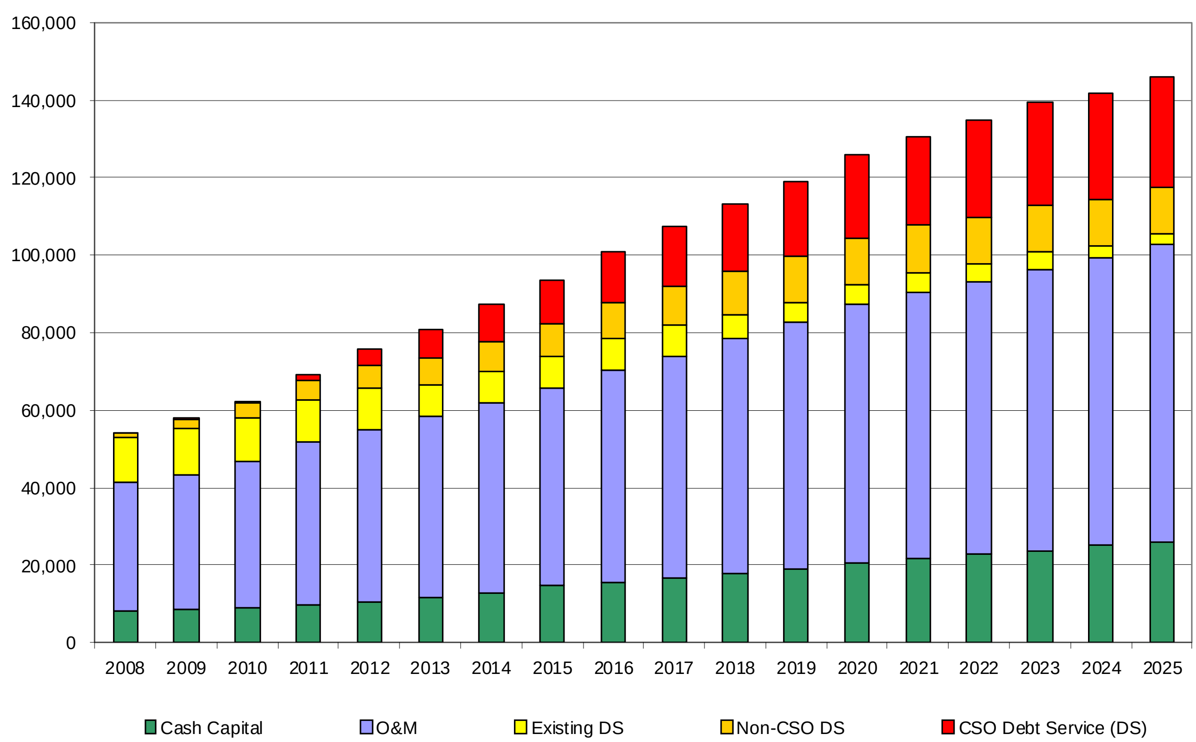
The total capital needed by the City of Fort Wayne over the next 18 years is estimated at nearly $927.7 million (inflated dollars) to fund both CSO improvements required by this LTCP and other projected wastewater collection and treatment needs. The total capital remaining for the LTCP is estimated at $239.4 million in current dollars or $361.7 million in future dollars. The Wastewater Improvements CIP includes the various master plans that have been prepared for the City, together with other wastewater improvements and maintenance needs. These include unspent portions of the North, South, and Plant Facility Master Plans, and other projected capital improvements and maintenance needs at the wastewater treatment plant and in the collection system. Since the costs published in the various master plans were developed at different times, all costs were converted to a common dollar base (2005 dollars). The total remaining capital need for the Wastewater Improvements CIP is estimated at $454.6 million in current dollars or $566.0 million in future dollars (Table 3.5.4.1).

Table 3.5.4.1
Total Capital Needed

Capital Program	Present Dollar Value	Future Dollar Value
LTCP (4/18, 1/12 events/year)	$239.4 million	$361.7 million
Wastewater Improvements CIP	$454.6 million	$566.0 million

Chart 3.5.4.1 displays the projected revenue requirements for the wastewater system over the forecast period. For the period 2008 to 2014, the average annual increase in revenue requirements will grow nearly 10.5 percent per year. On average, through the end of 2025, the City's revenue requirements will increase by approximately 7.0 percent per year.

Chart 3.5.4.1
Projected Revenue Requirements *($, 000)*



As the chart shows, new debt service to ensure the long-term integrity of the system, LTCP compliance, and O&M growth as a result of significant investments in infrastructure, contributes to an overall increase in revenue requirements of nearly 383% over the 18 year implementation period.

3.5.5 Financing Assumptions

The City desires to finance this CIP with a combination of State Revolving Fund (SRF), Indiana Bond Bank revenue bonds, and 'pay-as-you-go' funds. The City does not believe that SRF financing will be readily available in large quantities in future years, so the City assumed that most of the financing will be accomplished through the Indiana Bond Bank. Over the 18 year LTCP implementation period, the City has assumed that all debt issued will have a term of 20 years with an average interest rate of 6 percent. Debt issuance costs are estimated at 2.0% of bond issues. Additionally, FWCU is assuming that the Indiana Bond Bank has an unlimited amount of financing available.

FWCU is also assuming that over the 18 year implementation period, market interest rates do not increase significantly from current levels, and that its revenue bond rating will not drop below Aa3. The weighted average rate of 6.0 percent provides a cushion of approximately 100 to 125 basis points above current market rates. FWCU recognizes that in the short term, this is a conservative interest rate assumption, as current rates are at historically-low levels. If the weighted average rates were to increase to 7.0 percent from the current assumption of 6.0 percent, the average cost per household could increase by approximately $33 per year.

3.5.6 Impacts of Future Competition and Inflation of Capital Costs

The costs of construction is expected to increase at a faster pace than general inflation for several reasons: 1) increased demand for construction services within the local construction market, 2) increased demand for specialized CSO construction services within the Midwest, and 3) recent 5 year trend in which construction costs outpaced general inflation by nearly 1 percent.

Demand for local construction services will increase during this projection period simply as a result of the LTCP and other Utility construction plans. Prior to this program, typical wastewater construction spending averaged around $8 million. The average annual construction spending under this program is $45 million. Basic economics suggest that this increase in spending will have an inflationary effect on construction services. In addition to the increased spending anticipated by this program, the City intends to accelerate investment in infrastructure to attract and retain commercial and industrial enterprises. As noted in other sections of this document, the City’s economic indicators suggest stagnation if not an actual decline in socio-economic conditions. Although, the City assumes no noticeable growth during the projection period, local investments will be made in an attempt to improve on that situation.

Moreover, the City is concerned that the large number of CSO programs underway at the same time in the Midwest will stretch the specialized construction resources associated with these types of programs. Table 3.5.6.1 shows nine Midwestern cities that have estimated CSO control programs totaling approximately $10.9 billion. This is in addition to the CSO programs being implemented by Fort Wayne and 103 other Indiana communities.

Table 3.5.6.1
Midwest Cities' CSO Control Programs - Estimated Costs

City	Estimated CSO Control Program ($ Billion)
Cincinnati	$1.5
Toledo	$0.8
Detroit	$1.4
Cleveland	$1.6
Akron	$0.4
Columbus, Ohio	$1.5
Youngstown	$0.4
Pittsburgh	$3.0
Indianapolis	$1.8

Given this high concentration of similar programs in the region, FWCU expects considerable regional competition for engineering and construction resources. Construction resources can be the most critical component for achieving required implementation schedules.

Various economic pressures, including global competition and increasing cost of energy have created a gap in the inflationary growth rate of construction verses general inflation. Over the past five years, the CPI has increased by approximately 2.5% per year. The growth rate of construction costs over the past 5 years has been approximately 3.5%, or about 1% more than the general CPI growth.

In addition to the economic pressures created by numerous Midwestern sewer separation programs, construction prices in Indiana will likely face additional pressures as a result of the *Major Moves* initiative. *Major Moves* is a comprehensive ten-year transportation investment plan funded by the State's recent $3.85 billion lease of the Indiana Toll Road. One-third of the proceeds from this lease will be allocated to Toll Road counties (the seven northernmost).[7] These counties are in close proximity to Allen County and will place heavy demands upon the local construction industry. In Allen County alone, the State of Indiana will spend $360,787,785 over the next ten years on *Major Moves* projects.[8]

[7] *Major Moves: Creating a Top-Tier Economy Through Top-Tier Transportation*. Governor Mitch Daniels, Jr. 2005. p. 36

[8] http://www.state.in.us/dot/div/projects/tenyear/county/Allen.pdf

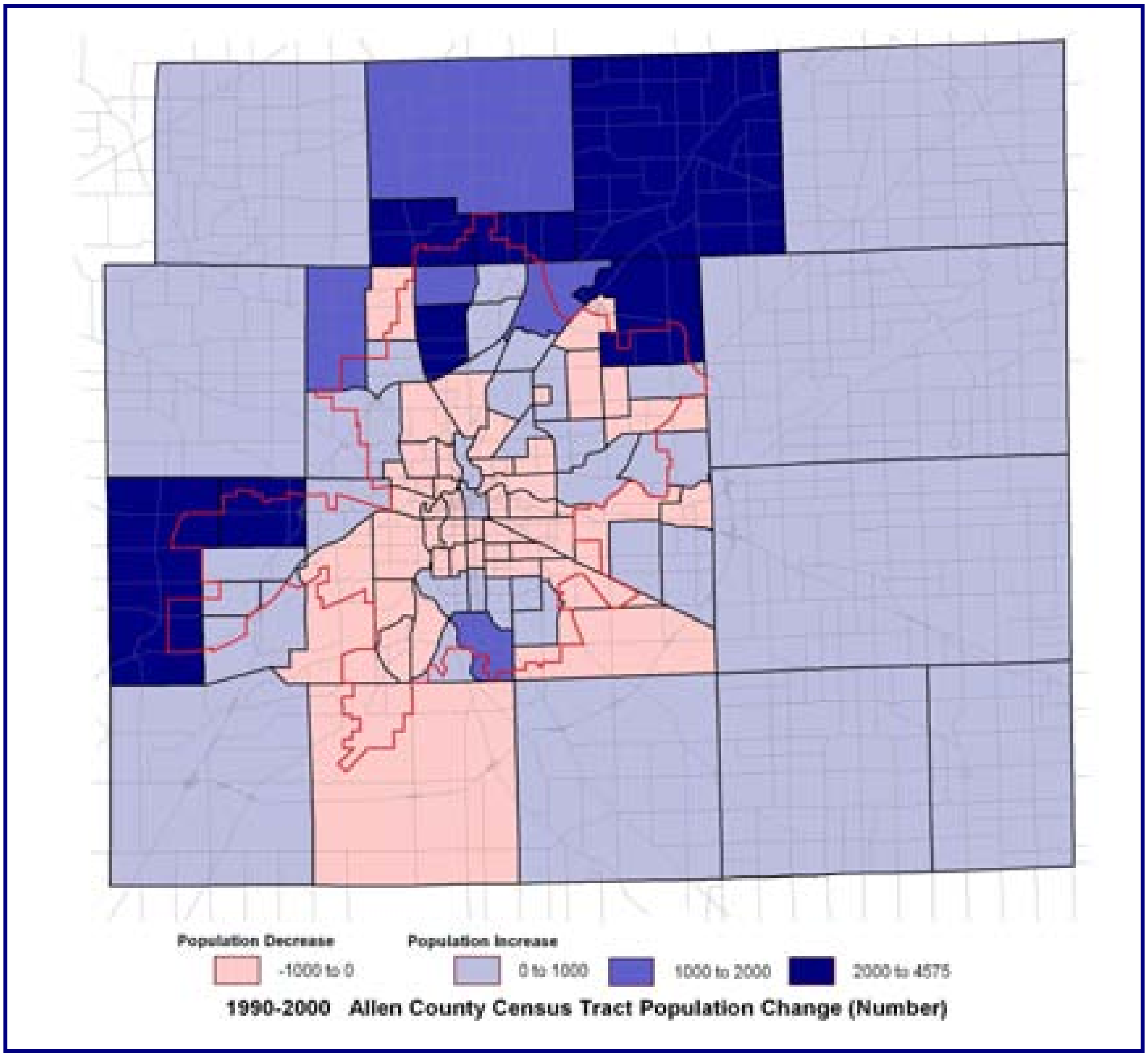
As a result of the large amount of anticipated construction and the concentration of similar CSO-related programs, as well as similar impacts in other areas around the country, the City believes that its capital costs will increase faster than the more general CPI growth assumption used for O&M growth. Therefore, these projections assume that capital costs will increase at one percentage point higher than the CPI growth assumption of 2.5 percent throughout the projected period.

3.5.7 Effect of Competing Utilities/Urban Sprawl

Over the years, FWCU has made tireless efforts to combat the economic and environmental externalities of urban sprawl while simultaneously improving the environmental conditions is Allen County. These efforts include the acquisition (during the 1980's) of the underperforming Imbalco sewer system and several other smaller, private utility systems to address dire environmental situations. In addition, several other underperforming and failed municipal sewer treatment systems were decommissioned under EPA regionalization efforts in the 1970's. More recently, in 2005, FWCU acquired the once-troubled Deer Track sanitary sewer utility in 2005 to ensure adequate environmental performance and manage the growth potential of this provider.

There has been a tremendous migration from the central city areas into surrounding suburbs as former agricultural land at the fringes of the community has been developed. It is important to note that this migration has outpaced the overall population growth in Allen County. In addition, Figure 3.5.7.1 more precisely illustrates this continued exodus from the central city throughout the 1990's. This results in a loss of customers from the FWCU service area to other surrounding providers, unless FWCU reestablishes these customers in other portions of its service area or indirectly (and financially incompletely) through contract treatment customers. This outmigration has been facilitated by the start-up and the expansion of water and sewer systems outside the City's boundaries by private utility competition. These suburban providers are not similarly burdened with the legacy cost of addressing CSO's, septic system relief, and other community environmental challenges. In addition, FWCU has noted a concerning lack of customer recapture in a recent study of this issue. The results of this study revealed that although FWCU is recapturing approximately 57% of customer outmigration directly and 16% more though contract customers, FWCU is failing to recapture a significant 27% of the customer outmigration. This can be attributed to the cost and availability of sanitary sewer service that FWCU and other competing sewer utility providers can provide.

Figure 3.5.7.1
Shift in Population, 1990 – 2000

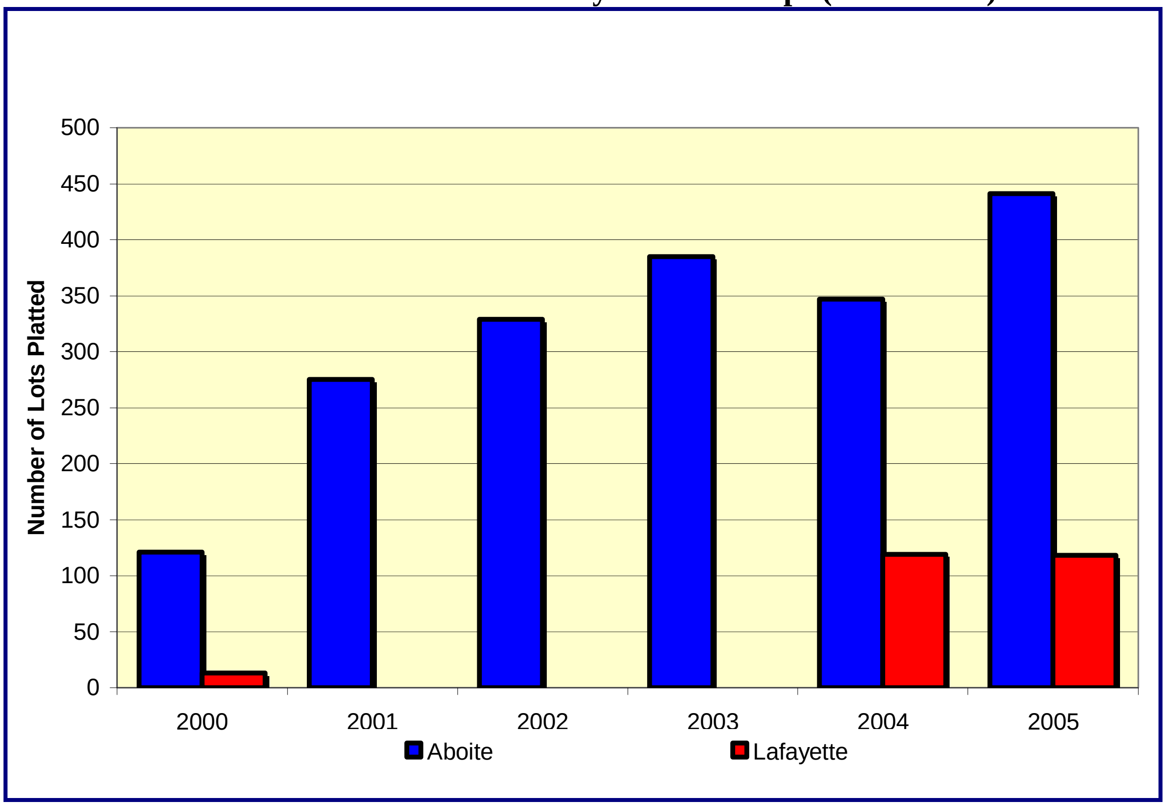


Basic economic theory suggests that a significant rate increase from one utility would drive customers to a competing utility. This is of primary concern, as AquaIndiana has recently expanded its Certificate of Territorial Authority (CTA) to most all of Aboite Township and into a large portion of Lafayette Township (both townships are largely outside of FWCU's service area).[9] Chart 3.5.7.1 shows the number of platted lots in Aboite and Lafayette Townships over the past six years. Continued decreases in the population of FWCU's service area will make it increasingly difficult to continue to generate the revenue streams necessary to support the bonds financing the LTCP.

[9] AquaIndiana is a large private water and sewer provider within Allen County whose service area includes portions of Fort Wayne. Competition from AquaIndiana imposes significant and practical economic pressure upon FWCU. The City is unaware of any similar municipality who faces daily competition from a significant private utility at and within its borders.

Moreover, the general funds of the City of Fort Wayne and many of its overlapping entities could be at risk as significant numbers of residents relocate to suburban areas within the AquaIndiana CTA or other suburban providers. The reasons are twofold. First, a declining population within the service area would result in fewer households paying property taxes. Second, a declining population would likely result in decreased property values, which would compound the problem by generating lower property tax revenues.

Chart 3.5.7.1
Lots Platted in Aboite and Lafayette Townships (2000 - 2005)



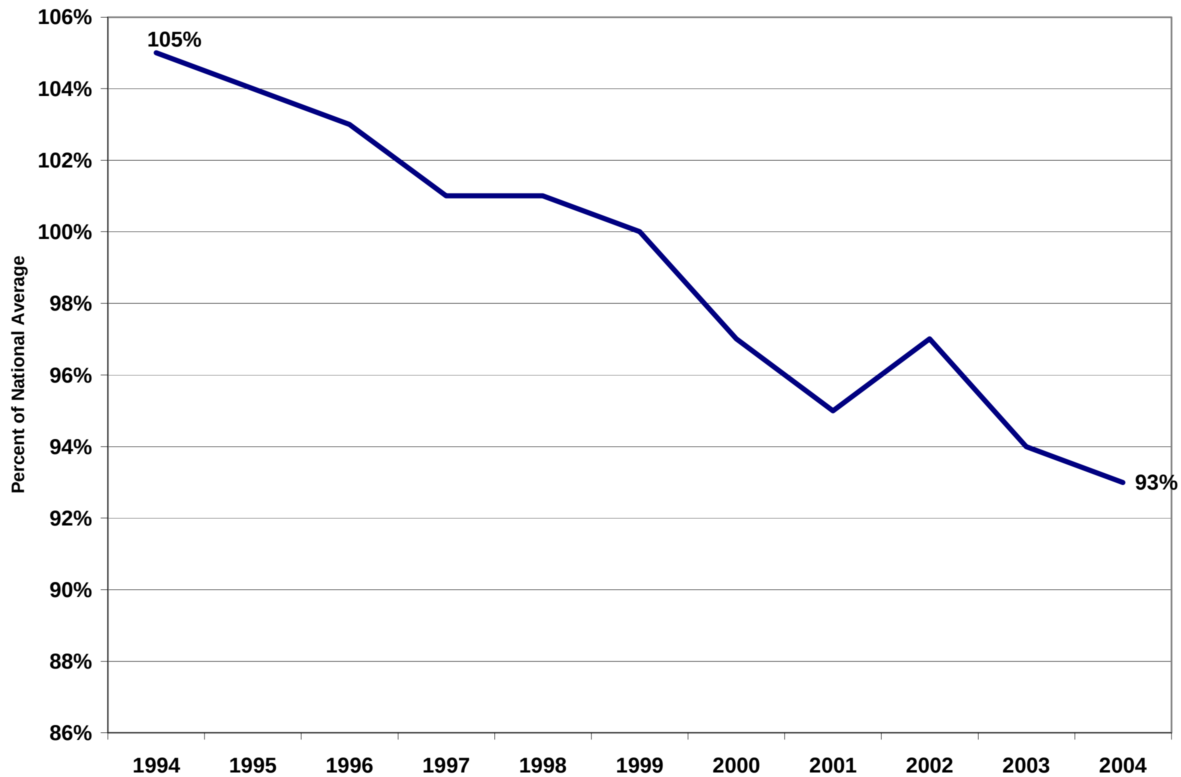
The competitive pressures posed to the FWCU by the outlying private utilities appear to distinguish Fort Wayne from many, if not most, other CSO communities. This situation also acts as a practical deterrent to the FWCU from allocating a portion of LTCP costs to contract customers.

3.5.8 Median Household Income

FWCU has discovered that the MHI inflation-adjusting formula prescribed by the guidance document does not provide an accurate description of Fort Wayne's economy, primarily because the CPI adjustment over-inflates the service area's MHI. In 1999, the MHI of the service area was $40,258. Applying a CPI adjustment would result in a 2005 MHI of $46,490. However, for reasons discussed below, FWCU believes that the actual 2005 MHI for the service area is approximately $42,791.

Fort Wayne's economy is in transition. While it is slowly transforming from an economy based on heavy-manufacturing, the negative economic effects of this lack of diversification have become quite apparent over the past decade. While portions of the country benefited from the ".com boom" of the late-1990's, Fort Wayne's economy was still concentrated in manufacturing. Moreover, when the tech bubble burst, Fort Wayne's economy was hard-hit, as the ripple-effect from this downturn spread throughout other industrial sectors. In fact, Fort Wayne has still not recovered from the 2001-2003 recession. For example, as shown in Chart 3.5.8.1, Allen County enjoyed a per-capita personal income that was 105% of the national average as recently as 1994. However, by 2004, Allen County was at 93% of the national average.

Chart 3.5.8.1
Annual Per Capita Income in Allen County as a Percentage of the U.S.[10]



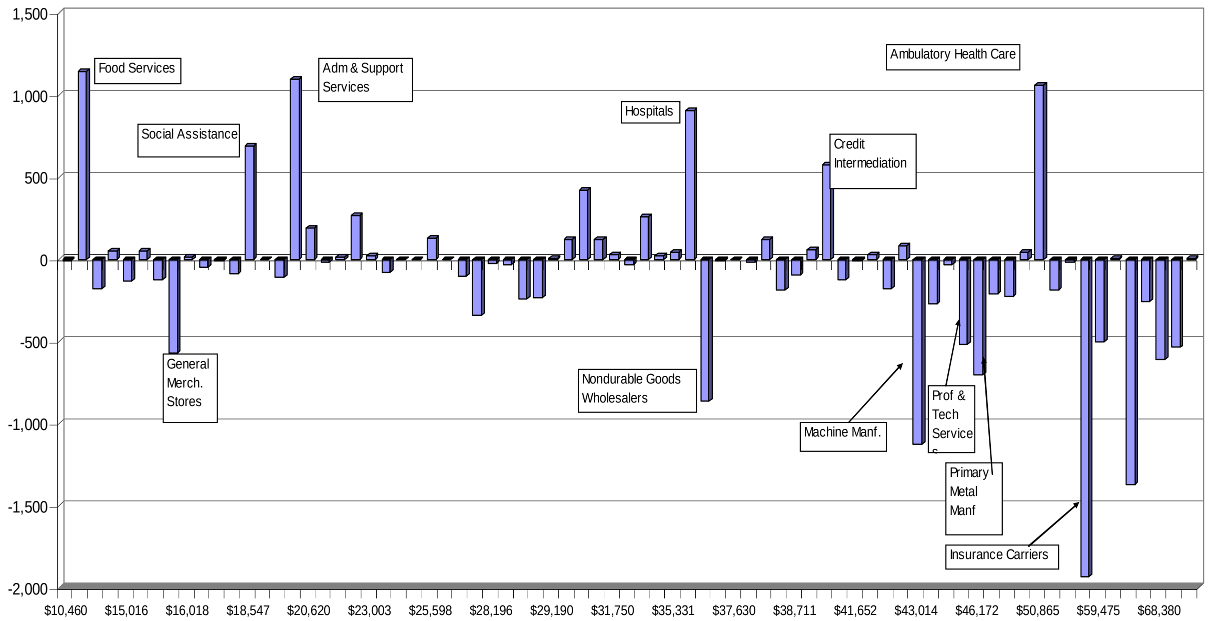
Fort Wayne residents are experiencing a significant degree of underemployment, as the high-paying manufacturing jobs that previously existed have been replaced with lower-paying service jobs. Chart 3.5.8.2 demonstrates how Fort Wayne's manufacturing economy was affected by the last recession. The blue, vertical bars represent various industries, with their average annual wage listed on the x-axis. The y-axis reflects the number of jobs gained or lost in these industries from 2001 - 2004. During this period,

[10] Source: U.S. Bureau of Economic Analysis, *Local Personal Income Data Series*

jobs in the higher-paying economic sectors were replaced with ones in significantly lower-paying industries.

Chart 3.5.8.2

2001 - 2004 Job Change by 2004 Annual Wage (Allen County)



While this trend may be generally indicative of many CSO communities, the transformation to lower paying jobs has been more accentuated in Fort Wayne over the past 25 years as Fort Wayne's economy has failed to keep pace with those of other communities within the nation. As shown in Chart 3.5.8.3, a comparison of 15 similar Midwestern and Southeastern cities shows Fort Wayne's growth in per-capita personal income from 1969 to 2004 to be among the lowest (in 12th place). Charts 3.5.8.4 and 3.5.8.5 reveal that over this same time period, Fort Wayne's per-capita personal income has dropped from 9th to 14th (next to last) among this set of cities.

Fort Wayne's location quotient for manufacturing of 1.4 helps to explain this phenomenon. A location quotient is an indicator of the concentration of a particular activity in a given area, compared to the region as a whole. A location quotient greater than one demonstrates that the area's share of that activity is greater than experienced by the surrounding region, while a location quotient of less than one shows that the area has less of a share of the activity than found nationally. Chart 3.5.8.6 shows the manufacturing location quotient for each of the 15 cities, and demonstrates that Fort Wayne is among the most dependent on manufacturing employment. Because manufacturing industries are typically large consumers of sewer services, an increase in sewer rates will only further exacerbate Fort Wayne's loss of manufacturing employment.

In July 2006, the Brookings Institution conducted a report entitled, "Bearing the Brunt: Manufacturing Job Loss in the Great Lakes Region, 1995 - 2005." This report analyzed manufacturing activity in the 25 largest metropolitan statistical areas (MSA's) in the seven-state Great Lakes Region. Of the 25 MSA's, the report identified Fort Wayne as being the seventh-most manufacturing dependent, with 17.2% of its jobs in manufacturing. Perhaps even more startling is that the report found that of these 25 MSA's, Fort Wayne was the only MSA that also lost advanced service jobs from 1995 - 2005.

Chart 3.5.8.3
Percentage Growth in Per Capita Personal Income between 1969 and 2004

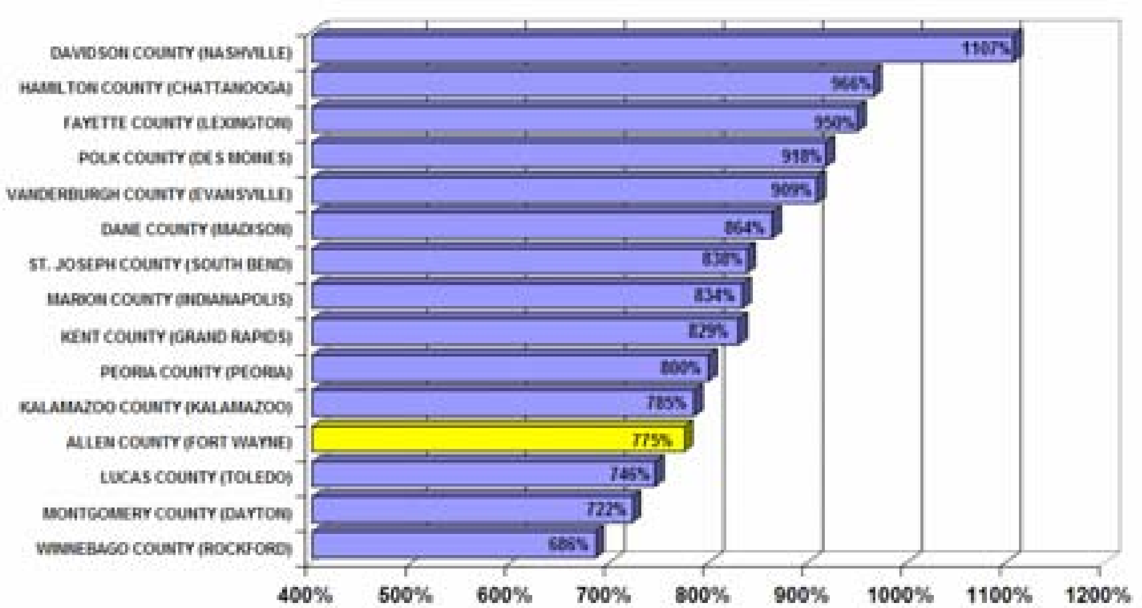


Chart 3.5.8.4
Per Capita Personal Income in 1969

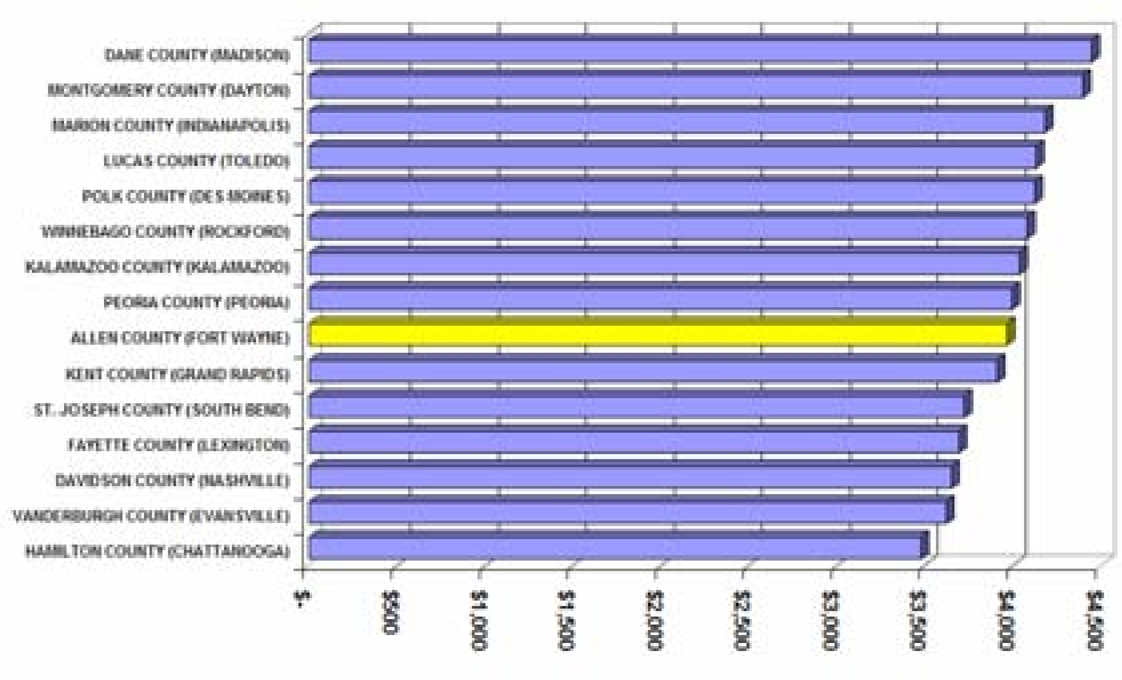


Chart 3.5.8.5
Per Capita Personal Income in 2004

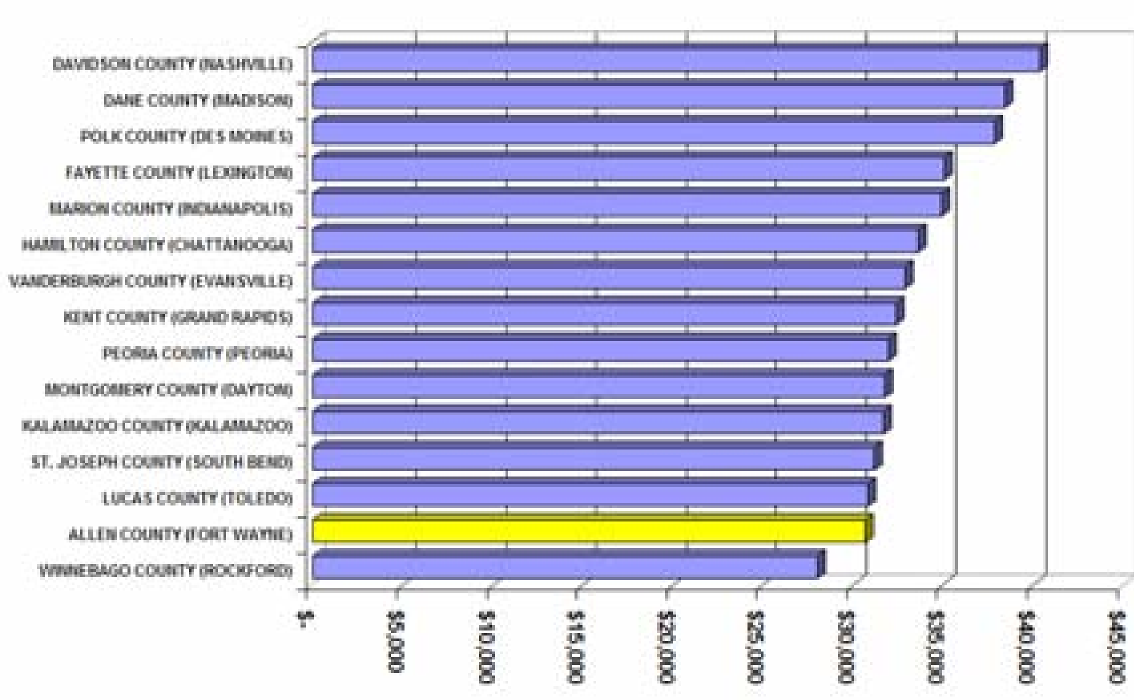
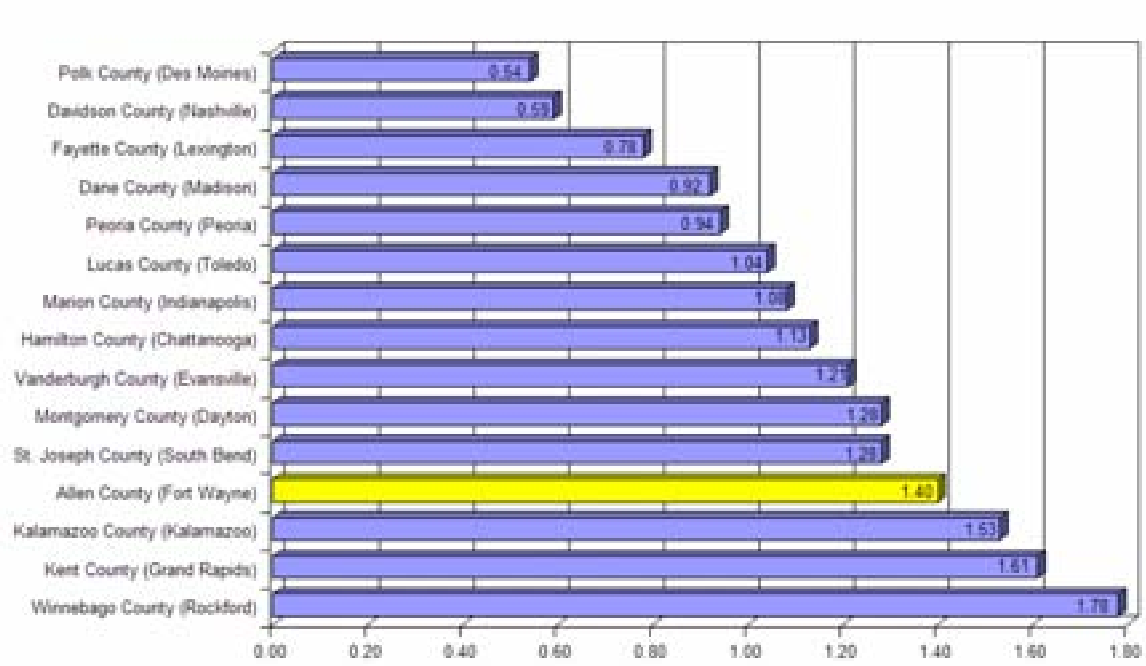


Chart 3.5.8.6

2004 Location Quotients for Manufacturing



An analysis of these comparative trends caused FWCU to question the applicability of the CPI-adjustment methodology. Accordingly, FWCU sought additional sources of income data to independently determine the current MHI of its service area. This information was found in the U.S. Census Bureau's *American Community Survey*. The ACS reported that the 2005 MHI for Allen County was $45,356. However, to arrive at an accurate reflection of the MHI of the service area, this figure must be adjusted based on historical differences between county and service area income levels. This was done using the following formula.

$$\frac{\text{Service Area MHI, 1999}}{\text{Allen County MHI, 1999}} \text{(Allen County MHI, 2005)} = \text{Service Area MHI, 2005}$$ [11]

$$\therefore \quad \frac{\$40{,}258}{\$42{,}671} (\$45{,}356) = \$42{,}791$$

The 1999 MHI of FWCU's service area was calculated by gathering the MHI of each census tract. The incomes of each census tract were then weighted according to their respective portion of the total service area according to the formula prescribed by the EPA in the guidance document. This formula is shown below in Table 3.5.8.1.

[11] Source: 1999 MHI, *2000 Census*. 2005 MHI, *2005 American Community Survey*.

Table 3.5.8.1

EPA Sample Formula for Calculation of Base-Year (1999) MHI [12]

Jurisdiction	MHI	Number of Households (HH)
A	$30,000	100,000
B	$45,000	25,000
C	$25,000	50,000
		175,000

Weighted MHI

$$MHI_A \left(\frac{HH_A}{\text{Total HH}} \right) + MHI_B \left(\frac{HH_B}{\text{Total HH}} \right) + MHI_C + \left(\frac{HH_C}{\text{Total HH}} \right)$$

$$\$30{,}000 \left(\frac{100{,}000}{175{,}000} \right) + \$45{,}000 \left(\frac{25{,}000}{175{,}000} \right) + \$25{,}000 + \left(\frac{50{,}000}{175{,}000} \right)$$

$$\left(\$17{,}143 \right) + \left(\$6{,}429 \right) + \quad + \left(\$7{,}143 \right)$$

$$= \$30{,}715$$

Careful analysis has shown that the American Community Survey (ACS) data provided by the U.S. Census Bureau provides a more accurate reflection of the economic conditions affecting the FWCU service area. Similarly, other governmental agencies, particularly those at the Federal level, such as the United States' Economic Development Administration, place their confidence in the validity of ACS by requiring their grant applicants to use the ACS for their source data.[13]

3.5.9 U.S. EPA Financial Capability Analysis

The guidance document sets forth an approach for evaluating the financial capability of a community to undertake CSO controls to achieve water quality compliance. This is primarily assessed through the Residential Indicator, which is defined as the ratio of the cost per residential household of the CSO control project and other water pollution controls to the MHI within the municipality's sewer service area.

This section presents the results of that assessment. It is important to understand that since the CSO program will be most likely funded by revenue bonds and not general obligation bonds, some of these indicators do not reflect the financial capability of issuing revenue bonds. The assessment is performed in two phases. Phase One

[12] The numbers show in Table 3.5.8.1 are for demonstrative purposes and not reflective of the FWCU customer base.

[13] *Pre-Application for Investment Assistance* (Form ED-900P). U.S. Economic Development Administration. p. 12

determines the "Residential Indicator," and Phase Two develops the "Permittee Financial Capability Indicators," which include six indicators in the sub-categories of Debt Indicators, Socioeconomic Indicators, and Financial Management Indicators.

The U.S. EPA guidance also encourages a community to include additional factors or alternative methods in assessing its financial capability and negotiating the CSO program implementation schedule by submitting, "...any additional documentation that would create a more accurate and complete picture of their financial capability".[14] Accordingly, FWCU has provided supplemental information related to population, employment, and property tax reassessments.

3.5.9.1 The Residential Indicator

Under the EPA guidance, a key measure of affordability is the Residential Indicator: the ratio of the wastewater cost per-household to MHI. The Residential Indicator is compared to EPA-defined criteria to determine whether costs impose a low, mid-range, or high impact on residential users. Table 3.5.9.1 illustrates EPA's Residential Indicator criteria, which define a "low" impact as a cost per household less than 1.0 percent of MHI, a "mid-range" impact between 1.0 and 2.0 percent, and "high" impact as greater than 2.0 percent of MHI.

Table 3.5.9.1
Financial Impact Based on Residential Indicator

Financial Impact	U.S. EPA Residential Indicator
Low	Less than One Percent
Medium	One Percent to Two Percent
High	Greater than Two Percent

In order to measure the financial impact of current and proposed Wet Weather Treatment (WWT) and CSO controls on residential users, the costs per household (CPH) of current and proposed WWT and CSO controls were identified over a 18-year implementation period. Current WWT costs are defined as current annual wastewater and stormwater operating and maintenance expenses (excluding depreciation) plus current annual debt service (principal and interest). Expenses for funded depreciation, capital replacement funds, and other types of capital reserve funds are not included in current WWT costs. Estimates of projected costs are made for any proposed WWT projects and the CSO controls. These costs reflect the present value of projected operation and maintenance expenses, plus projected debt service costs for any proposed WWT and the CSO controls. The residential or household costs exclude the portion of expenses attributable to commercial, governmental, industrial, and institutional wastewater discharges.

[14] U.S. EPA: *Combined Sewer Overflows - Guidance for Financial Capability Assessment and Schedule Development*. February 1997. Page 7.

3.5.9.2 Cost per Household

For the 18-year period, the current and projected annual WWT and CSO Costs to achieve a four annual overflow level of control are approximately $1.8 billion, of which, approximately 60 percent will need to be supported by the Utility's 71,546 residential customers, each paying approximately $1,138 per year in sewer fees. Current costs include annual wastewater system operations and maintenance (O&M) expenses plus current annual debt service payments. Proposed costs include debt service necessary to fund required capital improvements related to the CSO and SSO controls, as well as other needed capital expenditures, and the associated O&M expenses. The portion of current and proposed costs related to the 60 percent residential component is estimated based on relative flow contribution. With an inflated Median Household Income (MHI) of $63,309 for the peak year of 2023, these sewer fees constitute 1.80% of MHI, as summarized in Table 3.5.9.2. Although this residential indicator value will have a medium impact according to the guidance document, it must be recognized that the value is nearly at the threshold of the high burden range.

Table 3.5.9.2
Residential Indicator Analysis Based on Implementation Period

Total Implementation Period (Years)	Peak Future Annual Costs ($/yr) FV	Peak Percent MHI	U.S. EPA Residential Indicator
18	1,138	1.80%	Medium

3.5.9.3 Impacts to Specific Communities

For the median service area household, the residential indicator will increase from 0.86 percent in 2007 to nearly 1.0 percent by 2010 and over 1.5 percent by 2017. Given an 18-year schedule, this median household will bear a sewer bill approaching two percent of income for the final nine years and beyond. However, for large, specific areas and segments of the community, the burdens will be even more onerous.

According to the ACS, Wayne Township, the City's most populous, had a 2005 population comprising 44,156 households, approximately half the population of the FWCU service area. The ACS also reported 9,682 (21.9%) of the Wayne Township households as being below poverty level. With a 2005 MHI of $30,873, the typical Wayne Township household will be paying 2.49% percent of its income to sewer rates during the peak year, well within U.S. EPA's definition of highly burdened. Half of the Wayne Township population (22,078 households) will be paying an even higher percentage of income. This half of Wayne Township represents a nearly a quarter of the service area population and does not include households in other townships with comparable financial situations. An illustration of the peak impact in Wayne Township is shown in Table 3.5.9.3.

Table 3.5.9.3
Peak Impact, Wayne Township

Community	Estimated 2005 MHI (Dollars)	Estimated 2023 MHI (Dollars)	Peak Impact 18-Year Implementation (Percent MHI)	U.S. EPA Residential Indicator
Wayne Township	30,873	45,677	2.49%	High

Given the recommended 18-year schedule for a four overflow level of control, the most economically depressed households in Fort Wayne will experience a burden exceeding that of Wayne Township. Furthermore, even the most economically advantaged block group in the service area, the Autumn Ridge neighborhood, will incur a burden slightly below mid-range from such an undertaking. The MHI of the Autumn Ridge area appears to be unique, as it is 15.7% higher than the tract with the second-highest MHI. Thus, it would be the only community within the FWCU with a low burden, according to the residential indicator. An illustration of the percentage of median household income that would be contributed toward sewer fees from a wide-sampling of neighborhoods is shown in Table 3.5.9.4. These neighborhoods roughly follow the same boundaries as the census tract, although there may be small overlaps into other tracts or the tracts may include small portions of other neighborhoods.

Table 3.5.9.4
Peak Impact - Selected Communities

Community (Census Tract)	Estimated 2005 MHI (Dollars)	Estimated 2023 MHI (Dollars)	Peak Impact 18-Year Implementation (Percent MHI)	U.S. EPA Residential RI
West Central (12)	13,535	20,025	5.68%	High
Hanna - Creighton (17)	18,058	26,717	4.26%	High
East Central (14)	26,025	38,504	2.96%	High
Harvester Neighborhood (15)	27,104	40,100	2.84%	High
Oakdale (25)	42,441	62,792	1.81%	Medium
Glenwood Park (108.05)	53,126	78,600	1.45%	Medium
Arlington Park (108.08)	73,025	108,041	1.05%	Medium
Autumn Ridge (103.04 BG2)	95,662	141,532	0.80%	Low

Based on these projections and using the EPA guidance, FWCU anticipates that the residential burden will reach the high end of the medium burden range for the service area's typical household in or about 2023. That burden level is projected to persist through the end of the forecast period (2025) and beyond. For the other classes of the City's residential base (Wayne Township and poverty level households), the burden is projected to be well within the high burden category beginning in approximately 2013 for Wayne Township. That burden will remain throughout the forecast period and a significant period after thereafter.

The City believes that these are reasonable projections of financial impact. However, they assume that the share of billable flow allocated to residential customers will remain flat and that wholesale customers will pay a share of the cost increases. The projections also assume that the share of revenues generated from industrial and commercial customers remains stable, despite a history of declines in base flow over time. Finally, these projections are subject to actual construction and financing costs, which may vary from the City's current projections.

3.5.9.4 Permittee Financial Indicators

In the Phase Two assessment, financial capability is further evaluated by factors assessing a community's economic health and financing capability. The results of this evaluation will supplement the residential financial burden estimated in Phase One. The Phase Two assessment computes six benchmarks, two in each of the following subcategories: debt indicators, socioeconomic indicators, and financial management indicators.

3.5.9.4.1 Debt Indicators

The two debt indicators are bond rating and the overall net debt as a percent of the full market property value in FWCU's service area.

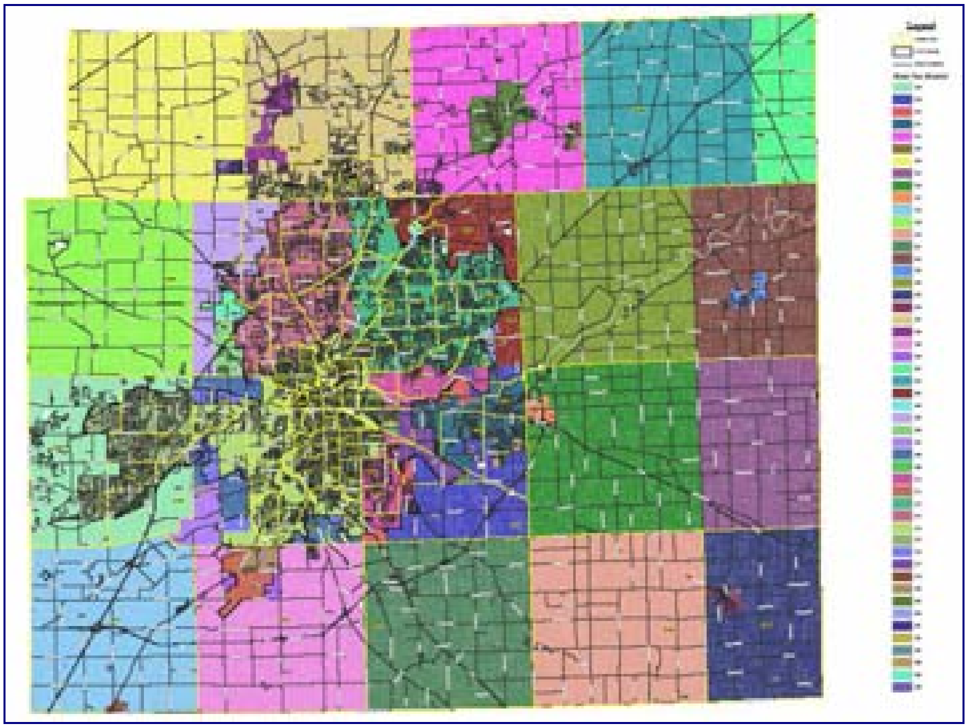
3.5.9.4.1.1 Bond Rating

This indicator is intended to address a community's general capacity to undertake debt. In 2005, Moody's Investors Service rated the City's general obligation credit to be AA2, which, according to the guidance document, is considered *strong*. The last sewer revenue bond, issued in 2003, was rated A2, which is also in the *strong* category.

3.5.9.4.1.2 Net Debt

Net debt is the amount of property tax-backed bond debt for all taxing units, including, but not limited to, the City of Fort Wayne, Allen County, the Allen County Public Library, one of three school districts, a park district, and a redevelopment district. These bonds are not supported by revenue from user fees or sales taxes. The combination of these debt-carrying entities, along with other jurisdictions that do not carry debt, have created 50 different taxing districts within Allen County. Of these 50 districts, 16 are within the FWCU service area. These districts are represented in Figure 3.5.9.4 The outstanding bonds from each taxing unit were obtained from the City of Fort Wayne's 2004 Comprehensive Annual Financial Report (CAFR) and supporting information from the 2004 Allen County Financial Report. Using this data, it has been determined that the cumulative outstanding debt of these 16 taxing districts is $262,526,681.

Figure 3.5.9.4
Taxing Districts within Allen County



To determine the FMV of real property within FWCU's service area, the cumulative assessed valuation of each of the 16 taxing districts within the service area was taken from the 2004 Allen County Abstract (taxes payable 2005). This cumulative assessed valuation is $9,775,946,090. In Indiana, property is assessed at 100% of market value. Thus, no adjustments to this figure are necessary. This outstanding debt represents 2.69% of the full market value of real property in Allen County; a *mid-range* burden according to the guidance document.

Overall net debt is anticipated to increase, as Fort Wayne Community Schools (FWCS) faces a series of bond issues to repair/replace aging and dilapidated buildings. For example, two facility studies conducted in 2005 and 2006 showed that:

- 85% of FWCS buildings need upgrades to infrastructure;
- at least 58% of the buildings need to have heating and ventilation systems upgraded or replaced;
- at least 36% have roofs near or past the end of their estimated service life;
- at least 60% have plumbing systems beyond their estimated service life;
- and, at least 46% need new windows or have single-pane or un-insulated windows, and at least 25% of the schools need more electrical outlets or circuits.

The total amount of capital to make all necessary repairs to FWCS' buildings is $500 million[15]. Additionally, Northwest Allen County Public Schools (NWACS), which is already overcrowded, is projected to continue steady growth. In a 2005 study, growth in NWACS was estimated at 28.9 percent from the 2004 to 2009 graduation years, and growing by an additional 11.6 percent by 2014[16].

3.5.9.5 Socioeconomic Indicators

3.5.9.5.1 Unemployment Rate

According to estimates prepared by the Indiana Department of Workforce Development, in cooperation with the U.S. Bureau of Labor Statistics, the July 2006 unemployment rates in Allen County, Indiana, and the City of Fort Wayne, were 5.5 percent and 5.9 percent, respectively[17]. While Fort Wayne's unemployment was nearly a percentage point above the national unemployment rate of 5.0, because it is less than one, this is a *mid-range* benchmark according to the guidance document. For purposes of consistency, all unemployment figures are non-seasonally adjusted.

3.5.9.5.2 Service Area MHI v. National MHI

The service area adjusted MHI of $42,791 is 5.73% lower than the national MHI of $46,242[18], as reported by the 2005 ACS. According to the guidance document, this represents a mid-range value, as the MHI of the service area does not vary by more than 25% when compared to the national MHI. However, if the Wayne Twp. portion of the service area were evaluated, this factor would fall within the weak range.

3.5.9.6 Financial Management Indicators

In December 1998, the Indiana Supreme Court ruled that the state's methodology of property tax assessment was unconstitutional and required that the state implement a more market-based approach to valuation. The new rules for assessment were implemented in 2002 for taxes payable in 2003, resulting in a substantial shift in tax burden from business to residential taxpayers.

In 2002, the Indiana General Assembly adopted a significant tax reform package, including provisions to phase-out certain business personal property taxes, place caps on certain local tax levies, and institute property tax relief measures for homeowners to mitigate the impact of the new assessment methodology. As a result of the combined

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[15] http://www.fwcs.k12.in.us/schoolboard/Presentations/022607_Presentation.pdf

[16] *A Feasibility Study for the Northwest Allen County School Corporation. http://www.nacs.k12.in.us/nacs/FeasibilityStudyNoMaps.pdf*

[17] http://www.in.gov/dwd/newsroom/news_releases/NR_08-23-06.pdf

[18] http://factfinder.census.gov/servlet/STTable?_bm=y&-geo_id=01000US&-qr_name=ACS_2005_EST_G00_S1901&-ds_name=ACS_2005_EST_G00_

impact of reassessment, appeals, and tax reform, the FWCU service area has seen a real decline in both assessed value and property tax revenue.

To evaluate Fort Wayne's financial management ability, property tax revenue as a percent of FMV of real property and the property tax revenue collection rate were examined. The 2004 CAFR and 2004 Abstract were used to calculate this indicator.

3.5.9.6.1 Property Tax Revenues as a Percent of Full Market Value

As stated earlier, the 2004 Abstract (taxes payable 2005) identifies the FMV of real property within the service area as $9,775,946,090. Tax Revenue was obtained by adding the Net Taxes Payable in 2005 from the taxing districts within the service area. This tax revenue, $191,900,352, is 1.96% of the FMV of real property within the FWCU service area. According to the guidance document, this is a *strong* benchmark.

3.5.9.6.2 Property Tax Revenue Collection Rate

According to the 2004 CAFR, property taxes in the amount of $404,939,852 were levied in Allen County in 2004. From the levy, only $392,526,880 in taxes was collected, resulting in a property tax revenue collection rate of 96.93%. According to the guidance document's benchmark, this is considered *mid-range*.

3.5.9.7 Analyzing Financial Capability Indicators

The guidance document has given a rating system to each of the benchmarks in order to determine a permittee's overall financial capability. Weak, mid-range, and strong burdens have each been assigned one, two, and three points, respectively. These financial capability benchmarks are summarized below in Table 3.5.9.5, and FWCU's placement according to the benchmark is highlighted in yellow for each indicator. There are a total of 14 cumulative points in Table 3.5.9.5. Dividing this cumulative total by the number of indicators results in an average score of 2.33.

Table 3.5.9.5

Summary of Financial Capability per U.S. EPA Benchmarks

Indicator	Strong	Mid-Range	Weak	Points
Bond Rating	AAA-A or Aaa-A	BBB or Baa	BB-D or Ba-C	3
Overall Net Debt	<2%	2% - 5%	> 5%	2
Median Household Income	>25% above National MHI	+/- 25% National MHI	More than 25% below National MHI	2
Property Tax Revenues	< 2%	2% - 4%	> 4%	3

Unemployment Rate	More than 1% below National average	+/- 1% National Average	More than 1% above National Average	2
Property Tax Collection Rate	> 98%	94% - 98%	< 94%	2

Incorporation of the average score of 2.33 into the guidance document's *Financial Capability Matrix*, (Table 3.5.9.6) coupled with the 1.80% Residential Indicator, reveals that the proposed construction by FWCU of CSO controls on an 18 year schedule with a four-overflow level of control would pose a financial burden at the high end of the medium burden range upon FWCU and its ratepayers. Given the marginally affordable burden this places on the median household (five-hundredths of one-percent below a RI of High), and even more severe burdens placed on half the population, this scenario represents the absolute maximum burden FWCU's ratepayers can feasibly incur.

Table 3.5.9.6
Financial Capability Matrix

Indicator	Low Residential Indicator (Below 1%)	Mid Residential Indicator (1.0 - 2.0%)	High Residential Indicator (Above 2.0%)
Weak Financial Capability (Below 1.5)	Medium Burden	High Burden	High Burden
Mid Financial Capability (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong Financial Capability (Above 2.5)	Low Burden	Low Burden	Medium Burden

Alternatively, if the residential indicator value for Wayne Township were inserted into this matrix and the Phase II (Permittee Financial Indicators) for the entire service were utilized rather than developing separate Permittee Financial Indicators for Wayne Township, the proposed CSO control project would unquestionably produce a high financial burden, based on the EPA guidance, for residents of Wayne Township. As may be inferred from the discussion above, there are smaller neighborhoods within the service area for which the financial burden will be markedly in the high burden range.

3.5.10 Summary

The City believes that it has properly and thoroughly assessed its financial capability and that its analysis actually well-supports an implementation period in excess of 18 years and four activations. However, in an earnest and good-faith effort to quickly reach a mutually acceptable compromise, the City has here presented an 18-year, four activation LTCP. In proposing such implementation period and level of control for regulatory approval, FWCU is presenting the maximum threshold to which FWCU believes the community can accept, both financially and politically.

APPENDIX 3

TABLES

Table 3.1.1.1
Summary of Public Meetings During LTCP Development

DATE	PARTICIPANTS	TOPIC
2/2/00	Sewer Advisory Group	Discussed sewer plan alternatives
4/5/00	Sewer Advisory Group	Discussed sewer plan alternatives
4/17/00	Northside Neighborhood Association	Described options for sewer improvement plan
5/3/00	Sewer Advisory Group	Discussed sewer plan alternatives
5/16/00	City Council	Presented plan of neighborhood and public meetings to council
6/6/00	Sewer Advisory Group	Discussed sewer plan alternatives
6/8/00	Northeast Area Partnership	Presented sewer plan alternatives
6/12/00	Public meeting at IPFW	Presented sewer plan alternatives
6/13/00	Public meeting at Omni Room	Presented sewer plan alternatives
6/14/00	Southeast Area Partnership	Presented sewer plan alternatives
6/15/00	Northwest Area Partnership	Presented sewer plan alternatives
6/21/00	Southwest Area Partnership	Presented sewer plan alternatives
6/25/00	City Council	Presented 3 sewer improvement plans to council. “Cautious” plan received council backing
7/6/00	Sewer Advisory Group	Discussed sewer plan alternatives
8/2/00	Sewer Advisory Group	Discussed sewer plan alternatives
9/6/00	Sewer Advisory Group	Discussed sewer plan alternatives
10/3/00	City Council	Discussed sewer rate plan
12/6/00	Sewer Advisory Group	Discussed sewer plan alternatives
1/25/01	Public Hearing at Omni Room	Discussion of how sewer rate increase will be used to improve sewers
2/7/01	Sewer Advisory Group	Discussed sewer plan alternatives
4/4/01	Sewer advisory group	Discussed sewer plan alternatives
4/4/01	City Council	Explanation of changes to sewer plan
4/17/01	City Council	Further Explanation of changes to sewer plan
6/6/01	Sewer Advisory Group	Discussed sewer plan alternatives
6/20/01	Sewer Advisory Group	Discussed sewer Plan alternatives
7/11/01	Sewer Advisory Group	Discussed sewer plan alternatives

Table 3.3.5.1
Summary of Technology Screening Process

CONTROL TECHNOLOGY	CATEGORY	SCREENING CRITERIA			ADVANTAGES
		PERFORMANCE FACTORS (Reduce Volume, Frequency, and/or Pollutant Load)	**IMPLEMENTATION & OPERATION FACTORS (Construction/Environmental Impacts, O&M Burden, Phasing Potential, Integration With Other City Programs)**	**COST FACTORS (Capital and O&M Costs)**	
Source Controls	Street sweeping	Reduces litter and first flush effects; little measurable water quality benefit	Labor intensive; requires specialized equipment	Low capital and high O&M cost	Expansion of existing City program; easy to implement
	Catch basin cleaning	Reduces litter and first flush effects; little measurable water quality benefit.	Labor intensive; requires specialized equipment	Low capital and high O&M cost	Expansion of existing City program; easy to implement
	Sewer flushing	Reduces first flush effect and TSS load; little measurable water quality benefit	Labor intensive; requires specialized equipment	Low capital and high O&M cost	Expansion of existing City program; easy to implement
	Surface storage	Can reduce overflow volume	Can be implemented in phases, with initial phases as early action projects. May create undesirable ponding/flooding	Low overall cost	Easy to implement
	Others: Public education, conservation programs	Quantitative benefit cannot be established; qualitative benefit in terms of public	Integrates with ongoing City commitments	Low overall cost	Expansion of existing City program; easy to implement

CONTROL TECHNOLOGY	CATEGORY	SCREENING CRITERIA			ADVANTAGES
		PERFORMANCE FACTORS (Reduce Volume, Frequency, and/or Pollutant Load)	IMPLEMENTATION & OPERATION FACTORS (Construction/Environmental Impacts, O&M Burden, Phasing Potential, Integration With Other City Programs)	COST FACTORS (Capital and O&M Costs)	
		support high			
Collection System Controls	Pump station modifications	Maximizes system storage and reduces overflow activity	Relatively easy to implement with existing pump stations; potential for increased O&M burden	Low capital and moderate O&M cost	Easy to implement
	Regulator modifications	Reduces overflow activity through increased capture of small events and/or in-line storage of overflow	Relatively easy to implement with existing regulators; potential for increased O&M burden. Can increase risk of upstream flooding.	Low capital and moderate O&M cost	Relatively easy to implement
	Sewer separation	Reduces overflow activity, with potential to eliminate overflows. Increases net load of stormwater pollutants.	Very disruptive to affected areas; may be cost-prohibitive. Coordinates and benefits Combined Sewer Capacity Improvements Program	High capital cost and low O&M cost	Potential for elimination of CSOs
	Flow diversion	Reduces overflow activity by redirecting flows to areas with existing capacity	Can only be implemented if excess capacity and/or in-line storage potential exists in the system	Moderate capital and O&M cost	Relatively easy to implement
Storage Technologies	In-line storage	Reduces overflow activity and pollutant load by	Can only be implemented if in-line storage potential exists in the system	Moderate capital and O&M cost	Makes use of existing infrastructure

CONTROL TECHNOLOGY	CATEGORY	SCREENING CRITERIA			ADVANTAGES
		PERFORMANCE FACTORS (Reduce Volume, Frequency, and/or Pollutant Load)	IMPLEMENTATION & OPERATION FACTORS (Construction/Environmental Impacts, O&M Burden, Phasing Potential, Integration With Other City Programs)	COST FACTORS (Capital and O&M Costs)	
		retaining wet-weather flows in the system. Full secondary treatment for stored flow.			
	Storage tunnel	Reduces overflow activity and pollutant load by storing wet-weather flow. Full secondary treatment for dewatered flow.	Long-term implementation with high initial cost. Disruptive at shaft locations. Increased O&M burden due to pumping costs.	Very high capital and moderate O&M cost	Low visibility once in operation; can achieve high level of control
	Off-line storage basins	Reduces overflow activity and pollutant load by storing wet-weather flow. Full secondary treatment for dewatered flow.	Disruptive to affected areas during construction. Increased O&M burden for satellite facilities and associated pumping costs.	High capital and O&M cost	Can achieve high level of control.
Treatment technologies	Satellite disinfection basins	Reduces bacteria load by providing disinfection to overflow	Disruptive to affected areas during construction. Increased O&M burden due to satellite facilities, transport and storage of chemicals, and pumping costs.	High capital and O&M cost	Relatively simple satellite facilities.
	Vortex separator with	Reduces solids,	Disruptive to affected areas during	High capital and	Small footprint.

CONTROL TECHNOLOGY	CATEGORY	SCREENING CRITERIA			ADVANTAGES
		PERFORMANCE FACTORS (Reduce Volume, Frequency, and/or Pollutant Load)	IMPLEMENTATION & OPERATION FACTORS (Construction/Environmental Impacts, O&M Burden, Phasing Potential, Integration With Other City Programs)	COST FACTORS (Capital and O&M Costs)	
	disinfection	BOD, and bacteria load	construction. Increased O&M burden due to satellite facilities, transport and storage of chemicals, and pumping costs.	O&M cost	
	High Rate Treatment/Enhanced High Rate Clarification with disinfection	Reduces solids, BOD, and bacteria load	Disruptive to affected areas during construction. Increased O&M burden due to satellite facilities, transport and storage of chemicals, and pumping costs.	High capital and O&M cost	High level of treatment for a satellite facility.
Floatables Control Technologies	Continuous deflective separators (CDS); netting traps; screening	Controls visible pollution; little chemical or biological water quality benefit.	Relatively inexpensive and easy to implement; O&M required after storm events	Low capital and high O&M cost	Compliance with Nine Minimum Controls.
Non-Traditional Alternatives	Wetlands treatment	Provides some pollution control	Relatively inexpensive. May require high level of O&M to maintain effectiveness.	Low capital and uncertain O&M cost	Low relative cost and potential for high public acceptance
	Stream restoration, channel modification, stream aeration, habitat modification	Difficult to quantify benefit; however, conceptually, these approaches have a net benefit on instream biota.	Relatively inexpensive. Minimal O&M costs.	Low capital and O&M cost	Low relative cost and potential for high public acceptance
Non-CSO Source Alternatives	Express sewers	Reduce volume of flow in combined	Can be difficult to implement in urban areas. Construction is	High capital and low O&M cost	Clarifies regulatory distinction between

CONTROL TECHNOLOGY	CATEGORY	SCREENING CRITERIA			ADVANTAGES
		PERFORMANCE FACTORS (Reduce Volume, Frequency, and/or Pollutant Load)	**IMPLEMENTATION & OPERATION FACTORS (Construction/Environmental Impacts, O&M Burden, Phasing Potential, Integration With Other City Programs)**	**COST FACTORS (Capital and O&M Costs)**	
		sewers thereby reducing overflow frequency and volume	highly disruptive along sewer corridor.		wet-weather flow types.
	Infiltration and Inflow (I/I) reduction	Reduce volume of flow in combined sewers thereby reducing overflow frequency and volume	Low impact implementation in public areas; however, can create residential hardship if required on private property. Very little O&M required; may in fact reduce existing O&M burden due to reduced flows.	Moderate capital and low O&M cost	Increases capacity for future growth.

Table 3.3.5.2
Components of Integrated System-Wide Alternatives

Alternative No.	Description	Satellite Facilities	Conveyance Facilities	WPCP Facilities	System Separation
1	Storage Tunnel	G	G		
2	Satellite Disinfection Basins	G			
3(1)	Conveyance to CSO Ponds With Treatment/Storage/Dewatering at Ponds		G	G	
4(2)	Conveyance to CSO Ponds With Treatment at Ponds, Combined With Satellite Treatment in Subbasin K11010	G	G	G	
5	System-Wide Partial Separation				G
6	Conveyance to CSO Ponds With Treatment at Ponds, Combined With Local Complete Separation In Subbasin K11010		G	G	G
7	System-Wide Complete Separation				G

Notes:
(1) Made up of five subalternatives.
(2) Made up of two subalternatives.

Table 3.3.5.3
Configuration of Alternatives to Capture all Overflows

Overflow Permit ID	Overflow SIP ID	Regulator	Existing Conditions: Annual Overflow Volume (cf)	Existing Conditions: Annual Number of Overflow Events	Technology Configuration of Alternatives: Alternative 1[1]	Alternative 2	Alternative 3	Alternative 4A	Alternative 4B	Alternative 6	Alternative 7
18/19	K11165/ K11178	K11163/K11162	52,519,264	71	Tunnel	SD[5]	PI to CSO Ponds[6]	EHRC/HRT w. D[7]	SD	CS	CS
26/33/27	M10151/ M10313/ M10202	M10150/M10148/M10199	19,534,059	56	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
48	O10252	O10312/010311	10,650,200	39	To CSO Ponds						
13	K06298	K06285/K06275	8,623,553	44	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			CS
CSO PS (57)	NA	P06014	8,006,963	25	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
55	P06192	P06119	4,604,087	47	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
36	M18032	M18256	4,216,299	34	SS[3]	SD	PI to CSO Ponds	PI to CSO Ponds			
20	K15116	K15009	3,908,404	40	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
11/12	K06234	K06231	3,532,237	30	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
39	N06022	N06007	2,980,121	25	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
5	J11164	J11163	2,972,631	48	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
21	K19044	L19018	2,645,744	41	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
17	K07176	K07171	2,378,948	37	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
24	L06420	L06088	2,104,910	23	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
28	M10238	M10279	1,783,417	26	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
50	O10277	O10273	1,705,907	44	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
61	R14137	S18082	1,678,781	14	SS	SD	SD	SD			
62	R14138	R18188	1,176,229	14	SS	SD	SD	SD			
NA	NA	O10256	986,456	37	Eliminated						
4	J02090	J02089	724,620	14	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			CS
64	S02035	Q07022/Q03011	706,082	16	SS	SS	SS	SS			
52[2]	O22004	P22001	547,406	12	CS[4]	SD	SD	SD			
54	O23080	O19009	511,038	27	SS	SD	SD	SD			
51	O22002	O22045	471,221	9	CS	SD	SD	SD			
NA	NA	L06098	454,898	20	Gates permanently shut; does not activate						
53	O22094	O22095	411,440	13	CS	SD	SD	SD			CS
60	R06031	R06030	360,417	11	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
32	M10306	M06706	335,513	5	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
68	N18254	N18241	311,151	8	CS	SD	SD	SD			
23	L06103	L06102	306,128	13	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
67		K15110	186,580	7	Being separated as part of CSSCIP						
29[2]	M10265	M10256	168,893	4	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			CS
29[2]	M10265	M10309	147,433	3	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
NA	NA	P18031	144,006	3	Eliminated						
NA	NA	P18036	76,503	5	Eliminated						
58	Q06034	Q06036	67,379	3	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			CS
45	N22103	N22101	28,274	2	CS	SD	SD	SD			
25	L06421	L06086	13,899	1	Tunnel	SD	PI to CSO Ponds	PI to CSO Ponds			
16		K07006	6,621	9	Eliminated						
52[2]	O22004	P22139	1,338	1	CS	SD	SD	SD			CS
14	K07106	K07101/K07115	0	0	Does not activate during average year						
56/07	J03313	J03267	0	0	Does not activate during average year						
44	N22093	N22092	0	0	Does not activate during average year						
NA	NA	L06438	NA	NA	Upstream of L06087/88						
NA	NA	K15111	NA	NA	Eliminated						
NA	NA	M18015	NA	NA	Moved to N18241						

NOTES:

1 WPCP dewatering capacity may place an upper limit on the control level that can be achieved with in-system storage in Alternative 1. If this occurs, satellite disinfection technologies will be added at higher control levels.

2 These outfalls receive contributions from two regulators

3 SS - Satellite storage basin

4 CS - Complete separation

5 SD - Satellite disinfection basin

6 PI to CSO Ponds - Parallel interceptor to CSO Ponds

7 EHRC/HRT w. D - Enhanced High Rate Clarification with disinfection

8 EHRC/HRT is typically referred to by the trade name DensaDeg or ACTIFLO

CSO Pond Components	CSO Pond Component
3A - EHRC/HRT with disinfection 3B - Flow equalization plus EHRC/HRT with disinfection 3C - Wet-weather storage with bleedback to WPCP 3D - High-rate mixing with disinfection 3E - Wet-weather storage in Pond 1 with bleedback to WPCP, EHRC/HRT plus disinfection for flows above storage capacity	3B - Flow equalization plus EHRC/HRT with disinfection

Table 3.3.5.4

Estimated Cost-effective Partial Sewer Separation Areas for CSO Program

Subbasin	Total Area in acres	Combined Sewer Area	Estimated Separation Acres
K06290B	681	471	174
O22092	129	91	91
O22061B	176	135	135
Q06002	470	332	70
J03012	352	191	0
P06014	831	831	40
R14033	325	138	138
L06087	32	32	4
L06438	339	231	18
N06007	376	240	146
L06078	67	67	12
J02089	189	49	30
N23078	313	100	0
N22005	145	116	0
R14075	189	125	47
K19071	46	46	42
L19252	330	202	72
M06711	153	137	14
M10250	79	79	0
M14007	39	39	39
M06044	68	68	24
Q06049	63	63	15
L06086	13	13	6
TOTAL	5405	3796	1117

Table 3.3.5.5
Completed CSSCIP Improvements

Subbasin	Status	Improvement Cost To Date	Additional Improvement Cost Under Construction or Planned	Total Improvement Cost
M18-256	Completed	$ 227,000	$ -	$ 227,000
M10-120	Completed	$ 7,915,000	$ -	$ 7,915,000
K07-026	Completed	$ 527,488	$ -	$ 527,488
O10-101	Completed	$ 9,540,000	$ -	$ 9,540,000
Q14-025A	Completed	$ 907,000	$ -	$ 907,000
K11-010	Ongoing	$ 19,534,522	$ 4,791,000	$ 24,325,522
S02-008	Completed	$ 157,000	$ -	$ 157,000
K15-009	Completed	$ 172,000	$ -	$ 172,000
K06-290A	Ongoing	$ 437,000	$ 1,950,000	$ 2,387,000
			Total	$ 46,158,010

Table 3.3.5.6
Individual CSSCIP Projects in Subbasin K11010

CSSCIP Component	Benefit to CSO Control Objectives	Total Improvement Cost
Contract #1: Southgate Plaza Storm Sewer & Detention Basin	Yes	$1,417,000
Contract #2: Southgate Plaza Storm Sewer Ph II	Yes	$1,344,000
Contract #3: Oakdale Storm Sewers	Yes	$3,130,000
Contract #4: Lexington Ave Storm Sewers	Yes	$1,167,000
Contract #5: Camp Scott Pump Station	Yes	$4,058,000
Contract #6: Camp Scott Force Main	Yes	$972,000
Contract #7: Camp Scott Wetlands Ph I	Yes	$132,000
Contract #8: Camp Scott Wetlands Ph II	Yes	$1,375,000
Contract #9: Camp Scott Excess Water Outlet	Yes	$515,522
Contract #10: McMillen North Storm Sewers Contract A	Yes	$2,457,000
Contract #11: McMillen North Storm Sewers Contract B	Yes	$1,298,000
Contract #12: McMillen North Storm Sewers Contract C	Yes	$1,669,000
Contract #13: McMillen South Storm Sewers Contract 1[1]	Yes	$2,691,000
Contract #14: McMillen South Storm Sewers Contract 2[1]	Yes	$2,100,000
	Total	$24,325,522

Notes:
1) Construction in progress

Table 3.3.5.7
Sewer Separation in K11010 - Sanitary Sewer Capacity Estimates

Basin Data

Land Use	Area, acres	Percent of Total
Residential	1362	83.9%
Comm	121	7.5%
Inst	87	5.4%
Ind	2	0.1%
Open	51	3.1%
Total	1623	100.0%

Wastewater Flow Calculations

Characteristic	Quantity
Population	17074
People per acre	13
People per house	3.5
Acres per house	0.28
Houses per acre	3.6
Avg flow, gpcd	100
Peaking factor	4.2
Est areal flow, gpd/acre	5265

Estimated Pipe Capacities

Pipe size, in.	Capacity, mgd	Minimum slope, %	Slope, %	Max est area sewer will serve, acres
8	0.50	0.400	0.403	94
12	1.12	0.220	0.235	212
15	1.74	0.150	0.174	331
18	2.51	0.120	0.136	476
24	4.46	0.080	0.093	848
30	6.35	0.058	0.057	1206
36	9.13	0.046	0.044	1734
42	12.44	0.037	0.036	2363
48	16.27	Not given	0.030	3091
54	20.59	Not given	0.026	3911
60	25.34	Not given	0.022	4814

NOTES:

Minimum slope is taken from Recommended Standards for Wastewater Facilities, 1997 Edition

Capacity is calculated from value given in slope column

Manning's n is assumed to be 0.013

Table 3.3.6.1
Relationship Between Design Storm Return Period and Assumed Control Level

Control Overflows For The	Assumed Control Level	Assumed Number of Annual Activations Per Typical Year
1-month design storm	1 month	12
2-month design storm	2 month	6
3-month design storm	3 month	4
4-month design storm	4 month	3
6-month design storm	6 month	2
12-month design storm	12 month	1

Table 3.3.6.2

Peak Overflow Rate by Design Storm

Regulator	Overflow Link	12 activations/year (1 month 6 hour storm) Peak Overflow Rate (cfs)	6 activations/year (2 month 6 hour storm) Peak Overflow Rate (cfs)	4 activations/year (3 month 6 hour storm) Peak Overflow Rate (cfs)	3 activations per year (4 month 6 hour storm) Peak Overflow Rate (cfs)	2 activations/year (6 month 6 hour storm) Peak Overflow Rate (cfs)	1 activation per year (12 month 6 hour storm) Peak Overflow Rate (cfs)
J02089	LJ02089.0	1	2	2	3	3	4
J03267	LJ03267.0	0	Table	0	0	0	0
J11163	LJ11163.0	8	14	17	19	24	32
K06231	LK06231.0	7	17	22	25	32	46
K06285	LK06285.0	15	30	40	47	63	96
K06275	LK06275.0	0	0	0	0	0	0
K07006	LK07006.0	Regulator K07006 has been abandoned					
K07101	LK07101.0	0	0	0	0	0	0
K07171	LK07171.0	4	7	11	14	20	33
K11163	LK11163.O	72	126	171	208	293	451
K11162	LK11162.O	3	6	8	9	13	23
K15009	LK15009.0	7	13	19	24	34	55
K15111	LK15111.O	Regulator K15111 has been abandoned					
K15110	LK15110.O	0	0	1	1	2	3
L06086	LL06086.1	0	0	0	0	0	1
L06088	LL06087.2	4	13	18	22	28	41
L06098	LL06098.0	2	3	3	3	3	4
L06102	LL06102.0	0	3	4	4	5	6
L06438	LL06314	Upstream of L06087/88					
L19018	LL19018.0	4	8	10	11	15	24
M06706	LM06706.1	0	2	5	6	9	14
M10150	LM10200 [1]	25	50	64	73	96	126
M10148	LM10148.0	0	0	0	0	0	0
M10199	LM10199.O	8	19	24	27	43	54
M10256	LM10256.0	0	2	3	3	5	8
M10279	LM10279.0	6	9	10	10	11	12
M10309	LM10309.0	0	0	0	2	4	9
M18256	LM18256.0	3	5	6	7	10	16
N06007	LN06007.2	5	12	16	19	25	39
N18241	LN18241.O	0	0	2	3	5	10
N22092	LN22092.O	0	0	0	0	0	0
N22101	LN22101.O	0	0	0	0	1	1
O10256	LO10256.0	1	1	2	2	2	2
O10273	LO10273.0	5	11	14	16	20	26
O10311	LO10311.0	0	0	0	0	0	0
O10312	LO10312.0	21	37	50	59	76	107
O19009	LO19009.0	0	0	2	3	5	9
O22045	LO22045.0	3	3	3	4	6	11
O22095	LO22095.0	0	1	2	3	5	9
P06014	LP06014.O	12	29	39	46	59	85
P06119	LP06119.0	10	18	23	26	33	46
P18031	LP18031.0	0	0	2	2	2	3
P18036	LP18036.0	0	0	0	1	3	3
P22001	LO22001.0	0	2	3	4	5	8
P22139	LP22139.0	0	0	0	0	0	0
Q06036	LQ06036.O	0	0	0	0	0	0
Q07022	LQ07022.O	0	2	2	3	3	5
R06030	LR06030.O	2	3	4	4	6	7
R18188	LR18188.O	0	4	6	8	12	20
S18082	LS18082.O	1	6	11	15	23	39

Notes

1 Represents combined overflow from Regulators M10148, M10150, and M10199

Table 3.3.6.3

Total Overflow Volume by Design Storm

Regulator	Overflow Link	12 activations/year (1 month 6 hour storm) Overflow Volume (Cubic Feet)	6 activations/year (2 month 6 hour storm) Overflow Volume (Cubic Feet)	4 activations/year (3 month 6 hour storm) Overflow Volume (Cubic Feet)	3 activations per year (4 month 6 hour storm) Overflow Volume (Cubic Feet)	2 activations/year (6 month 6 hour storm) Overflow Volume (Cubic Feet)	1 activation per year (12 month 6 hour storm) Overflow Volume (Cubic Feet)
J02089	LJ02089.0	4,606	9,090	11,377	13,034	25,336	57,446
J03267	LJ03267.0	0	0	0	0	0	0
J11163	LJ11163.0	49,458	98,106	124,231	139,913	171,686	247,295
K06231	LK06231.0	33,457	98,281	140,952	174,102	267,259	501,228
K06285	LK06285.0	90,780	272,671	435,958	547,818	805,777	1,343,605
K06275	LK06275.0	0	0	0	0	0	0
K07006	LK07006.0	Regulator K07006 has been abandoned					
K07101	LK07101.0	0	0	0	0	0	0
K07171	LK07171.0	14,978	60,496	103,843	132,812	199,673	344,728
K11163	LK11163.O	586,965	1,394,576	2,123,467	2,595,911	3,648,074	5,605,963
K11162	LK11162.O	40,556	79,488	112,594	132,660	181,283	290,207
K15009	LK15009.0	33,589	114,910	196,575	251,992	378,083	621,484
K15111	LK15111.O	Regulator K15111 has been abandoned					
K15110	LK15110.O	1,444	6,284	10,598	14,118	20,623	30,542
L06086	LL06086.1	0	0	0	0	0	2,298
L06088	LL06087.2	13,105	63,019	105,160	140,859	242,022	485,681
L06098	LL06098.0	5,665	18,109	24,698	28,590	40,076	55,995
L06102	LL06102.0	170	10,974	16,950	21,907	29,080	50,528
L06438	LL06314	Upstream of L06087/88					
L19018	LL19018.0	39,441	67,597	83,744	97,132	141,338	270,258
M06706	LM06706.1	0	4,446	13,728	21,815	50,102	127,227
M10150	LM10200 [1]	186,733	443,764	628,789	755,191	1,046,399	1,677,003
M10148	LM10148.0	0	0	0	0	0	0
M10199	LM10199.O	47,939	128,496	189,599	233,238	347,276	568,632
M10256	LM10256.0	0	1,837	4,494	6,814	16,956	51,584
M10279	LM10279.0	23,358	66,938	96,221	117,925	152,543	198,569
M10309	LM10309.0	0	0	1,317	4,829	21,454	69,446
M18256	LM18256.0	25,741	50,682	79,322	99,965	149,487	248,518
N06007	LN06007.2	21,502	83,495	151,532	203,341	331,004	596,144
N18241	LN18241.O	0	1,318	9,388	17,106	37,270	90,676
N22092	LN22092.O	0	0	3	13	11	15
N22101	LN22101.O	0	40	186	312	638	5,731
O10256	LO10256.0	21,026	26,278	28,099	28,977	30,488	33,456
O10273	LO10273.0	30,160	62,831	80,051	90,366	111,749	160,127
O10311	LO10311.0	0	0	0	0	0	0
O10312	LO10312.0	594,461	836,382	1,067,572	1,222,521	1,548,563	2,101,104
O19009	LO19009.0	301	7,694	22,646	34,821	65,934	134,053
O22045	LO22045.0	0	4,236	16,706	27,801	59,040	130,695
O22095	LO22095.0	740	8,498	16,124	23,261	45,675	97,895
P06014	LP06014.O	76,201	253,668	398,842	499,544	735,538	1,225,602
P06119	LP06119.0	86,006	163,955	203,660	230,748	296,099	427,789
P18031	LP18031.0	0	2,573	10,485	14,233	18,985	23,330
P18036	LP18036.0	0	0	0	2,542	12,799	24,463
P22001	LO22001.0	3,552	15,292	27,904	37,862	62,603	112,274
P22139	LP22139.0	0	0	0	0	0	0
Q06036	LQ06036.O	0	0	0	0	0	0
Q07022	LQ07022.O	9,755	18,276	26,257	32,172	47,111	79,878
R06030	LR06030.O	3,823	9,308	12,477	14,402	18,527	40,535
R18188	LR18188.O	281	29,339	64,461	90,251	149,218	261,854
S18082	LS18082.O	1,629	37,706	88,746	125,392	215,512	394,198

Notes

1 Represents combined overflow from Regulators M10148, M10150, and M10199

Table 3.3.7.1
Stage 1 Capital Cost Estimates By Alternative

Control Level – Activations Per Typical Year	Estimate of Capital Cost ($M) Collection System and CSO Pond Improvements Only										
	Alt. 1	**Alt. 2**	**Alt. 3A**	**Alt. 3B**	**Alt. 3C**	**Alt. 3D**	**Alt. 3E**	**Alt. 4A**	**Alt. 4B**	**Alt. 6**	**Alt. 7**
12	$147	$38	$75	$49	$76	$48	$92	$53	$45	$120	$544(3)
6	$184	$56	$125	$74	$101	$70	$117	$78	$64	$136	
4	$211	$68	$159	$91	$118	$85	$134	$94	$77	$145	
3	$228	$76	$186	$109	$133	$99	$149	$108	$88	$153	
2	$266	$92	$250	$159	$169	$132	$185	$143	$116	$175	
1	$334	$126	$376	$262	$243	$199	$259	$218	$177	$224	

Notes:

(1) Capital Costs represent cost of collection system and CSO Pond improvements. They do not include the WPCP and CSSCIP components of the LTCP. All costs in 2005 $
(2) Capital costs include a 25% contingency and 25% non-construction costs
(3) Alt. 7, Complete Separation, eliminates all CSOs, and so achieves full control under all conditions

Table 3.3.9.3
General Operational Issues Associated With Wet-Weather Control Technologies

TECHNOLOGY	SOLIDS HANDLING	ODOR CONTROL	SCREENINGS	PHYSICAL FACILITY (PUMPS, GRASS, ETC.)	BULK CHEMICALS	FLUSHING WATER
Open storage basins	H	NA	H	H	NA	H
Covered storage basins	M	M	H	H	NA	H
Tunnels	L	H	H	H	NA	M
Netting, trash traps	NA	NA	H	NA	NA	NA
Treatment basins	M	M	H	H	H	M
Ballasted treatment (EHRC/HRT facilities)	H	L	H	L	H+	L

Notes:
1) H = High level of effort M = Medium level of effort L = Low level of effort NA – Not Applicable

Table 3.4.4.1
Non-Monetary Factors Important to the City of Fort Wayne

CRITERION
Level of Treatment
Inconvenience (Construction phase)
Inconvenience (Operation)
Operation & Maintenance Staff
Adaptability to Future Regulatory Issues
Coordination with Other Programs
Potential for Regulatory Support
Smoothness of Rate Impact

Table 3.4.5.1
Weighting of Selection Criteria

CRITERION	WEIGHT
Level of Treatment	20
Inconvenience (Construction phase)	7.5
Inconvenience (Operation)	17.5
Operation & Maintenance Staff	15
Capital Cost	25
Operation & Maintenance Cost	15
Adaptability to Future Regulatory Issues	15
Coordination with Other Programs	15
Potential for Regulatory Support	10
Smoothness of Rate Impact	20

Table 3.4.5.2
Average Scores by Individual Criteria for Each Alternative

	Alternative Average Score (unweighted)									
Criterion	**1**	**2**	**3A**	**3B**	**3C**	**3D**	**3E**	**4A**	**4B**	**6**
Level of Treatment	10	1	5	5	10	4.5	10	4.5	2.5	5
Inconvenience (Construction phase)	6	2.5	6	6	6.5	6.5	6.5	3	3	0.5
Inconvenience (Operation)	10	3.5	9.5	9	9.5	9	9.5	3.5	3.5	9
Operation & Maintenance Staff	9.5	0	4	4.5	4	4.5	4	3.5	3.5	5
Capital Cost	0.5	9.5	5.5	6	5	6.5	4.5	5.5	6	3.3
Operation & Maintenance Cost	9.5	0	4	6.5	4.5	7.5	4	4.5	4	7.7
Adaptability to Future Regulatory Issues	6.5	5.5	7.5	7.5	8	7.5	10	5	5	4.5
Coordination with other programs	5.5	2.5	6	6	6.5	6.5	6.5	5	5	7.5
Potential for regulatory support	9.5	2.5	5.5	5.5	9	5.5	10	5	4	5
Smoothness of Rate Impact	1.7	7.8	3.3	5.0	3.3	5.6	3.3	3.9	3.9	5

Table 3.4.5.3
Weighted Scores for Alternatives

		Alternative Composite Score (weighted)									
Criterion	**Weight**	**1**	**2**	**3A**	**3B**	**3C**	**3D**	**3E**	**4A**	**4B**	**6**
Level of Treatment	20	200	20	100	100	200	90	200	90	50	100
Inconvenience (Construction phase)	7.5	45	18.75	45	45	48.75	48.75	48.75	22.5	22.5	3.75
Inconvenience (Operation)	17.5	175	61.25	166.25	157.5	166.25	157.5	166.25	61.25	61.25	157.5
Operation & Maintenance Staff	15	142.5	0	60	67.5	60	67.5	60	52.5	52.5	75
Capital Cost	25	12.5	237.5	137.5	150	125	162.5	112.5	137.5	150	82.5
Operation & Maintenance Cost	15	142.5	0	60	97.5	67.5	112.5	60	67.5	60	115.5
Adaptability to Future Regulatory Issues	15	97.5	82.5	112.5	112.5	120	112.5	150	75	75	67.5
Coordination with other programs	15	82.5	37.5	90	90	97.5	97.5	97.5	75	75	112.5
Potential for regulatory support	10	95	25	55	55	90	55	100	50	40	50
Smoothness of Rate Impact	20	33.3	155.6	66.7	100.0	66.7	111.1	66	77.8	77.8	100.0
TOTAL SCORE		1025.8	638.1	892.9	975.0	**1041.7**	1014.9	1061.0	709.0	664.0	864.3
NORMALIZED SCORE		97	60	84	92	98	96	100	67	63	81
	2001	98	61	86	93	**100**	97		68	64	82

Table 3.4.5.4
Stage 2 Capital Costs for Short-Listed Alternatives

Control Level – Activations Per Typical Year	Estimate of Capital Cost ($M) Full CSO Program – Includes WPCP and CSSCIP Costs	
	Alt. 3E	**Alt. 4A**
12	$269.6	$252.6
6	$301.4	$283.6
4	$321.1	$298.0
3	$349.6	$318.2
2	$424.6	$345.3
1	$486.7	$401.2
0	$592.4	$463.0

Notes:

(1) Capital Costs represent cost for full CSO Program, i.e., include WPCP and CSSCIP costs
(2) All costs in 2005 $
(3) Capital costs include a 25% contingency and 25% non-construction costs

Table 3.4.5.5
Present Worth Costs for Short-Listed Alternatives

Control Level – Activations Per Typical Year	Estimate of Present Worth ($M) Full CSO Program – Includes WPCP and CSSCIP Costs	
	Alt. 3E	**Alt. 4A**
12	$271.6	$275.5
6	$292.7	$315.0
4	$307.7	$329.0
3	$329.0	$354.4
2	$388.5	$383.0
1	$425.1	$434.6
0	$504.2	$517.1

Notes:

(1) All costs in 2005 $
(2) Present Worth assumptions presented in Section 3.4.5.2.3

Table 3.4.5.6
Present Worth Cost Versus Performance for Alternative 3E

Control Level	Present Worth $M	Performance in Typical Year			
		Number of Annual Activations	Annual OF Volume (ft3)	Annual OF Volume (mg)	Annual Days Exceeding Bacteria WQS Due to CSO Discharges
Existing Conditions	$ -	71	141,471,394	1,058	86
1-month	$ 271.6	12	47,121,636	352	24
2-month	$ 292.7	6	26,379,426	197	15
3-month	$ 307.7	4	18,799,842	141	10
4-month	$ 329.0	3	14,450,214	108	7
6-month	$ 388.5	2	8,769,791	66	3
12-month	$ 425.1	1	4,208,531	31	2
Full Control	$ 504.2	0	0	0	0

Notes:
(1) All costs in 2005 $

Table 3.4.5.7
Present Worth Cost Versus Performance for Alternative 4A

Control Level	Present Worth $M	Performance in Typical Year			
		Number of Annual Activations	Annual OF Volume		Annual Days Exceeding Bacteria WQS Due to CSO Discharges
			(ft3)	(mg)	
Existing Conditions	$ -	71	141,471,394	1,058	86
1-month	$ 275.5	12	45,902,799	343	20
2-month	$ 315.0	6	22,607,120	169	11
3-month	$ 329.0	4	17,252,590	129	9
4-month	$ 354.4	3	13,366,380	100	4
6-month	$ 383.0	2	8,853,431	66	3
12-month	$ 434.6	1	4,953,024	37	2
Full Control	$ 517.1	0	0	0	0

Notes:
(1) All costs in 2005 $

Table 3.4.5.8
Summary of Stage 2 Comparison

Measure	Alternative 3E	Alternative 4A
Performance	Equal	Equal
Capital Cost	Disadvantage	Advantage
Present Worth	Advantage	Disadvantage
Cost/Performance	Advantage	Disadvantage
Water Quality Benefits	Advantage	Disadvantage
Siting Issues	Advantage	Disadvantage
Impacts on O&M Program	Advantage	Disadvantage

Notes:
(1) Alternative 3E and Alternative 4A were rated and ranked against a broader set of criteria in Stage 1. The Stage 2 comparison focused on potential differentiators between these two alternatives.

FIGURES

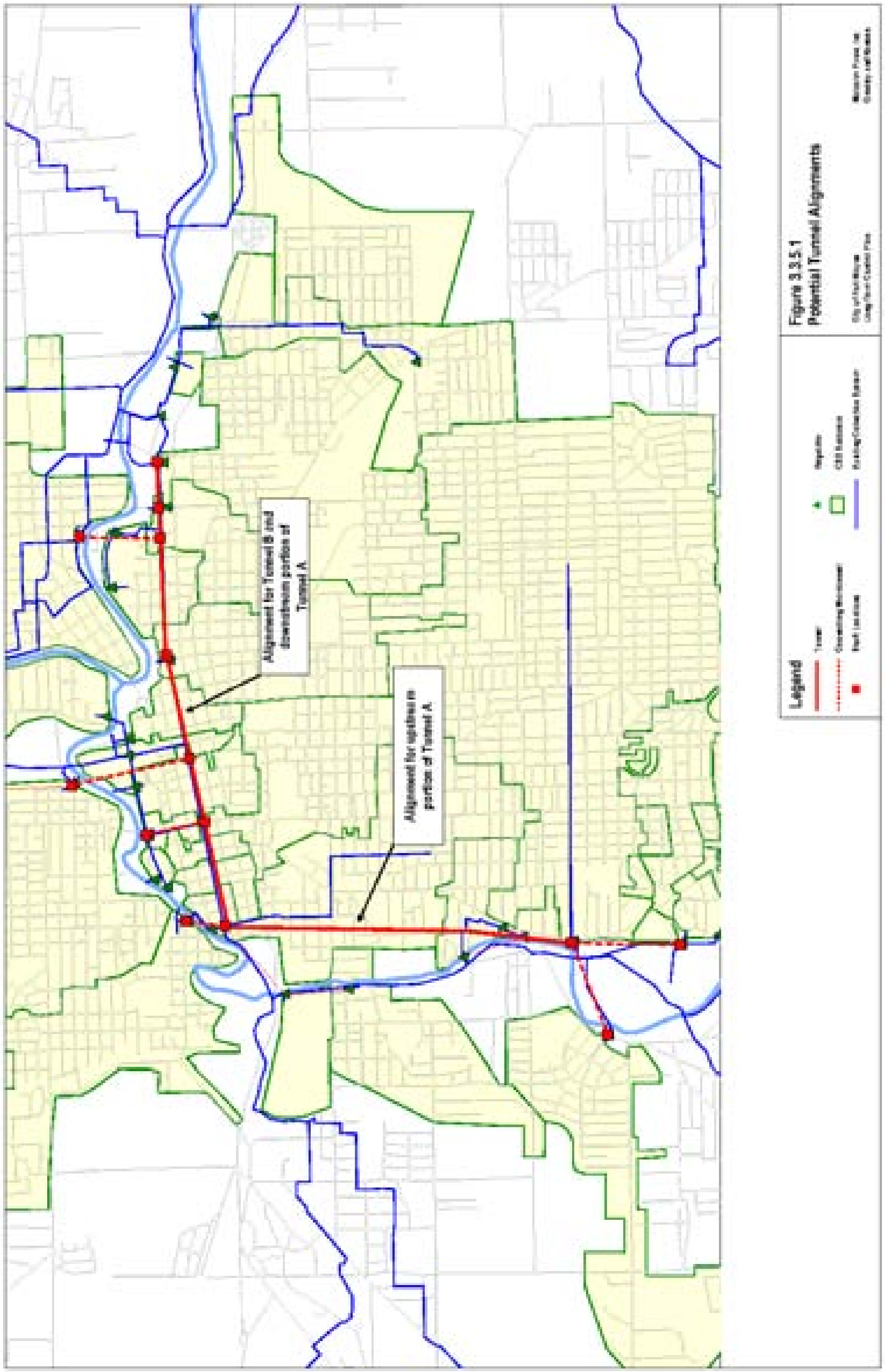


Figure 3.3.5.1
Potential Tunnel Alignments
Legend
Alignment for Tunnel B and downstream portion of Tunnel A
Alignment for upstream portion of Tunnel A

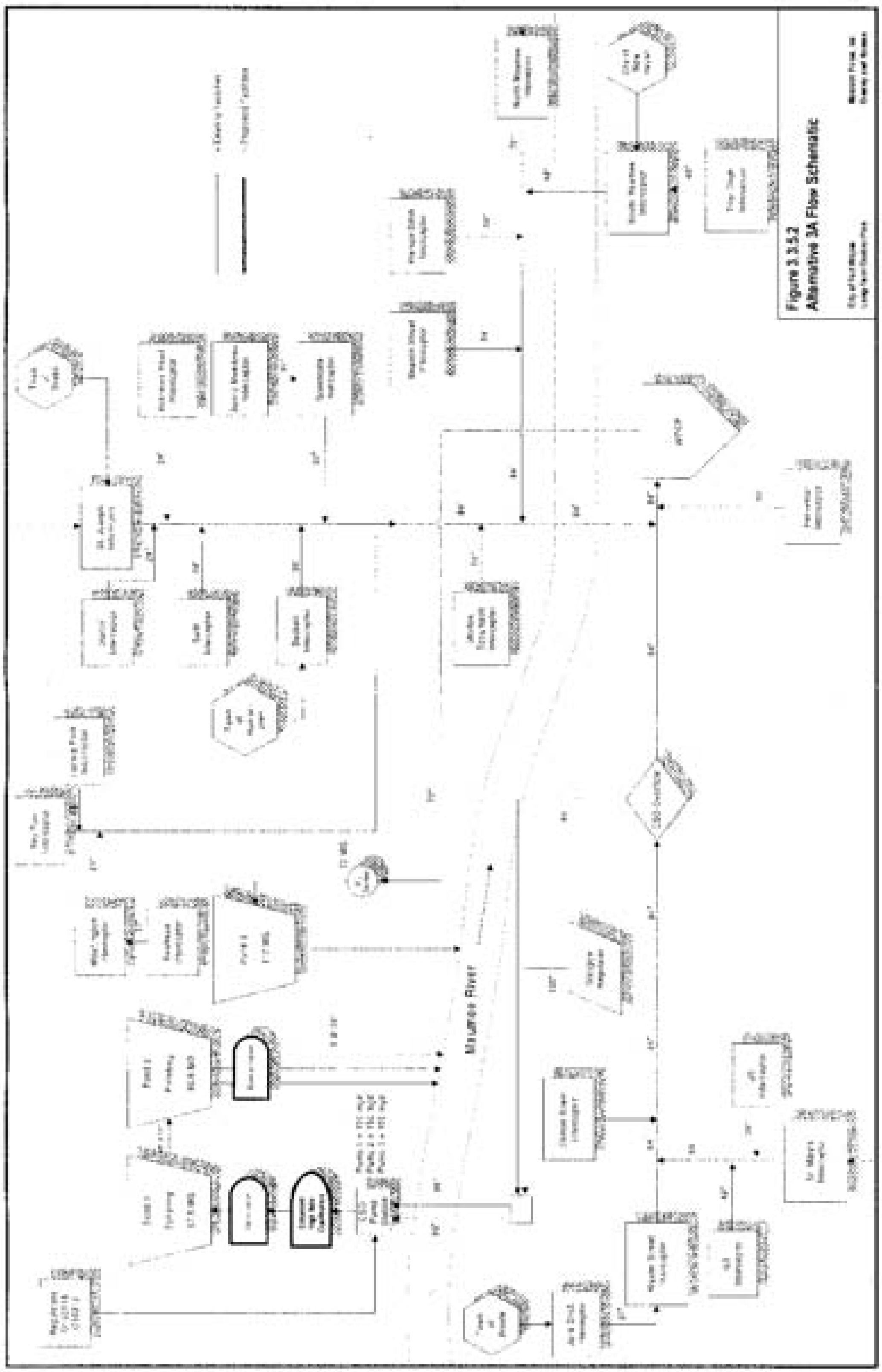
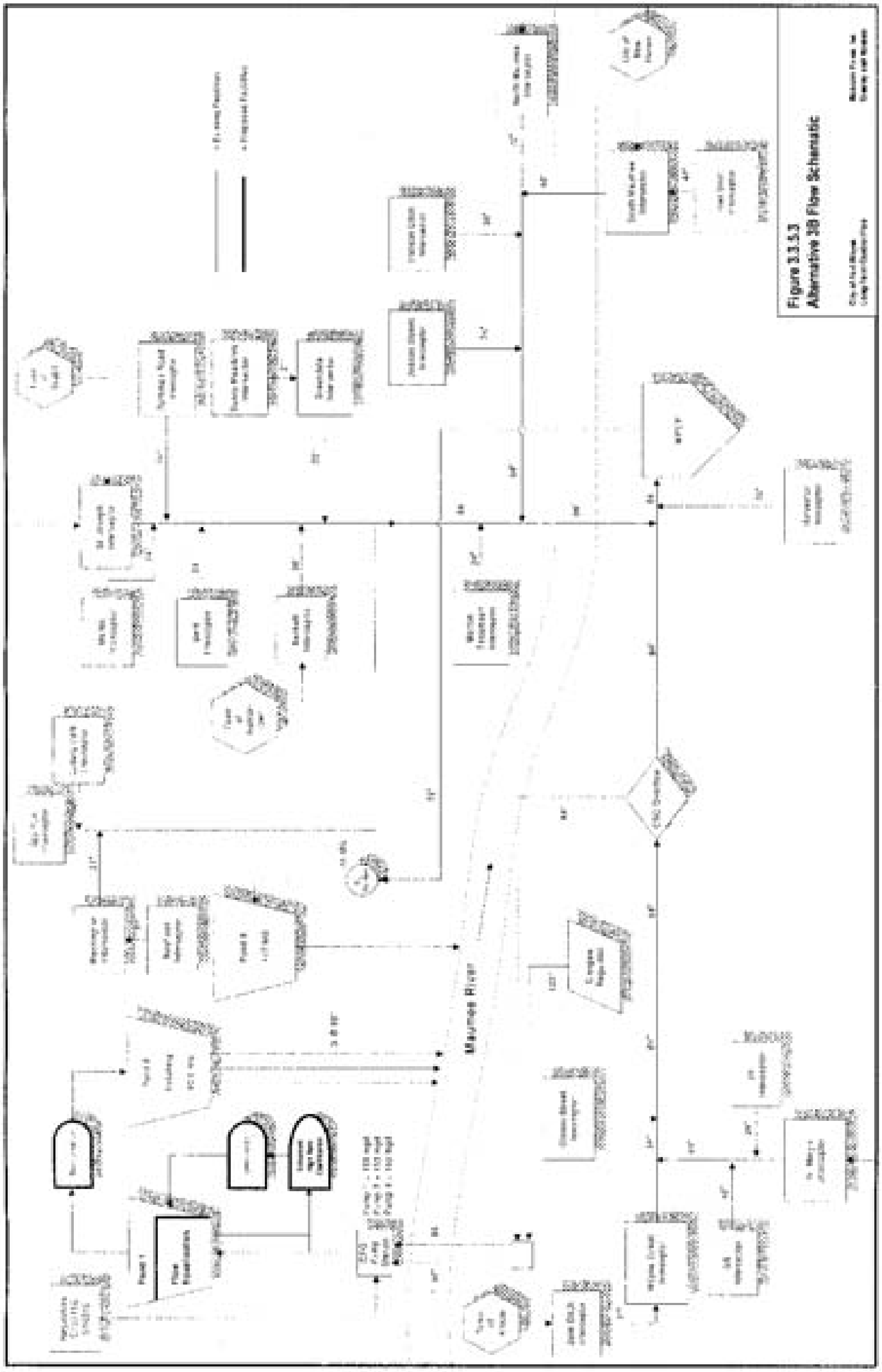


Figure 3.3.5.2
Alternative 3A Flow Schematic
Maumee River


Maumee River

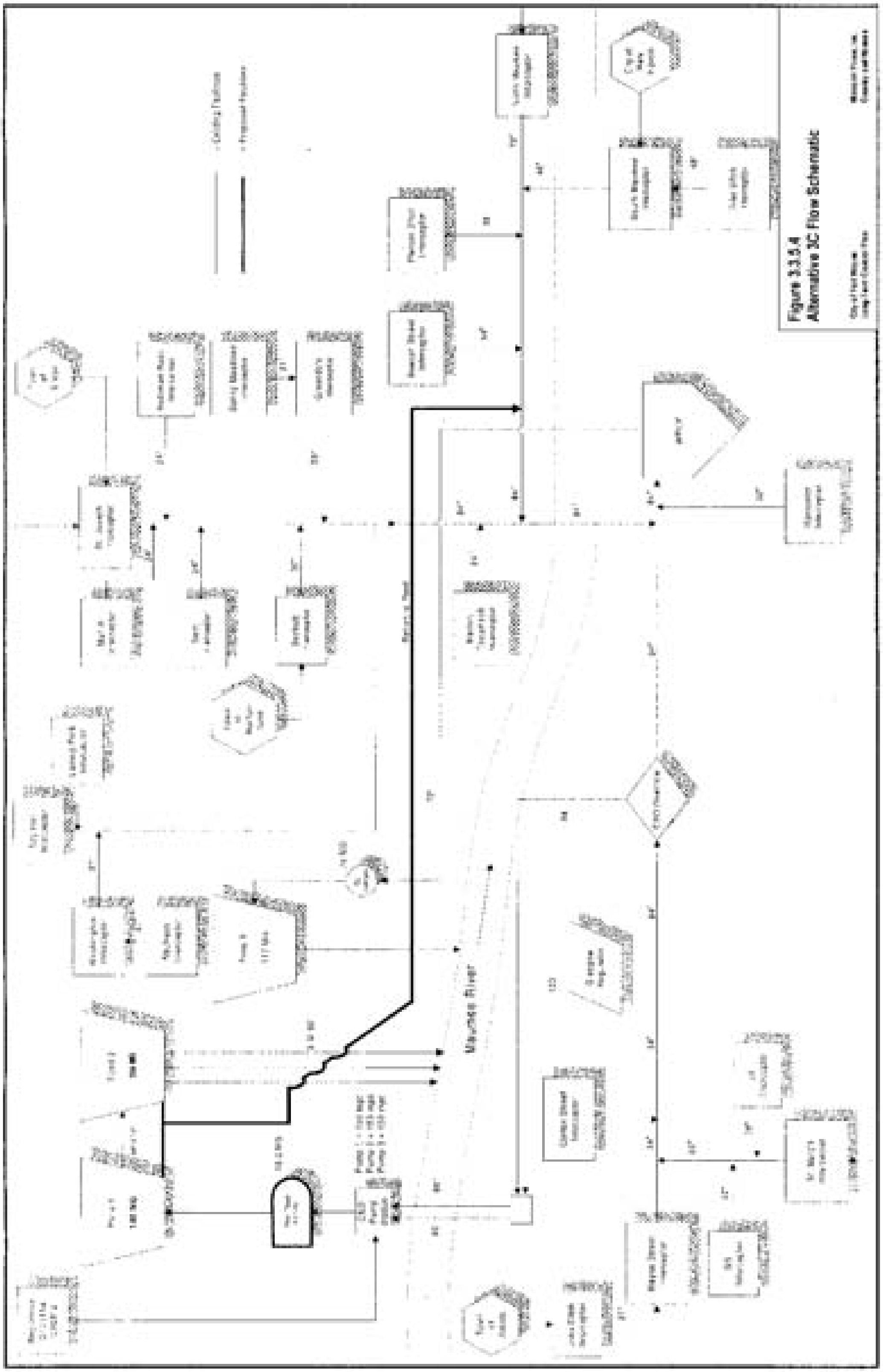


Figure 3.3.5.4
Alternative 3C Flow Schematic

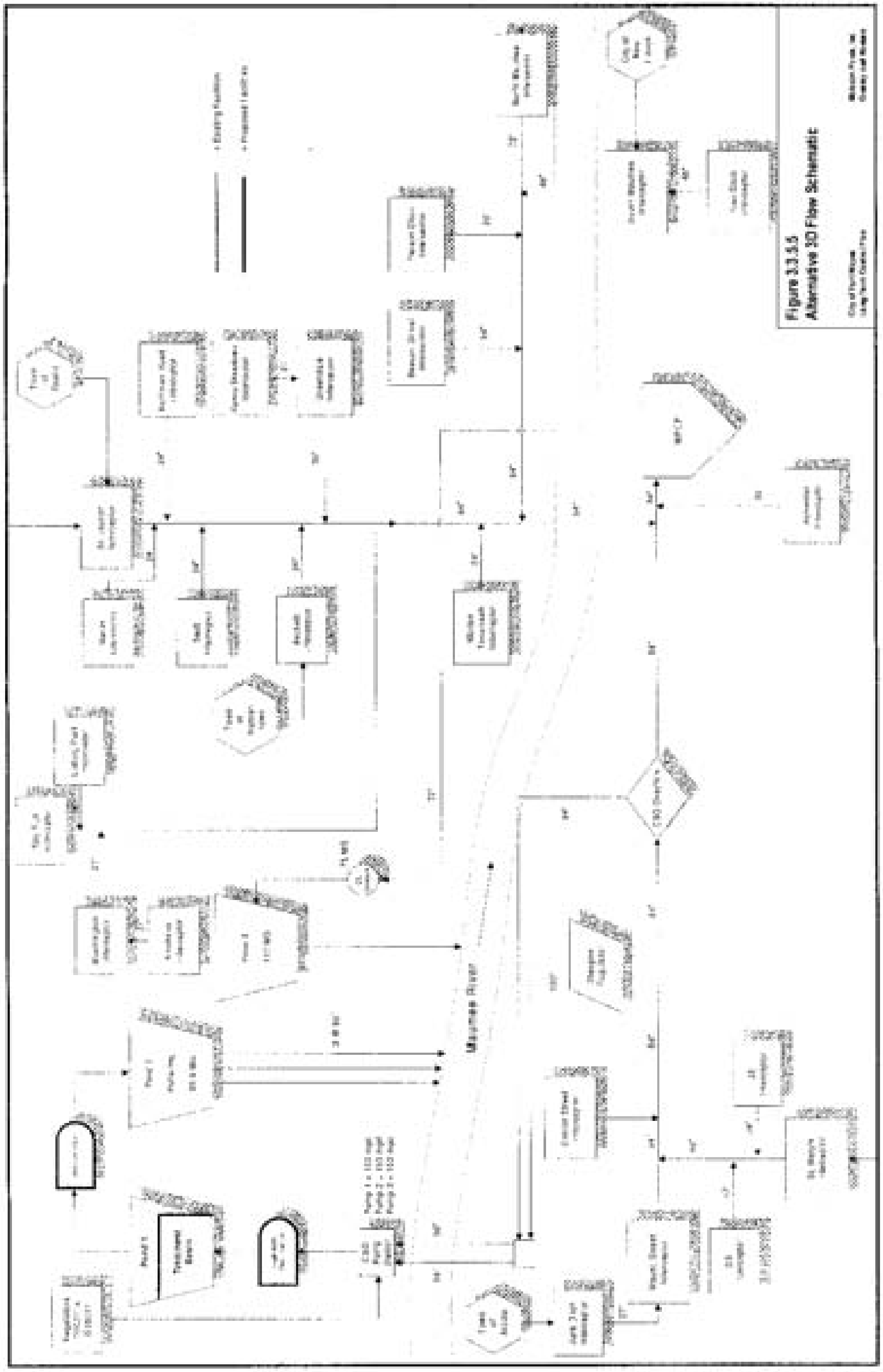


Figure 3.3.5.5
Alternative 3D Flow Schematic
Maumee River
WPCP

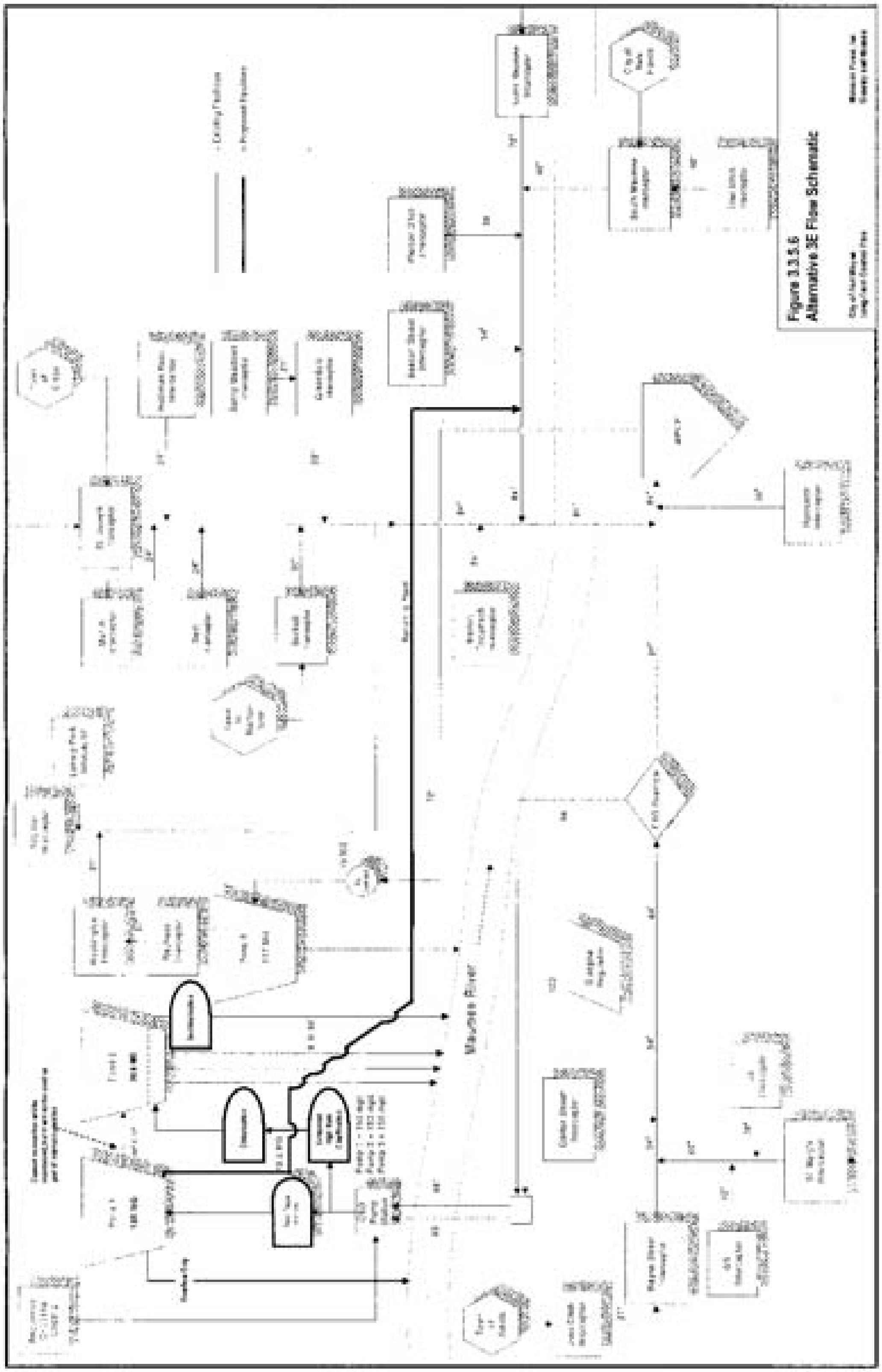
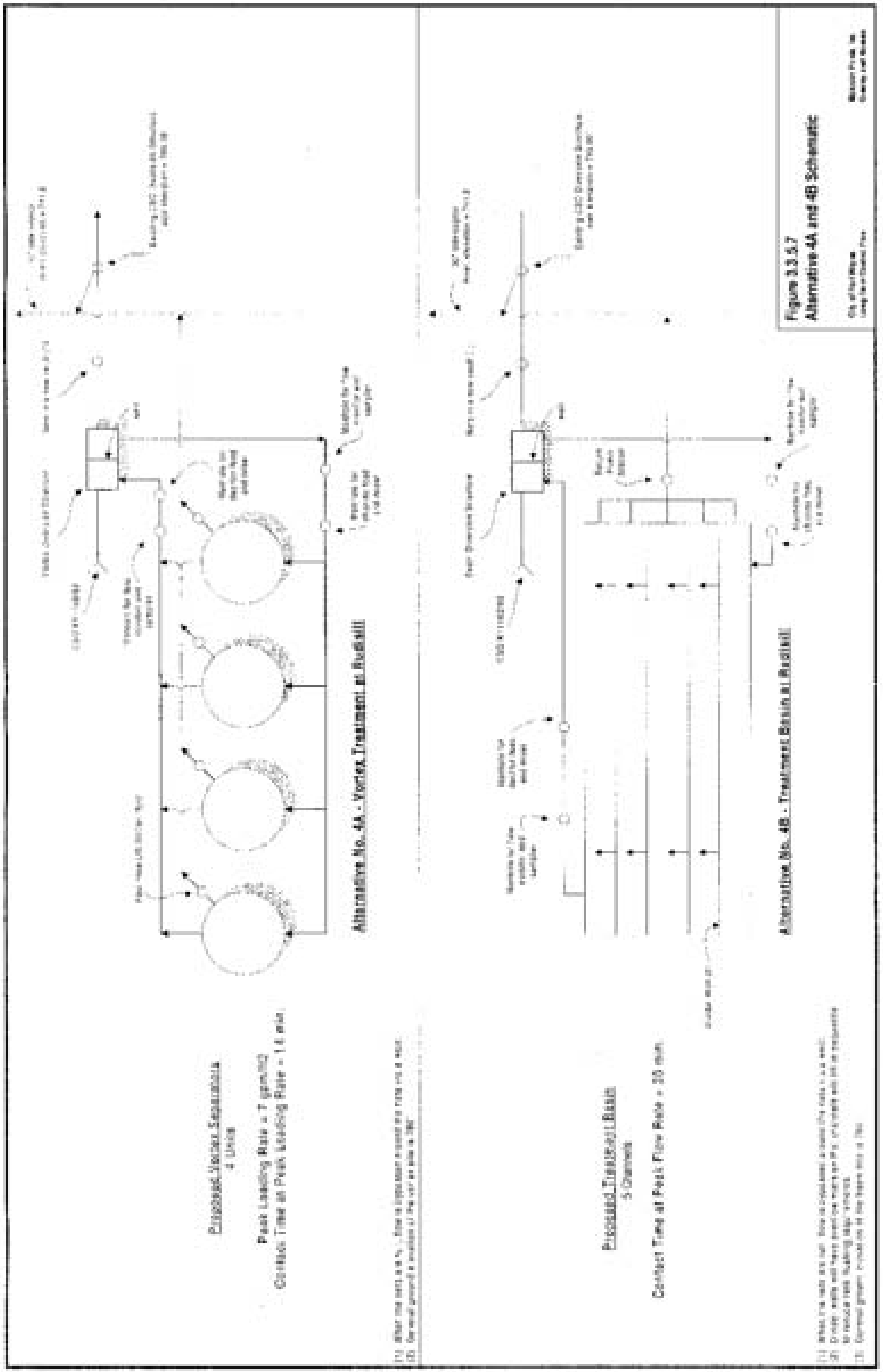


Figure 3.3.5.6
Alternative 3E Flow Schematic
Maumee River



Alternative No. 4A - Vortex Treatment at Rudisill
Alternative No. 4B - Treatment Basin at Rudisill
Proposed Vortex Separators
Proposed Treatment Basin

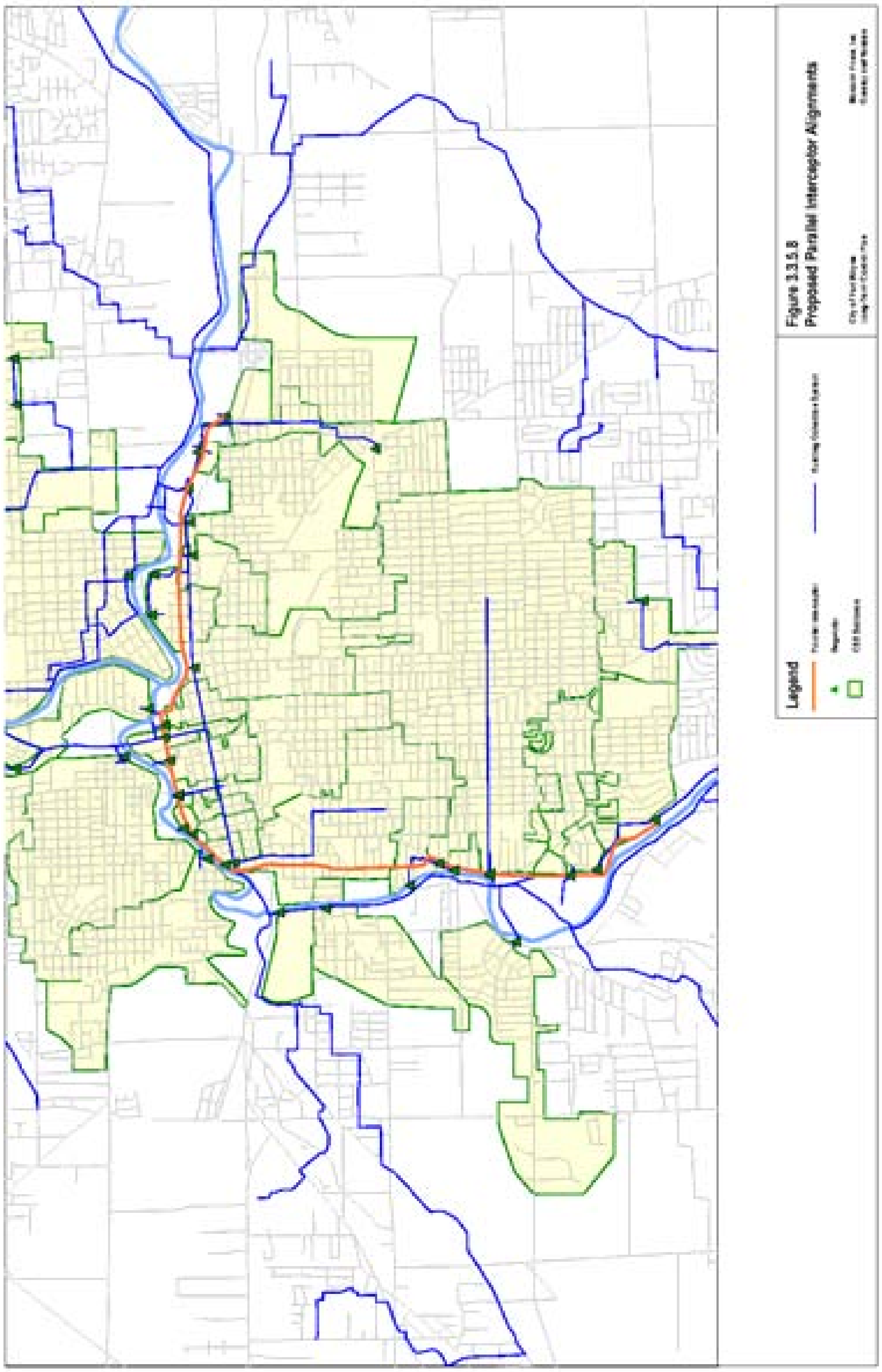


Figure 3.3.5.8
Proposed Parallel Interceptor Alignments
Legend

Figure 3.3.7.1
Preliminary Cost/Performance Curves

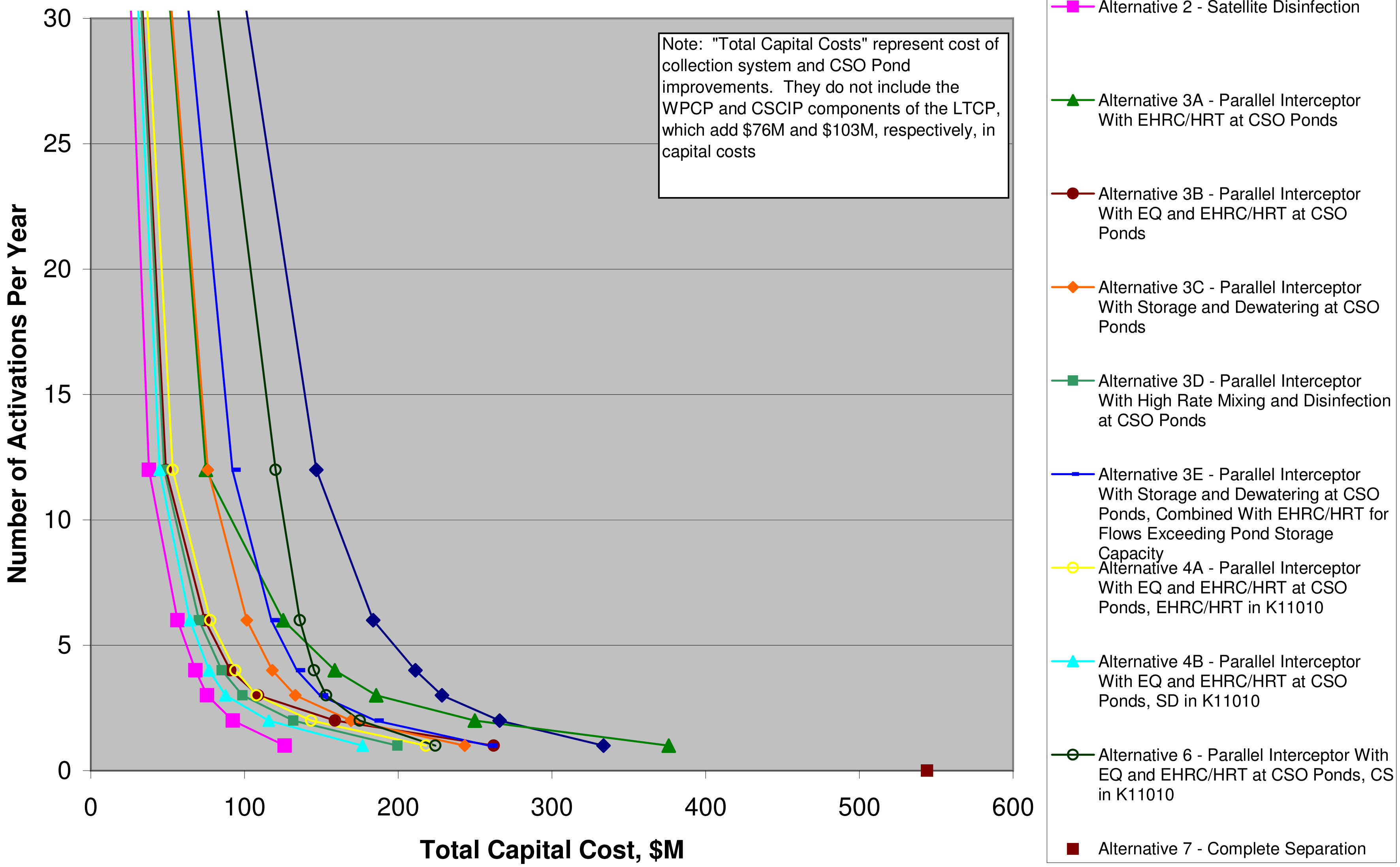


Figure 3.4.5.1
Summary of Alternative Scoring

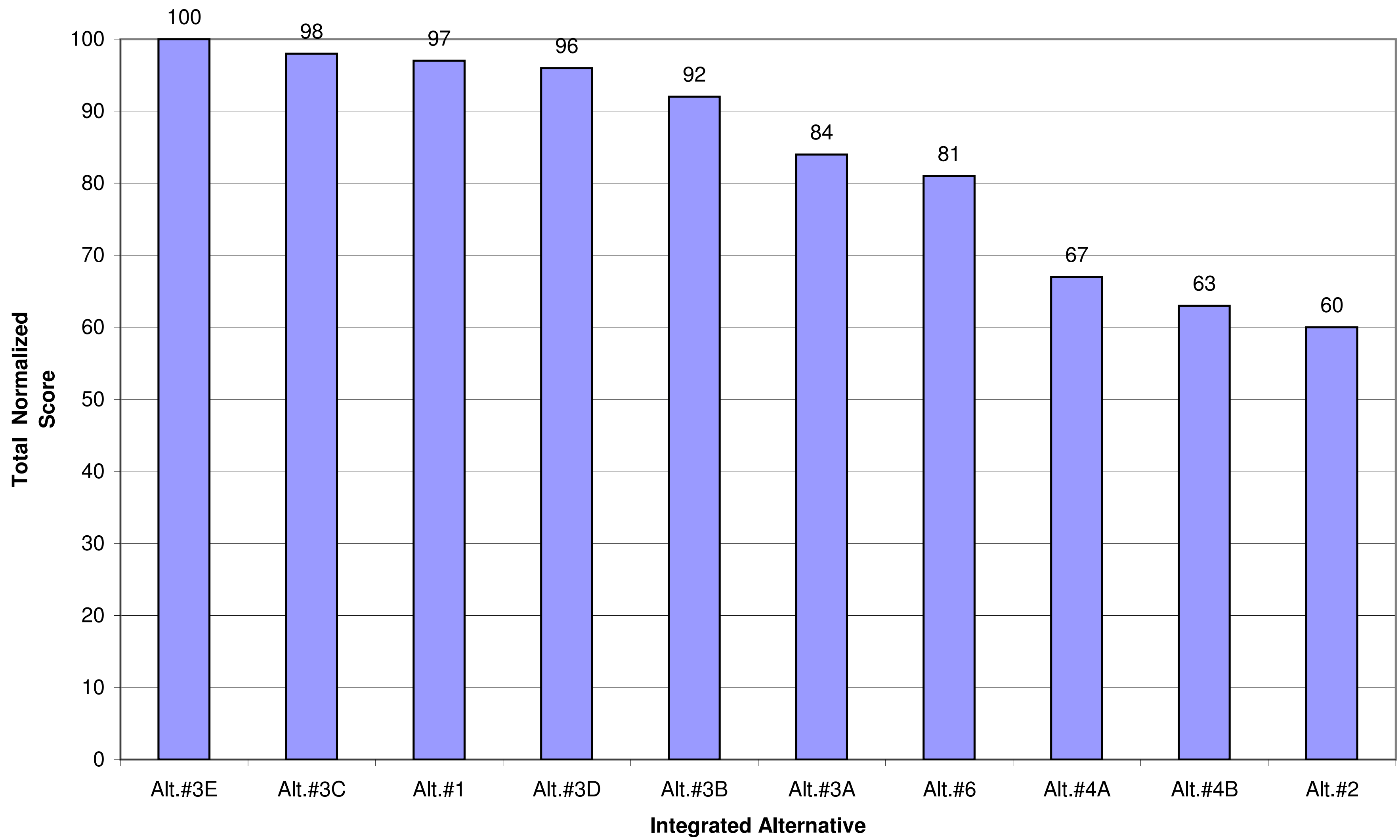


Figure 3.4.5.2
Cost/Performance Curves
Annual Activations

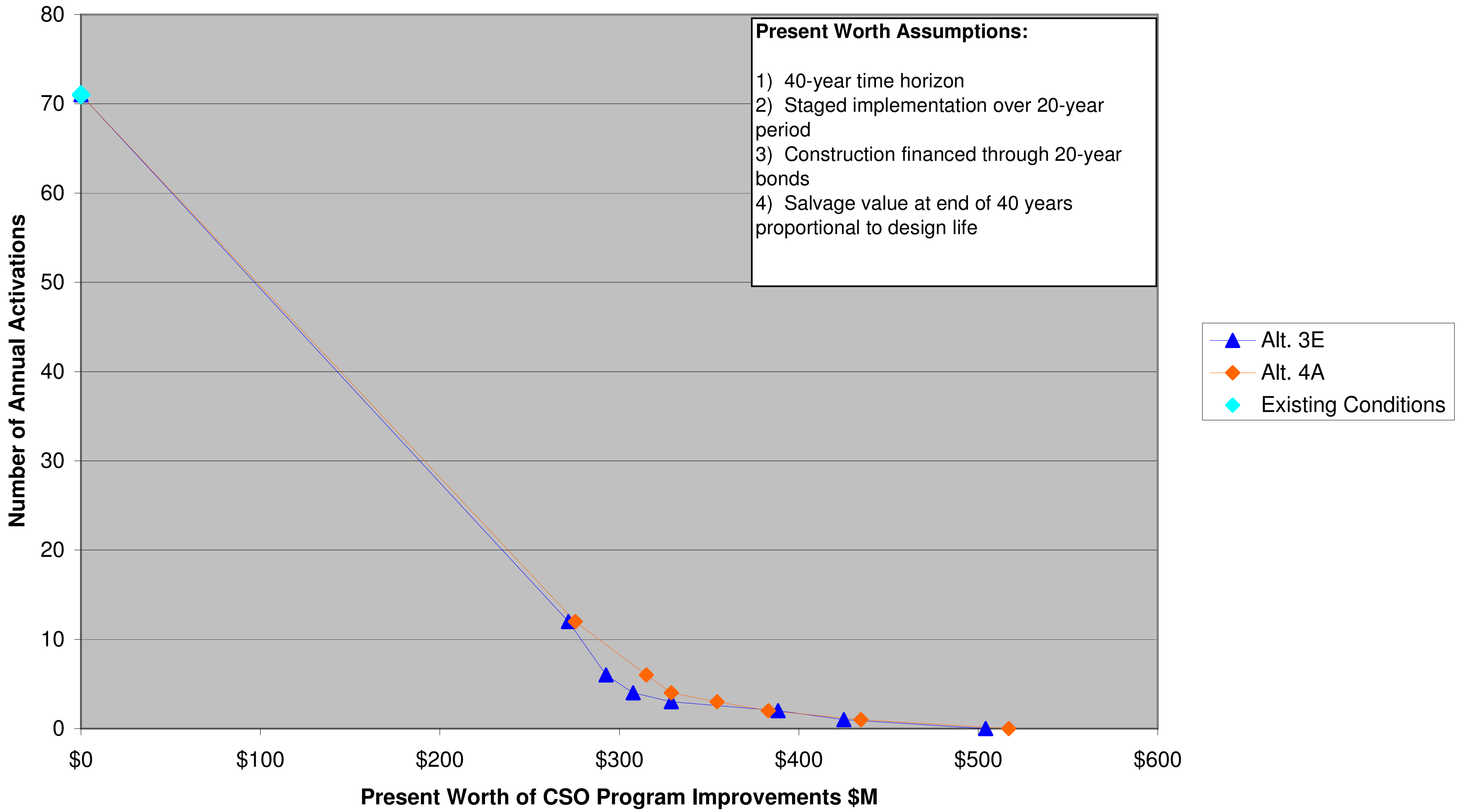


Figure 3.4.5.3
Cost/Performance Curves
Annual Overflow Volume From System CSOs

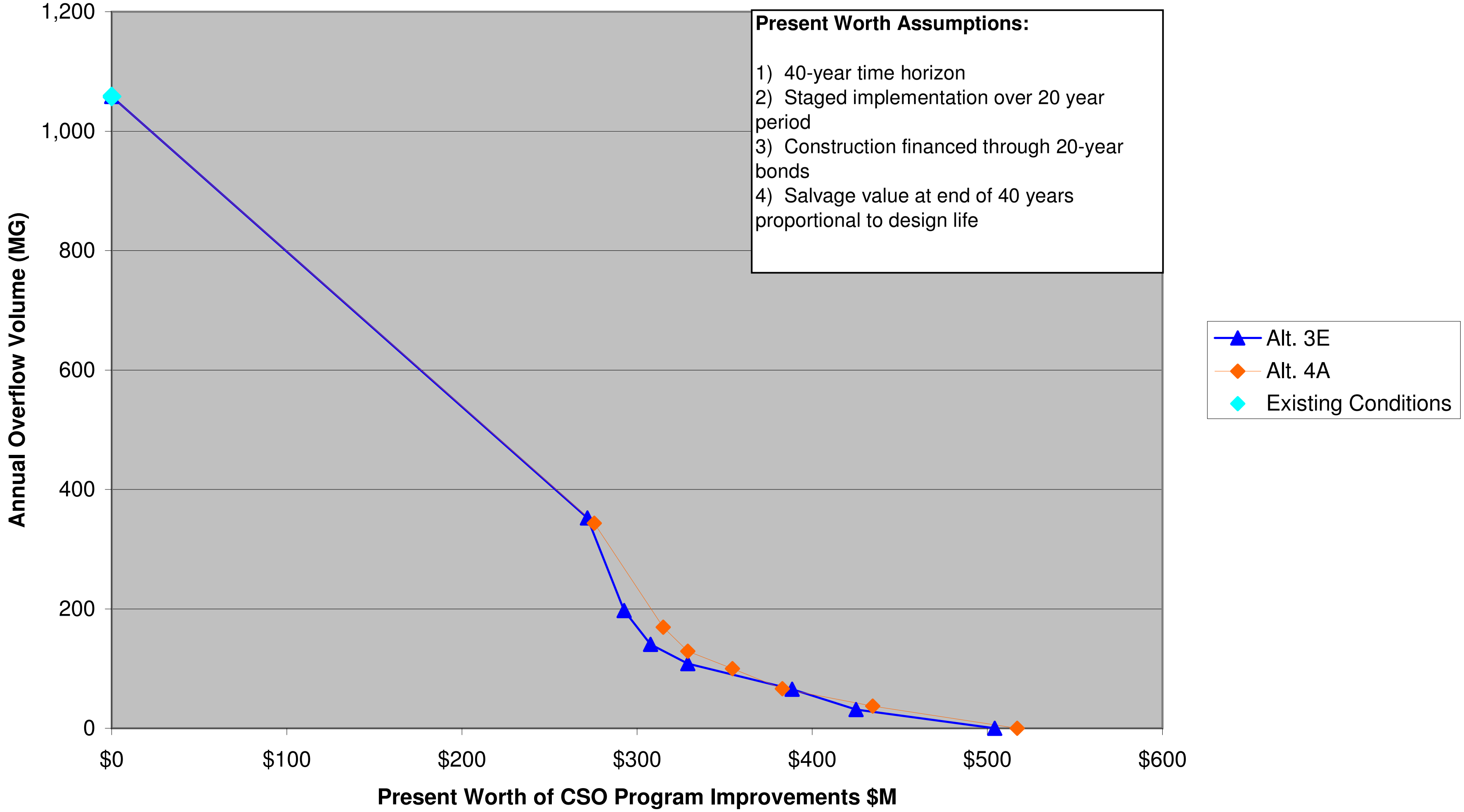


Figure 3.4.5.4
Cost/Performance Curves
Annual Days Exceeding Instream Bacteria Water Quality Standards

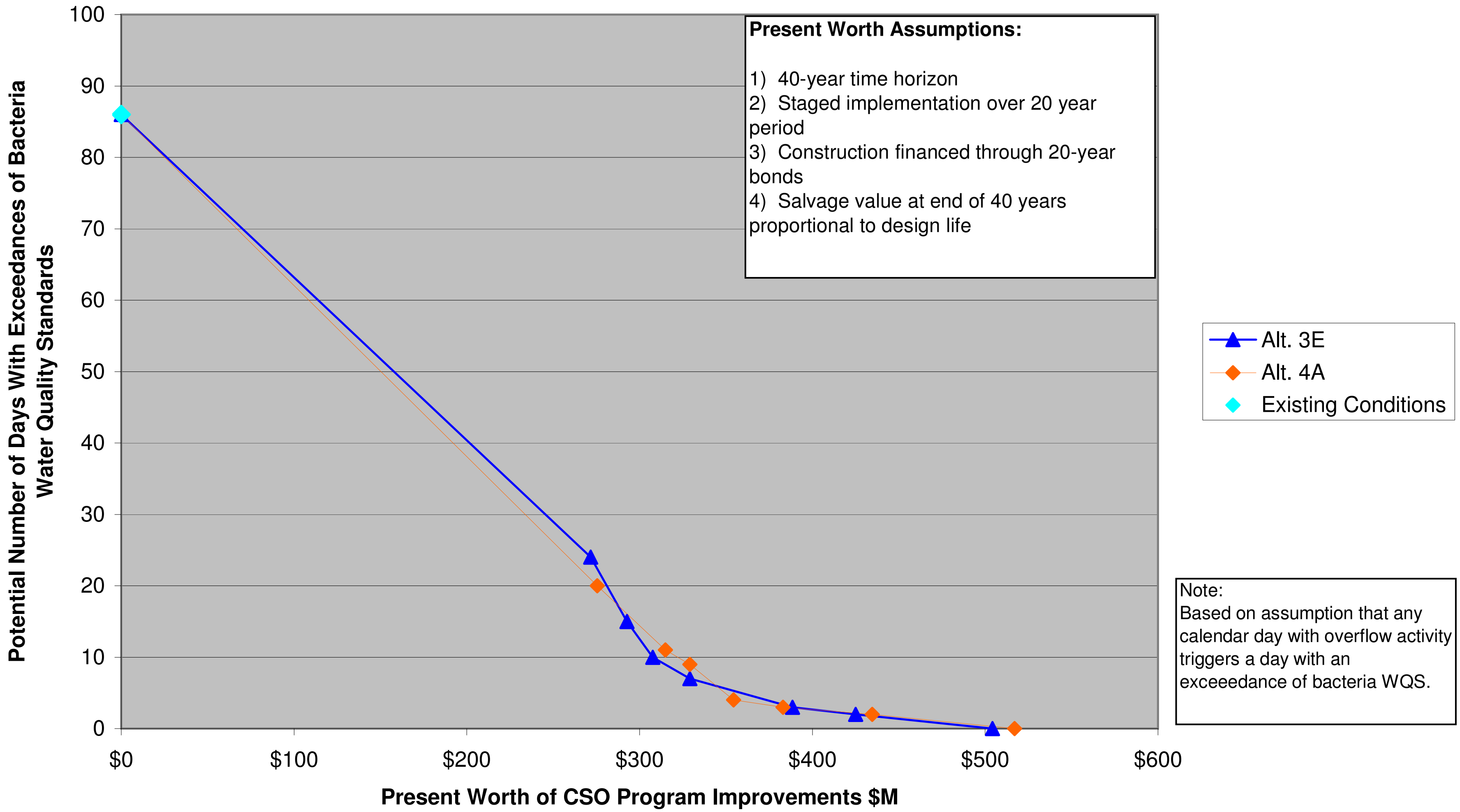
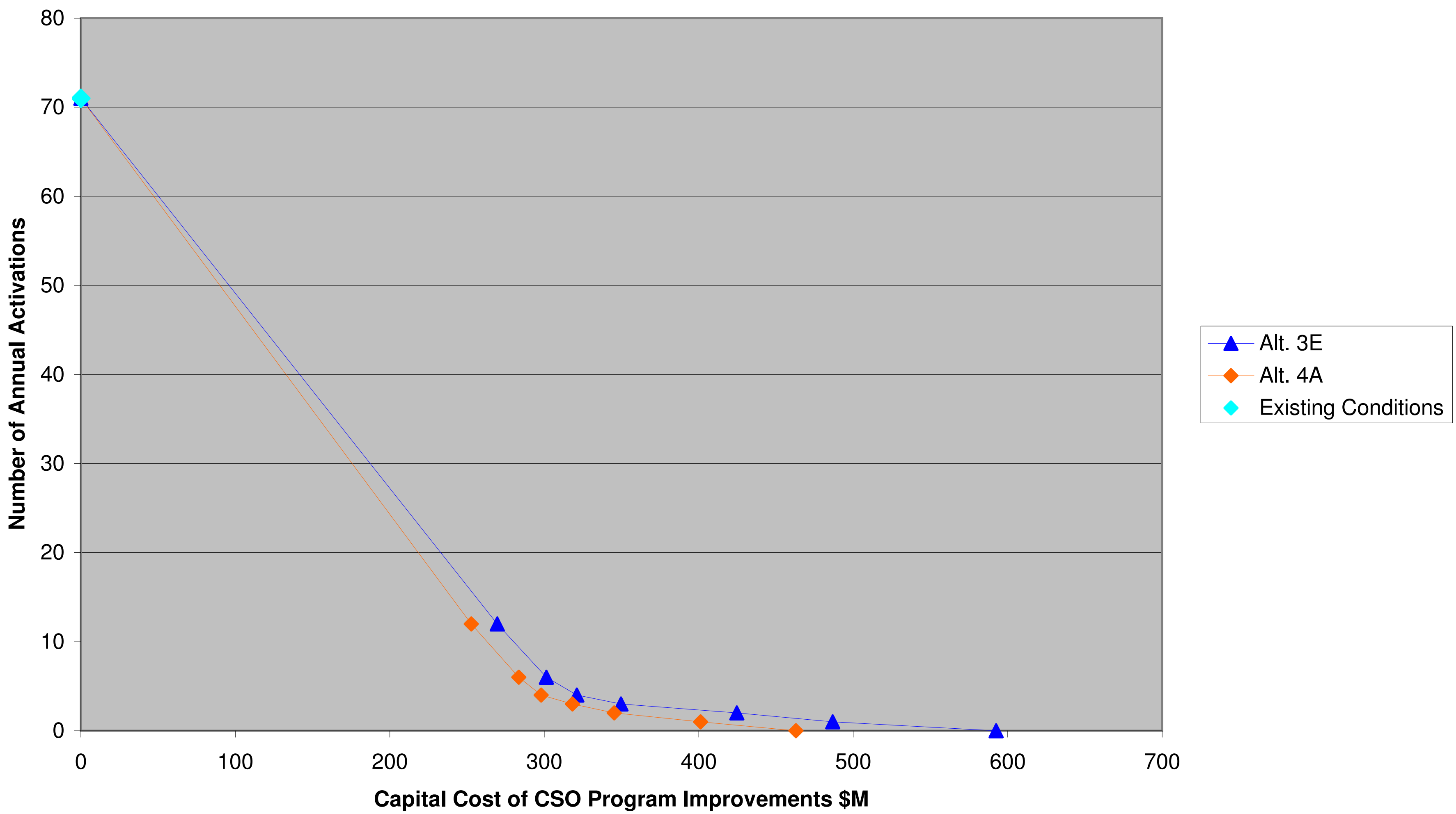


Figure 3.4.5.5
Cost/Performance Curves
Annual Activations In Terms of Capital Costs



ATTACHMENT 1

ATTACHMENT 1

CITY OF FORT WAYNE
CSO LONG TERM CONTROL PLAN
COST ESTIMATING METHODOLOGY

DECEMBER 2007

Table of Contents

1 INTRODUCTION

As part of developing the integrated alternatives under the City of Fort Wayne's CSO Long-Term Control Plan (LTCP), preliminary cost estimates were defined to serve as a selection criterion. The preliminary cost estimates include both capital costs and annual Operation and Maintenance (O&M) costs. This document presents the basis for the cost estimates developed for the various CSO Long Term Control Plan integrated alternative technologies. The procedures and assumptions used are documented here to support the sections of the CSO LTCP report where technologies and costs are presented.

The major collection system technology categories in the City's LTCP include the following:

- Tunnels
- Parallel Interceptor
- Satellite Storage Basin
- Satellite Disinfection Basin
- Complete Sewer Separation

The major CSO Pond technology categories include the following:

- Pump Station Rehabilitation
- Enhanced High Rate Clarification/High Rate Treatment
- Disinfection
- Flow Equalization
- First Flush Facility
- High Rate Mixing

Each of the above technology categories and costs are discussed in greater detail in Sections 3 and 4 of this document. All costs presented in this document are expressed using August 2005 as the baseline.

2 COMMON COST ELEMENTS

Common cost elements are those items that are usually included in all cost estimates in one form or another. The primary cost types are Capital and O&M.

2.1 Capital Costs

Capital costs generally include costs for engineering design, construction, and construction management. During the conceptual stage of the project cost development, construction costs are typically developed first based on the recommended physical improvements. A contingency of 25 percent is added to develop the total construction cost estimate. Non-construction costs, including engineering design and construction management costs, are assumed to be 25 percent of the total construction cost. The resultant total is considered the project capital cost estimate.

2.1.1 Construction Cost

Construction costs typically include the following items:

- equipment and materials
- labor and installation
- mobilization
- contractor general conditions, overhead, and profit

When available, past project bid tabs are used to estimate the construction costs for similar projects. Bid tabs are preferred because they are generally considered more accurate representations of the true construction cost than engineer's cost estimates. Bid tabs include the above-mentioned items either as direct costs or embedded in related bid items.

When bid tabs are not available for a particular project, equipment and material costs are obtained from either suppliers, past project cost estimates, Means Building Construction Data book, or cost curves developed from actual construction costs from similar projects. Labor and installation costs can be calculated based on prevailing wage rates or expressed as a percentage of the equipment or material costs and can vary widely depending on the project. Each improvement technology category uses the most appropriate method in developing costs for that particular technology. By nature, the methods are different for each category.

Unit costs were adjusted to August 2005 construction costs using the Engineering News Record Construction Cost Index (ENRCCI) factor, if appropriate. Generally, the unit costs and cost curves utilized include costs for items such as:

- Excavation, backfill, select fill.
- Excavation sheeting.
- Excavation dewatering.

- Manholes.
- Pavement/surface restoration.
- Piping materials.

Mobilization costs are the costs incurred by the contractor for moving equipment to and from the construction site and may include other ancillary costs as well. Contractor general conditions include miscellaneous items that sometimes are not accounted for in detailed cost estimates such as project trailer, project management, scheduling, miscellaneous equipment, accounting, scheduling, health and safety coordination, etc. Contractor overhead and profit is generally expressed as a percentage of the total construction cost.

Contingencies are those costs that cannot be accounted for at the time of construction cost development because of uncertainties. At the conceptual level, there are uncertainties associated with almost every design aspect of each project including sizes, depths, capacities, materials, operational sophistication, locations, alignments, and more. While each improvement concept has generally been developed conservatively, small changes in any of those aspects can have a large impact on the final project costs. Contingencies are assume to be 25 percent of the construction cost estimate. Therefore, total construction cost as described herein is equal to construction cost multiplied by a factor of 1.25.

2.1.2 Non-Construction Cost

Engineering and Construction Management costs, in most cases, include the costs for preliminary design, detailed design, assistance with bidding and awarding the construction contract, and for construction administration and site inspections. Non-construction cost is assumed to be 25 percent of the total construction cost estimate.

2.2 Operation and Maintenance (O&M) Costs

O&M costs are generally expressed as yearly costs for items needed to operate and maintain facilities and assets. O&M costs were calculated to provide a basis for maintenance planning and budgeting, and also to calculate the present worth of each alternative for comparison. The following discussion presents the sources for various O&M cost assumptions incorporated in the City's analysis.

There is very little operational data available from other municipalities to define O&M costs for large storage tunnel facilities. Therefore, tunnel O&M costs were derived from a cost curve developed from actual O&M costs for very large CSO detention basins constructed in Detroit (City of Detroit, CSO LTCP). Treatment basin O&M costs for screens, disinfection and pumping were taken from EPA/625/R-93/007 (Manual for Combined Sewer Overflow Control), September 1993, and EPA/430/9-78/009, October 1978. O&M costs for netting systems were also taken from EPA/625/R-93/007. O&M costs for high-rate treatment systems were calculated as a percentage of the construction cost of similar systems constructed as part of CSO studies performed for the cities of South Bend and Mishawaka, Indiana. Chemical costs included in the calculation were provided by manufacturers (Actiflo/Kruger). O&M costs for sewer separation alternatives were derived using O&M cost curves from the EPA Manual MCD-53 and were based on a cost per acre or a cost per length of sewer, respectively, both as functions of wastewater flow.

Analysis of all O&M costs revealed a generally consistent relationship, calculated as a percentage of the capital cost for each integrated alternative. For typical mixes of equipment, structure, and pipe, 1.65 percent was used. Predominately pipe projects used 0.5 percent, with some judgment adjustment where appropriate.

3 COLLECTION SYSTEM TECHNOLOGIES

3.1 Tunnels

To estimate tunnel cost, planning level cost estimates from the following three references were assembled and compared.

- The City's *Draft CSO LTCP*, Section 8.3.2.3 (2001).
- City of Columbus, Ohio *Wet Weather Management Plan*, Appendix U, Section U.3.1 (2005)
- City of Indianapolis, Indiana *Cost Estimating Procedures for Raw Sewage Overflow Control Program,* Section 6.2 (2004).

3.1.1 City of Fort Wayne Reference

Fort Wayne identified the costs associated with building a storage tunnel to include:

- The mining of the tunnel itself using a tunnel boring machine or conventional tunneling methods (such as the use of a shield).
- The construction of entrance and exit shafts (for the advancement and removal of the TMB prior to and following tunnel mining operations.
- The construction of work shafts (at regulators that will overflow to the tunnel; also includes drop shafts at the tunnel if the regulator is distant).
- Ventilation facilities.
- Odor control facilities.
- Pumping costs.
- Microtunnels (to direct the overflow of distant regulators to the tunnel).
- Shaft connections.
- Lining of tunnel, drop shafts, and entrance/exit shafts.
- Transport and disposal of tunnel cuttings.

Unit prices used for Fort Wayne's 2001 cost estimate for storage tunnels were obtained from a variety of sources, including Means Construction Costs Data Book, recent similar bids and previous evaluations. The unit costs for mining of the tunnel assume that the entire alignment can be constructed in bedrock. Construction in soil or mixed-face (soil and bedrock) tunneling would increase the unit cost for the tunnel.

In the original LTCP, there were two potential tunnel alignments. The different alignments had the same unit cost for the tunnel component, as both alignments provide the same storage volume. Given that the two potential alignments have different configurations, a separate unit cost was defined to account for the variability in length and diameter. These two unit cost methods were used to examine potential costs for the two tunnel configurations:

- Method 1 used a cost per gallon unit cost (based on bid tabs from similar projects) plus microtunnel costs.
- Method 2 used a cost per lineal foot for tunneling (based on bid tabs and Means costs), shafts and microtunnels.

Method 1 unit costs included contingencies, which are separate line items in Method 2. The total costs, costs per gallon, and annual O&M costs are summarized in EXHIBIT 3.1. O&M costs for the tunnel configurations were derived from curves developed from actual O&M costs for large CSO detention basins constructed in the City of Detroit, and are a function of the capital cost of the structures.

EXHIBIT 3.1 Comparison of Tunnel Cost Estimating Methods[1]

Tunnel	Cost Method	Total Cost	Final Cost / Gallon	Annual O&M
A	1	$260,836,000	$5.70	$616,100
B	1	$268,001,000	$5.86	$622,000
A	2	$133,700,000	$2.92	$492,300
B	2	$119,780,000	$2.62	$475,300

EXHIBIT 3.2 shows the cost calculations for Method 1, and EXHIBIT 3.3 and EXHIBIT 3.4 show the cost calculations for Method 2 for Tunnels A and B, respectively. Land acquisition and easement costs were not included in this estimate, nor were costs for traffic maintenance.

EXHIBIT 3.2 Summary of Tunnel Construction Costs for Method 1[1]

	Tunnel A Volume (gal)	Tunnel A Cost/Gal*	Tunnel A Total Cost
Tunnel	45,730,000	$5.41	$247,399,300
Microtunnels			$13,436,819
Total - Tunnel A		**$5.70**	**$260,836,119**
	Tunnel B Volume (gal)	**Tunnel B Cost/Gal***	**Tunnel B Total Cost**
Tunnel	45,730,000	$5.41	$247,399,300
Parallel Interceptor			$12,079,115
Microtunnels			$8,522,707
Total - Tunnel B		**$5.86**	**$268,001,162**

NOTES:
* This unit cost includes 25% for contingencies, and 25% for non-project costs.
Unit cost does not include land acquisition.

[1] City of Fort Wayne, Indiana *Draft CSO LTCP*, Section 8.3.2.3 (2001)

EXHIBIT 3.3 Summary of Tunnel Construction Costs for Method 2[1] Tunnel A				
Item	**Unit**	**Quantity**	**Cost**	**Total**
19' diameter tunnel	Length	21,900	2,572	56,327,019
Microtunnels:				
from J11163	Length	2,500	898	2,243,948
from K15009	Length	3,000	898	2,692,737
from K6231	Length	1,200	898	1,077,095
from L6087	Length	1,500	898	1,346,369
from M10150, 48, 99	Length	3,250	1,120	3,640,444
From O10311 and 12	Length	2,230	1,120	2,497,905
Entrance/Exit Shafts				
at K11162 and 63	Depth	80	6,719	537,498
at K6285	Depth	60	6,719	403,123
at P6014	Depth	40	6,719	268,749
Work Shafts				
at K15009	Depth	80	2,800	223,985
at J11163	Depth	80	2,800	223,985
at K6231	Depth	60	2,800	167,989
at L6438	Depth	60	2,800	167,989
At L6087	Depth	60	2,800	167,989
at M10150, 48, 99	Depth	60	2,800	167,989
@ tunnel	Depth	60	2,800	167,989
N6007	Depth	50	2,800	139,991
at O10311	Depth	50	2,800	139,991
@ tunnel	Depth	50	2,800	139,991
at P6119	Depth	40	2,800	111,993
Regulator Reconstruction	ea	12	112,014	1,344,164
Ventilation Duct and Fan	ea	5	398,924	1,994,620
Odor Control Facilities	ea	3	560,068	1,680,205
Outlet Control Structure	ea	1	1,680,204	1,680,205
Shaft Connections	ea	14	280,297	3,924,152
Pump Station	~40,000 gpm	1	2,090,000	2,090,000
			Subtotal	$85,568,112
			Contingency 25%	21,392,028
			Subtotal	106,960,140
			Non-Project Costs 25%	26,740,035
			TOTAL	**$133,700,175**

NOTE: Costs do not include land acquisition

EXHIBIT 3.4 Summary of Tunnel Construction Costs for Method 2[1] Tunnel B				
Item	**Unit**	**Quantity**	**Cost**	**Total**
25’ diameter tunnel	Length	12600	3,476	43,796,186
Microtunnels:				
from K6231	Length	1200	898	1,077,095
from L6087	Length	1500	898	1,346,369
from M10150, 48, 99	Length	3250	1,120	3,640,444
from O10311 and 12	Length	2230	1,120	2,497,905
Entrance/Exit Shafts				
at K6285	Depth	60	6,719	403,123
at P6014	Depth	40	6,719	268,749
Work Shafts				
at K6231	Depth	60	2,800	167,989
at L6438	Depth	60	2,800	167,989
at L6087	Depth	60	2,800	167,989
at M10150, 48, 99	Depth	60	2,800	167,989
@ tunnel	Depth	60	2,800	167,989
N6007	Depth	50	2,800	139,991
at O10311 and 12	Depth	50	2,800	139,991
@ tunnel	Depth	50	2,800	139,991
at P6119	Depth	40	2,800	111,993
Regulator Reconstruction	ea	9	112,014	1,008,123
Ventilation Duct and Fan	ea	3	398,924	1,196,772
Odor Control Facilities	ea	2	560,068	1,120,137
Outlet Control Structure	ea	1	1,680,205	1,680,205
Shaft Connections	ea	11	280,297	3,083,263
Parallel Interceptor (to SMI)	ea	1	12,079,155	12,079,155
Pump Station	~40,000 gpm	1	2,090,000	2,090,000
			Subtotal	$76,659,434
			Contingency 25%	19,164,859
			Subtotal	95,824,293
			Non-Project Costs 25%	23,956,073
			TOTAL	**$119,780,366**

NOTE: Costs do not include land acquisition

3.1.2 City of Columbus Reference

The City of Columbus developed cost curves for tunnels through a three-step process. The first step consisted of characterizing the ground conditions in the required locations and determining what construction methods would be appropriate for the required sewer size in those conditions. The second step consisted of estimating the costs for constructing some of the required sewers of several different diameters in representative conditions. The final step was to divide the cost of constructing the entire sewer including tunnels, drops, shafts, etc., by the length of the sewer in order to determine a unit cost for the sewer construction of that size, in those ground conditions.

All of the alignments and elevations were analyzed in regards to depth of cover requirements, bedrock elevations, soil types overlaying the bedrock, and expected groundwater conditions. This analysis was based on information contained in the bedrock elevation maps, groundwater resources maps, and the mapping associated with the overburden mapping program, all of which was obtained from the Ohio Department of Natural Resources.

The results of the geologic/hydrogeologic analysis indicated that the invert elevations were above the bedrock surface in the vast majority of the tunnel alignments, and that sufficient cover existed to prevent excessive costs for settlement prevention. The two main types of soil conditions expected to be encountered during tunnel construction would be glacial tills with thin lenses of sand, and sand and gravel with lenses of finer grained silts and clays. All of the tunnel construction should be expected to encounter boulders and all tunnel construction would be under the naturally occurring groundwater table.

Based on the geologic/hydrogeologic analysis it was determined that the construction cost estimates would require four different construction methods. These construction methods and the condition each is associated with are detailed below.

1. Standard non-pressurized shield tunneling utilizing a “two-pass” cast-in-place lining system. The lining system would consist of a “primary” lining placed immediately behind the tunneling shield, and the final cast-in-place liner would then be placed after the excavation is complete. This method would be used when the ground conditions are primarily till, and when the required sewer is larger than 9-foot diameter.

2. Standard non-pressurized shield tunneling utilizing a two-pass pipe-in-tunnel lining system. The lining system would consist of a primary lining placed immediately behind the tunneling shield, and the final liner would consist of pipe placed inside the tunnel and grouted in place. This was the type of system used on the Upper Scioto West Interceptor Sewer tunnel project in Columbus. This method would be used when the ground conditions are primarily till, and when the required sewer is 9-foot diameter or smaller.

3. Pressurized shield tunneling utilizing a “one-pass” precast concrete segment lining system. The final liner is placed immediately behind the excavation in a one-pass lining system. This is the type of system that is currently being installed on the Big Walnut Augmentation Rickenbacker Sanitary Interceptor (BWARI) tunnel project in Columbus. This method will be used when the ground conditions are primarily sand and gravel, and when the required sewer is larger than 9-foot diameter.

4. Pressurized shield tunneling utilizing “pipe jacking” to install the final liner. This system is often referred to as microtunneling, in which the shield in pushed into the

ground with the pipe that will serve as the sewer once the excavation is complete. This method will be used when the ground conditions are primarily sand and gravel, and when the required sewer is 9-foot diameter or smaller.

Based on the geologic/hydrogeologic analysis done for the City of Columbus, it was determined that the tunnels which were north of Spring Street were appropriate for the construction outlined in 1 and 2 in the list above. All other tunnels required the methods as outlined in 3 and 4 listed above.

The procedure followed to develop the cost curves consisted of performing cost estimates for tunnels that are 5, 7, 9, 10, and 13 feet in diameter assuming construction north of Spring Street, representing one type of geologic condition. For the tunnels south of Spring Street, cost estimates were performed for sewers that are 5, 7, 9, 10, 12, and 13 feet in diameter, representing another type of geologic condition, generally.

The costs include the drop shafts, access points, tunnel boring machines, liners and assume available land for mucking operations. The primary cost estimating assumptions used to develop these cost curves were the following.

- Contractor overhead and profit 20%
- Construction cost contingency 40%

The costs shown in EXHIBIT 3.5 are for constructing the tunnels, drops, and access structures only, and include contractor overhead and profit and construction contingency. Design, Construction Management, Land Acquisition, etc. are not included.

EXHIBIT 3.5 Tunnel Capital Cost Estimates [2]

Pipe Diameter (feet)	North of Spring Street ($/LF)	South of Spring Street ($/LF)
5	$3,500	$4,100
7	$3,700	$4,500
9	$3,900	$4,900
10	$4,500	$5,800
12	$4,800	$6,400
13	$4,900	$6,600

*Cost estimates above include 20% Contractor Overhead & Profit and 40% Contingency.
Design, Construction Management, and Land Acquisition costs are **not included.

[2] City of Columbus, Ohio *Wet Weather Management Plan*, Appendix U, Section U.3.1 (2005)

3.1.3 City of Indianapolis Reference

EXHIBIT 3.6 presents the base construction costs for deep tunnels developed by the City of Indianapolis. These costs are based on the cost equation below.

*Cost ($ per LF) = (current ENRCCI/6635) * (1450 + 145 D)*

Where: D = Inside tunnel diameter

EXHIBIT 3.6 Deep Tunnel Construction Costs[3]	
Inside Diameter (feet)	**Cost per Linear Foot ($)**
5	2,175
10	2,900
15	3,625
20	4,350
25	5,075
30	5,800
35	6,525

The costs include mobilization, tunnel shafts, dewatering, material disposal and tunnel lining. Costs represent a complete tunnel in place, without any ancillary features such as deep pump stations or odor control facilities. These shall be added by the estimator, if needed. Costs not included in the base, but that may apply based upon site-specific considerations, include excess dewatering, utility relocation, boulder zone, and pavement restoration.

Tunnel costs assume tunneling in good rock, limited groundwater, no grouting, no ground gasses and an open faced tunnel boring machine. While the rock conditions in Indianapolis have not yet been sufficiently defined, initial assessments indicate geology at the intended tunneling depth to be sedimentary dolomite, limestone and shale formations.

[3] City of Indianapolis, Indiana *Cost Estimating Procedures for Raw Sewage Overflow Control Program,* Section 6.2 (2004)

3.1.4 Tunnel Cost Model Selection

Each reference's unit cost was adjusted to incorporate similar assumptions and components, and was converted to 2005 dollars. The costs were indexed using the ENRCCI to develop August 2005 cost information. EXHIBIT 3.7 presents a summary of the adjusted unit costs used for comparison purposes.

EXHIBIT 3.7 Tunnel Construction Cost Estimates ($/LF) [(a)]

City of Fort Wayne[1] (14-foot dia.)	City of Columbus[2] (13-foot dia.)	City of Indianapolis[3] (15-foot dia.)
$3,984	$4,620	$5,035

(a) Construction only; no contingencies are included.

Consolidating all of the above information, the costs derived for tunnel construction in the City's LTCP were based on the following cost curve equation.

*Cost ($ per LF) = 1.127130369 * (1600 + 160 D)* *Equation (1)*

Where: D = inside tunnel diameter (ft)

3.2 Parallel Interceptor to CSO Ponds

To estimate the parallel interceptor cost, planning level cost estimates from the following three references were assembled and compared.

- The City's *Draft CSO LTCP*, Section 8.9.2.5 (2001).
- City of Columbus, Ohio *Wet Weather Management Plan*, Appendix U, EXHIBIT U.3.10 (2005)
- City of Indianapolis, Indiana *Cost Estimating Procedures for Raw Sewage Overflow Control Program*, Table 9 (2004).

3.2.1 City of Fort Wayne Reference

The preliminary cost estimate for the City of Fort Wayne parallel interceptor was developed in 2001 based on a series of design storm modeling analyses of the collection system. The parallel interceptor size was optimized with the modeling analysis to carry the selected control level wet-weather flows from various existing regulators without surcharging. The parallel interceptor costs, broken down by the length required for each pipe diameter, are provided in EXHIBIT 3.8.

EXHIBIT 3.8 Estimate of Capital Costs for Parallel Interceptor Alternative A[4]

Sewer Diameter (ft)	Sewer Length (ft)	Cost
2	5,248	$760,100
3	5,909	$1,197,700
4	572	$248,000
7	9,764	$5,595,300
8	15,784	$14,459,000
12	1,608	$2,520,500
Total	**38,885**	**$24,780,400**
25% Contingency Cost		$6,195,100
Total (Construction + Contingency)		$30,975,500
25% Engineering Cost		$7,743,875
Total Cost (Construction + Contingency + Engineering)		**$38,719,375**

Reach-specific, detailed costs of the parallel interceptor to convey wet-weather flows to the CSO Ponds and WPCP are provided in EXHIBIT 3.9. EXHIBIT 3.10 provides a summary of total estimated costs. The costs for regulators O10311 and O10312 was based upon the assumption that overflows would be conveyed directly to the CSO Ponds. Presently, the required Morton Street Pump Station improvements are in the design stage under the CSCI Program. The capital costs required for the river crossing to the CSO Ponds and the cost for additional capacity at the WPCP were not included in the cost estimate.

[4] City of Fort Wayne, Indiana *Draft CSO LTCP*, Section 8.9.2.5 (2001)

EXHIBIT 3.9 Reach-Specific Estimates of Capital Costs for Parallel Interceptor Alternative A[4]					
Parallel Sewer Segment	**Sewer Dia. (ft)**	**Length (ft)**	**Depth of Cut (ft)**	**Construction Cost ($/LF)**	**Cost**
O10273 to New Sewer	2	1,120	15	157	$175,560
L19018 to K11163	2	2,994	13	136	$406,762
L19018 to K11163	2	1,134	15	157	$177,736
L19018 to K11163	3	2,993	15	209	$625,589
J11163 to K11162	3	2,716	11	188	$510,810
River Crossing at J11163	3	200		306	$61,258
M10150 to Clinton St.	4	572	22	314	$179,416
K11163 to K06285	7	1,298	12	481	$623,968
K11163 to K06285	7	951	13	491	$466,838
K11163 to K06285	7	1,028	15	523	$536,884
K11163 to K06285	7	1,030	18	554	$570,621
K11163 to K06285	7	1,208	23	627	$757,548
K11163 to K06285	7	964	21	601	$579,063
K11163 to K06285	7	1,083	19	564	$610,996
K11163 to K06285	7	669	23	627	$419,689
K11163 to K06285	7	358	25	669	$239,250
K11163 to K06285	7	769	25	669	$514,240
K11163 to K06285	7	407	26	679	$276,129
K06285 to K06231	8	634	23	747	$473,806
K06285 to K06231	8	515	22	732	$376,744
K06231 to L06102	8	986	22	732	$721,237
River Crossing at K06231	4	200		343	$68,573
L06102 to L06098	8	378	23	747	$282,148
L06098 to L06088	8	1,176	25	810	$952,178
L06088 to M01256	8	1,349	29	867	$1,170,437
L06088 to M01256	8	944	31	930	$877,530
L06088 to M01256	8	401	29	867	$347,478
L06088 to M01256	8	466	29	867	$404,315
M10256 to Q06057	8	1,114	28	857	$954,287
M10256 to Q06057	8	906	30	920	$833,461
M10256 to Q06057	8	2,025	36	1,024	$2,073,925
M10256 to Q06057	8	1,221	41	1,129	$1,377,648
M10256 to Q06057	8	987	42	1,134	$1,118,677
M10256 to Q06057	8	1,308	37	1,066	$1,393,984
M10256 to Q06057	8	256	33	961	$245,936
M10256 to Q06057	8	920	31	930	$855,200
Q06057 to Ponds	12	1,608	26	1,568	$2,520,493
				Total Construction Cost	**$24,780,414**
				25% Contingency Cost	**$6,195,103**
				Total (Construction + Contingency)	**$30,975,517**
				25% Engineering Cost	**$7,743,879**
				Total (Construction + Contingency + Engineering)	**$38,719,396**

EXHIBIT 3.10 Summary of Total Estimated Cost for Parallel Interceptor Alternative A[4]			
Task Description	**Quantity**	**Unit Cost**	**Cost**
New Parallel Interceptor	7.4 miles	$130 to $1,500 ($/LF)	$38,719,396
Regulator Upgrade	17	$52,250	$888,250
Regulator O10312 *	1	-	$4,590,267
River Crossing at CSO Ponds	-	-	See note (a)
Upgrade Capacity of WPCP to 85 MGD	-	-	See note (b)
Total			**$44,197,913**

Notes:
(a) The parallel interceptor alternative costs do not include costs for a required river crossing
(b) Budgeted elsewhere, independent of Parallel Interceptor
"*" Also includes Regulator O10311

3.2.2 City of Columbus Reference

To develop cost for open cut sanitary sewer installations, bid tabulations from the City of Columbus were obtained and divided into relief sewer installation versus general sewer installation. It was assumed that relief sewers are relatively straight connections from one manhole to another, and general installation requires reconnection of laterals.

The bid tabulations were first analyzed to determine if there were multiple pipe sizes represented or a singular pipe size. It was assumed that if 75% or more of the piping was of one size, that project cost was "mostly" attributable to that pipe size. The lowest and second lowest bids were then divided by the total length of the project pipe to develop a benchmark cost per linear foot for that pipe size.

Using the developed benchmarks, the original lengths of pipe by size for each of the bids was multiplied by the benchmark unit costs. The total project cost was compared to the lowest and next lowest bids. Adjustments were made to the unit prices until the calculated project costs were equal to or greater than the lowest and next lowest bids. Unit costs were assumed appropriate if the calculated project costs were within 30% of the actual bids.

EXHIBIT 3.11 provides City of Columbus unit costs per linear foot of sanitary sewer pipe. Assumptions contained in the unit costs include:

- Because the unit costs were developed from the total bid prices, the unit prices shown generally include ancillary costs such as excavation and backfill, surface restoration, bypass pumping, etc.

- Although nearly all construction is assumed to occur in the City's right of way, it is possible and probable that temporary easements will be necessary. The cost of these easements will vary significantly depending on the project's location. Therefore, these costs have not been included in the unit cost estimates presented.
- Mobilization, contractor general conditions, bonds and permits, and contractor overhead and profit are all included in the unit costs. Land acquisition, engineering and construction management, and the contingency markup elements are not included, since the researched costs are "as-bid" costs and do not reflect change orders or final project costs.

EXHIBIT 3.11 Sanitary Sewer Pipe Unit Costs[5]				
Pipe Size (inches)	**General Installation ($/LF)**	**Urban General Installation ($/LF)**	**Relief Sewers Installation ($/LF)**	**Relief Sewer Urban Installation ($/LF)**
8	$ 248	$ 422	$ 248	$ 422
10	$ 310	$ 527	$ 310	$ 527
12	$ 372	$ 632	$ 375	$ 638
15	$ 465	$ 791	$ 435	$ 740
18	$ 558	$ 949	$ 455	$ 774
21	$ 651	$ 1,107	$ 475	$ 808
24	$ 744	$ 1,265	$ 495	$ 842
27	$ 837	$ 1,423	$ 515	$ 876
30	$ 930	$ 1,581	$ 530	$ 901
36	$ 1,116	$ 1,897	$ 550	$ 935
42	$ 1,302	$ 2,213	$ 570	$ 969
48	$ 1,488	$ 2,530	$ 590	$ 1,003
54	$ 1,674	$ 2,846	$ 610	$ 1,037
60	$ 1,860	$ 3,162	$ 630	$ 1,071
66	$ 2,046	$ 3,478	$ 650	$ 1,105
72	$ 2,232	$ 3,794	$ 670	$ 1,139

Note: "General Installation" refers to installation which includes lateral tie-ins. "Relief Sewer Installation" refers to an installation from an upstream manhole to some downstream manhole with no lateral tie-ins.

[5] City of Columbus, Ohio *Wet Weather Management Plan*, Appendix U, EXHIBIT U.3.10 (2005)

3.2.3 City of Indianapolis Reference

EXHIBIT 3.12 presents the City of Indianapolis base construction costs for reinforced concrete pipe (RCP) sewer construction. The pipe is assumed to be RCP Class IV with gaskets and PVC liner for corrosion protection.

EXHIBIT 3.12 Sewer Construction Costs[6]	
Diameter (inches)	**Cost per Linear Foot ($)**
12	$47
15	$53
18	$61
24	$77
30	$117
36	$151
42	$192
48	$250
60	$272
72	$349
84	$487
96	$975

The cost includes excavation, sheeting and bracing, bedding, backfill, disposal, compaction, and pipe with an average depth of 16 feet not including rock excavation. Manholes and appurtenances are added by means of the site adjustment factors. Pavement restoration, traffic routing and extensive dewatering are also covered by these adjustment factors. The estimator is responsible for applying these factors to represent anticipated conditions.

For sewers greater than 0.5 miles in length, the following discount is applied:

- 5 percent for greater than 0.5 miles
- 10 percent for greater than 2 miles
- 15 percent for greater than 5 miles

For sewers less than 200 feet in length, an additional 10 percent is added to the pipe cost.

[6] City of Indianapolis, Indiana *Cost Estimating Procedures for Raw Sewage Overflow Control Program,* Table 9 (2004)

3.2.4 Parallel Interceptor Cost Model Selection

Each reference's unit costs were averaged and converted to 2005 dollars. The costs were indexed using the ENRCCI to develop August 2005 cost information. EXHIBIT 3.13 presents a summary of the averaged unit costs.

EXHIBIT 3.13
Parallel Interceptor Construction Cost Estimate[a]

Diameter (inch)	Average Cost ($/LF)
24	$177
30	$195
36	$235
42	$245
48	$328
60	$303
72	$354
84	$658
96	$1,117
102	$1,193
108	$1,313
120	$1,567
144	$2,114

(a) Construction only; no contingencies are included.

The following cost curve equation was derived from the parallel interceptor construction unit costs in EXHIBIT 3.13.

*Cost ($ per LF) = 97.789 * EXP(0.2732 * D)* *Equation (2)*

Where: D = Interceptor diameter (ft)

3.3 Satellite Storage Basin

To estimate satellite storage basin cost, planning level cost estimates from the following three references were assembled and compared.

- The City's *Draft CSO LTCP*, Section 8.4.2.3 (2001).
- City of Columbus, Ohio *Wet Weather Management Plan*, Appendix U, Section U.3.6 (2005)
- City of Indianapolis, Indiana *Cost Estimating Procedures for Raw Sewage Overflow Control Program*, Section 6.1, Table 20 (2004).

3.3.1 City of Fort Wayne Reference

In 2001, the City of Fort Wayne estimated costs for storage basins based on curves developed from bids for similar basins, ranging from \$3.35/gallon to \$7.85/gallon. The costs associated with building storage basins include construction of concrete basins, pumps and screens, odor control, land acquisition where necessary, excavation and backfill, piping, and contingencies. Other costs include fencing, an access road, a control building (for pumps), tie-down anchor systems, and a washdown system.

EXHIBIT 3.14 summarizes the preliminary costs that were developed by the City of Fort Wayne for storage basins.

EXHIBIT 3.14
Summary of Storage Basin Costs[7]

Volume (ft^3)	Cost[(a)] (\$)
1,691,600	\$42,312,194
941,700	\$25,763,123
632,370	\$18,783,337
704,500	\$20,650,480
538,983	\$16,641,407
348,000	\$11,696,760
177,200	\$7,341,038
371,683	\$12,347,514
115,600	\$5,421,594
92,910	\$4,720,562
208,900	\$8,082,794
153,300	\$6,770,309
229,800	\$8,622,022
80,520	\$4,720,445
110,000	\$5,330,921

(a) Includes contingencies and non-construction costs.

[7] City of Fort Wayne, Indiana *Draft CSO LTCP*, Section 8.4.2.3 (2001)

3.3.2 City of Columbus Reference

The City of Columbus estimated cost of off-line below ground storage tanks with the following components: a buried concrete tank with internal and external coating, a tank flushing system to minimize sediment accumulation, pertinent valving and on-site piping to convey sewage into and out of the tank, site development, and land acquisition.

To develop storage tank costs, a literature search was completed. Most of the researched tanks were within public parkland or suburban areas. An initial review of just the land cost difference between areas around flow regulators located in the heart of the Columbus business district and those regulators located in less urban areas reflected a factor of 1.2 for urban land versus suburban. Bid tabulations for pipe within the downtown area versus the suburban areas also reflected a difference resulting in a factor of between 1.2 and 1.8. The following facilities were obtained through an internet search of facilities:

- Kenduskeag, Maine CSO storage facility- developed through installation of a series of precast box sections and placed underneath a parking facility. Completed in 2001. Storage of 1.2 Million Gallons (MG).
- Davis Brook (Bangor, Maine) CSO storage facility- an in-line tunnel-like structure constructed of precast concrete box sections located along a waterfront park area. Included washdown facilities, odor control and overflow controls. Completed in 1998. Storage of 1.2 MG.
- Cloverdale, Vancouver, BC CSO storage facility- circular tank design with flushing mechanism, includes landscaping, on-site piping. Completed in 2003. Storage of 1.8 MG.
- Wethersfield, CT storage facility- a concrete tank accepting flow from seven overflow points within the system. Includes wash-out facilities and limited control technology. Completed in 2003. Storage of 3.6 MG.
- Wethersfield, CT storage facility- a concrete tank accepting flow from largest overflow point within the system. Includes wash-out facilities and limited control technology. Completed in 2003. Storage of 5.4 MG.
- Seattle, WA storage facility- a concrete tank with limited control technology and wash-out facilities in suburban Seattle along river front. Completed in 1999. Storage of 14 MG.
- Akron, Ohio No. 40 storage facility- a “trash rack” rehabilitation and addition of a large storage facility located in a suburban area of Akron, Ohio. Includes concrete tankage, trash rack rehabilitation, on-site piping, limited control technologies. Completed in 2004. Storage of 15.3 MG.
- Detroit, Michigan storage facility- a “smaller” basin within the Detroit system located near the Tournament Players Championship golf course in Detroit. Completed in 2001. Storage of 22 MG.

The costs from each of these facilities were indexed by Columbus using the Engineering News Record Construction Cost Index to develop January 2005 cost information.

The EPA Fact Sheet for Combined Sewer Overflows, dated September 1999, was used for a check between the researched facilities and EPA's information. Finally, the factor provided in the City of Indianapolis' "Cost Estimating Procedures for Raw Sewage Overflow Control Program," 2004, was also used to determine if the overall costs were consistent with other costing methodologies.

3.3.2.1 Capital Costs

The capital costs for the off-line below ground storage tanks are to be divided into components that lend themselves to determining salvage values. These components have been identified as buildings, equipment, and miscellaneous. Because the costs developed as part of this section were based on total costs identified through a literature search, specific breakdowns cannot be easily defined. For the purposes of this section, some assumption will be made:

- The cost of excavation and backfill are included as part of the building.
- Land costs are assumed to be minor, since many of the tanks researched were located in municipally owned land.
- Telemetry equipment and control technology are assumed to be 5% ["Innovative and Alternative Technology Assessment Manual", USEPA, MCD-53, February 1980 (specifically Table A-2)] of the overall cost.
- Piping is assumed to be 8% ["Innovative and Alternative Technology Assessment Manual", USEPA, MCD-53, February 1980 (specifically Table A-2)] of the overall costs.

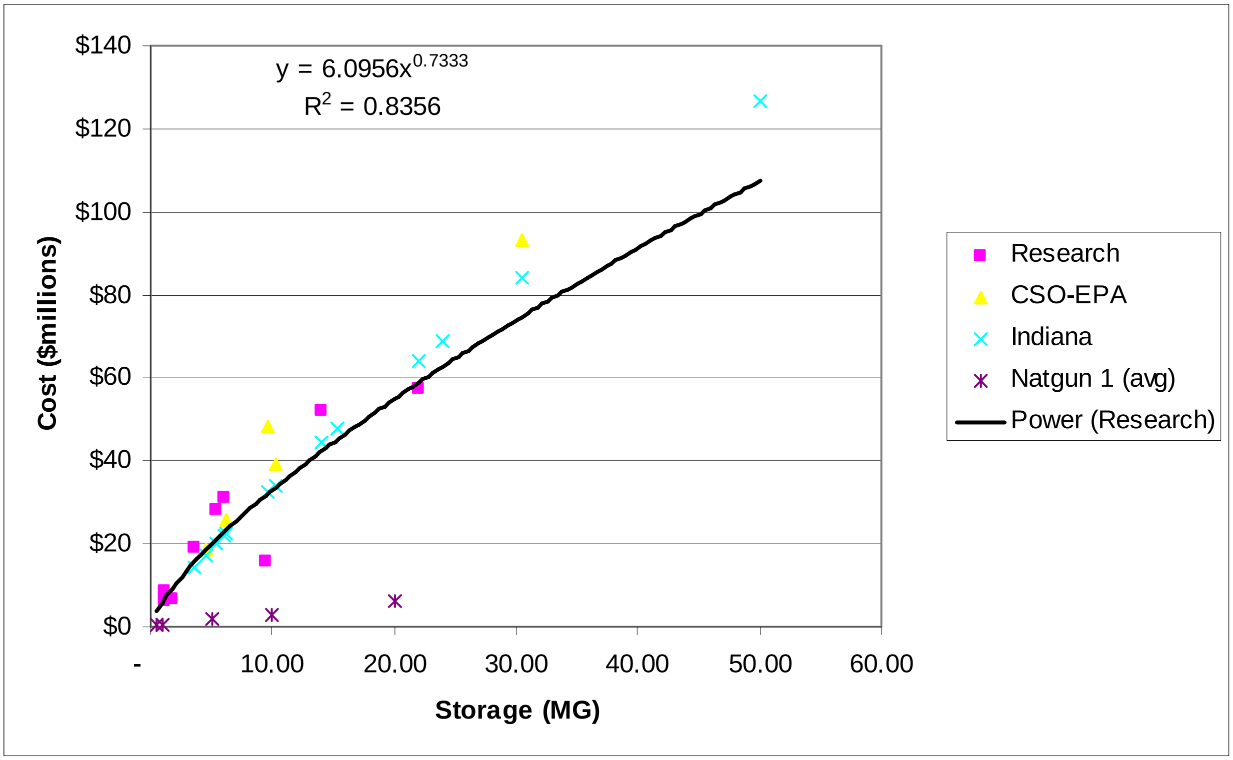
The resultant information is provided on EXHIBIT 3.15. It should be noted that an equation can be derived for the City of Columbus tank costs as follows:

$$CostofStorage = 6.0956 \times Volume^{0.7333}$$

Cost of storage is expressed in dollars, volume is expressed in gallons. Mobilization, contractor general conditions, bonds and permits, and contractor overhead and profit are all included in the tank cost equation. Land acquisition, engineering and construction management, and the contingency markup elements are not included in this cost.

A local tank representative was contacted for costs for below ground storage tanks, as well. The representative provided "tank only" costs. These were compared to the equation derived from other sources. Typically, the tank only costs represent approximately between 9 and 13% of the total cost.

EXHIBIT 3.15 Storage Tank Capital Cost Curve[8]



3.3.3 City of Indianapolis Reference

EXHIBIT 3.16 presents the base construction costs for subsurface storage. Cast-in-place tanks were assumed to be installed below grade with a covered top, including excavation, backfill and disposal of excess. Baffling was not required but represents a nominal increase (when applied for a chlorine contact chamber). Excavation dewatering is not included; property requirements are applied as an additional cost after construction. If pump station costs or disinfection facilities are desired at one of these sites, the costs for these technologies in other equations may be added. An equation adjustment factor of 0.50 was applied to better reflect local construction costs.

[8] City of Columbus, Ohio *Wet Weather Management Plan*, Appendix U, Section U.3.6 (2005)

EXHIBIT 3.16 Cast-in-Place Tank Subsurface Storage Construction Costs[9]		
Storage Volume (MG)	Construction Cost ($)	Unit Construction Cost ($/gallon)
0.15	525,000	$3.50
0.3	930,000	$3.10
0.5	1,418,000	$2.84
0.8	2,091,000	$2.61
1	2,514,000	$2.51
3	6,228,000	$2.08
5	9,497,000	$1.90
8	14,002,000	$1.75
10	16,836,000	$1.68
15	23,533,000	$1.57
20	29,846,000	$1.49
25	35,886,000	$1.44
30	41,719,000	$1.39

These costs apply for facility sizes in the range of 0.15 and 30 MG. Beyond 30 MG, multiple storage cells would be expected, and these costs represent those of an individual cell.

3.3.4 Satellite Storage Basin Cost Model Selection

Each reference's unit cost was adjusted to incorporate similar assumptions and components, and was converted to 2005 dollars. The total costs were indexed using the ENRCCI to develop August 2005 cost information. EXHIBIT 3.17 presents a summary of the adjusted unit costs used for comparison purposes.

EXHIBIT 3.17 Satellite Storage Basin Construction Cost Estimates [a]		
City of Fort Wayne	City of Columbus	City of Indianapolis
$26.07/CF	$58.98/CF	$35.75/CF
$3.48/gal	$7.88/gal	$4.78/gal

(a) Construction only; no contingencies are included.

The costs derived for satellite storage basin construction were based on the following cost equation.

$$Cost = 40 * (V) \qquad \text{Equation (3)}$$

Where: V = Volume of basin (CF)

[9] City of Indianapolis, Indiana *Cost Estimating Procedures for Raw Sewage Overflow Control Program,* Section 6.1, Table 20 (2004)

3.4 Satellite Disinfection Basin

In 2001, the City's Draft CSO LTCP used unit prices to estimate costs for treatment basins obtained from a variety of sources, including tank vendors, EPA guidance documents, Means Construction Costs Data Book, similar project bids, and previous evaluations. Costs for treatment basins ranged from \$5.75/gallon to \$25.10/gallon. Costs associated with building treatment basins include construction of concrete basins, pumps and screens, odor control, chlorine inductors, land acquisition where necessary, excavation and backfill, piping, and contingencies. Other costs include fencing, an access road, a control building (for pumps and disinfection facilities), tie-down anchor systems, and a washdown system.

To estimate satellite disinfection basin cost, planning level cost estimates from the 2001 draft CSO LTCP were evaluated and adjusted to remove contingencies and update to 2005 dollars. The total costs were indexed using the ENRCCI to develop August 2005 cost information. EXHIBIT 3.18 summarizes the preliminary disinfection basin costs.

EXHIBIT 3.18
Summary of Disinfection Basin Costs [7]

Q_{peak} (cfs)	2001 Cost (\$)	2005 Adjusted Cost[(a)] (\$)
132.2	\$10,359,294	\$6,350,171
47.2	\$4,304,146	\$2,638,410
34.8	\$3,450,590	\$2,115,186
33.2	\$3,317,562	\$2,033,641
23.7	\$2,828,397	\$1,733,786
15.5	\$1,967,840	\$1,206,271
15.2	\$2,007,654	\$1,230,677
11.7	\$1,619,019	\$992,447
11.5	\$1,625,289	\$996,290
8.7	\$1,343,766	\$823,719
8.1	\$1,259,748	\$772,216
8	\$1,274,169	\$781,056
7.6	\$1,209,170	\$741,212
5.9	\$1,054,301	\$646,279
3.8	\$810,130	\$496,604

(a) Construction only; no contingencies are included.

The following cost equation was derived for satellite storage basin construction.

$$Cost = Q \times 45{,}137 + 465{,}881 \qquad \text{Equation (4)}$$

Where: Q = Peak overflow rate (cfs)

3.5 Complete Sewer Separation

In 2001, the City's Draft CSO LTCP detailed complete sanitary sewer separation for Subbasin K11010 to eliminate Regulators K11163 and K11162. For complete sewer separation in Subbasin K11010, it was assumed that existing combined sewers would be used to convey storm sewer flows and a new sanitary sewer system would be constructed adjacent to the combined sewers to carry sanitary sewer flows. The cost estimate for complete separation was generated using an assumed depth of 8 feet for the collector sewers, with the sewers getting progressively deeper as the pipe diameter increases. Pipe quantities were estimated by breaking the entire area into smaller sanitary subbasins that loosely follow the existing stormwater basins. Lateral reconnections were assumed to include only the cost of reconnecting the laterals to new sanitary sewers. The cost of the removal of private property infiltration/inflow (I/I) sources was excluded. It was assumed that the average length of lateral was 100 feet.

Total cost per acre of combined sewer area was calculated and adjusted based on the 2001 cost estimate for Subbasin K11010. The total costs were indexed using the ENRCCI to develop August 2005 cost information. EXHIBIT 3.19 lists assumptions and details used to calculate the 2005 cost per acre for complete sewer separation.

EXHIBIT 3.19
Complete Sewer Separation Costs[10]

Component	2001 Cost ($)	2005 Adjusted Cost ($)
Sanitary Sewer Pipe	$6,961,200	-
Storm Sewer Pipe	$408,000	-
Storm and Sanitary Sewer Manholes	$2,241,013	-
Surface Restoration	$1,303,222	-
Lateral Connections	$7,850,000	-
Construction Subtotal	$18,764,000	-
Cost Per Acre (1623 Total Acres)	**$11,561**	**$14,174**
Add Technology-Specific 25% + 25% Contingency Cost		$22,147
Add $10,000 Per Acre for New Private Laterals		$10,000
Total Cost Per Acre		**$32,147**

Therefore, the following cost equation was used for complete sewer separation.

$$Cost = No.\ of\ Acres \times 32{,}147 \qquad \text{Equation (5)}$$

[10] City of Fort Wayne, Indiana *Draft CSO LTCP*, Table 8-31 (2001)

4 CSO POND TECHNOLOGIES

4.1 Pump Station Rehabilitation

The CSO pumping facilities would include rehabilitation of the existing 150-mgd pumps and the addition of a new 150-mgd pump; rehabilitation of the existing pre-engineered pump building; rehabilitation of the mechanically cleaned trash rack; and, the addition of new electrical and instrumentation and control (I&C) equipment.

The 2001 draft CSO LTCP developed preliminary project costs for a series of design flows ranging from 150-mgd to 350-mgd. It is important to note that capital improvement projects to rehabilitate the two existing 150-mgd pumps and construct a flood control levee to protect the pump station, would take place irrespective of this alternative. Therefore, total costs for these items were not included in the cost estimate. Pump station rehabilitation costs are summarized in EXHIBIT 4.1. The costs were indexed using the ENRCCI to develop August 2005 cost information.

EXHIBIT 4.1
Pump Station Rehabilitation Costs[11]

Q_{peak} (mgd)	Q_{peak} (cfs)	2001 Cost $	2005 Adjusted Cost[(a)] $
150	232	$596,000	$730,687
200	309	$700,000	$858,190
250	387	$2,038,000	$2,498,558
300	464	$2,038,000	$2,498,558
350	542	$2,142,000	$2,626,060

(a) Construction only; no contingencies are included.

Therefore, an equation was developed which allowed for the costing of the pump station based solely on the pumping rate.

$$Cost = Q \times 7{,}020 - 873{,}147 \qquad \text{Equation (6)}$$

Where Q = Peak flow to CSO Ponds (cfs)

4.2 Enhanced High Rate Clarification/High Rate Treatment

The EHRC/HRT facility would include concrete tankage for chemical (e.g., polymer, coagulants, and ballast sand or biological solids) addition, flash mixing, gentle mixing and sedimentation; chemical feed and pumping facilities and associated building; settling facilities; self cleaning fine screens; yard piping; and electrical and I&C equipment.

[11] City of Fort Wayne, Indiana *Draft CSO LTCP*, Table 8-13 (2001)

The 2001 draft CSO LTCP developed preliminary project costs for a series of design flows ranging from 150-mgd to 350-mgd. EXHIBIT 4.2 summarizes costs developed for Fort Wayne and an average cost per gallon developed for the City of Columbus. The costs were indexed using the ENRCCI to develop August 2005 cost information.

EXHIBIT 4.2
EHRC Facility Costs[11, 12]

Q_{peak} (mgd)	Q_{peak} (cfs)	Fort Wayne 2001 Cost $	Fort Wayne 2005 Adjusted Cost[(a)] $	Fort Wayne 2005 Cost[(a)] $/mgd	Columbus 2005 Cost[(a)] $/mgd
150	232	$10,774,000	$13,208,765	$0.09	$0.22
200	309	$15,644,000	$19,179,313	$0.10	
250	387	$20,440,000	$25,059,138	$0.10	
300	464	$22,833,000	$27,992,921	$0.09	
350	542	$25,261,000	$30,969,613	$0.09	

(a) Construction only; no contingencies are included.

As an average of the reference costs, $0.15 per mgd ($97,000 per cfs) was used to estimate cost for the EHRC facility, corresponding to the following equation.

$$Cost = Q \times 97{,}000 \qquad \text{Equation (7)}$$

Where Q = Peak flow to CSO Ponds (cfs)

4.3 Disinfection

The disinfection facility would include a new chemical storage and feed building, chemical storage tanks (for sodium hypochlorite and sodium bisulfite for chlorination/ dechlorination), chemical feed and pumping facilities, electrical and I&C equipment, and piping.

The 2001 draft CSO LTCP developed preliminary project costs for a series of design flows ranging from 150-mgd to 350-mgd. Disinfection facility costs are summarized in EXHIBIT 4.3. The costs were indexed using the ENRCCI to develop August 2005 cost information.

[12] City of Columbus, Ohio *Wet Weather Management Plan*, Appendix U, Section U.3.5 (2005)

EXHIBIT 4.3 Disinfection Facility Costs[11]			
Q_{peak} (mgd)	Q_{peak} (cfs)	2001 Cost $	2005 Adjusted Cost[(a)] $
150	232	$1,619,000	$1,984,870
200	309	$1,734,000	$2,125,858
250	387	$1,766,000	$2,165,090
300	464	$1,808,000	$2,216,581
350	542	$1,839,000	$2,254,587

(a) Construction only; no contingencies are included.

Therefore, an equation was developed which allowed for the costing of the disinfection facility based solely on the pumping rate.

$$Cost = Q \times 814.5 + 2{,}000{,}000 \qquad \text{Equation (8)}$$

Where Q = Peak flow to CSO Ponds (cfs)

4.4 Flow Equalization

Under certain alternatives, a portion of CSO Pond 1 is to be used for flow equalization rather than for polishing. Therefore, modifications would need to be made which would prevent solids from settling and which would allow the basin to be drained after use. Therefore, flow equalization would require lining and complete mixing of a portion of CSO Pond 1.

The 2001 draft CSO LTCP developed preliminary project costs for a series of design volumes ranging from 8 to 48 MG. The flow equalization facility costs included an 80 mil HDPE lining, floating mixers, site work, electrical, and I&C costs. Flow equalization facility costs are summarized in EXHIBIT 4.4. The costs were indexed using the ENRCCI to develop August 2005 cost information.

EXHIBIT 4.4 Flow Equalization Costs[13]		
Volume Required (MG)	**2001 Cost[(a)] $**	**2005 Adjusted Cost[(b)] $**
8	$1,003,000	$983,731
16	$2,006,000	$1,967,461
26	$3,260,000	$3,197,370
32	$4,013,000	$3,935,903
40	$5,016,000	$4,919,634
48	$6,019,000	$5,903,364

(a) 2001 cost includes 25% construction contingency.
(b) Construction only; no contingencies are included.

Therefore, an equation was developed which allowed for the costing of the equalization facility based solely on the volume required.

$$Cost = V \times 122{,}997 - 332.44 \qquad \textit{Equation (9)}$$

Where V = Equalization Volume Required (MG)

4.5 First Flush Facility

The first flush facility would be constructed to provide solids removal and would include concrete first flush and sedimentation tanks and have a total volume of 12.5 MG. The facility would require overflow weirs and solids pumping capability.

The 2001 draft CSO LTCP developed preliminary project costs for a peak flow rate of 300 mgd, the predicted peak flow from the 4-month design storm (with parallel interceptors). The first flush facility costs included earthwork, concrete, metals, building, demolition, process, mechanical, HVAC, plumbing, electrical, and I&C components. The first flush facility cost is shown in EXHIBIT 4.5. The cost was indexed using the ENRCCI to develop August 2005 cost information.

EXHIBIT 4.5

[13] City of Fort Wayne, Indiana *Draft CSO LTCP*, Table 8-14 (2001)

Flow Equalization Costs[14]		
Volume Required (MG)	**2001 Cost[(a)] $**	**2005 Adjusted Cost[(b)] $**
12.5	$17,849,000	$17,506,089

(a) 2001 cost includes 25% construction contingency.
(b) Construction only; no contingencies are included.

4.6 High Rate Mixing

High rate mixing facilities would require the use of high rate mixing to provide energy sufficient to break apart biological solids and to provide homogeneous mixing of sodium hypochlorite. High rate mixing facilities would require the addition of a tank and a mechanical mixer for flash mixing.

The 2001 draft CSO LTCP developed preliminary project costs for a peak flow of 300 mgd, which is equivalent to the expected flow during the 4-month design event, assuming additional system conveyance with the parallel interceptors. High rate mixing facility costs are summarized in EXHIBIT 4.6. The costs were categorized and indexed using the ENRCCI to develop August 2005 cost information.

EXHIBIT 4.6
High Rate Mixing Facility Costs

Q_{peak} (mgd)	High Rate Mixing 2005 Cost $	Disinfection + Piping 2005 Cost $	Total Cost[(a)] $
25	$1,230,625	$1,443,050	$2,673,675
50	$1,247,950	$1,539,050	$2,787,000
75	$1,265,275	$1,566,800	$2,832,075
100	$1,562,600	$1,594,550	$3,157,150
150	$1,807,250	$1,622,300	$3,429,550
300	$2,121,200	$1,622,300	$3,743,500

(a) Construction only; no contingencies are included.

Therefore, an equation was developed which allowed for the costing of the high rate mixing facility based solely on the peak flow rate rate.

$$Cost = 463{,}241 \times \ln(Q) + 1{,}000{,}000 \qquad \text{Equation (10)}$$

Where Q = Peak flow to CSO Ponds (mgd)

[14] City of Fort Wayne, Indiana *Draft CSO LTCP*, Table 8-15 (2001)

ATTACHMENT 2

ATTACHMENT 2

TYPICAL PRECIPITATION YEAR

A typical precipitation year was developed for Fort Wayne using long-term precipitation data. Long-term data was available for the period from 1949 through 1996. The purpose of developing a typical year was to provide a sound basis for annual estimates of CSO activity, including the average annual overflow volume, number of events, and number of overflow hours. The typical year is intended to approximate long-term averages relative to these parameters.

The 48-year hourly precipitation record was analyzed using the RAIN utility of XP-SWMM, which is equivalent to the USEPA SYNOP analysis package. RAIN reads hourly precipitation data, organizes the data into events, and computes statistics for each event, including depth, duration, average, and maximum intensity. RAIN also calculates inter-event time. The RAIN utility requires a definition of the minimum inter-event time as input; the inter-event time is used to identify the separation between two events. For the city of Fort Wayne a 6-hour inter-event time was considered an appropriate interval to separate storm events.

The statistical analysis of the 48-year precipitation data record revealed that a group defined by an annual precipitation of 31–35 inches has the highest probability of occurrence. Probability analyses of storm event volume, maximum intensity, average intensity, and storm duration were also performed for the 48- year data record.

Years 1995, 1989, and 1987 were identified as being the closest candidates for a typical year in terms of total annual rainfall. Event data for these years was subsequently examined in detail and compared with the long-term average event data. Year 1995 was found to be very close to a typical year. To convert 1995 into a true typical year, some storm events were added and removed to closely match the long-term average in terms of distribution of storm event sizes within a year. A summary of these storms are presented in Table A2-1.

For example, based on the long-term average, one storm with a volume greater than 2 inches typically occurs during May to October of each year. However, 1995 did not include any such storm. Therefore, the 1995 precipitation data was modified by adding a storm greater than 2 inches from the Year 1990 precipitation data. Similarly, the 1995 precipitation record had larger than normal number of storm events with depths less than 0.09 inches, so several storm events of less than 0.09 inches were deleted from the 1995 data to bring it into agreement with the long-term average.

The resulting typical year consists of 122 storm events with a total depth of 33.18 inches.

Table A2-1

Modifications to Precipitation Year 1995

Date	Start Hour	Duration (Hours)	Volume (in.)	Avg. Intensity (in/hr)	Max. Intensity (in/hr)	Inter Event Duration (hr)
Events Deleted from 1995 Ranfall Data						
1/13/1995	4	4	0.07	0.02	0.06	32
2/15/1995	2	15	0.07	0	0.02	252
7/5/1995	5	2	0.05	0.03	0.04	14
9/8/1995	4	1	0.01	0.01	0.01	9
9/8/1995	16	1	0.01	0.01	0.01	11
12/11/1995	21	3	0.03	0.01	0.01	66
12/13/1995	1	3	0.07	0.02	0.03	25
Events Replaced in 1995 Rainfall Data						
8/17/1995	10	14	1.82	0.13	1.48	44
Replaced with						
5/4/1990	5	14	1.44	0.1	0.33	7
Events Added to 1995 Precipitation Data						
6/18/1995						
Added with						
8/17/1990	17	16	2.2	0.14	0.34	107

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4 SELECTION AND IMPLEMENTATION OF THE LONG-TERM CONTROL PLAN

4.1 PUBLIC PARTICIPATION

Informing the public about CSO Control alternatives is one part of the public participation process. Once the City developed the integrated backbone alternatives presented in Section 3.3, a series of Alternative Selection Workshops were held to rank and select a backbone alternative and develop the overall conceptual LTCP:

- An initial comprehensive selection workshop was held with key City staff. Participants included experienced decision makers responsible for administration, management and operations of the Water Pollution Control Plant and the collection system. To rank the backbone alternatives, selection criteria were developed, weights were assigned to each criterion, and each backbone alternative was rated. Ratings for each alternative were weighted and totaled to develop a final numerical value reflecting the ability of each alternative to meet all the desired criteria.
- A Peer Review workshop was held to obtain outside input and objective review of the City's planning and selection process. Working with City staff, a team of independent consultants confirmed the soundness of the City's process.
- Following a transition in City administration, two additional workshops were held to confirm the selection of the backbone alternative and develop the overall conceptual LTCP.

4.2 FINAL SELECTION AND DEVELOPMENT OF RECOMMENDED PLAN

As explained in Section 3.4.5.2, Alternative 3E emerged as the preferred alternative for the City's LTCP. This conclusion was based on a systematic rating and ranking process that was carried out in two stages:

- Stage 1 evaluated all 12 of the City's candidate alternatives based on cost, performance, and non-monetary factors. This stage provided a consistent initial assessment of the full range of viable system-wide solutions.
- Stage 2 evaluated the two short-listed alternatives from Stage 1 using an expanded set of performance metrics and refined analysis methods. This allowed the City *"to 'step back' from the evaluation process to ensure that the recommendations make sense and that program goals are being met,"* consistent with the approach recommended in the CSO Guidance.

In developing the final configuration of Alternative 3E and the recommended CSO Control Measures, the City incorporated the financial capability considerations outlined in Section 3.5, the perspective of local stakeholders, and the position of the regulatory community. This process led to the development of a recommended plan that balanced control level, implementation schedule, and affordability considerations in a manner that was satisfactory to all parties.

4.2.1 Selection of Control Level for the Recommended Plan

A key decision in developing the recommended plan was selection of the ultimate CSO control level, as measured by number of activations in a typical year. As explained in Section 3.4.5.2.5.4, the cost-benefit knee-of-the curve for Alternative 3E for all metrics (annual overflow volume, annual activations, annual number of days exceeding in-stream bacteria standards) is at approximately the 3-month control level, or 4 activations per year.

As part of the control level selection process, the City investigated whether going beyond the knee-of-the-curve, to 3 activations per year, would further the goals of the EPA's CSO Control Policy by achieving additional water quality benefits commensurate with the additional cost. To do this, the City compared a 4 activation plan with 3 activation plan in terms of important CSO metrics, with the results shown in Table 4.2.1.1.

The most significant benefit of a 3 activation plan over a 4 activation plan is that it is projected to reduce annual overflow volume on a system-wide basis by approximately 25 percent. However, given that the primary pollutant of concern in the City's waterways is bacteria, the controlling metrics are activations and hours of overflow. Simply stated, bacteria by its nature is a "problem" in terms of potential recreational use anytime it reaches the receiving stream, and once its in the stream the volume of overflow is secondary. A 3 activation plan would be expected to result in one less opportunity for public contact with bacteria in the CSO-impacted rivers on an annual basis (3 times per year as opposed to 4 times per year); however, it is striking that a 3 activation plan reduces the hours of overflow by only 2 to 4 hours (depending on the river segment).

The capital cost associated with increasing the Alternative 3E control level from 4 activations per year to 3 activations per year is approximately $30M. Based on the comparison in Table 4.2.1.1, a 3 activation plan would require City ratepayers to fund an additional $30M in CSO control projects to gain at most 4 additional annual hours of overflow reduction. The City is confident that even the most ardent users of Fort Wayne's river corridors would question whether that incremental achievement represents a wise use of $30M in local funds.

Given that a system-wide 3 activation plan is not warranted from a cost-benefit point of view, the City examined the option of targeting the St. Joseph River for a locally higher level of control. This option was investigated because community surveys show that the St. Joseph River consistently receives the highest recognition for general use (riverway hiking, etc.) of any of the local waterways. In addition to this local stakeholder recognition, the CSO reach of the St. Joseph River has been identified as presenting potential instream habitat for native species (based on a species study done by the City and submitted to USEPA and IDEM in 2005 as described in Chapter 2).

The St. Joseph River receives overflows from six of the City's CSOs, as shown in Figure 4.2.1.1. Given the high local value of this waterway, the City examined a 1 activation plan with respect to the St. Joseph River, implemented over a fast-track 12-year schedule, where all six CSOs would be controlled to at most 1 activation in a typical year. Combining this St. Joseph River component with a 4 activation plan for the remainder of the combined sewer system results in a hybrid plan with a total capital cost of $239.4M, or $18.5M more than a system-wide 4 activation plan.

Considering the local value placed on the St. Joseph River, the City made the decision to invest the additional $18.5M to achieve the hybrid control level outlined above – 4 activations in a typical year on the St. Mary's and Maumee Rivers, and 1 activation per typical year on the St. Joseph River. The logic for this hybrid plan is simple – given that a 4-activation plan is already expected to dramatically reduce overflow activity (e.g., to 12 to 30 hours per average year), additional incremental reductions in system-wide activity are difficult to justify for the associated costs. Given this, the City believes that additional investment is better targeted at the St. Joseph River as a priority waterway, where even incremental improvements are likely to be perceived as a real benefit.

The important overflow metrics for the hybrid plan are included in Table 4.2.1.1. For the St. Mary's River and Maumee River, the metrics are the same as a system-wide 4 activation plan. For the St. Joseph River, the metrics are consistently better than a system-wide 3 activation plan.

4.2.2 Technology Configuration of the Recommended Plan

The technology configuration of the recommended plan by individual CSO is shown in Table 4.2.2.1. The configuration is very similar to the original Alternative 3E; the only changes to note are as follows:

- First, since development of the original Alternative 3E configuration, IDEM has issued a draft non-rule policy document expressing an interpretation of 327 IAC 3-2-6. If such interpretation proves to be correct and legal enforceable, the City believes, for all practical purposes, it would become virtually impossible for the City to reasonably site satellite disinfection facilities within residentially developed areas. While City reserves its right to disagree with the regulatory interpretation expressed in IDEM's draft non-rule policy document it has conservatively elected to change the control technology proposed for several CSOs on the St. Joseph River from satellite disinfection to satellite storage (the draft IDEM non-rule policy document does not purport to be applicable to storage facilities). Furthermore, as explained in the footnotes to Table 4.2.4.1, other sites identified for satellite disinfection may also ultimately be changed to satellite storage (such would require additional, and currently unplanned, additional investment by the City).
- Second, current modeling projections indicate that a wet-weather EHRC/HRT facility is not required at the CSO Ponds in order to achieve a control level of 4 untreated discharges from the CSO Ponds in a typical year - the addition of storage and dewatering capabilities at CSO Pond 1 is expected to allow the achievement of the selected control level without an EHRC/HRT facility. Therefore, the CSO Pond EHRC/HRT facility is not specified in the plan and will be constructed only if required to achieve the performance criteria for the Maumee River, i.e. 4 overflow events, as determined through future performance assessments.

As part of the Alternative 3E base configuration, it is the City's intent to continue its Combined Sewer System Capital Improvement Program (CSSCIP) as noted in Section 3.3.5.2.6.3. The program is projected to address two to three combined sewer subbasins per calendar year until the program is completed. Once identified and implemented, these partial separation projects will have the effect of reducing local CSO activity and potentially reducing the size of the subsequent CSO control measure in the LTCP. Note the CSO control measures identified in Alternate 3E assume no sewer separation in the combined sewer system; therefore, the City's current facility sizing and design criteria for the CSO control level are not dependent on achieving an assumed level of sewer separation under the CSSCIP.

4.2.3 Schedule and Costs for the Recommended Plan

Table 4.2.3.1 provides the schedule and annual capital cost expenditures for the recommended plan. The plan is scheduled in terms of CSO Control Measures, which represent logical groupings of individual improvements for implementation purposes, according to priority and required engineering sequencing. As can be seen, the St. Joseph River components (CSOs 45, 51, 52, 53, and 68) are to be controlled within 12 years, and the remainder of the improvements are to be implemented within 18 years. Also to be noted is that CSO Control Measure 1 "Plant Primaries" is already in progress and projected to be completed in 2008. This Control Measure is a compilation of several plant improvements already completed, or currently underway, as part of the City's future planned upgrade of its Water Pollution Control Plant (WPCP) to 85mgd peak capacity. Additional details on the final LTCP schedule can be found in Section 4.4.

4.2.4 Design Criteria, Performance Criteria, and Critical Milestones for the Recommended Plan

Table 4.2.4.1 provides a full presentation of all the major CSO Control Measures in the recommended plan in terms of a description, the individual CSOs controlled by each measure, the design criteria, the performance criteria, and critical milestones. In reviewing and interpreting Table 4.2.4.1, it is important to understand several key assumptions and characteristics of the City's approach to developing and implementing the components of the recommended plan:

- Upon full implementation, the CSO Control Measures listed in Table 4.2.4.1 are expected to result in 4 CSO events on the St. Marys and Maumee Rivers and 1 CSO event on the St. Joseph River in a "typical year," as evaluated in accordance with Section 4.6 below. Either a revision to Indiana's current water quality standards or some other legal mechanism will be necessary to authorize overflows caused by storms **exceeding those levels of control**. Chapter 5 of this LTCP describes federal and state requirements associated with a Use Attainability Analysis (UAA), provides an introduction to the City's draft UAA to be submitted to IDEM for consideration, and requests approval by IDEM (and ultimately EPA) of a revision to the recreational designated use for the waterways impacted by the City's CSOs to the Indiana CSO Wet Weather Limited Use Subcategory. The design and construction of CSO Control Measures 1, 2, 4, 6, and 10 are not dependent on the level of control ultimately determined, and therefore, the City will implement CSO Control Measures 1, 2, 4, 6, and 10 according to the terms and schedules set forth in this Table. The City is scheduled to start investing heavily in CSO Control Measures 3, 5, 7 through 9, and 11 through 15, which are level of control-dependent, in the years following approval of the City's LTCP. Accordingly, all parties intend that the UAA process be completed within five years of LTCP approval. If the UAA process is not completed within five years, under certain circumstances specified in a consent decree, the City can seek a modification of the implementation schedule set forth in Table 4.2.4.1.

- The Description and Design Criteria are based upon LTCP-level planning estimates and may be subject to revision during facility planning and design. One of the conditions of Description and Design Criteria, applicable to all of the facilities set forth in Table 4.2.4.1, is that the specific facility will be designed in accordance with good engineering practice to ensure that corresponding facility-specific, river-specific, and system-wide Performance Criteria will be achieved.
- CSO Control Measures will be designed to achieve Performance Criteria of 4 CSO events for the St. Marys and Maumee Rivers and 1 CSO event for the St. Joseph River in a "typical year." "Typical year" performance, and achievement of Performance Criteria, is based on average annual statistics over a representative five-year period. The method to assess "typical year" performance over a typical 5-year period will be selected from the options presented in Section 4.6.

4.3 FINANCING PLAN

4.3.1 Summary of Future Wastewater Utility Revenue Requirements

As explained in Section 3.5, implementing the LTCP will place a significant financial and economic burden on the City of Fort Wayne. As part of the Financial Capability Analysis (FCA) in Section 3.5, the City developed an estimated capital improvement plan and operating cost projections for the next approximately 20 years of the wastewater utility. The resulting analysis showed that the City's annual costs for its wastewater system are expected to grow nearly 10.5 percent per year between 2008 and 2014, and by 7 percent per year through 2025. This includes the cost of expanding, improving, operating and maintaining existing wastewater facilities as well as the cost to build new infrastructure to reduce sewer overflows as part of the LTCP. Comparing these costs on a common dollar base of year 2005, the estimated cost to build the remaining improvements in the LTCP from years 2008 to 2025 is $239.4 million, while the costs to operate, maintain, improve and expand the wastewater system are estimated to be $454.6 million.

4.3.2 Key Assumptions

The $239.4 million cost of the LTCP is based upon conceptual planning and facilities have not been designed and alignments have not been set. Accordingly, each project and category of work has an appropriate contingency included in its estimated cost. As facility plans and detailed engineering designs are completed, costs will be updated and the overall LTCP cost re-assessed. The City's estimation of total LTCP costs for developing the financing plan assumes that the Consumer Price Index (CPI) increases by an average of 3.5 percent per year. Because the LTCP cost is based upon conceptual planning cost estimates, the Consent Decree includes provisions that allow the City to seek an extension of the implementation schedule for control measures if the capital cost of the LTCP exceeds a significantly higher specified amount.

The City has assumed that it will finance its program mostly through Indiana Bond Bank revenue bonds and a limited amount of State Revolving Fund (SRF) bonds. The City is assuming that this debt will carry a weighted average interest rate of 6 percent with a 20-year debt. The City is also assuming that over the 18 year implementation period, market interest rates do not increase significantly from current levels, and that its general obligation bond rating will not drop below Aa3. The weighted average rate of 6 percent provides a cushion of approximately 120-125 points above current market rates.

4.3.3 Alternative Financing Evaluations

While City of Fort Wayne rate payers clearly support the idea of river water quality improvement, their support for a higher level of water quality improvement may be inversely proportional to what they will be asked to spend to support the LTCP. While a number of alternative sources of funding for water quality improvement programs are discussed from time to time at the State and national level, the Federal requirement for CSO solutions is essentially an unfunded mandate. From the perspective of the utility, a sewer system is an asset to a community when it operates well, protects the environment and provides good service at a cost the community can afford.

The City will be organizing a panel of financial and policy experts who will help the City investigate various options for reducing the impact of LTCP costs on sewer utility rate payers. This “blue ribbon” committee will:

- Identify alternative methods for raising capital for the Fort Wayne sewer utility. The list may include methods that can currently be legally implemented by a second class city in Indiana and options that would require a change in State law. Funding methods that would allow the cost of CSO improvements to be spread over a larger base will be considered. Federally sourced funds would be the largest base, then State, then regional, county, City and lastly Sewer Utility.

- Analyze the costs and benefits of each option. A cost/benefit analysis should consider impacts to Fort Wayne civil city government, Fort Wayne’s sewer and other utilities, the business community and city residents, both customers and non-customers of the sewer utility. Experiences of other communities will be valuable in this analysis.

- Based on the cost/benefit analysis and knowledge of the Fort Wayne community, develop a feasibility analysis for each option.

- For the options that are determined to be feasible, develop a brief implementation plan including an analysis of the entities that would have to approve implementation of each option.

4.4 IMPLEMENTATION SCHEDULE

4.4.1 Basis of LTCP Schedule

The agreed upon 18 year implementation schedule for the LTCP allows the City to construct CSO control measures in a planned and orderly fashion. The City reviewed all the project categories from a logical engineering and construction perspective to determine project relationships and to develop the sequence in which the projects should be constructed. The City's FCA was a significant part of the determination and negotiation for the total length of schedule in which to implement the LTCP. Also, as noted in Section 4.2.1, as part of the final LTCP development the St. Joseph River was determined to be a high priority and improvements to address CSOs along the St Joseph River were sequenced to allow for the St Joseph River control measures to be completed within 12 years.

Figure 4.4.1.1 is a graphical overview of the final LTCP implementation schedule. The schedule generally follows the 15 main categories of control measures in the LTCP per Table 4.2.4.1. The Critical Milestones, which per Table 4.2.4.1 are the "Bid Year" and "Achievement of Full Operation", are shown. The Critical Milestones dates noted are <u>the latest dates</u> the City can complete the milestone without paying stipulated penalties per the Consent Decree. The schedule also shows that the LTCP implementation process can be defined in terms of river watersheds, where the St. Joseph River controls will be fully implemented by 2019, the Maumee River controls by 2022, and the St. Mary's River controls by 2025.

4.5 OPERATIONAL PLAN

The Amended Combined Sewer System Operational Plan (CSSOP) Report, September 2007, is designed to be used by the City, through its wastewater utility, Board of Public Works, and other departments involved in programs that affect the operations and maintenance (O&M) of the City's combined sewer system. The Chapters describe how the City intends to continue to implement the Nine Minimum Controls (NMCs) consistently with EPA's 1995 Combined Sewer Overflows: Guidance for Nine Minimum Controls and identifies programs to be implemented to reduce the effects of Combined Sewer Overflows (CSOs) on receiving stream water quality.

The City's Amended CSSOP document is intended to be a "living" document in that the City intends to revise and update the CSSOP as (i) more information pertaining to receiving stream water quality, combined sewers, the collection system, and the WPCP becomes available; (ii) system revisions or modifications are made; and (iii) new facilities, equipment, or personnel are added. By functioning as a "living" document, changes in regulatory requirements, administrative goals, strategies, and resources will also be incorporated into the CSSOP.

The City's Amended CSSOP is a separate document and not part of its LTCP. A copy of the Amended CSSOP Report can be located in the City's Planning & Design Services department library.

4.6 POST-CONSTRUCTION MONITORING PROGRAM

4.6.1 Introduction

The City's CSO Long-Term Control Plan will implement a series of aggressive controls to dramatically reduce the amount of combined sewage discharged to the St. Joseph, St. Mary's, and Maumee Rivers. While CSOs are only one of many pollutant sources impacting the rivers, it is expected that CSO control will result in a net benefit to the rivers and improve water quality. The purpose of the Post-Construction Monitoring Program is to assess performance of the City's CSO Control Measures and to add to the City's ongoing investigation of overall stream conditions, including tracking changes in water quality over time.

This section describes the key elements of the proposed program for post-construction monitoring activities. The Post-Construction Monitoring Program has been developed to assess the performance and observable water quality impact of CSO control measures as they are implemented, while integrating with the City's ongoing water quality monitoring program (a part of which operates under a cooperative agreement with IDEM). From a regulatory perspective, the Post-Construction Monitoring Program will document the effectiveness of the City's overall CSO control program in achieving performance requirements. The elements of the program are as follows:

- A monitoring schedule, identified sampling locations, and associated monitoring procedures to collect data associated with the Performance Criteria (presented in Table 4.2.4.1) and *E. coli* levels in CSO-impacted receiving streams.
- Analysis of collected data to determine whether CSO control measures are meeting the Performance Criteria presented in Table 4.2.4.1.
- Analysis of the collected data to assess long-term trends in instream *E. coli* levels, and documentation of any environmental benefits that occur as the LTCP is implemented.
- Evaluation and analysis of the data for reporting status and progress to regulatory agencies and the public.

The City's Post-Construction Monitoring Program will be implemented on a river-watershed basis, beginning on the St. Joseph River, followed by the Maumee River, followed by the St. Mary's River. This progression is guided by the implementation schedule for CSO controls, and allows for assessment of environmental benefit on a waterbody basis. The monitoring program will assess the control program's effectiveness at meeting river-specific Performance Criteria – 1 overflow event[1] on the St. Joseph River in a typical year and 4 overflow events on the St.

[1] An "*overflow event*" is as defined in the Presumption Approach of the CSO Control Policy – "*an overflow event is one or more overflows from a CSS as the result of a precipitation event*." For the purposes of the City's selected CSO Control Measures, the definition is applied on a river
system basis, i.e. independently to the St. Joseph River and the St. Marys/Maumee river system, rather than a full

Mary's/Maumee River system in a typical year. The frequency of CSO overflow events will vary year-to-year because of variation in annual rainfall. For example, where the level of control is 4 overflow events per typical year, actual overflow frequency is expected to range from 0 to 10 overflow events per year (it should be noted that it is not possible to put a firm upper bound on this range due to rainfall variability).

The City views the Post-Construction Monitoring Program as a key mechanism for supporting dialogue with the regulatory agencies and the public. Fort Wayne City Utilities will compile monitoring results, submit milestone reports to regulatory agencies, and use the information to report progress to the public.

4.6.1.1 Regulatory Requirements

U.S. EPA requires CSO communities to conduct a post-construction monitoring program during and after LTCP implementation "to help determine the effectiveness of the overall program in meeting [Clean Water Act] requirements and achieving local water quality goals."[2] This program will collect data that measures the effectiveness of CSO controls and their impact on water quality, and intends to utilize existing monitoring stations used in previous studies of the waterways and sewer system in order to compare results to conditions before controls were put in place. The program will include a map of monitoring stations, a record of sampling frequency at each station, a list of data to be collected, and a quality assurance/quality control (QA/QC) plan.

In U.S. EPA's December 2001 Report to Congress: Implementation and Enforcement of the Combined Sewer Overflow Control Policy, the agency noted the difficulty of establishing a monitoring and tracking program for CSO control programs. "Monitoring programs need to be targeted and implemented in a consistent manner from year to year to be able to establish pre-control baseline conditions and to identify meaningful trends over time as CSO controls are implemented," the report said. "In practice, it is often difficult, and in some instances impossible, to link environmental conditions or results to a single source of pollution, such as CSOs. In most instances, water quality is impacted by multiple sources, and trends over time reflect the change in loadings on a watershed scale from a variety of environmental programs." The report also noted that weather conditions and rainfall totals vary significantly from storm to storm and year to year, making comparisons difficult.

4.6.1.2 Purpose & Scope

This Post-Construction Monitoring Program will collect the necessary data to assess the impact of the City of Fort Wayne's CSO LTCP. CSO controls are expected to provide two positive impacts:

- First, control CSOs to the Performance Criteria provided in Table 4.2.4.1. The monitoring program will collect the requisite end-of-pipe data to assess performance of the controls.

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combined sewer system (CSS) basis. Furthermore, discrete overflow events are defined as being separated by a 6-hour or longer inter-event duration, consistent with the methodology and analysis presented in the City's LTCP.

[2] _Combined Sewer Overflows, Guidance for Long-Term Control Plan_ (EPA 832-B-95-002, August 1995) p. 4-15.

- Second, improve water quality on local rivers. As noted in U.S. EPA's Report to Congress, "…it is often difficult, and in some instances impossible, to link environmental conditions or results to a single source of pollution, such as CSOs." However, the monitoring program will collect the requisite instream data to assess the trends over time as CSO controls are implemented. In order to compare post-construction water quality trends to current conditions and historic data, the proposed monitoring program makes use of all of the City's current water quality monitoring stations.

In addition to collecting data to assess CSO control performance and instream water quality trends, the Post-Construction Monitoring Program will develop documentation to support regulatory reporting requirements and communicate with the public.

The waterbodies included in this plan are the St. Joseph River, the Maumee River, and the St. Mary's River. The City's monitoring program is a part of the following overall scope of work:

- Document Current Baseline Conditions: During development of the LTCP, the City conducted a significant amount of characterization work. The results of the characterization and documentation of current baseline conditions are presented in Chapter 2.
- Identify Parameters of Concern: During the system characterization effort and through subsequent discussions with U.S. EPA and IDEM, the City identified *E. coli* bacteria as the parameter of concern in local waterbodies. This decision process is described in more detail in Chapter 2. Therefore, the City will use *E. coli* (or other applicable pathogen or pathogen indicator as described below in Section 4.6.2.2) to measure the effect of its long-term CSO control measures on receiving streams.
- Prepare and execute Post-Construction Monitoring: The City's monitoring program is the focus of this section 4.6, with individual elements and approach described in detail in Sections 4.6.2 through 4.6.6.
- Report Results to State and Federal Agencies: The results and observations from the post-construction monitoring will be provided to U.S. EPA and IDEM through a series of milestone reports and a final report. A milestone report will be prepared for each of the three river watersheds, when all the CSO controls in a particular river watershed are operational. The reports will provide documentation of facility performance relative to the Performance Criteria in Table 4.2.4.1, along with a presentation of observed water quality trends. Section 4.6.7 presents the City's plan for reporting progress to the regulatory agencies.
- Provide Public Information on Water Quality: Fort Wayne City Utilities will continue distributing information on the CSO LTCP, including water quality issues, to the public through the program described in Chapter 7 of the Combined Sewer System Operational Plan (CSSOP).

4.6.2 Program Elements

The City of Fort Wayne will implement the CSO Long-Term Control Plan as a series of CSO Control Measures according to the schedule provided in Table 4.2.4.1. The CSO Control Measures have been grouped for implementation purposes according to priority and required engineering sequencing. Milestones in the implementation process can be defined in terms of river watersheds, where the St. Joseph River controls will be fully implemented by 2019, the Maumee River controls by 2022, and the St. Mary's River controls by 2025. At each implementation milestone, the City will proceed with the data evaluation and progress reporting to assess compliance with the Performance Criteria in Table 4.2.4.1 and document improvements in instream water quality conditions. Note that while the Maumee River post-construction monitoring will begin in 2022, the full impact of CSO Control Measures on Maumee River water quality will be realized in 2025 once the controls in the upstream St. Mary's River watershed are fully implemented.

4.6.2.1 Performance Criteria

The Performance Criteria for the City's CSO Control Measures are expressed as number of activations in a typical year. The required Performance Criteria - 1 overflow event on the St. Joseph River in a typical year, 4 overflow events on the Maumee River in a typical year, and 4 overflow events on the St. Mary's River in a typical year - are provided in Table 4.2.4.1. As explained in Section 4.6.1 above, the actual frequency of CSO overflow events will vary year-to-year because of variation in annual rainfall. The City will assess the average performance of CSO control measures by river watershed following the Achievement of Full Operation of the full set of controls for each river watershed. The assessment of performance, and the resulting determination of compliance with the Performance Criteria during a typical year, will be performed with a combination of outfall monitoring and collection system modeling and documented in Table 4.6.2.1. A full explanation of the performance assessment is provided in Section 4.6.4.

4.6.2.2 Water Quality Measures

The Water Quality Measures are data-based indicators of instream water quality, in particular the long-term trends in expected improvements due to implementation of the City's CSO Control Measures. A strong baseline of existing water quality conditions in the rivers has already been established through the City's ongoing water quality monitoring program. The water quality component of the Post-Construction Monitoring Program will continue to collect instream samples during and after implementation of the CSO Control measures in order to document changes in water quality conditions.

The Water Quality Measure incorporated in the City's Post-Construction Monitoring Plan is *E. coli* bacteria (or other pathogen indicator, to the extent applicable water quality standards have been revised to include a different applicable pathogen indicator). Bacteria has been established as the parameter of concern with respect to CSO control, based on the City's completed system characterization efforts and discussion with U.S. EPA and IDEM.

The City will collect data to measure and evaluate improvements to instream *E. coli* bacteria counts that can be attributed, at least in part, to CSO control measures. It is unlikely that CSO controls alone will result in attainment of Indiana's *E. coli* standards for primary contact recreation due to numerous *E. coli* sources in the environment. Because the e. coli counts in water bodies may be subject to contribution from various sources, for the purpose of determining compliance with this decree, an in-stream water quality value will not be imposed. Rather, the City will analyze trends in both dry-weather and wet-weather *E. coli* levels and compare them to historic monitoring data and modeling predictions to determine improvement in water quality and to ensure that residual CSO discharges do not interfere with applicable recreational uses (to be determined through the City's Use Attainability Analysis). A different pathogen indicator other than *E. coli* may be requested by IDEM in accordance with this paragraph to the extent the applicable water quality standards are revised to include a different pathogen indicator.

4.6.3 Post-Construction Monitoring and Data Collection

This section details the field program that the City will implement to support the overall Post-Construction Monitoring Program. The field program combines CSO outfall flow monitoring, a pilot CSO disinfection study, river water quality sampling, WPCP effluent sampling, and rainfall monitoring to collect the data necessary for characterizing the benefits of implemented CSO Control Measures.

4.6.3.1 Monitoring Schedule

By definition, the post-construction monitoring schedule is dictated by the construction schedule for the City's LTCP. As shown in Table 4.6.2.1, post-construction monitoring will begin after completion of all LTCP projects in the St. Joseph River watershed. Post-construction monitoring will continue through implementation of the other groups of watershed controls (on the Maumee River and St. Mary's River), and provide the data for the Final Post-Construction Monitoring Report (scheduled for submission within five years following Achievement of Full Operation of all LTCP projects). After review of the Final Post-Construction Monitoring Report by U.S. EPA and IDEM, the City will modify the Post-Construction Monitoring Program as appropriate to satisfy ongoing reporting requirements.

While post-construction monitoring cannot begin until associated construction phases are completed, the City intends to continue its current monitoring programs until the St. Joseph watershed controls are implemented. As explained below, the current CSO outfall flow monitoring locations and river water quality sampling locations will also serve as the post-construction monitoring locations. Therefore, these current programs will provide an ongoing understanding of CSO performance and instream water quality conditions prior to post-construction monitoring. This data will provide the necessary baseline from which to assess the impact and benefit of implemented CSO Control Measures.

4.6.3.2 Monitoring Stations

The City's current monitoring programs have been designed to fully characterize the existing system in terms of CSO discharges and receiving water quality trends. The following stations are included in these current programs:

- *Stream monitoring.* The USGS maintains five gauging stations in and around Fort Wayne, one each on the St. Joseph River and St. Mary's River, and three on the Maumee River.
- *CSO outfall flow monitoring*. Of the City's 44 permitted CSO discharge points:
    - 33 locations are monitored with continuous depth/velocity meter configurations
    - 5 locations are monitored via pump runtime meters at overflow pump stations.

  - 3 locations (007, 012, 027) are emergency gravity discharges at overflow pump stations. These emergency overflows are not monitored, as they activate only when the associated pump stations fail.
  - 2 locations (003 and 081) are visually inspected to determine activation. Visual inspections occur daily on weekdays, and during runoff events on weekends and holidays.
  - 1 location (014) has very low flows and typically activates less than once per year.
- *River water quality sampling.* The City collects water quality samples at the following six locations in cooperation with IDEM:
  - Mayhew Road Bridge – St. Joseph
  - Tennessee Avenue Bridge – St. Joseph
  - Ferguson Road Bridge – St. Mary's
  - Spy Run Bridge – St. Mary's
  - Anthony Boulevard Bridge – Maumee
  - Landin Road Bridge – Maumee

  Monthly sampling is conducted with IDEM on a year-round basis. The City augments the monthly program with weekly sampling from April 1 to October 31.
- *WPCP effluent monitoring.* Per NPDES permit requirements, the City collects effluent samples at Outfall 001.
- *Rainfall monitoring.* The City maintains a network of 10 rain gauges, distributed over the service area to adequately capture typical rainfall patterns and distributions.

Given that the above monitoring locations were designed to properly characterize the existing system and receiving water conditions, often in concert with U.S. EPA and/or IDEM, the City has identified them as the proper monitoring locations for the Post-Construction Monitoring Program. CSO discharge locations will not change (other than through elimination), and river flow patterns will remain the same, following implementation of the CSO Control Measures. Therefore, these monitoring locations are appropriate for the purposes of the Post-Construction Monitoring Program – to assess compliance with CSO Performance Criteria, and document improvements to water quality over time. Additional details on these programs and locations are provided below in Sections 4.6.3.3 through 4.6.3.7.

The City's current (and post-construction) monitoring station locations, along with the reasons for selection, monitoring equipment types, monitoring frequencies, and monitoring parameters are presented in Table 4.6.3.1. The locations of these stations are displayed on Figure 4.6.3.1. The City's distributed rain gauge network is also shown on Figure 4.6.3.1.

The City may, after consultation and agreement with U.S. EPA and IDEM, add, modify, remove, or relocate monitoring stations, as necessary, during or after implementation of CSO Control Measures to address any changes that may be necessary as a result of facility planning, design, and construction.

4.6.3.3 Stream Monitoring

The USGS maintains five real-time stream gauging stations in and around Fort Wayne, with one each on the St. Joseph River and St. Mary's River, and three on the Maumee River, as shown on

Figure 4.6.3.1. Four of these stations monitor stage in the streams, which the USGS then uses to estimate flow. The fifth station monitors stage only. The City has used and intends to continue using this USGS data to provide long-term stream monitoring as part of their wet-weather program. As with all USGS gauging stations, standard equipment, procedures, and protocols will be used for data collection, and USGS personnel are responsible for maintenance, calibration, and data processing at these locations.

4.6.3.4 CSO Outfall Monitoring

4.6.3.4.1 Outfall Monitoring for Activations

The primary purpose of CSO outfall monitoring in the Post-Construction Monitoring Program is to determine if CSO Control Measures are complying with the Performance Criteria in Table 4.2.4.1.

The City is currently monitoring 33 CSO outfalls with continuously recording flow meters (depth/velocity meters), allowing estimates of overflow onset, duration, and volume. An additional 5 locations are monitored via pump runtime data at overflow pump stations, again allowing estimates of overflow onset, duration, and volume. The remaining 6 permitted outfalls are either emergency overflows (3 locations), visually inspected overflows using blocking to estimate activations (2 locations), or very low activity/volume overflows (1 location).

The City will continue monitoring these CSO outfalls until the initiation of post-construction monitoring (at the completion of the St. Joseph River watershed CSO Measures). The City may, after consultation and agreement with U.S. EPA and IDEM, change the monitoring equipment and protocols at selected locations during this time. For example, at locations where the depth/velocity meters are consistently problematic, or show that a CSO activates very infrequently and at low volume, the City may change to a simpler activation only monitoring scheme.

As part of initiating the post-construction monitoring, the locations and/or equipment associated with some monitoring sites may change to accommodate post-construction configurations. These changes will be discussed with U.S. EPA and IDEM prior to implementation.

4.6.3.4.2 Outfall Monitoring for Assessing Satellite Disinfection Performance

The City is proposing to construct four satellite disinfection facilities as a CSO Control Measure for Outfalls 52, 54, 61 and 62. However, the City will construct satellite storage facilities in lieu of satellite disinfection facilities if it comes to acquire, by January 1, 2010, the wastewater collection and treatment systems currently owned or operated by Utility Center, Inc. (a/k/a AquaSource or Aqua Indiana, Inc.) and connected to the Main Aboite and Midwest wastewater treatment facilities (for which the State has issued NPDES Permit Nos. IN0035378 and IN0042391). If the City does not acquire the aforementioned wastewater treatment and collection systems currently owned and operated by Utility Center, Inc. within the specified timeframe, it is not required to, but may nonetheless elect to, construct one or more satellite storage facilities in lieu of satellite disinfection facilities as the CSO Control Measure for

Outfalls 52, 54, 61 and/or 62. The effectiveness and required performance standards for any such satellite disinfection facilities in terms of pathogen control are dependent on a wide range of factors, and defining the performance of installed facilities is of high interest to the City and EPA/IDEM. If the City utilizes satellite disinfection instead of the other viable satellite control option, satellite storage, at these locations, the following conditions will apply to use of satellite disinfection.

A pilot disinfection facility shall be constructed at Outfall 52 per the schedule specified in Table 4.2.4.1. After achievement of full operation, this facility shall be studied to determine the effectiveness of disinfection of the flows entering the facility. The testing duration and protocol shall be per the City of Fort Wayne CSO Satellite Disinfection Pilot Study (Attachment 1). The effectiveness of disinfection will be measured using the testing protocol, in order to document the ability of the facility to attain the following performance measures at a minimum:

- Skimming or screening (or equivalent) of the detained flows to remove solids and floatables and proper disposal of all material in accordance with all applicable solid waste disposal laws and regulations
- Detention of flows for settling, combined with other solids removal mechanisms associated with solids and floatable control, to achieve the Total Suspended Solids (TSS) removal necessary for effective disinfection. Minimum detention period is 30 minutes.
- Disinfection of all detained flows to *E. coli* effluent limitation contained in the current NPDES permit.
- Dechlorination, if necessary, of all detained flows to the effluent limitation for Total Residual Chlorine (TRC) contained in the current NPDES permit.

If the results of the study indicate that the disinfection facility constructed at Outfall 52 does not provide effective disinfection, the City will follow the provisions outlined in the sections of the Consent Decree entitled, "*Extension of Deadlines to Achieve Performance Criteria*" and/or the "*Modification of Performance Criteria*" to identify the appropriate controls required to meet the activation performance criteria for Outfall 52, 54, 61 and 62. Conversely, if the study results indicate that the pilot satellite disinfection facility does provide effective disinfection, the City will proceed to construct the remaining satellite disinfection facilities in accordance with Tables 4.2.3.1 and 4.2.4.1 unless the City decides to install satellite storage facilities at the specified locations.

4.6.3.5 Water Quality Monitoring

The City currently collects water quality samples at six locations as part of a cooperative river water quality sampling program with IDEM. Samples are collected once per month on a year-round basis in support of the IDEM program; the City increases the frequency to weekly sampling during the period April 1 to October 31. All samples are analyzed for the following parameters:

- Field measurements are taken for pH, Dissolved Oxygen, and temperature.
- *E. coli*
- Ammonia-Nitrogen

- Total Phosphorus
- Total Suspended Solids

In addition, the monthly samples collected under the cooperative program with IDEM are analyzed for a range of metals including cadmium, copper, lead, and zinc.

This program will continue up until and after initiation of the Post-Construction Monitoring Plan (scheduled to start after completion of the St. Joseph CSO watershed controls). In this way, the City will have a strong baseline dataset to determine changes in water quality over time.

Sampling and analysis for *E. coli* bacteria (or other pathogens) is required under this Post-Construction Monitoring Plan, since it has been identified as the water quality measure for the Plan as explained in Section 4.6.2.2. The City will also continue, at its discretion, sampling and analysis for the other parameters listed above.

4.6.3.6 WPCP Effluent Monitoring

The City will continue monitoring the WPCP effluent as required by current and future NPDES permits.

4.6.3.7 Rainfall Monitoring

The City has a network of 10 rain gauges to measure rainfall across the service area. This network has been in place since 1983, and is currently maintained by the City's dedicated CSO crew. The distribution of gauges in the network has been configured to properly represent temporal and spatial rainfall patterns in the Fort Wayne area.

The City intends to maintain the current rain gauge network (or equivalent) up until and after initiation of the Post-Construction Monitoring Program. The collected rainfall data will support the wet-weather analyses and modeling described below in Section 4.6.4.

4.6.4 Data Retrieval, Management and Analysis

Two kinds of data will be collected, managed, and analyzed as part of the City's Post-Construction Monitoring Program – continuous flow data collected at CSO outfalls and discrete water quality data collected at river monitoring sites. Both of these data types are currently being collected as part of the City's ongoing monitoring program; as a result, the new data collected as part of the Post-Construction Monitoring Program will be integrated into existing data validation, archiving, retrieval, and management tools. The City will continue taking all necessary measures to ensure that monitoring objectives are attained.

This section first describes each of the data types, then presents the City's plan for using and analyzing the outfall flow data and collection system modeling tools to assess compliance with the Performance Criteria in Table 4.2.4.1.

The City has been collecting system-wide CSO outfall flow data since 2004 using flow meters and data management software provided by ADS Environmental Services (ADS). The City will have ongoing access to ADS's flow data management software (or equivalent) for the duration of the Post-Construction Monitoring Program. This software, known as Intelliserve, provides full functionality for archiving, retrieving, managing, and analyzing flow data. In addition, the City uses their telemetry system to collect necessary data at the five CSO locations monitored with pump runtime meters.

The City has been collecting water quality data on the St. Joseph, Maumee, and St. Mary's Rivers under various programs since the 1990s. The current sampling program collects monthly samples on a year-round basis and weekly samples from April 1 through October 31 at six sites. Field measurements are taken for pH, Dissolved Oxygen, and temperature. Sample volumes are also transported to the WPCP laboratory and analyzed for *E. coli*, Ammonia-Nitrogen, Total Phosphorus, and Total Suspended Solids.

Consistent with the current monitoring programs, all personnel involved in the Post-Construction Monitoring Plan will be experienced and familiar with the requirements of the data collection program. Given the duration of the City's LTCP program and post-construction monitoring period, it is likely that data management and analysis techniques will evolve and improve within the wet-weather industry over the duration of the implementation period. If this occurs, any recommended changes to the City's approach will be discussed with U.S. EPA and IDEM to ensure consensus prior to implementation.

A primary purpose of the Post-Construction Monitoring Program is to assess compliance with the Performance Criteria set forth in Table 4.2.4.1. In order to assess the Performance Criteria in terms of CSO activations, the City is proposing a model-based approach similar to the method recently approved for the City of Indianapolis, Indiana. In addition, given the importance of the assessment process, and recognizing that methods to assess average performance of CSO control measures per the CSO Policy are in their infancy, the City is allowing for the possibility that an improved alternative, or modified, approach may be identified in the future.

4.6.4.1 Model-Based Approach to Assessing Compliance

The City of Fort Wayne began its collection system modeling program in the late 1990s, and developed a fully dynamic, planning-level collection system model to support development of the Long-Term Control Plan. As explained in Chapter 2, the City's model was reviewed and approved for LTCP development purposes by U.S. EPA and IDEM in 2005.

Under the model-based approach, the City would update and utilize their collection system model to determine whether operational CSO Control Measures have achieved compliance with the Performance Criteria set forth in Table 4.2.4.1. At least two (2) years prior to the initiation of post construction monitoring on the first river-watershed, Fort Wayne shall propose to EPA and IDEM, in writing, the five years it has selected as a five year period for a typical year. The City would take the following steps under this approach, with each step guided by modeling industry standards and sound engineering judgment:

1. Collect CSO outfall data for a 12-month post-construction monitoring period in each watershed in accordance with Section 4.6.3.4.
2. Perform quality assurance and quality control of the data collected in Step 1.

3. Utilize the model (incorporating the improved collection system) in its previously-calibrated state and the rainfall data collected during the monitoring period, to run a continuous simulation of CSO discharges for the 12-month post-construction monitoring period.
4. Compare the continuous simulation outputs to the CSO monitoring data for the 12-month post-construction monitoring period to determine whether re-calibration of the collection system model is needed. Model re-calibration will not be needed if the model achieves at least the same degree of calibration as was achieved for pre-CSO Long-Term Control conditions during the LTCP development process, and there is a high degree of agreement between the model output and CSO monitoring data for activation frequency for the 12-month post-construction monitoring period. Otherwise, model re-calibration will be needed in accordance with Steps 5-7.
5. If re-calibration is needed, select two or more appropriate rainfall events from the 12-month post-construction monitoring period for model recalibration. The City will apply the standard of practice used in the collection system modeling industry in selecting the best candidate events for model calibration.
6. Develop an initial data set for use with the model and perform successive applications of the model with appropriate parameter adjustment until there is a high degree of agreement between the model output and the CSO monitoring data for the selected recalibration events. In making such adjustments, the City will consider the inherent variability in both the collection system model and in flow monitoring data, and will exercise sound engineering judgment and best industry practices so as to not compromise the overall representativeness of the model.
7. Once the model has been re-calibrated in accordance with Step 6, the City will verify the re-calibrated model by again utilizing the model and the rainfall data collected during the 12-month post-construction monitoring period, to run another continuous simulation for the 12-month post-construction monitoring period. The City will again compare the continuous simulation outputs to the CSO monitoring data for the 12-month post-construction monitoring period as described in Step 4, to determine whether additional re-calibration of the collection system model is needed. Re-calibration will be determined to be adequate if the model achieves at least the same degree of calibration, as was achieved for pre-CSO Long-Term Control conditions during the LTCP development process, and there is a high degree of agreement between the model output and CSO monitoring data for activation frequency for the 12-month post-construction monitoring period. Otherwise, further re-calibration will be needed in accordance with these Steps 5-7 until the model achieves at least the same degree of calibration as was achieved for pre-CSO Long-Term Control conditions during the LTCP development process, and there is a high degree of agreement between the model output and CSO monitoring data for activation frequency for the 12-month post-construction monitoring period.
8. Once the City has satisfactorily re-calibrated the model in accordance with Steps 5 through 7 (or shown that recalibration is not necessary in accordance with Step 4), the City will then utilize the original model (if recalibration was determined not to be necessary in accordance with Steps 4-7) or the recalibrated model to run a continuous simulation for a representative five-year period agreed to with IDEM and U.S. EPA. The model results for this five-year simulation will be used to determine whether the City has achieved the Performance Criteria set forth in Table 4.2.4.1.

9. The City shall be deemed to have achieved the Performance Criteria if the five-year simulation shows that there were a total of 24 or fewer CSO events into the Maumee River and St. Mary's River watershed for the five-year period, and a total of 6 or fewer CSO events into the St. Joseph River watershed for the five-year period, following construction of the necessary Control Measures in Table 4.2.4.1.
10. The overflow frequency performance criterion is based upon a "typical year," calculated using the 5-year continuous simulation of the collection system model, as described above. If the modeled average annual overflow frequency is less than or equal to 1.2 for the St. Joseph River and 4.8 for the Maumee and St. Mary's Rivers, the system is deemed to be in compliance with the performance criteria of 1 and 4 overflow events per year. This "rounding" is appropriate due to the inherent variability in model predictions. If the modeled overflow frequency exceeds 1.2 for the St. Joseph River and/or 4.8 for the Maumee and St. Mary's Rivers, then the City will prepare a Milestone Report of this negative result under Paragraph 4.6.6.1. The City may include an analysis of the following in the Milestone Report: (1) the volume, frequency, and factors causing the additional overflow frequency, (2) any impact on water quality, including designated uses, from the additional overflow frequency, (3) control options, if any, to reduce the frequency towards 4/1 (as appropriate), (4) associated costs for any additional control options, (5) any expected benefits from such control options and (6) a recommendation as to whether the City should proceed under Section XXI.D, XXI.E or another provision of the Consent Decree.

It is important to note that percent capture has not been identified as a formal Performance Criterion for the City's LTCP. Based on discussions with U.S. EPA and IDEM during development of the final recommended plan, average annual overflow frequency was identified as the controlling Performance Criterion and is identified as such in Table 4.2.4.1. However, the City recognizes that percent capture can sometimes be useful in assessing performance of a combined sewer system, and will continue to develop estimates of percent capture based on the 5-year simulations described above. These estimates will be included in documentation of system performance included in the Milestone Reports described in Section 4.6.6.1.

The City also plans to use their collections system model to support the process of refining the planning-level LTCP concepts into specific CSO control projects. This will require selected improvements to the level of detail and calibration of the model on an as-needed basis over the next 18 years. This process of refining the model to meet specific project needs has always been anticipated, and is consistent with the modeling approach followed by the City since the 1990s. The model is a valuable and dynamic tool that the City will use as appropriate to further system understanding from a design, operation, and maintenance perspective as they pursue their goal of improving water quality on local rivers.

4.6.4.2 Alternate Compliance Assessment Approach

The City may propose an alternate compliance assessment approach other than that described in Section 4.6.4.1. Such an alternate compliance assessment approach may be implemented by the City, in lieu of that described in Section 4.6.4.1, if approved by U.S. EPA and IDEM and subject to other approvals, if any, required by Section XXI of the City's Consent Decree. In order to provide sufficient time for agency review and approval to allow timely implementation, any proposal by the City for use of an alternative compliance assessment approach should be submitted to U.S. EPA and IDEM no later than December 31, 2015.

4.6.5 Quality Control

The City has Standard Operating Procedures (SOPs) in place for both of the core activities in the Post-Construction Monitoring Program, CSO outfall flow monitoring and river water quality sampling. Both of these programs have been ongoing in their current form since at least 2004, allowing for 3 years of field experience and identification of potential difficulties. The SOPs for these two programs are included in the Combined Sewer System Operational Plan.

All activities under the Post-Construction Monitoring Program will be implemented with appropriate quality control standards, including potential updates to the standards in response to industry trends. While the detailed procedures associated with many activities have in-place SOPs (as explained above), a general summary of the quality control procedures follows.

- Streamflow data is collected by the USGS under their typical quality control procedures. The City makes use of this streamflow data as part of their wet-weather program.
- CSO outfall flow monitoring is conducted by a dedicated CSO crew, following SOPs for maintenance, equipment replacement, data downloads, and associated field activities. Flow data is reviewed for validity and representativeness by the Program Manager of Wet-Weather Operations.
- The proposed City of Fort Wayne CSO Satellite Disinfection Pilot Study will be performed per the quality control requirements outlined in Attachment 1.
- River water quality sampling is performed by trained Industrial Pretreatment staff. Standard sampling procedures and documentation are a required part of the program, including use of chain-of-custody forms, appropriate sample preservation techniques, etc.
- Laboratory analysis of water quality samples is performed by the City’s certified WPCP laboratory. The City’s laboratory follows all standard and required protocols and documentation needs.
- Rainfall data is downloaded and archived by the dedicated CSO crew responsible for the CSO outfall monitoring program. Rain gauge field work and downloading activities are included in the flow monitoring program SOP.

4.6.6 Data Evaluation & Progress Reporting

As part of the City’s agreement with U.S. EPA and IDEM, regular reporting of activities and progress is required for the duration of the LTCP implementation process. Biannual reports are required under the Consent Decree, and these will include updates on the Post-Construction Monitoring Program as appropriate. In addition to the reporting required under the Consent Decree, the City will provide the Milestone Reports and Final Report described below to U.S. EPA and IDEM specifically for the Post-Construction Monitoring Program.

A second purpose for the progress reporting is to keep Fort Wayne’s public ratepayers aware of the City’s progress. A key goal of the City’s overall wet-weather control philosophy is to ensure that public monies are spent in an effective and prudent manner. As part of pursuing that goal, the City is committed to keeping the public informed on where, how, and to what benefit their money is being spent.

As explained previously in this plan, and recognized by U.S. EPA in their December 2001 Report to Congress, "it is often difficult, and in some instances impossible, to link environmental conditions or results to a single source of pollution, such as CSOs. In most instances, water quality is impacted by multiple sources, and trends over time reflect the change in loadings on a watershed scale from a variety of environmental programs." Therefore, it is unlikely that the reports described below will be able to definitively link any measurable water quality indicator to in-place CSO controls. However, the City's reporting will document progress towards complying with the Performance Criteria in Table 4.2.4.1, along with progress towards the common goal of improving instream water quality.

A summary of the schedule for the Milestone Reports and Final Report is presented in Table 4.6.6.1. As can be seen, the Milestone Reports provide an explicit mechanism for demonstrating compliance with the Performance Criteria set forth in Table 4.2.4.1 by 2027, or two years after Achievement of Full Operation for all CSO Control Measures. If compliance is demonstrated in 2027, the City will have satisfied the Performance Criteria for CSO Control Measures required under the Consent Decree. If compliance is not demonstrated in 2027, the final Milestone Report will include an analysis of the following: (1) the volume, frequency, and factors causing the additional overflow frequency, (2) any impact on water quality, including designated uses, from the additional overflow frequency, (3) control options, if any, to reduce the frequency towards 4/1 (as appropriate), (4) associated costs for any additional control options, (5) any expected benefits from such control options and (6) a recommendation as to whether the City should proceed under Section XXI.D, XXI.E or another provision of the Consent Decree.

4.6.6.1 Milestone Reports

After Achievement of Full Operation of all LTCP projects in a specified river watershed (St. Joseph River, Maumee River, or St. Mary's River), the City will prepare and submit a Milestone Report to the U.S. EPA and IDEM. The Milestone Report for each watershed will be submitted within two years following Achievement of Full Operation of the applicable CSO project(s), and include data related to the following information:

- Description of river and CSO controls being implemented
- CSO monitoring and rainfall monitoring results
- River water quality sampling results
- Evaluation of the effectiveness of CSO Control Measures, including results of analyses performed to assess whether the implemented controls are complying with the Performance Criteria in Table 4.2.4.1.
- A discussion of any significant variances from the Performance Criteria, including impacting factors and associated water quality impacts (if observed)
- Re-evaluation and proposed corrective action (if necessary)
- Status of upcoming CSO Control Measures in other watersheds (reporting on status of construction schedules, etc.)

The final Milestone Report, prepared in 2027 after Achievement of Full Operation of the St. Mary's River CSO controls, will include an assessment of the combined St. Mary's River and Maumee River controls. While the performance of the Maumee River CSO controls in terms of activations can be assessed in 2024, the full impact of CSO Control Measures on the Maumee River cannot be assessed until implementation of the upstream St. Mary's River controls.

4.6.6.2 Final Report

While the Milestone Reports are targeted at the regulatory agencies for the purpose of demonstrating compliance with the Performance Criteria set forth in Table 4.2.4.1, the Final Report is targeted at a broader audience, including Fort Wayne's ratepayers. As explained previously, the City is committed to keeping the public informed on where, how, and to what benefit their money is being spent. Therefore, the Final Report will be based on up to three years of monitoring following Achievement of Full Operation in order to further assess longer-term trends in expected instream water quality improvements.

The City shall develop and submit the Final Post-Construction Monitoring Report to U.S. EPA and IDEM within three years following Achievement of Full Operation of all LTCP projects. The Final Report will consolidate the information described above with respect to each watershed, plus any additional relevant information collected since submittal of the associated Milestone Report. The purpose of the Final Post-Construction Monitoring Report shall be to provide additional documentation on the performance of the fully implemented CSO Control Measures on a system-wide basis (based on an additional CSO activation data), and provide a further assessment of the longer-term trends in expected instream water quality improvements due to implementation of the City's CSO Control Measures.

4.6.6.3 Progress Report to Public

As noted above, a key goal of the City's overall wet-weather control philosophy is to ensure that public monies are spent in an effective and prudent manner. The City takes this obligation very seriously, given that City ratepayers are funding the CSO Control Measures required under the LTCP. Therefore, progress reporting to the public is analogous to informing an owner on the status of his or her investment.

The City has an active public information program related to wet-weather control (as described in Chapter 7 of the CSSOP), and will continue disseminating information on the status of LTCP implementation through this program. Public outreach will be ongoing during LTCP implementation, starting in 2008. The Milestone Reports described above will also provide information for focused public education periods, during which ratepayers will be shown costs to date and any observed trends in improved water quality.

4.6.7 Summary

The City's Post-Construction Monitoring Program is designed to assess the impact of the CSO Long-Term Control Plan. Given the City's investment of hundreds of millions of dollars in wet-weather control, it is critical to have a mechanism to measure benefit. The Post-Construction Monitoring Program will determine, document, and disseminate the effectiveness of the CSO control program in achieving performance requirements and improving water quality.

The Program includes the following steps:

- Implementation of a defined monitoring program designed to measure reductions in overflow activations and changes in instream water quality.
- Analysis and assessment of flow monitoring data and/or model simulation results to determine whether implemented CSO Control Measures are meeting the Performance Criteria in Table 4.2.4.1.
- Analysis and assessment of water quality data to establish trends in improving instream water quality.
- Preparation of Milestone Reports and a Final Report to document the success of the LTCP implementation, or identify any weak links in the implemented CSO control system and present any necessary corrective action.
- Dissemination of information on LTCP implementation to the Fort Wayne public, including important measures of cost and benefit.

The City's Post-Construction Monitoring Program addresses U.S. EPA and IDEM requirements, as outlined in the CSO Policy, for monitoring the performance of CSO control measures.

APPENDIX 4

TABLES

Table 4.2.1.1
Summary of CSO Metrics for Range of Activation Levels

Plan	Activations in Average Year	Total Capital Cost[(1)] ($M)	System-wide Annual Overflow Volume (MG)	Annual Overflow Volume (MG)			Annual Activations			Annual Hours of Overflow		
				St. Joseph	St. Marys	Maumee	St. Joseph	St. Marys	Maumee	St. Joseph	St. Marys	Maumee
Existing Conditions	71	0	1,058									
4 activation plan	4	220.9	101	7.3	78.1	15.3	4	4	4	17	12	30
3 activation plan	3	249.4	76	5.1	59.3	12.0	3	3	3	13	10	27
Hybrid activation plan	1 to 4	239.4	96	2.9	78.1	15.3	1	4	4	6	12	30

Notes:

(1) Cost of LTCP component only
(2) Overflow metrics are based on the City's approved LTCP collection system model.

Table 4.2.2.1
Configuration of Recommended Plan by Individual Overflow

NOTE: **Yellow shading indicates a change from Table 3.3.5.3. In some cases, the change is a simple wording change.**

Overflow Permit ID	Overflow SIP ID	Regulator	Existing Conditions: Annual Overflow Volume (Typical Year) (cf)	Existing Conditions: Number of Overflow Events (Typical Year)	Improved Conditions: Annual Number of Overflow Events (Typical Year)	Selected Alternative 3E
18/19	K11165/ K11178	K11163/K11162	52,519,264	71	4	PI to CSO Ponds[2]
26/33/27	M10151/ M10313/ M10202	M10150/M10148/M10199	19,534,059	56	4	PI to CSO Ponds
48	O10252	O10312/010311	10,650,200	39	0	Pumped to CSO Ponds
13	K06298	K06285/K06275	8,623,553	44	4	PI to CSO Ponds
CSO PS (57)	NA	P06014	8,006,963	25	4	Increase PS capacity to CSO Ponds
55	P06192	P06119	4,604,087	47	4	PI to CSO Ponds
36	M18032	M18256	4,216,299	34	4	PI to CSO Ponds
20	K15116	K15009	3,908,404	40	4	PI to CSO Ponds
11/12	K06234	K06231	3,532,237	30	4	PI to CSO Ponds
39	N06022	N06007	2,980,121	25	4	PI to CSO Ponds
5	J11164	J11163	2,972,631	48	4	PI to CSO Ponds
21	K19044	L19018	2,645,744	41	4	PI to CSO Ponds
17	K07176	K07171	2,378,948	37	4	PI to CSO Ponds
24	L06420	L06088	2,104,910	23	4	PI to CSO Ponds
28	M10238	M10279	1,783,417	26	4	PI to CSO Ponds
50	O10277	O10273	1,705,907	44	4	PI to CSO Ponds
61	R14137	S18082	1,678,781	14	4	SD/SS[3]
62	R14138	R18188	1,176,229	14	4	SD/SS[3]
NA	NA	O10256	986,456	37	0	Eliminated
4	J02090	J02089	724,620	14	4	PI to CSO Ponds
64	S02035	Q07022/Q03011	706,082	16	4	SS[4]
52[1]	O22004	P22001	547,406	12	1	SD/SS[3]
54	O23080	O19009	511,038	27	4	SD/SS[3]
51	O22002	O22045	471,221	9	1	SS
NA	NA	L06098	454,898	20	0	Gates permanently shut; does not activate
53	O22094	O22095	411,440	13	1	SS
60	R06031	R06030	360,417	11	4	PI to CSO Ponds
32	M10306	M06706	335,513	5	4	PI to CSO Ponds
68	N18254	N18241	311,151	8	1	SS
23	L06103	L06102	306,128	13	4	PI to CSO Ponds
67		K15110	186,580	7	0	Being seprated as part of CSCIP
29[1]	M10265	M10256	168,893	4	4	PI to CSO Ponds
29[1]	M10265	M10309	147,433	3	3	None required
NA	NA	P18031	144,006	3	0	Eliminated
NA	NA	P18036	76,503	5	0	Eliminated
58	Q06034	Q06036	67,379	3	3	None required
45	N22103	N22101	28,274	2	1	SS
25	L06421	L06086	13,899	1	1	None required
NA	NA	K07006	6,621	9	0	Eliminated
52[1]	O22004	P22139	1,338	1	1	None required
14	K07106	K07101/K07115	0	0	0	Does not activate during average year
56/07	J03313	J03267	0	0	0	Does not activate during average year
44	N22093	N22092	0	0	0	Does not activate during average year
NA	NA	L06438	NA	NA	NA	Upstream of L06087/88
NA	NA	K15111	NA	NA	0	Eliminated
NA	NA	M18015	NA	NA	0	Eliminated
002[6] 003[6]	NA	NA	NA	NA	4	Pond storage and dewatering

NOTES:

1 These outfalls receive contributions from two regulators

CSO Pond Components

3E - Wet-weather storage in Pond 1 with bleedback to WPCP

2 PI to CSO Ponds - Parallel interceptor to CSO Ponds

3 SD/SS - Satellite Disinfection basin or Satellite Storage basin. The preferred CSO Control Measure for these CSOs is Satellite Disinfection based on the technology screening and selection process conducted by the City. Alternatively, the City may elect to construct Satellite Storage facilities that will achieve the same Level of Control. See Section 4.6 and Footnote #8 on Table 4.2.4.1 for details on final selection of technology.

4 SS - Satellite storage basin

5 SD - Satellite disinfection basin

6 CSOs 002 and 003 are existing discharge point, but their operating protocol will change significantly with the planned CSO Pond storage/dewatering facility. After Achievement of Full Operation of all LTCP projects, activations from Outfalls 002/003 will be reduced to 4 per typical year.

Table 4.2.3.1
CSO Control Measures, Capital Costs, and Schedule

	CSO Control Measure	Capital Cost (2005$)	Duration (Years)	Bid Date	Projected Completion Date	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025
1	Plant Primaries[1]	$ 65,765,888	3		2008	[5]																	
2	Plant Phase III[1]	$ 10,000,000	2	2014	2015							5,000,000	5,000,000										
3	Early Floatables Control	$ 1,000,000	2	2008	2009	500,000	500,000																
4	CSSCIP - Basins with Planned Satellite Storage/Disinfection Technologies[1]	$ 7,201,000	6	2008	2013	1,200,167	1,200,167	1,200,167	1,200,167	1,200,167	1,200,167												
5	Pond Storage & Dewatering	$ 53,894,264	3	2011	2013				17,964,755	17,964,755	17,964,755												
6	CSSCIP - Basins Tributary to PI[1]	$ 61,130,000	7	2012	2018					8,732,857	8,732,857	8,732,857	8,732,857	8,732,857	8,732,857	8,732,857							
7	Satellite Storage at St. Joseph River CSOs	$ 21,914,750	4	2016	2019									5,478,688	5,478,688	5,478,688	5,478,688						
8	Satellite Disinfection at St. Joseph River CSOs[2]	$ 1,270,994	1	2013	2014							1,270,994											
9	Satellite Disinfection[2]	$ 3,869,868	4	2018	2021											967,467	967,467	967,467	967,467				
10	Morton Street/O10101 Reroute	$ 8,750,000	1	2019	2019												8,750,000						
11	Wayne Street Parallel Interceptor	$ 44,456,005	3	2020	2022													14,818,668	14,818,668	14,818,668			
12	St. Marys Parallel Interceptor	$ 19,211,345	3	2023	2025																6,403,782	6,403,782	6,403,782
13	Late Floatables Control	$ 4,762,100	6	2020	2025													793,683	793,683	793,683	793,683	793,683	793,683
14	Satellite Storage	$ 1,937,500	1	2025	2025																		1,937,500
15	CSO Pond High Rate Treatment[3]	TBD	TBD	TBD	TBD																		
	Total LTCP Capital Costs By Year[4]	$ 305,163,713				1,700,167	1,700,167	1,200,167	19,164,921	27,897,779	27,897,779	15,003,851	13,732,857	14,211,545	14,211,545	15,179,012	15,196,154	16,579,818	16,579,818	15,612,352	7,197,465	7,197,465	9,134,965
	Total LTCP Capital Cost Year 2008 - 2025 [5]	**$ 239,397,825**																					

Footnotes:

(1) The CSO Control Measure is not expected to achieve target activation levels on its own, but will work in conjunction with other CSO Control Measures at the specified CSO outfalls to achieve the performance goals.

(2) The preferred CSO Control Measure for these CSOs is Satellite Disinfection based on the technology screening and selection process conducted by the City. Alternatively, the City may elect to construct Satellite Storage facilities that acheive the same level of control. See Section 4.6 and Footnote #8 on Table 4.2.4.1 for details on final selection of technology.

(3) The completed LTCP analysis indicates that the Pond Storage & Dewatering (CSO Control Measure 3) will reduce Pond activations to 4 overflow events per "typical year." Therefore, the CSO Pond EHRC/HRT facility will be constructed only if required to achieve the agreed-upon performance criteria for the Maumee River, i.e. 4 overflow events per "typical year," following completion of CSO Control Measures 5, 11, and 12.

(4) Capital costs presented in this table reflect costs for CSO Control Measures to be implemented beginning in 2008, with the exception of CSO Control Measure 1. The City has also incurred additional capital costs for pre-2008 projects under its CSSCIP program. The total projected capital expenditures for the City's LTCP program, including pre-2008 CSSCIP costs, are presented in Chapter 3.

(5) CSO Control Measure 1 is under construction and projected to be complete in 2008. The Capital Cost for CSO Control Measure 1 is not included in the 18-year (2008 - 2025) LTCP schedule of costs .

Table 4.2.4.1
CSO Control Measures, Design Criteria, Performance Criteria, and Critical Milestones

	CSO Control Measure[1]	Description[2]	CSOs Controlled (By Overflow Permit ID)	Design Criteria[2]	Performance Criteria	Critical Milestones[3]
1	Plant Primaries[4]	Upgrade WPCP primaries to achieve peak capacity of 85 mgd and firm capacity of 74 mgd[5].	57; Outfall 002/003	When combined with the rest of the WPCP improvements, provide peak primary treatment capacity of 85 mgd and firm capacity of 74 mgd.	When combined with the rest of the WPCP improvements, facility achieves peak capacity of 85 mgd while complying with effluent limits of current NPDES permit at Outfall 001.	To be completed and in full operation in 2008
2	Plant Phase III[4]	Upgrade remaining WPCP facilities to achieve peak capacity of 85 mgd and firm capacity of 74 mgd[5].	57; Outfall 002/003	When combined with the rest of the WPCP improvements, provide peak secondary treatment capacity of 85 mgd and firm capacity of 74 mgd.	When combined with the rest of the WPCP improvements, facility achieves peak capacity of 85 mgd while complying with effluent limits of current NPDES permit at Outfall 001.	Bid Year - 2014 Achievement of Full Operation - 2015
3	Early Floatables Control	Pilot testing of selected floatables control technologies to assess performance in Fort Wayne[6].	3 pilot locations	CSO-specific; provide instantaneous peak floatables control rate equal to highest annual flow rate in "typical year."	Capture most coarse solids and floatables; design target is to remove one-half-inch diameter and larger solids and floatables.	Commence study - Ongoing Complete study - 2008 Initiate pilot program and make fully operational - 2009 Monitor pilot installations - 2009-2010
4	CSSCIP - Basins with Planned Satellite Storage/Disinfection Technologies[4]	Partial separation projects identified as cost-effective components of the Combined Sewer System Capacity Improvements Program.	45, 61, 62, 64, 51, 52, 53, 54, 68	Storm drains designed as per Fort Wayne Stormwater Standards. Sanitary sewers designed as per Fort Wayne Sanitary Standards and Ten State Standards.	Partial separation of sewers to address basement flooding concerns and reduce local CSOs.	The CSSCIP Program was begun in 1999. The program schedule typically addresses two to three combined sewer subbasins per calendar year. CSSCIP work under this Control Measure will be scheduled in two phases: Phase 1 will address CSO Outfalls 45, 51, 52, 53, and 68, and be completed by 2010; Phase 2 will address CSO Outfalls 61, 62, 64, and 54, and be completed by 2013.
5	Pond Storage & Dewatering	Improvements to CSO Pond 1 to allow storage of combined sewer overflow with subsequent dewatering to WPCP.	When combined with the Parallel Interceptor and Morton Street solution, all CSOs tributary to the Parallel Interceptor, plus CSO 48 and 57, plus Outfalls 002/003	Provide storage capacity of approximately 95 MG.	Achieve 4 overflow events from Ponds[7]	Optimization of existing facilities to allow interim dewatering - 2008 Bid Year for Full Dewatering Capability - 2011 Achievement of Full Operation - 2013
6	CSSCIP - Basins Tributary to PI[4]	Partial separation projects identified as cost-effective components of the Combined Sewer System Capacity Improvements Program.	4, 5, 11, 12, 13, 17, 18, 19, 20, 21, 23, 24, 26, 27, 28, 29, 32, 33, 36, 39, 50, 55, 60 (Note: CSSCIP work associated with Outfalls 17, 26, 27, 28, 33, and 36 already completed as of 2007)	Storm drains designed as per Fort Wayne Stormwater Standards. Sanitary sewers designed as per Fort Wayne Sanitary Standards and Ten State Standards.	Partial separation of sewers to address basement flooding concerns and reduce local CSOs.	The CSSCIP Program began in 1999 and typically addresses two to three combined sewer subbasins per calendar year. Remaining CSSCIP work under this Control Measure will be initiated in 2012 and completed in 2018.
7	Satellite Storage at St. Joseph River CSOs	Satellite storage facilities	45, 51, 53, 68	Provide storage volume of: CSO 45: 0.04 MG CSO 51: 0.76 MG CSO 53: 0.65 MG CSO 68: 1.17 MG	Achieve 1 overflow event[7]	Bid Year (first facility) - 2016 Achievement of Full Operation (final facility) - 2019
8	Satellite Disinfection at St. Joseph River CSOs[8]	Satellite disinfection facility	52	Provide peak disinfection treatment rate of 5.0 MGD[12]	Achieve 1 overflow event[7]; provide treatment to meet NPDES effluent limits for Satellite Disinfection for all other discharge events.[13]	Bid Year - 2013 Achievement of Full Operation - 2014
9	Satellite Disinfection[8]	Satellite disinfection facilities	54, 61, 62	Provide peak disinfection treatment rate of: [12] CSO 54: 1.2 MGD CSO 61: 8.4 MGD CSO 62: 5.8 MGD	Achieve 1 overflow event[7]; provide treatment to meet NPDES effluent limits for Satellite Disinfection for all other discharge events.[13]	Bid Year (first facility) - 2018 Achievement of Full Operation (final facility) - 2021
10	Morton Street/O10101 Reroute	Re-route overflow pump station discharge to CSO Pond 1.	48	Provide peak pumping capacity equal to highest annual flow rate in "typical year."	Achieve 0 overflow events[7]	Bid Year - 2019 Achievement of Full Operation - 2019
11	Wayne Street Parallel Interceptor	Parallel interceptor to capture combined sewer overflows for conveyance to WPCP/CSO Ponds. Begins near CSO 13 (K06298) at western end and discharges into the treatment complex at/near the overflow to the CSO Ponds (Regulator Q06057).	11, 12, 13, 23, 24, 26, 27, 28, 29, 32, 33, 36, 39, 50, 55, 60	Provide approximate instantaneous peak flow rate of 376 MGD at downstream end[9].	Achieve 4 overflow events[7]	Bid Year - 2020 Achievement of Full Operation - 2022

Table 4.2.4.1
CSO Control Measures, Design Criteria, Performance Criteria, and Critical Milestones

	CSO Control Measure[1]	Description[2]	CSOs Controlled (By Overflow Permit ID)	Design Criteria[2]	Performance Criteria	Critical Milestones[3]
12	St. Marys Parallel Interceptor	Parallel interceptor to capture combined sewer overflows for conveyance to WPCP/CSO Ponds. Begins near CSO 21 (K19044) at southern end and discharges into the Wayne Street Parallel Interceptor.	4, 5, 17, 18, 19, 20, 21	Provide approximate instantaneous peak flowrate of 176 MGD at downstream end[9].	Achieve 4 overflow events[7]	Bid Year - 2023 Achievement of Full Operation - 2025
13	Late Floatables Control	Overflow-specific solids and floatables controls[6].	All CSOs for which floatables not addressed through other facilities	CSO-specific; provide instantaneous peak floatables control rate equal to highest annual flow rate in "typical year."	Capture most coarse solids and floatables; design target is to remove one-half-inch diameter and larger solids and floatables[10].	Bid Year (first facility) - 2020 Achievement of Full Operation (final facility) - 2025
14	Satellite Storage	Satellite storage facility	64	Provide storage volume of 0.23 MG	Achieve 4 overflow events[7]	Bid Year - 2025 Achievement of Full Operation - 2025
15	CSO Pond High Rate Treatment[11]	Enhanced High Rate Clarification facility, typically referred to by the trade names DensaDeg or ACTIFLO.	When combined with the Parallel Interceptor and Morton Street solution, all CSOs tributary to the Parallel Interceptor plus CSO 48.	TBD	Achieve 4 overflow events[7]	TBD

Footnotes:

(1) Upon full implementation, the CSO Control Measures listed in Table 4.2.4.1 are expected to result in 4 CSO events on the St. Marys and Maumee Rivers and 1 CSO event on the St. Joseph River in a "typical year," as evaluated in accordance with footnote 5 (note: Outfall 48 on the Maumee River will be controlled to 0 CSO events in a "typical year"). Either a revision to Indiana's current water quality standards or some other legal mechanism is necessary to authorize overflows due to storms exceeding those levels of control. In Chapter 5 of the LTCP, the City of Fort Wayne is requesting a revision to the applicable water quality criteria consistent with this level of control through the establishment of a CSO wet-weather limited use subcategory supported by a Use Attainability Analysis (UAA). The design and construction of CSO Control Measures 1, 2, 4, 6, and 10 are not dependent on the level of control ultimately determined, and therefore the City will implement CSO Control Measures 1, 2, 4, 6, and 10 according to the terms and schedules set forth in this Table.

(2) The Description and Design Criteria are based upon LTCP-level planning estimates and may be subject to revision during facility planning and design. One of the conditions of Description and Design Criteria, applicable to all of the facilities set forth in this Table 4.2.4.1, is that the specific facility will be designed in accordance with good engineering practice to ensure that corresponding facility-specific, river-specific, and system-wide Performance Criteria will be achieved.

(3) The term "Bid Year" means "Completion of the Bidding Process."

(4) The CSO Control Measure is not expected to achieve target activation levels on its own, but will work in conjunction with other CSO Control Measures at the specified CSO outfalls to achieve the performance goals.

(5) With all units in service, peak WPCP capacity of 85 mgd can be maintained for over 24 hours.

(6) Implementation of floatables control using industry-standard technologies (e.g., baffles, in-line netting, mechanical screens, passive screens, vortex separators) is contingent on IDEM interpretation of setback requirements. The City's proposed floatables control program assumes that these typical, industry-standard control technologies will continue to not be subject to setback requirements.

(7) CSO Control Measure will be designed to achieve Performance Criteria of 4 CSO events for the St. Marys and Maumee Rivers and 1 CSO event for the St. Joseph River in a "typical year." (Note: Outfall 48 on the Maumee River will be controlled to 0 CSO events in a "typical year"). "Typical year" performance, and achievement of Performance Criteria, is based on average annual statistics over a representative five-year period. The method to assess "typical year" performance over a typical 5-year period will be selected from the options presented in Section 4.6 of Appendix 4 (Post-Construction Monitoring).

(8) The preferred CSO Control Measure for these CSOs is Satellite Disinfection based on the technology screening and selection process conducted by the City. The City will proceed as described in Section 4.6 of Appendix 4 to conduct a Satellite Disinfection Pilot Study if it ultimately elects to construct one or more Satellite Disinfection facilities. Alternatively, the City may elect to construct Satellite Storage facilities that will achieve the same Level of Control. The City will construct Satellite Storage facilities in lieu of Satellite Disinfection facilities if it comes to acquire, by January 1, 2010, the wastewater collection and treatment systems currently owned or operated by Utility Center, Inc. (a/k/a AquaSource or Aqua Indiana, Inc.) and connected to the Main Aboite and Midwest wastewater treatment facilities (for which the State has issued NPDES Permit Nos. IN0035378 and IN0042391).

(9) The stated downstream end capacity is the largest capacity required by the referenced Parallel Interceptor. Capacity will decrease, and the parallel interceptor pipe diameter will decrease, in upstream sections due to lower peak flows. This is consistent with standard engineering practice for a pipe that accepts incremental flows from its upstream end to its downstream end. Capacity requirements at interim locations along the Parallel Interceptor are presented in Section 3.3.

(10) Design target of removing one-half-inch and larger solids and floatables will be confirmed or modified based on results of pilot floatables control program (CSO Control Measure 3).

(11) The completed LTCP analysis indicates that the Pond Storage & Dewatering (CSO Control Measure 3) will reduce Pond activations to 4 overflow events per "typical year." Therefore, the CSO Pond EHRC/HRT facility will be constructed only if required to achieve the agreed-upon performance criteria for the Maumee River, i.e. 4 overflow events per "typical year," following completion of CSO Control Measures 5, 11, and 12.

(12) Required disinfection protocol and associated effluent limits for flows up to and including the peak flowrate shall be defined as noted in Section 4.6 of Appendix 4.

(13) If Satellite Disinfection technology is utilized, NPDES effluent limits shall be as noted in Section 4.6 of Appendix 4.

Table 4.6.2.1
Post-Construction Monitoring for CSO Control Measures by River Watershed

Watershed	CSO Control Measure[1]		CSOs Controlled (By Overflow Permit ID)	Monitoring Data[2]		Typical Year Performance[2]		Overflow Frequency Performance Criteria Achieved (Yes/No)[4]	Comments
				CSO Volume (MG)	Overflow Frequency By Watershed	CSO Volume (MG)	Overflow Frequency By Watershed[3]		
St. Joseph River	7	Satellite Storage at St. Joseph River CSOs	45, 51, 53, 68						
	8	Satellite Disinfection at St. Joseph River CSOs[5]	52						
Maumee River	5	Pond Storage & Dewatering	57, plus Outfalls 002/003						
	10	Morton Street/O10101 Reroute	48						
	11	Wayne Street Parallel Interceptor	11, 12, 13, 23, 24, 26, 27, 28, 29, 32, 33, 36, 39, 50, 55, 60						
	14	Satellite Storage	64						
	9	Satellite Disinfection[5]	61, 62						
St. Marys River	12	St. Marys Parallel Interceptor	4, 5, 17, 18, 19, 20, 21						
	9	Satellite Disinfection[5]	54						

Footnotes:

(1) CSO Control Measures are listed in LTCP Table 4.2.4.1 along with Achievement of Full Operation (AFO) dates. Note that additional CSO Control Measures, not specific to a particular river watershed, will also be implemented (as outlined in Table 4.2.4.1).

(2) The monitoring period duration, and method to assess Typical Year Performance, will be selected from the options presented in Section 4.6.4.

(3) Typical Year Performance Criteria of 1 overflow event (for the St. Joseph River) or 4 overflow events (for the Maumee and St. Marys Rivers) is based on average annual statistics over a representative five-year period. The method to assess "typical year" performance over a typical 5-year period will be selected from the options presented in Section 4.6.4.

(4) Milestone reports on the achievement of performance criteria will be prepared for each watershed, as described in Section 4.6.6.

(5) The preferred CSO Control Measure for these CSOs is Satellite Disinfection based on the technology screening and selection process conducted by the City. The City will proceed as described in Section 4.6 to conduct a Satellite Disinfection Pilot Study if it ultimately elects to construct one or more Satellite Disinfection facilities. Alternatively, the City may elect to construct Satellite Storage facilities.

Table 4.6.3.1
CSO and Stream Monitoring

Site ID	Location	Receiving Stream	Rationale	Real-time Discharge	Intermittent Water Quality	Monitoring Frequency	Monitoring Protocols
1	Mayhew Road Bridge	St. Joseph	Located upstream of the City service area, representing St. Joseph River water quality without any effects of Fort Wayne urban sources. This location provides an indicator of water quality conditions and loads entering City waterways from upstream watersheds.		X	Monthly on a year-round basis; weekly from April 1 to October 31	pH, Dissolved Oxygen, temperature, *E. coli*, Ammonia-Nitrogen, Total Phosphorus, Total Suspended Solids. In addition, monthly sample only - Cadmium, Copper, Lead & Zinc.
2	Tennessee Avenue Bridge	St. Joseph	Located downstream of St. Joseph River CSOs and prior to confluence with the Maumee River, repesenting the cumulative impact of CSO and other urban sources. This location will be used to track the impact of St. Joseph River CSO controls.		X	Monthly on a year-round basis; weekly from April 1 to October 31	pH, Dissolved Oxygen, temperature, *E. coli*, Ammonia-Nitrogen, Total Phosphorus, Total Suspended Solids. In addition, monthly sample only - Cadmium, Copper, Lead & Zinc.
3	Ferguson Road Bridge	St. Marys	Located upstream of the City service area, representing St. Marys River water quality without any effects of Fort Wayne urban sources. This location provides an indicator of water quality conditions and loads entering City waterways from upstream watersheds.		X	Monthly on a year-round basis; weekly from April 1 to October 31	pH, Dissolved Oxygen, temperature, *E. coli*, Ammonia-Nitrogen, Total Phosphorus, Total Suspended Solids. In addition, monthly sample only - Cadmium, Copper, Lead & Zinc.
4	Spy Run Bridge	St. Marys	Located downstream of St. Marys River CSOs and prior to confluence with the Maumee River, repesenting the cumulative impact of CSO and other urban sources. This location will be used to track the impact of St. Marys River CSO controls.		X	Monthly on a year-round basis; weekly from April 1 to October 31	pH, Dissolved Oxygen, temperature, *E. coli*, Ammonia-Nitrogen, Total Phosphorus, Total Suspended Solids. In addition, monthly sample only - Cadmium, Copper, Lead & Zinc.
5	Anthony Boulevard Bridge	Maumee	Located downstream of St. Joseph River and St. Marys River CSOs, and upstream of the WPCP and Pond discharges. This location will be used to track the impact of all upstream CSOs (under current and improved conditions) independent of WPCP and CSO Pond improvements.		X	Monthly on a year-round basis; weekly from April 1 to October 31	pH, Dissolved Oxygen, temperature, *E. coli*, Ammonia-Nitrogen, Total Phosphorus, Total Suspended Solids. In addition, monthly sample only - Cadmium, Copper, Lead & Zinc.
6	Landin Road Bridge	Maumee	Located downstream of Fort Wayne to evaluate the cumulative impact of all CSO Control Measures in the City.		X	Monthly on a year-round basis; weekly from April 1 to October 31	pH, Dissolved Oxygen, temperature, *E. coli*, Ammonia-Nitrogen, Total Phosphorus, Total Suspended Solids. In addition, monthly sample only - Cadmium, Copper, Lead & Zinc.
USGS-1	Anthony Boulevard Bridge	Maumee	USGS Gauging Station #04182900			Continuous	Water stage
USGS-2	Coliseum Boulevard Bridge	Maumee	USGS Gauging Station #04182950	X		Continuous	River flow, water stage
USGS-3	Landin Road Bridge	Maumee	USGS Gauging Station #04183000	X		Continuous	River flow, water stage
USGS-4	Latitude 41°10'38" Longitude 85°03'21"	St. Joseph	USGS Gauging Station #04180500	X		Continuous	River flow, water stage
USGS-5	Anthony Extended Bridge	St. Marys	USGS Gauging Station #04182000	X		Continuous	River flow, water stage
Outfall 003	CSO Pond 1	Maumee	Currently a permitted discharge, but not active; potential future discharge point	X		Continuous	Post-construction monitoring will be via new equipment installed as part of LTCP improvements.
Outfall 002	CSO Pond 2	Maumee	Monitoring required per NPDES permit	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
Outfall 001	WPCP Discharge	Maumee	Monitoring required per NPDES permit	X	X	Daily/Continuous	Per NPDES Permit
CSO 004	Rolling Mills regulator	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)

Table 4.6.3.1
CSO and Stream Monitoring

Site ID	Location	Receiving Stream	Rationale	Real-time Discharge	Intermittent Water Quality	Monitoring Frequency	Monitoring Protocols
CSO 005	Foster Park at swing bridge	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 011	Nebraska Pump Station	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Pump run time meters used to estimate flow (onset, duration, and volume of overflow)
CSO 013	Wayne and Nelson	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity of influent (onset, duration of overflow) plus weir equation
CSO 017	Wildwood and Wildmere	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 018	Broadway and Rudisill	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 019	Broadway and Rudisill	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 020	Harman Road	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 021	Century Court	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 023	Jackson and Superior	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 024	Ewing and Superior (east manhole)	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 025	Ewing and Superior (west manhole)	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 026	Third Street Pump Station	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 028	Glasgow Pump Station	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Pump run time meters used to estimate flow (onset, duration, and volume of overflow)
CSO 029	Barr and Superior/Clinton and Superior	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 032	Superior and Wayne	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 033	Third Street Pump Station	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Pump run time meters used to estimate flow (onset, duration, and volume of overflow)
CSO 036	Westbrook	Spy Run (into St. Marys)	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 039	Wayne and Hanna	Maumee	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 044	Spy Run extended and Dalgreen	St. Joseph	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 045	250 feet east of Spy Run extended and Dalgreen	St. Joseph	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 048	Morton Street Pump Station	Maumee	Monitored CSO for City monthly reporting requirements	X		Continuous	Pump run time meters used to estimate flow (onset, duration, and volume of overflow)
CSO 050	Coombs @ CAJ Foods	Maumee	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 051	3420 Woodrow Avenue	St. Joseph	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)

Table 4.6.3.1
CSO and Stream Monitoring

Site ID	Location	Receiving Stream	Rationale	Real-time Discharge	Intermittent Water Quality	Monitoring Frequency	Monitoring Protocols
CSO 052	Crescent and Springfield/Concordia H.S. parking lot	St. Joseph	Monitored CSO for City monthly reporting requirements	X	X(1)	Continuous	Flow, level, velocity (onset, duration, and volume of overflow). Effluent parameters per NPDES Permit. (2)
CSO 053	1124 St. Joseph River Drive	St. Joseph	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 054	Smith and Belmont	Natural Drain No. 4 (into St. Marys)	Monitored CSO for City monthly reporting requirements	X	X(1)	Continuous	Flow, level, velocity (onset, duration, and volume of overflow). Effluent parameters per NPDES Permit. (2)
CSO 055	Anthony and Wayne	Maumee	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 056	Brown Street Pump Station	St. Marys	Monitored CSO for City monthly reporting requirements	X		Continuous	Pump run time meters used to estimate flow (onset, duration, and volume of overflow)
CSO 057	Wayne and Glascow/WPCP in front of headworks	Maumee	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 058	East of WPCP	Maumee	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 060	Formerly Farrell Gas (east of Omin Source offices)	Un-named ditch (to Maumee)	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 061	Coliseum and State	Baldwin Ditch (to Maumee)	Monitored CSO for City monthly reporting requirements	X	X(1)	Continuous	Flow, level, velocity (onset, duration, and volume of overflow). Effluent parameters per NPDES Permit. (2)
CSO 062	State and Laverne	Baldwin Ditch (to Maumee)	Monitored CSO for City monthly reporting requirements	X	X(1)	Continuous	Flow, level, velocity (onset, duration, and volume of overflow). Effluent parameters per NPDES Permit. (2)
CSO 064	Pontiac	Un-named ditch (to Maumee)	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 068	Glazier and North Side Drive	St. Joseph	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity (onset, duration, and volume of overflow)
CSO 080	Alley beside 2316 Kensington/alley beside 1815 E. State Boulevard	Baldwin Ditch (to Maumee)	Monitored CSO for City monthly reporting requirements	X		Continuous	Flow, level, velocity of influent (onset, duration of overflow) plus weir equation

(1) Intermittent Water Quality monitoring required only if Satellite Disinfection technology constructed.

(2) If Satellite Disinfection technology is utilized, NPDES effluent limits shall be as noted in Section 4.6.

Table 4.6.6.1

PCMP Reporting Schedule

Watershed	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
St. Joseph River	AFO	M	MR									
Maumee River				AFO	M	MR						
St. Marys/Maumee River System							AFO	M	MR			
Full System								Continued activation monitoring and instream sampling				
												FR

AFO	Achievement of Full Operation
M	12-month activation monitoring period for Model-Based Approach to assessing compliance with Performance Criteria in Table 4.2.4.1
MR	Milestone Report
FR	Final Report

FIGURES

Figure 4.2.1.1
St. Joseph River CSOs

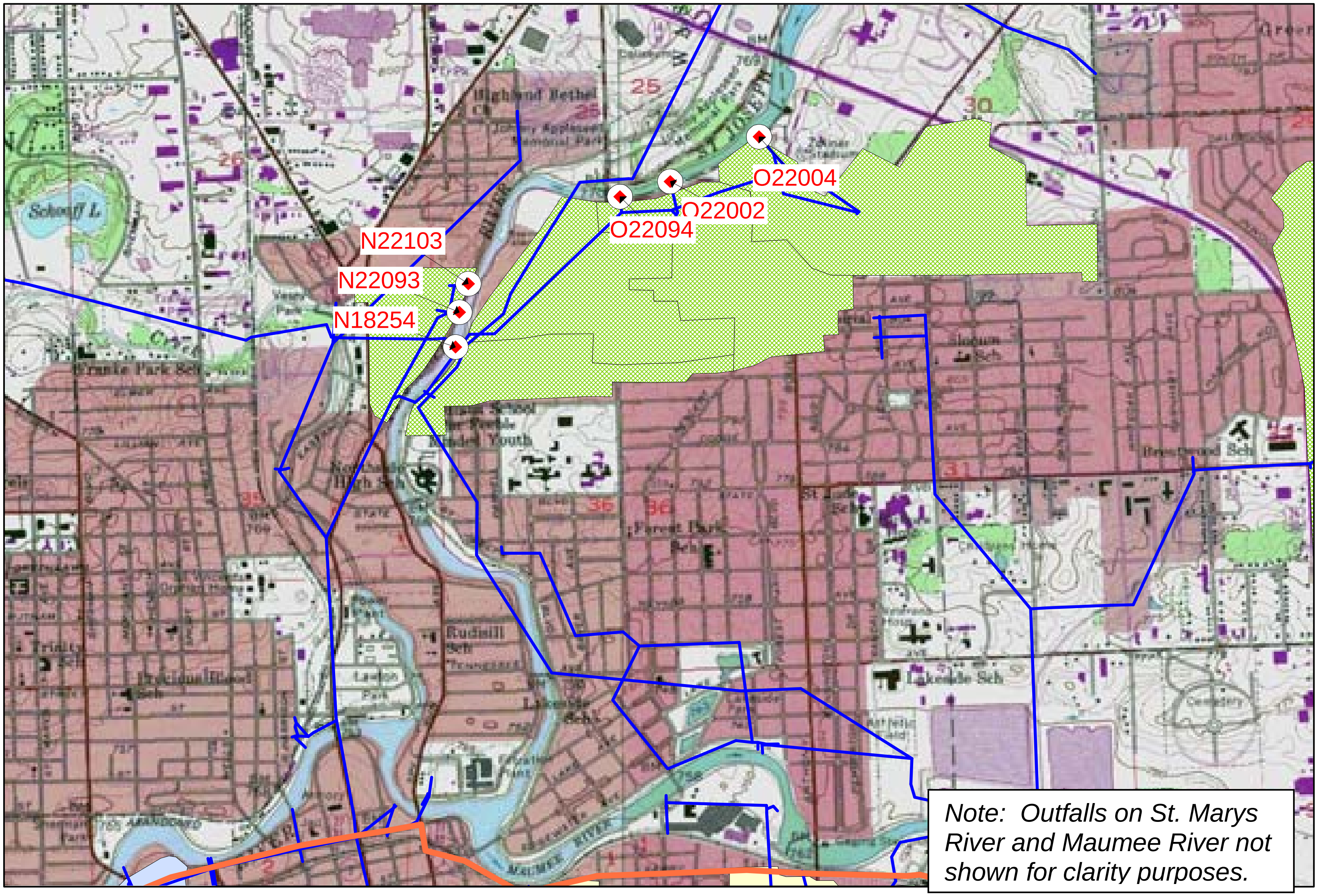
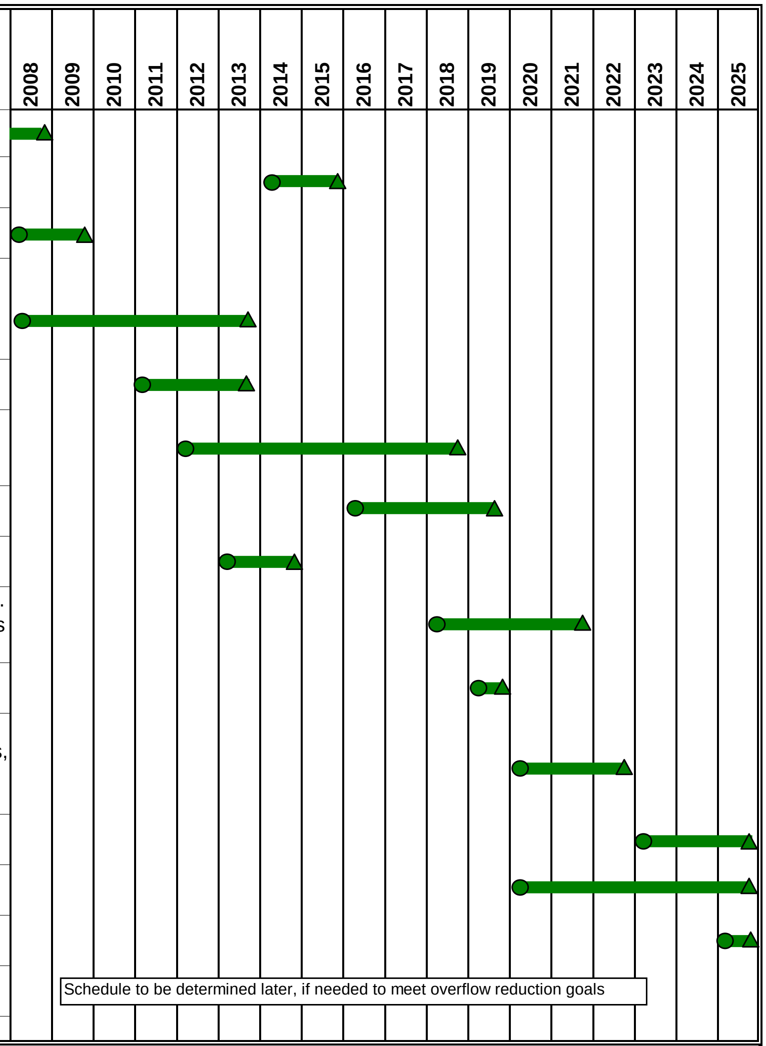


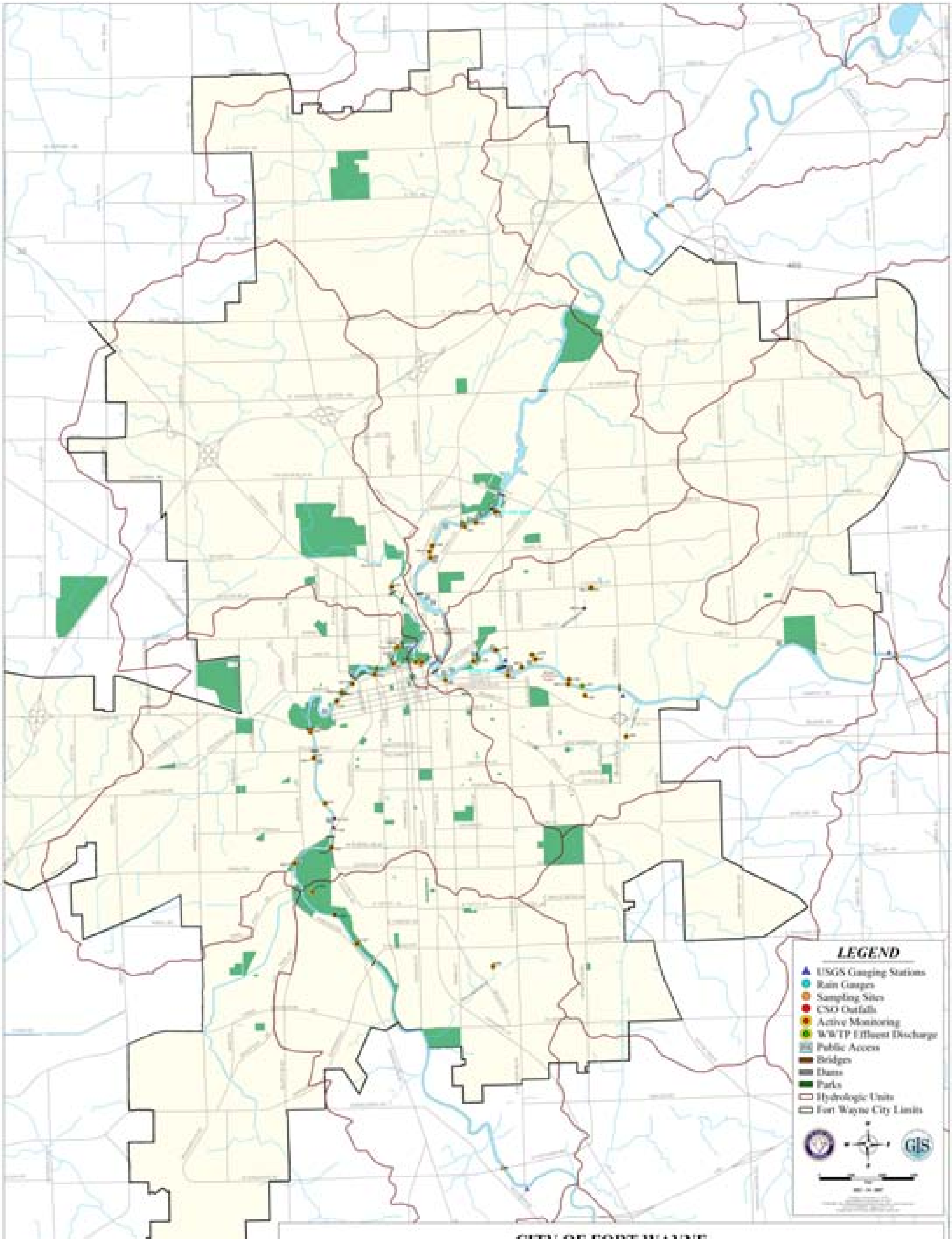
Figure 4.4.1.1

LTCP Implementation Schedule

	Sewer Overflow Control Measure	Waterway Affected
1	Expand Primary Capacity at Treatment Plant	Maumee
2	Expand Capacity of Remaining Treatment Treatment Plant Facilities	Maumee
3	Pilot Testing to Control Trash in Streams (Phase 1)	All
4	Partial Sewer Separation Projects to Address Basement Flooding and Reduce Sewer Overflows (Phase 1)	St. Joseph, St. Marys tributary, Maumee tributaries
5	Improvements to CSO Pond 1 to create Overflow Storage and Dewatering Facilities	St. Marys and Maumee
6	Partial Sewer Separation Projects to Address Basement Flooding and Reduce Sewer Overflows (Phase 2)	St. Marys and Maumee
7	Storage Facilities for St. Joseph River Overflows	St. Joseph
8	Disinfection Facility for St. Joseph River Overflow	St. Joseph
9	Disinfection Facilities for Baldwin Branch and Wayne Natural Drain Overflows	Maumee and St. Marys tributaries
10	Reroute Morton Street Pump Station Overflows to CSO Pond 1	Maumee
11	Wayne Street Parallel Sewer Interceptor to Capture Sewer Overflows	St Marys, St. Marys tributaries, Maumee
12	St. Marys Parallel Sewer Interceptor to Capture Sewer Overflows	St. Marys
13	Implement Technologies to Control Trash in Streams (Phase II)	All
14	Storage Facilities for Harverstor Drain Overflows	Maumee tributary
15	CSO Pond High Rate Treatment (if necessary)	St. Marys and Maumee



● Completion of Bidding Process
▲ Achievement of Full Operation



CITY OF FORT WAYNE

FIGURE 4.6.3.1

POST CONSTRUCTION MONITORING STATIONS

ATTACHMENT 1

ATTACHMENT 1

CITY OF FORT WAYNE
CSO SATELLITE DISINFECTION PILOT STUDY

1 Introduction

As part of its CSO LTCP implementation process, Fort Wayne shall carry out a study to provide information regarding the effectiveness of the CSO disinfection technology proposed by Fort Wayne for four of its CSOs. Fort Wayne shall carry out this study at the proposed satellite disinfection facility to be constructed at CSO 052 located on the lower St. Joseph River. This study shall be carried out over the course of 18 months, following the attainment of full operation of the referenced satellite CSO disinfection facility. The results of such sampling shall not be used to determine compliance with water quality standards unless the State has by that time adopted standards for these specific pathogens.

2 Sampling

Sampling will be carried out for a total of 5 overflow events for all parameters except for *Cryptosporidium* and *Giardia* which shall be carried out for a total of 3 overflow events. Samples shall be collected just prior to entrance of the wastewater into the treatment unit (“influent”), and after the wastewater has been treated (“effluent”), before it enters the receiving water. All effluent samples shall be collected in duplicate, so as to accommodate the pretreatment procedure described below. All bacteria and viral samples shall be de-chlorinated upon collection, and all samples shall be collected, preserved and handled in accordance with 40 CFR Part 136, and other applicable USEPA guidance.

Grab sample collection during each event will span the time during which the subject control facility is active, beginning as soon as possible after the overflow begins. Samples will then be collected every two hours during the overflow, up to a maximum of five samples per event.

Collected samples will be prepared and analyzed for both conventional pollutants and specific pathogens as described below and as identified in Table 1.

2.1 Sampling Plan/QA/QC Procedures

Fort Wayne will develop appropriate, 40 CFR Part 136-compliant sample collection, storage, preservation, and handling procedures through consultation with the laboratories selected to conduct the analyses. These procedures will be incorporated into a Sampling Plan which will be submitted to EPA for approval one year prior to the date the basin will become operational. The sampling plan will also include the QA/QC procedures developed to insure the quality of the data to be generated. Fort Wayne’s QA/QC plan shall be consistent with USEPA’s current QAPP guidance document (“Guidance for Quality Assurance Project plans; EPA QA/G-5," December 2002).

3 Parameters and Analytical Procedures

The parameters and methods in Table 1 will be used during this study.

Table 1: Parameters and Analytical Methods

Parameter	Method
Adenoviruses, types 40 and 41	Integrated cell culture (ICC) - real time PCR (EPA 815-B-04-001 - Quality Assurance/ Quality Control Guidance for Laboratories Performing PCR Analyses on Environmental Samples, October 2004)
Shigella	SM 9260 D
Enterococcus	EPA Method 1600: Membrane filter (EPA-821-R-02-022)
Salmonella	SM 9260 C
E. coli	*Escherichia coli* Detection - Membrane Filter Technique (EPA Method 1105)
Bacteroides fragilis bacteriophage	ISO 10705-4
flow volume (or rate)	Continuous measurement
water temperature and air temperature	Field measurement
pH	Field measurement
dissolved oxygen (DO)	Field measurement
turbidity	SM 2130 B
total suspended solids (TSS)	SM 2540 D
Cryptosporidium and *Giardia*	*Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA (EPA Method 1623)

One split of each effluent sample shall be pre-treated using either mechanical agitation or sonification to break up suspended solids particles and release entrapped organisms that might otherwise fail to enumerate during the above-listed analyses. As part of its sampling program, Fort Wayne shall carry out initial testing of raw CSO discharge to identify a mixing or sonification procedure that provides sufficient energy to liberate entrapped organisms, but which does not provide sufficient energy to result in organism deactivation. In carrying this initial effluent testing, Fort Wayne shall utilize a series of split samples, and shall submit one set of splits to a range of energy levels. Fort Wayne shall then analyze both sets of split effluent samples for *E. Coli*, and shall note which energy level maximizes the increase in bacteria counts compared to the splits not receiving pretreatment. The resulting procedure shall identify both energy level and time of blending or sonification, and shall employ aseptic methods and conditions.

The City may propose alternate sample preparation or analytical procedures prior to preparing its sampling plan. The City will advise EPA of the alternative procedure(s) it wishes to use, and provide information regarding the nature of these procedures and the reason why alternative procedures are being requested, in order for EPA to determine if the alternative procedure will provide sufficient information to meet the needs of this study.

4 Reporting

The analytical results obtained for each sampling event shall be transmitted to EPA within 60 days of the completion of each sampling event. The report will contain:

- Date and time of sample collection.
- Status of the treatment unit, to include detailed flow information (i.e. event hydrograph) and a description of any operational issues that occurred during the event
- Detailed (15 minute) rainfall data for the event
- Antecedent rainfall - The amount of rainfall in the sewer basin on the two days prior to the overflow event will also be reported.
- Analytical results - Including copies of the actual laboratory reports.
- QA/QC results - Including copies of the laboratory QA/QC results; any discrepancies will be identified and explained by the City.
- Copies of completed chain of custody pages.

At the completion of the sampling period, the City of Fort Wayne shall submit a report that will include all of the above sampling, summarize the results of such sampling including sampling results for the non-pretreated split samples and the pre-treated split samples. Fort Wayne shall compare such samples to NPDES permit limits and, based on those results, recommend measures to be taken by the City to achieve effective disinfection as necessary to comply with defined, numeric water quality standards.

CHAPTER 5

TABLE OF CONTENTS

5.0 USE ATTAINABILITY ANALYSIS

5.1 INTRODUCTION

5.1.1 Purpose and Objectives

The selected CSO Control Measures in the City of Fort Wayne's Long-Term Control Plan ("LTCP") will achieve a high level of control for the remaining CSOs in the City's combined sewer system. When fully implemented, the LTCP will reduce the number of overflow events for the City's CSO outfalls from as high as 20 to 71 annual events[1] in the "typical year" to a maximum of 4 annual overflow events where treatment capabilities will not be adequate to meet currently applicable water quality criteria for water-based recreation. Moreover, the six CSOs discharging to the St. Joseph River, the City's highest quality waterway, will see activations reduced to a single annual overflow event in the "typical year." This represents an exemplary level of control for previously uncontrolled wet weather discharges of combined sewage to the City's CSO-impacted waterways.

Notwithstanding these impressive control levels, which go beyond the point of diminishing returns from a cost-effectiveness perspective, the CSO Control Measures specified by the LTCP will not, as alluded to above, achieve compliance with Indiana's water quality standards for water-based recreation under relatively severe wet weather conditions. Thus, the City's LTCP, though it will achieve much at a capital cost of over $340 Million and the expenditure of many more millions of dollars in additional annual operations and maintenance expenses and debt service costs, will not be expected to produce water quality under more severe wet weather conditions that is consistent with the Clean Water Act's water quality goals unless the current water quality standards for recreation can be revised on a site-specific basis to reflect the capabilities of the LTCP. The City's LTCP is in fact predicated upon a proposed revision in the designated recreational use for the City's urban waterways to Indiana's CSO Wet Weather Limited Use subcategory. To obtain approval for this revision in designated recreational use for the City's CSO-impacted waterways, it will be necessary for the City to establish eligibility for and perform a Use Attainability Analysis (UAA) that justifies the revision consistent with relevant federal and state law.

This Section of the LTCP describes federal and state requirements associated with a UAA, provides an introduction to the City's draft UAA to be submitted to IDEM for consideration, and requests approval by IDEM (and ultimately EPA) of a revision to the recreational designated use for the waterways impacted by the City's CSOs to the Indiana CSO Wet Weather Limited Use Subcategory. These waterways ("CSO-impacted Waterways") specifically include the following:

[1] The 19 CSO regulators with highest activation rates in the City's combined sewer system range from 20 to 71 annual overflow events in the "typical year".

- St. Mary's River (from its junction with Natural Drain #4 near Tillman Road, to the confluence with St. Joseph River)

- Natural Drain #4 (from CSO Outfall 054 near the intersection of Hollis Lane and Mercer Avenue, to its junction with the St. Mary's River)

- St. Joseph River (from CSO Outfall 052, located immediately south of Coliseum Blvd., near N. Anthony Boulevard, to the confluence with St. Mary's River)

- Spy Run Creek (from CSO Outfall 036, located north of W. State Street along Eastbrook/Westbrook Drive, to its junction with the St. Mary's River south of 4th Street near Lawton Park)

- Baldwin Ditch (from CSO Outfalls 061 and 062 near the intersection of E. State Street and Barnhart Avenue, to its junction with the Maumee River near CSO Ponds 1 and 2)

- Maumee River (from its origin to approximately the boundary between Defiance and Henry counties, Ohio)

For clarity of further reference to these waterbodies, the parenthetically identified reaches represent those portions of the waterbodies which are projected to experience *E. coli* in excess of the bacteriological criteria to protect full-body recreational use solely as a result of uncontrolled CSO discharges which statistically would occur in the "typical year" <u>notwithstanding</u> the full implementation of the City's LTCP.

As will be explained and supported, Fort Wayne's draft UAA rests upon the following points that are relevant under applicable law:

- First, the effects of urbanization preclude the attainment of the recreational use after large storm events because of the presence of non-CSO sources of bacteria (including, for example, loadings from upstream sources, wildlife and domestic animals near and in the urban streams) that will prevent attainment of the recreational water quality standard during any substantial wet weather event; and

- Second, substantial and widespread economic and social impacts would be caused by a requirement to implement controls beyond those contained in the City's LTCP as approved by IDEM and U.S. EPA.

The conclusion of the draft UAA is that the currently designated recreational use is not attainable in the City's CSO-impacted waterways during and for a short period of time following wet weather events that exceed the high level of CSO control provided for in the LTCP.

5.1.2 General Regulatory Requirements for UAAs

Federal water quality regulations[2] describe the purpose of a UAA to be as follows: a UAA provides the informational base upon which a State may demonstrate that attaining a designated use in a waterbody is not feasible so as to justify removing the designated use or establishing subcategories of the use which require less stringent criteria. The specific grounds on which the infeasibility of attaining a designated use may be demonstrated include:

(1) Naturally occuring pollutant concentrations prevent the attainment of the use; or
(2) Natural, ephemeral, intermittent or low flow conditions or water levels prevent the attainment of the use, unless these conditions may be compensated for by the discharge of sufficient volume of effluent discharges without violating State water conservation requirements to enable uses to be met; or
(3) Human caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place; or
(4) Dams, diversions, or other types of hydrologic modifications preclude the attainment of the use, and it is not feasible to restore the water body to its original condition or to operate such modification in a way that would result in attainment of the use; or
(5) Physical conditions related to the natural features of the water body, such as the lack of a proper substrate, cover, flow, depth, pools, riffles, and the like, unrelated to water quality, preclude attainment of aquatic life protection uses; or
(6) Controls more stringent than those required by sections 301(b) and 306 of the Act would result in substantial and widespread economic and social impact.

40 CFR § 131.10 (g).

A UAA is defined by federal regulations as "a structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors as described in § 131.10(g)."[3]

5.1.3 EPA and Indiana Policies Support the Coordination of LTCP Development with Review of the Potential Appropriateness of Water Quality Standard Revisions

5.1.3.1 EPA Policy and Guidance

EPA's Combined Sewer Overflow (CSO) Control Policy[4] states that one of its key elements is the "development of the long-term plan …[in coordination] with the review and appropriate revision of water quality standards and implementation procedures on CSO-impacted waters to ensure that the long-term controls will be sufficient to meet water quality standards." As part of

[2] *See* 40 CFR 131.10(g) and 40 CFR 131.10(j)(2).
[3] 40 CFR 131.3(g).
[4] 59 *Federal Register* 18688, April 19, 1994.

the analysis, "States should evaluate whether the designated use could be attained if CSO control were implemented."[5] In 2002, the EPA published further national guidance on coordinating the development of CSO long-term control plans with water quality standards reviews.[6] This guidance recognizes the unique relationship between CSOs, designated uses and water quality standards in CSO-impacted water bodies. In this document, EPA calls for a water quality standards review to be conducted in conjunction with LTCP development and specifies that appropriate and attainable standards should be established for CSO-impacted waters.

5.1.3.2 State Policy

Indiana law is reflective of EPA's regulation and guidance. During its 2005 session, the Indiana legislature enacted P.L. 54-2005, also known as Senate Enrolled Act (SEA) 620. Among other provisions, this legislation establishes:

- A CSO Wet Weather Limited Use subcategory of recreational use for CSO impacted waters with an approved long-term control plan; and

- A requirement for the Water Pollution Control Board to adopt rules to implement the new recreational use subcategory.

Under SEA 620, the CSO wet weather limited use subcategory may be applied to the CSO-impacted waterbodies of a CSO community if: (i) a CSO LTCP has been approved by IDEM and incorporated into the community's NPDES permit or an order of the IDEM commissioner; (ii) the revision to the designated use pursuant to a UAA is approved by IDEM and EPA in accordance with 40 CFR 131.10, 4 CFR 131.20, and 40 CFR 131.21; and (iii) the approved LTCP has been implemented. The water quality-based requirements for the CSO wet-weather limited use subcategory's application to a particular waterbody are determined through the approved CSO LTCP.

5.2 CURRENT RECREATIONAL STANDARDS APPLICABLE TO WATERS IMPACTED BY THE CITY'S CSOs

All surface waters within Indiana's portion of the Great Lakes drainage basin, including the receiving waters for the City's CSOs, are designated for full-body contact recreation by the water quality standards for such waters adopted by the Indiana Water Pollution Control Board. 327 IAC 2-1.5-5(a)(1). The following numeric water quality criteria for *E. coli* are established by these water quality standards to support the designated recreational use during the annual recreational season of April through October: [7]

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[5] *Id*., at III.B, paragraph 2
[6] Guidance: Coordinating CSO Long Term Control Planning with Water Quality Standards Reviews; EPA Document #833R01002, July 2001.
[7] 327 IAC 2-1.5-8(e)(2). Indiana's NPDES rules for discharges to the Great Lakes specify that the E. coli criteria should be applied as end-of-pipe effluent limitations. 327 IAC 5-2-11.4(d).

- Geometric mean of 125 colony-forming units per 100 milliliters (cfu/100 mL) based upon five equally spaced samples taken in a one-month period.

- Single sample maximum of 235 cfu/100 mL.

These bacteriological water quality criteria are intended to protect full-body immersion contact (such as occurs during swimming and some other water recreational activities) from unreasonable risk of disease. The water quality standards apply these criteria to all waters, whether or not they are officially designated as public swimming areas and whether or not any particular water body is reasonably suited for full-body contact recreation. While appropriate for some waters during certain periods, this designation clearly is not attainable in all waters, under all conditions.

Many Indiana water bodies have not and do not currently meet the *E. coli* criteria specified for full-body contact recreation swimming all the time – especially during and following wet weather events. For example, in its 2006 Water Assessment Report, IDEM listed more than 7,620 miles (67.5% of evaluated stream miles) as not attaining the recreational use due to excessive bacteria levels. Those portions of the St. Mary's River, St. Joseph River and Maumee River affected by the City's CSOs are included in this list of non-attaining waterways.

5.3 DETERMINATION OF EXISTING USE

As stated above, the City's LTCP is predicated on the revision of the currently applicable use designation of full body contact recreation for the City's CSO-impacted waterways to allow application of Indiana's CSO Wet Weather Limited Use Subcategory during wet weather conditions exceeding the level of control to be provided through implementation of the LTCP.

Under federal regulations at 40 CFR 131.10(g), a water body's designated use cannot be removed (or revised to a less protective level) if it is an "existing use." An "existing use" is defined at 40 CFR 131.3(e) as a "use *actually attained* in the water body on or after November 28, 1975, whether or not they are included in the water quality standards." (Emphasis added.)

For reasons summarized in the draft UAA, the City has concluded, in accordance with IDEM guidance on existing use determinations,[8] that no existing recreational uses in the City's CSO-impacted waterways will be removed by the application of the CSO Wet Weather Limited Use Subcategory to those waterways.

[8] *Application of Existing Use Concept in Conducting Use Attainability Analyses for Long Term Control Plan Communities for Primary Contact Recreational Uses,* IDEM Nonrule Policy Document No. Water-014, draft June 27, 2007 ("*IDEM Existing Use Guidance*").

5.4 ATTAINING THE CURRENT RECREATIONAL DESIGNATED USE IS NOT FEASIBLE DURING WET WEATHER CONDITIONS

The draft UAA documents and explains why attainment of the current designated use of full-body contract recreation is not feasible in the City's CSO-impacted waters during certain wet weather conditions. More specifically, this designated use cannot be feasibly attained during those wet weather conditions in which untreated CSO discharges would occur after implementation of the City's proposed LTCP. As a consequence, relief from the current designated use and the accompanying *E. coli* water quality criteria is warranted during those wet weather conditions. The City proposes, as a result, that the CSO wet weather limited use subcategory provided under Indiana law be approved under federal and state law for application to the City's CSO-impacted waters during such circumstances. However, even if the CSO wet weather limited use subcategory were not available as a possible designated use refinement, the current designated recreational use can and should be appropriately removed or suspended during the wet weather conditions referenced above and an *ad hoc* alternative use established for those conditions under 40 CFR 131.10(g).

5.4.1 Reasons for Infeasibility of Attainment of Full-body Contract Recreation During Specified Wet Weather Conditions

Revision of the recreational use for the City's CSO-impacted waters during the referenced wet weather conditions and application of the CSO wet weather limited use subcategory is supported based upon the following two factors provided in 40 CFR Sec. 131.10(g):

- Human-caused conditions or sources of pollution prevent the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place.
- Controls more stringent than those required by sections 301(b) and 306 of the Clean Water Act would result in substantial and widespread economic and social impact.

The basis for application of each of these factors and the results of that evaluation are discussed in the draft UAA.

GLOSSARY

GLOSSARY

A

AO: Administrative Order
Aqua Indiana: A private utility serving large areas of western and northern Fort Wayne and Allen County.

B

Board of Public Works: The Board of Public Works of the City of Fort Wayne, Indiana.
BOD: Biological Oxygen Demand – A measure of the amount of oxygen consumed in the biological processes that break down organic matter in water. The greater the BOD, the greater the degree of pollution.

C

Catch Basin: Structures used to collect storm water entering Fort Wayne's combined sewer system. A catch basin is a modified inlet where the invert of the outlet pipe is several feet above the bottom of the structure and where a 90 degree trap is installed on the end of the outlet pipe.
CCC Limits: Criterion Continuous Concentration – An estimate of the highest concentration of material in the water column to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect.
CFR: Code of Federal Regulations
City: The City of Fort Wayne
Collection System: Pipes used to collect and carry wastewater from individual sources to an interceptor sewer that will carry it to a treatment facility.
CMC Limits: Criterion Maximum Concentration – An estimate of the highest concentration of a material in the water column to which an aquatic community can be exposed briefly without resulting in an unacceptable effect.
CSO: Combined Sewer Overflow – During heavy periods of rainfall or snowmelt, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies.
CSS: Combined Sewer System – A sewer system that carries both sewage and storm-water runoff. Normally, its entire flow goes to a waste treatment plant, but during wet weather, the volume may be so great as to cause overflows of untreated mixtures of storm water and sewage into receiving waters. Storm-water runoff may also carry toxic chemicals from industrial areas or streets into the sewer system.
CSSCIP: City's Combined Sewer System Capacity Improvement Program

D

Dam: A barrier to obstruct the flow of water.
Designated Use: Uses specified in water quality standards for each water body or segment whether or not they are being attained (40 CFR 131.3).
DO: Dissolved Oxygen – The oxygen freely available in water, vital to fish and other aquatic life and for the prevention of odors. DO levels are considered a most important indicator of a

water body's ability to support desirable aquatic life. Secondary and advanced waste treatment and generally designed to ensure adequate DO in waste-receiving waters.
DWO: Dry Weather Overflow – An overflow or discharge from a combined or sanitary sewerage system or storm drainage system that is not the result of wet-weather flows into the system. These flows may be the result of a variety of processes. Dry-weather overflows from combined sewer systems are generally not permitted.

E
Existing Use: Uses actually attained in the water body on or after November 28, 1975, whether or not they are included in the water quality standards (40 CFR 131.3).
EPA: U.S. Environmental Protection Agency
EHRC: Enhanced High Rate Clarification

G
GIS: Geographic Information System – GIS is a term used to describe the creation, manipulation, analysis, and storage of spatial data. This technology integrates common database operations such as query and statistical analysis with geographic data through visualization and maps. These attributes distinguish GIS from other information systems and make it valuable for exploring options, explaining results, and deciding strategies.

H
HRT: High Rate Treatment
HU: Hydrologic Unit

I
IDEM: Indiana Department of Environmental Management
Industrial Pre-Treatment Program: A City program that handles the process to reduce, eliminate, or alter the nature of wastewater pollutants from non-domestic sources (mostly industrial) before they are discharged into Publicly Owned Treatment Works (POTWs).
Infiltration: The penetration of water entering sewers or pipes through defective joints, connections, or manhole walls.
Inflow: Stormwater entering a sewer system from sources such as basement drains, manholes, and storm and driveway drains.
Interceptor Sewer: Large sewer lines that, in a combined system, control the flow of sewage to the treatment plant. In a storm, they allow some of the sewage to flow directly into a receiving stream, thus keeping it from overflowing onto the streets. Also used in separate systems to collect the flows from main and trunk sewers and carry them to treatment points.
IU: Industrial User

K
Knee-of-the-curve: The point at which the incremental change in the cost of the control alternative per change in performance of the control alternative changes most rapidly.

L

LTCP: Long-Term Control Plan – A document developed by CSO communities to describe existing waterway conditions and various CSO abatement technologies that will be used to control overflows.

M

MGD: Million Gallons per Day – Measure of flow.
MHI: Median Household Income

N

NMC: Nine Minimum Controls – Measures that can reduce CSOs and their effects on receiving water quality and that should not require significant engineering studies or major construction.
NPDES: National Pollutant Discharge Elimination System – A national program under Section 402 of the Clean Water Act (CWA) for regulation of discharges from point sources to waters of the United States. Discharges are illegal unless authorized by an NPDES permit.

O

O&M: Operations and Maintenance

P

PCB: Polychlorinated Biphenyls
pH: An expression of the intensity of the basic or acid condition of a liquid; may range from 0 to 14, where 0 is the most acid and 7 neutral. Natural waters usually have a pH between 6.5 and 8.5.
POTW: Publicly Owned Treatment Works
Primary Treatment: Primary treatment is the second step in treatment and separates suspended solids and greases from wastewater. Waste-water is held in a quiet tank for several hours allowing the particles to settle to the bottom and the greases to float to the top. The solids drawn off the bottom and skimmed off the top receive further treatment as sludge. The clarified wastewater flows on to the next stage of wastewater treatment. Clarifiers and septic tanks are usually used to provide primary treatment. Removal of floating solids and suspended solids, both fine and coarse, from raw sewage.
Pump Station (Lift Station): A station positioned in the public sewer system at which wastewater is pumped to a higher level.

R

Regulator: Engineered bottleneck in the collection system.
Run Off: That part of precipitation, snow melt, or irrigation water that runs off the land into streams or other surface water. It can carry pollutants from the air and land into receiving waters.

S

SAG: Sewer Advisory Group – Fort Wayne's SAG is a voluntary citizen-based group that has been actively helping the City make decisions about its sewer utility operations since 1995.

Secondary Treatment: The second step in most publicly owned waste treatment systems in which bacteria consume the organic parts of the waste. It is accomplished by bringing the waste, bacteria, and oxygen in trickling filters or in the activated sludge process. This treatment removes floating and settleable solids and about 90 percent of the oxygen-demanding substances and suspended solids. Disinfection is the final stage of secondary treatment.
Sewage: The waste and wastewater produced by residential and commercial sources and discharged into sewers.
SIP: Structure Inventory Program
SIU: Significant Industrial User – An indirect discharger that is the focus of control efforts under the national pretreatment program; includes all indirect dischargers subject to national categorical pretreatment standards, and all other indirect dischargers that contribute 25,000 gpd or more of process wastewater, or which make up five percent or more of the hydraulic or organic loading to the municipal treatment plant, subject to certain exceptions [40 CFR 122.23(b)(9)]
SOP: Standards of Operation
SRCER: Stream Reach Characterization and Evaluation Report
Sanitary Sewer Discharge (SSD) – any discharge to waters of the State as defined by applicable state law, or to navigable waters of the United States as defined by Section 502(7) of the Clean Water Act, 33 U.S.C. § 1362(7), from Fort Wayne's Sanitary Sewer System.
STF: Sewer Task Force – STF was originally organized to develop recommendations on how the City should proceed to reduce the likelihood of sewer backups into basements. STF is now known as the Sewer Advisory Group (SAG).
Storm Sewer: A system of pipes (separate from sanitary sewers) that carry water runoff from buildings and land surfaces.
SUO: Sewer Use Ordinance

T

TMDL: Total Maximum Daily Load
Trunk Sewer: A sewer that receives many tributary branches and serves a large territory.
TSS: Total Suspended Solids – A measure of the suspended solids in wastewater, effluent, or water bodies, determined by tests for "total suspended non-filterable solids."

U

Use Attainability Analysis (UAA): A structured scientific assessment of the factors affecting the attainment of the use, which may include physical, chemical, biological, and economic factors as described in § 131.10(g).
U.S.EPA: United States Environmental Protection Agency
USGS: United States Geological Survey
UTA: Utility Administration Group

W

Water Quality Criteria: Levels of water quality expected to render a body of water suitable for its designated use. Criteria are based on specific levels of pollutants that would make the water harmful if used for drinking, swimming, farming, fish production, or industrial processes.

WQS: Water Quality Standards – State-adopted and EPA-approved ambient standards for water bodies. The standards prescribe the use of water body and establish the water quality criteria that must be met to protect designated uses.
WEF: Water Environment Federation
Weir: A wall or obstruction used to control flow from settling tanks and clarifiers to ensure a uniform flow rate and avoid short-circuiting.
WPCM: Water Pollution Control Maintenance
WPCP: Water Pollution Control Plant
WQS: Water Quality Standards – Regulations that are designed to protect the surface waters of the State. They contain statements and numeric limits that are adopted through administrative rule-making procedures. The standards set forth the water quality needed to protect the uses of the water, such as swimming, public water supply, and the propagation and growth of aquatic life.