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

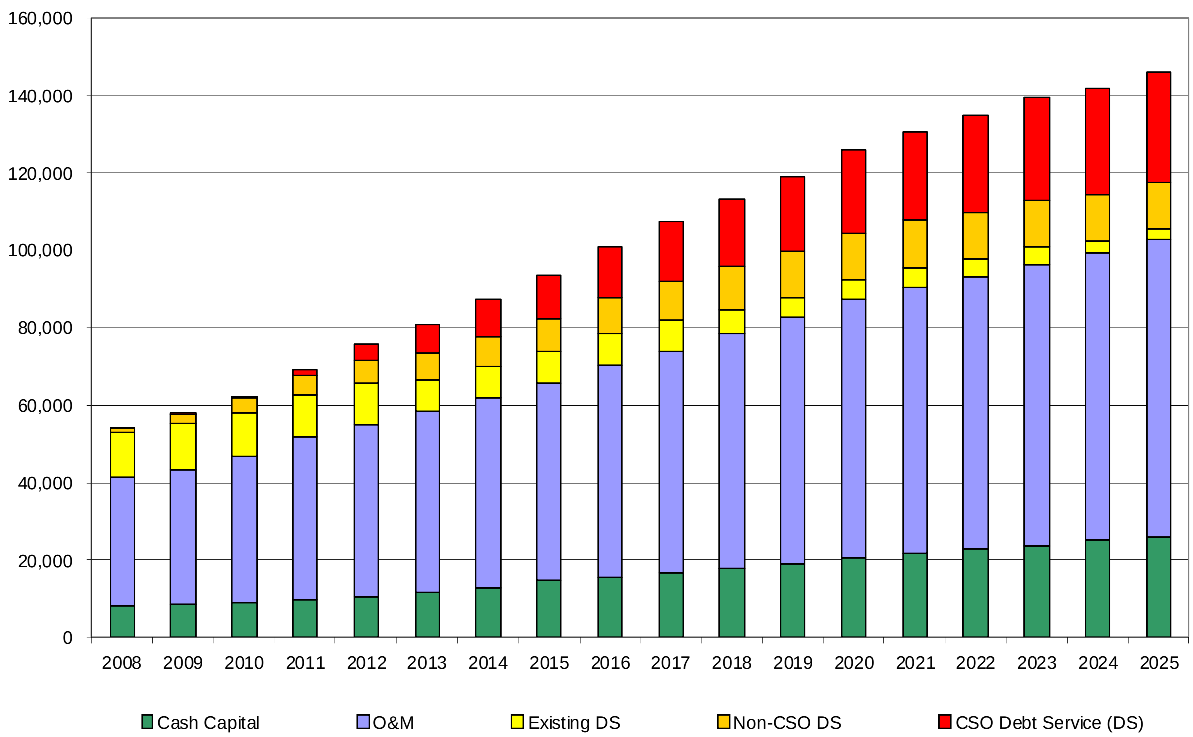
The total capital needed by the City of Fort Wayne over the next 18 years is estimated at nearly $927.7 million (inflated dollars) to fund both CSO improvements required by this LTCP and other projected wastewater collection and treatment needs. The total capital remaining for the LTCP is estimated at $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

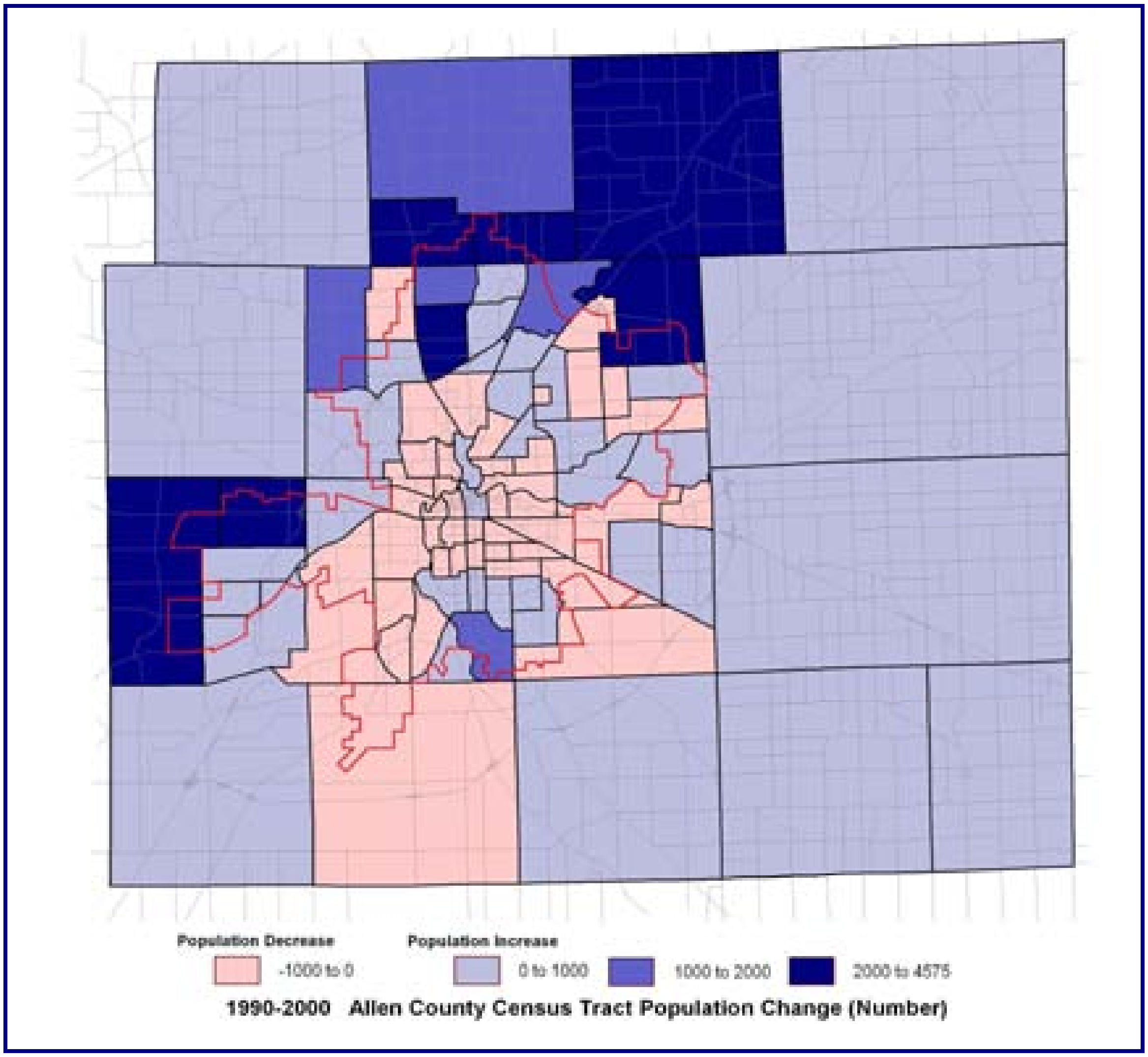
As a result of the large amount of anticipated construction and the concentration of similar CSO-related programs, as well as similar impacts in other areas around the country, the City believes that its capital costs will increase faster than the more general CPI growth assumption used for O&M growth. 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

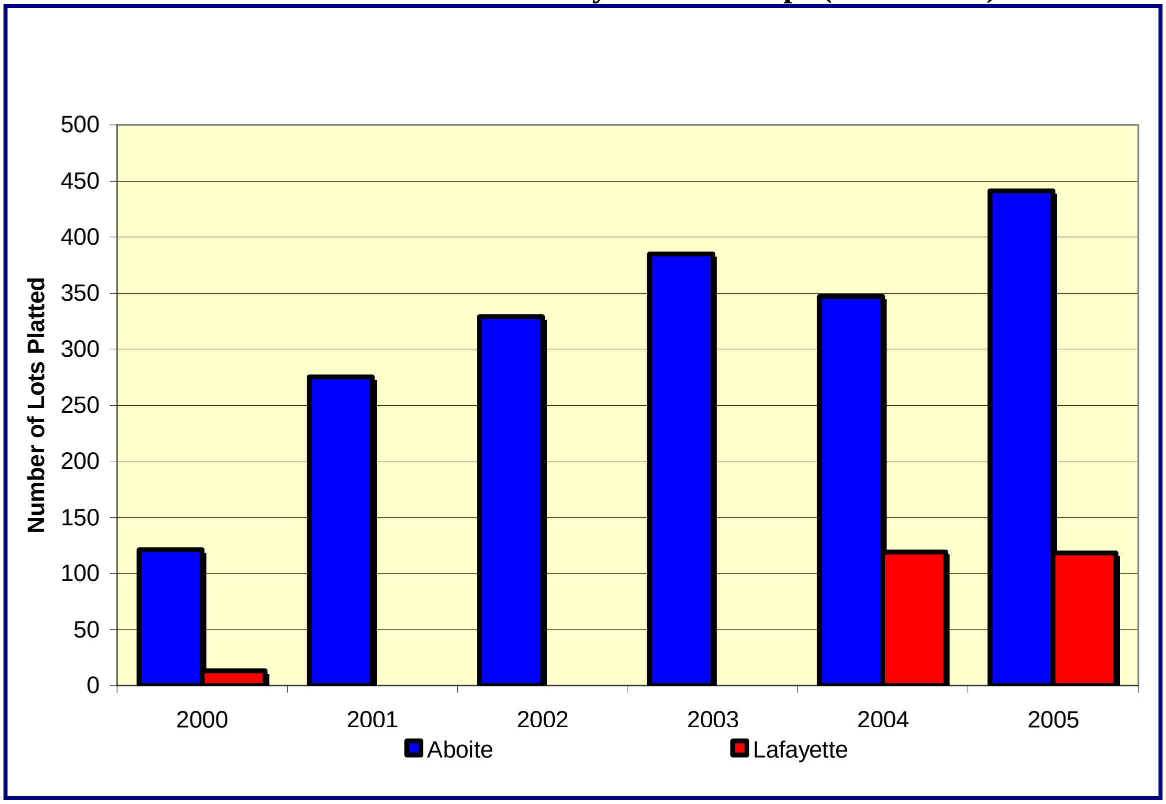


Basic economic theory suggests that a significant rate increase from one utility would drive customers to a competing utility. This is of primary concern, as AquaIndiana has recently expanded its Certificate of Territorial Authority (CTA) to most all of Aboite Township and into a large portion of Lafayette 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.

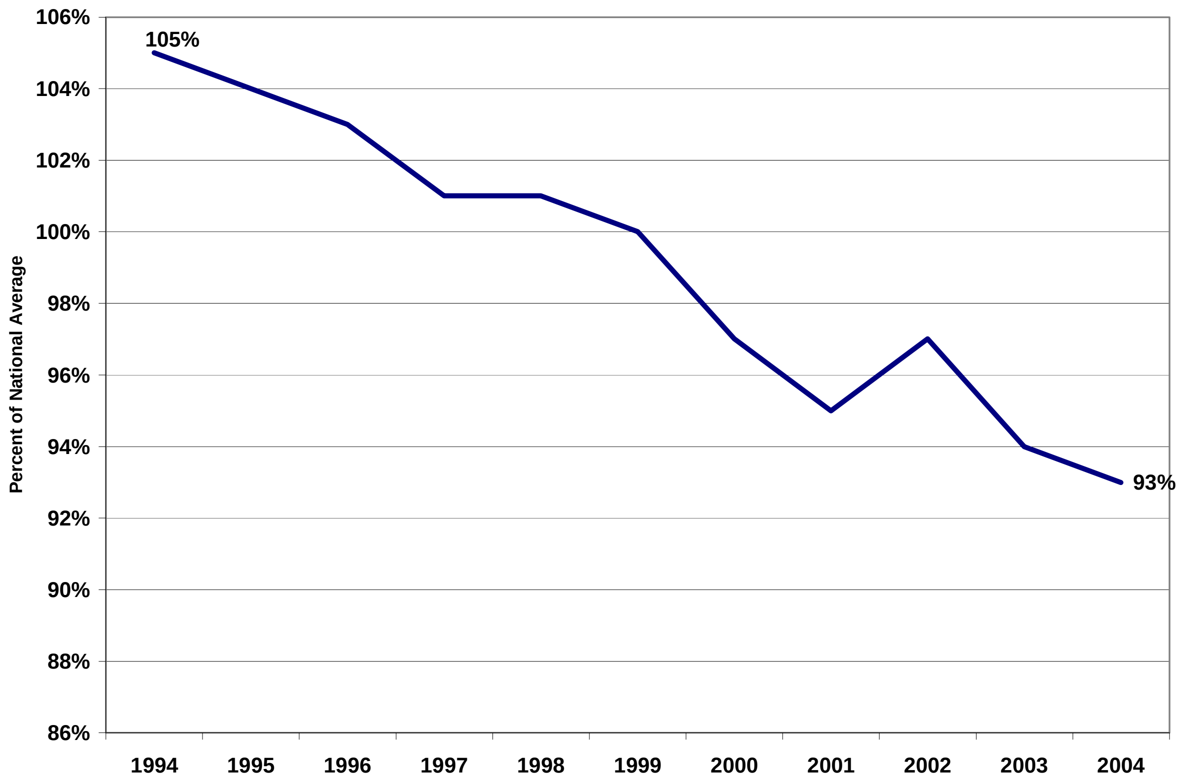
3.5.8 Median Household Income

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]



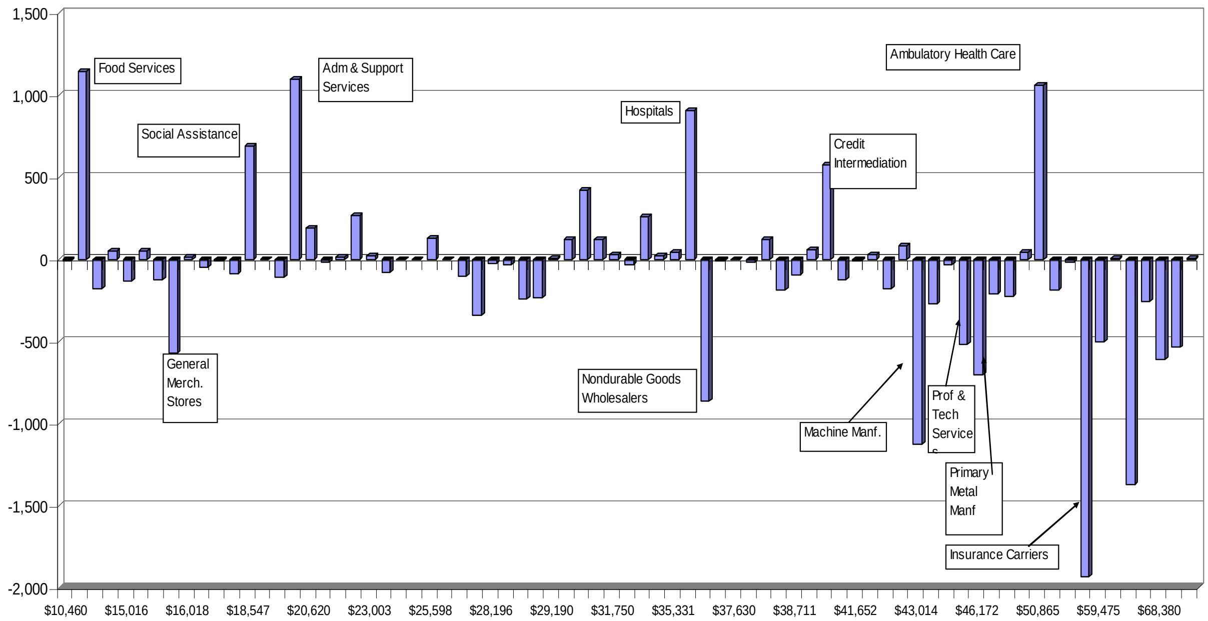
Fort Wayne residents are experiencing a significant degree of underemployment, as the high-paying manufacturing jobs that previously existed have been replaced with lower-paying service jobs. Chart 3.5.8.2 demonstrates how Fort Wayne's manufacturing economy was affected by the last recession. The blue, 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

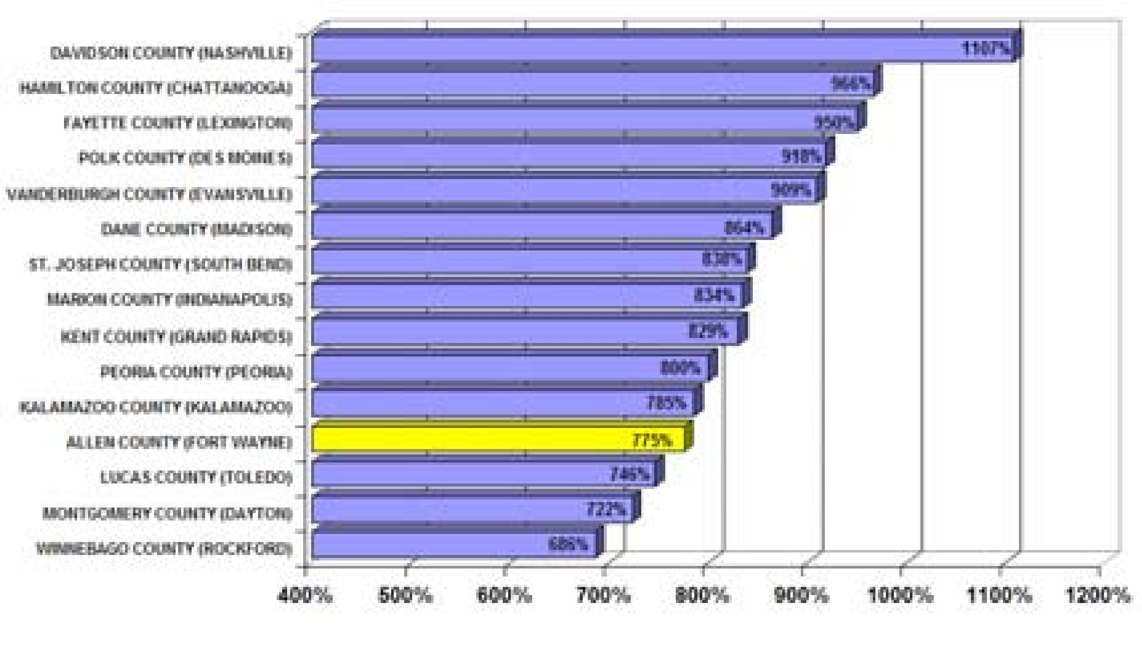


Chart 3.5.8.4

Per Capita Personal Income in 1969

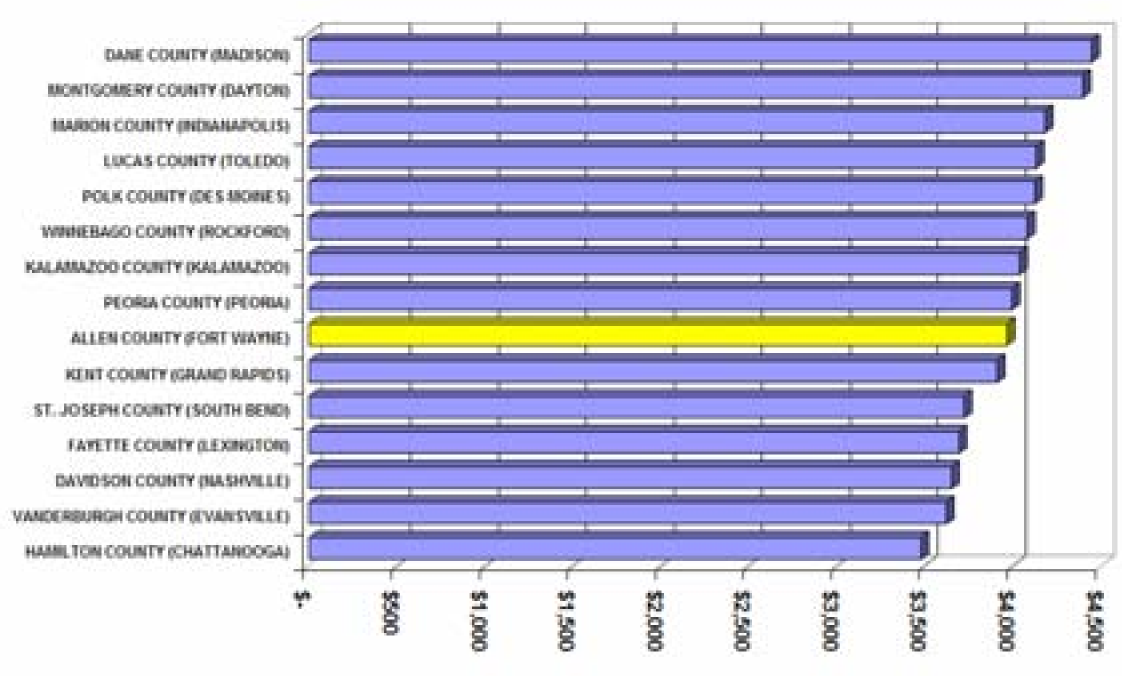


Chart 3.5.8.5

Per Capita Personal Income in 2004

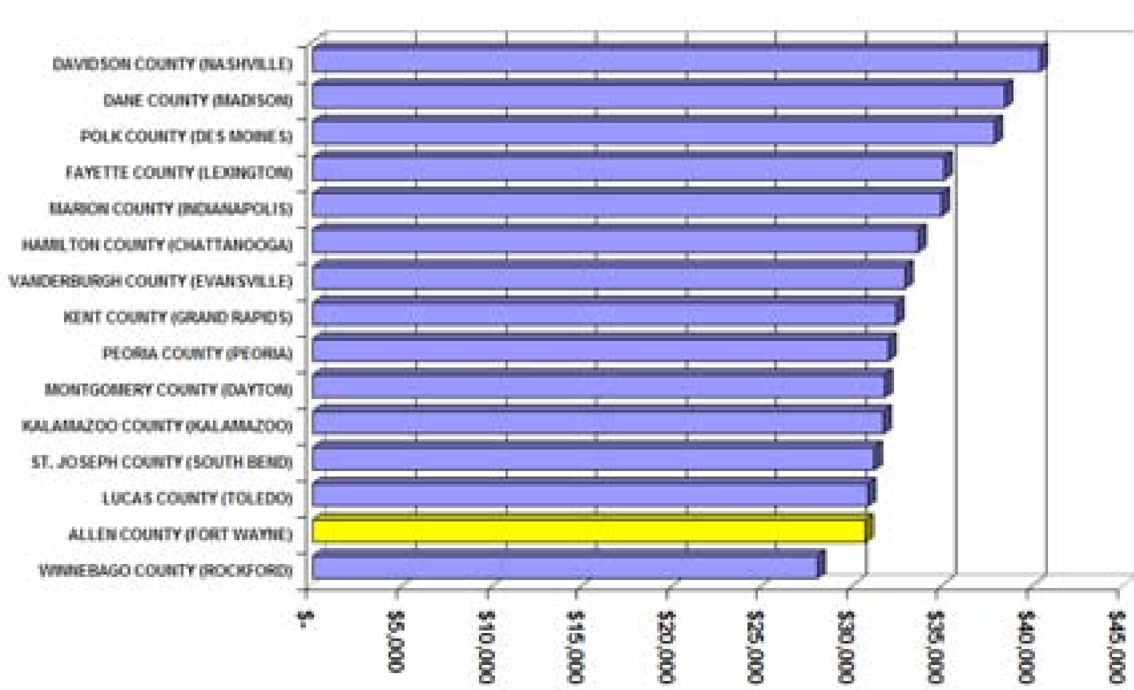
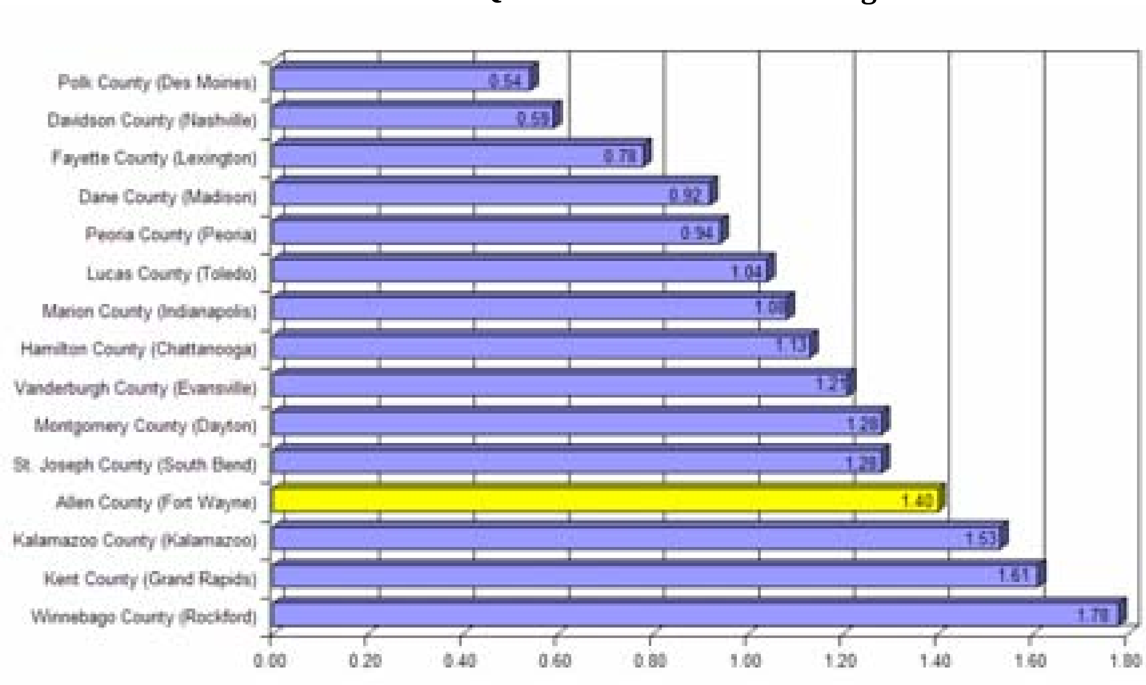


Chart 3.5.8.6
2004 Location Quotients for Manufacturing



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]

$$\therefore\ \frac{\$40{,}258}{\$42{,}671}\ (\$45{,}356) = \$42{,}791$$

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.

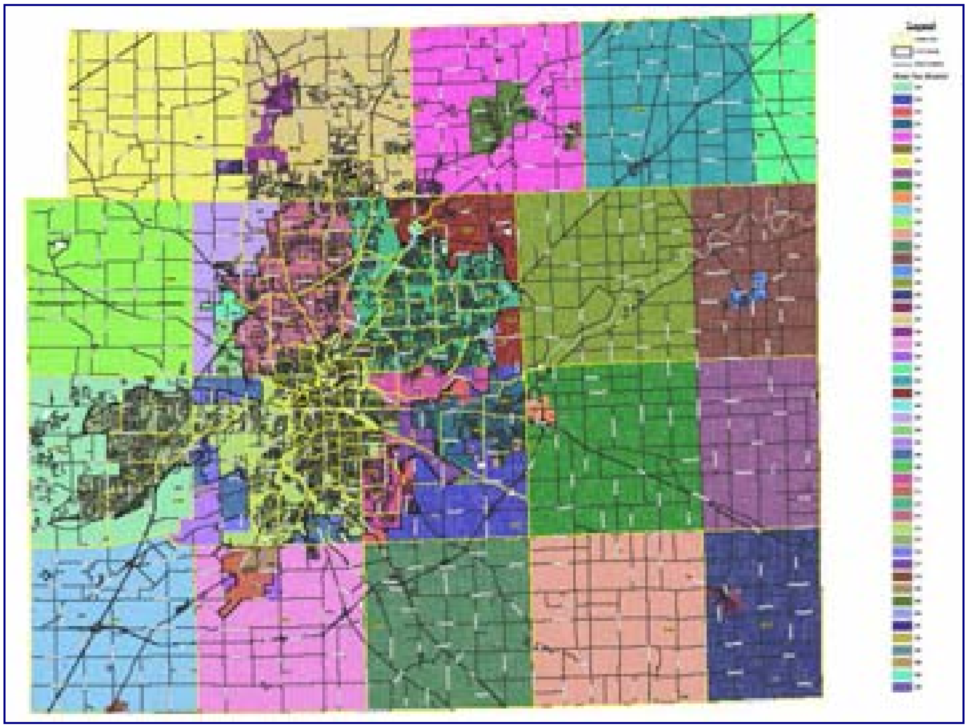
3.5.9.4.1.1 Bond Rating

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

			Existing Conditions		Technology Configuration of Alternatives						
Overflow Permit ID	Overflow SIP ID	Regulator	Annual Overflow Volume (cf)	Annual Number of Overflow Events	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

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

CSO Pond Component

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

		12 activations/year (1 month 6 hour storm)	6 activations/year (2 month 6 hour storm)	4 activations/year (3 month 6 hour storm)	3 activations per year (4 month 6 hour storm)	2 activations/year (6 month 6 hour storm)	1 activation per year (12 month 6 hour storm)
Regulator	Overflow Link	Peak Overflow Rate (cfs)	Peak Overflow Rate (cfs)	Peak Overflow Rate (cfs)	Peak Overflow Rate (cfs)	Peak Overflow Rate (cfs)	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		Annual Days Exceeding Bacteria WQS Due to CSO Discharges
			(ft3)	(mg)	
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

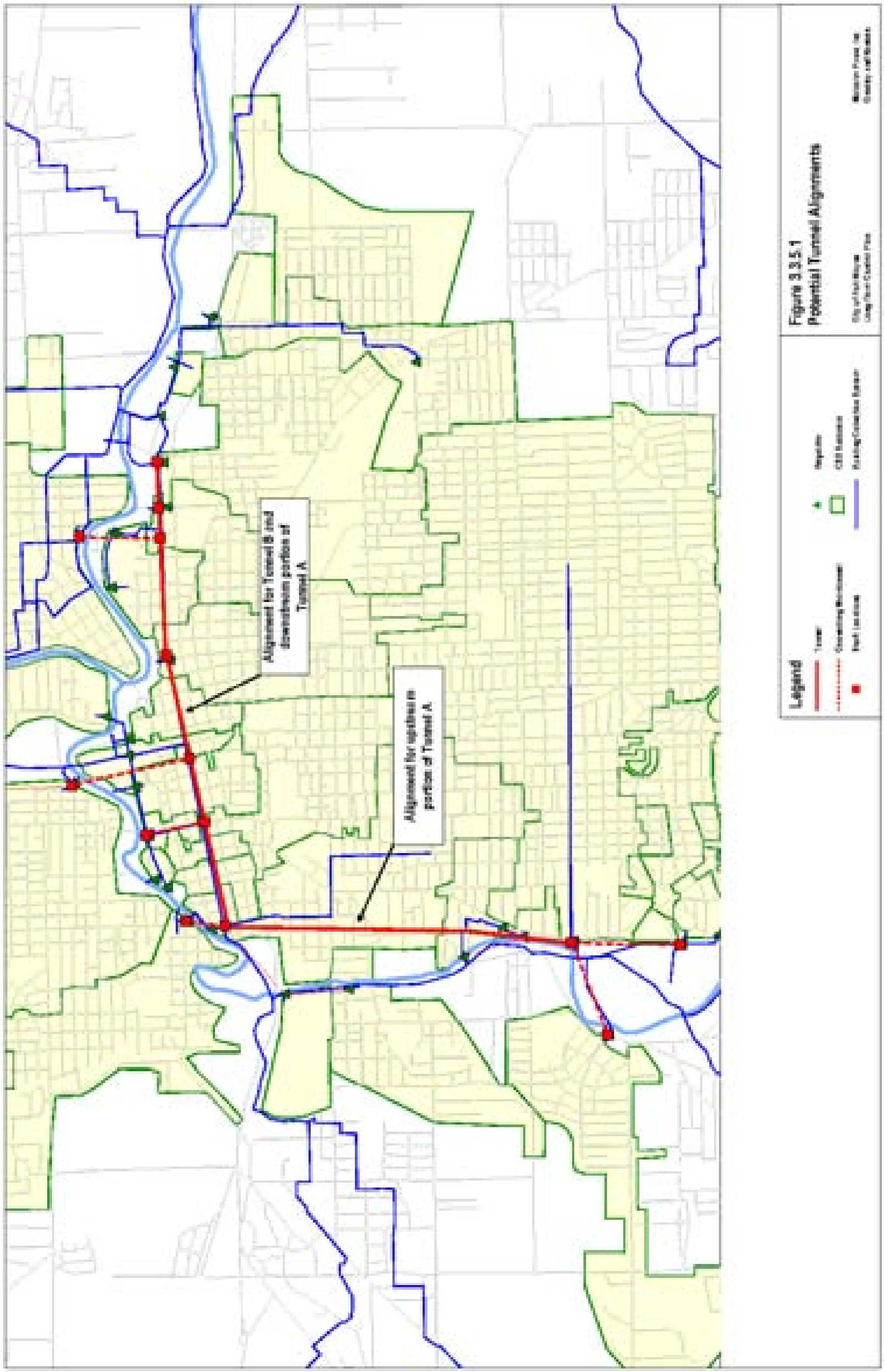


Figure 3.3.5.1
Potential Tunnel Alignments
Legend
Alignment for Tunnel B and downstream portion of Tunnel A
Alignment for upstream portion of Tunnel A

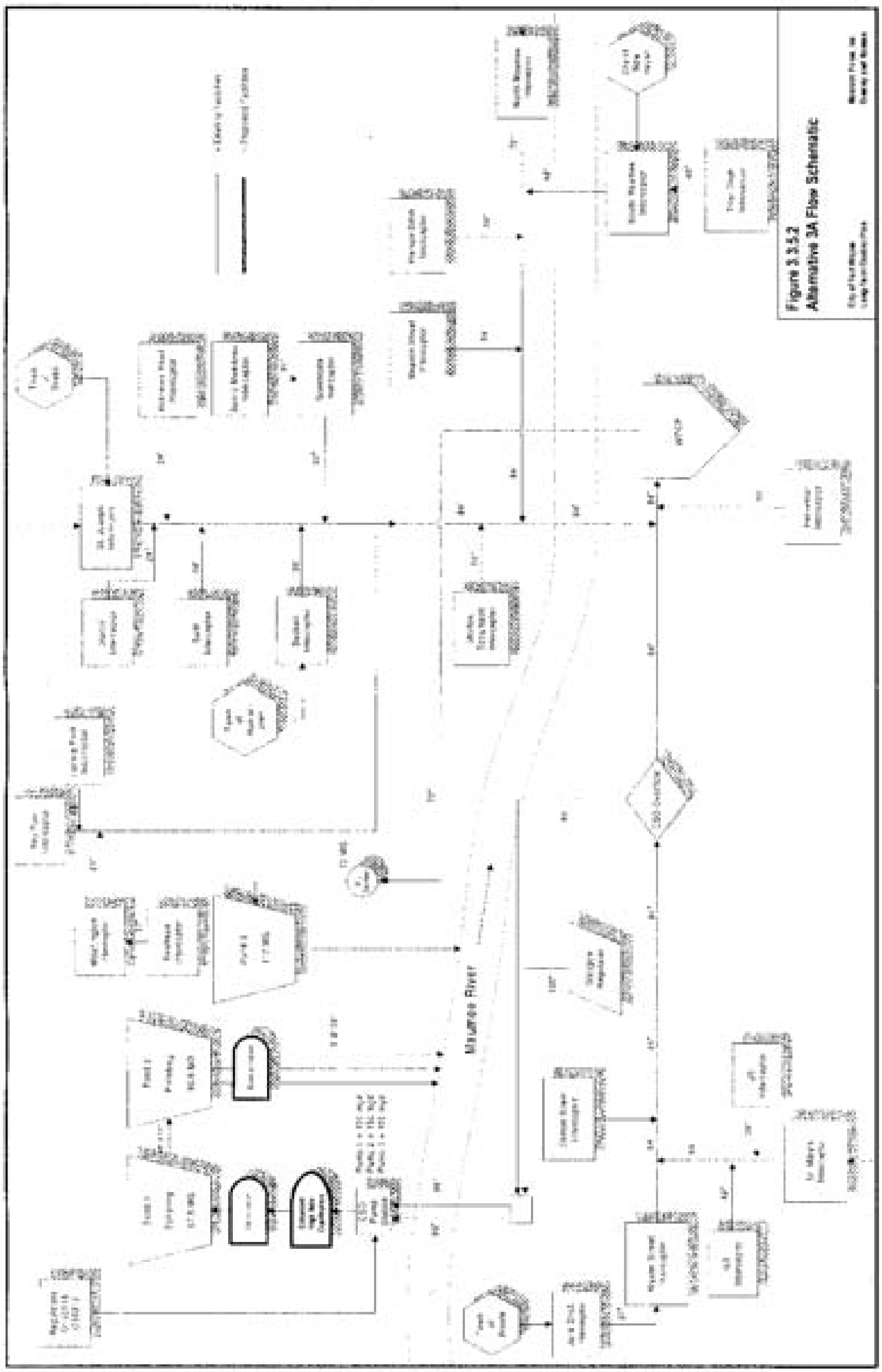


Figure 3.3.5.2
Alternative 3A Flow Schematic
Maumee River

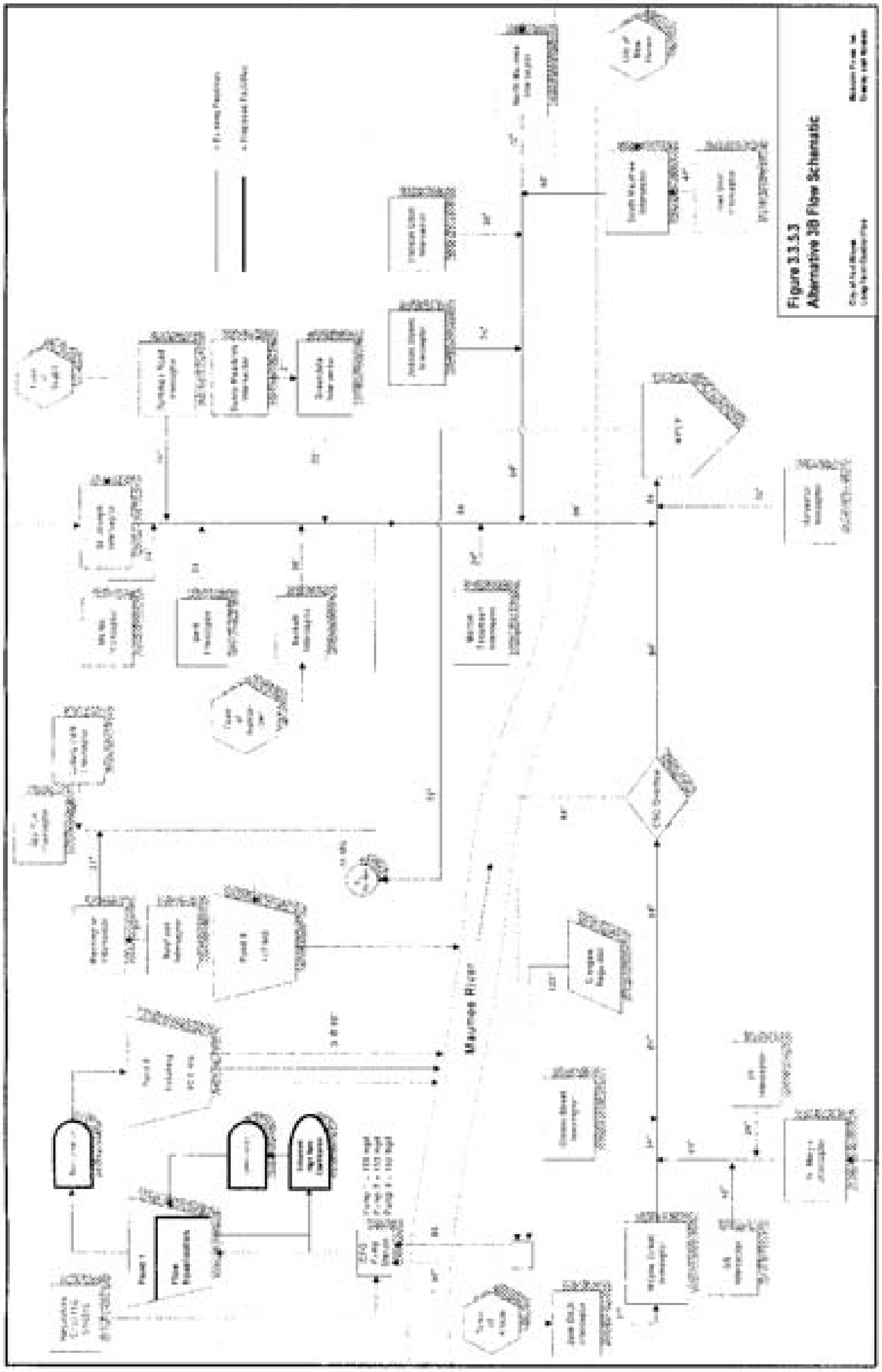


Figure 3.3.5.3
Alternative 3B Flow Schematic
Maumee River

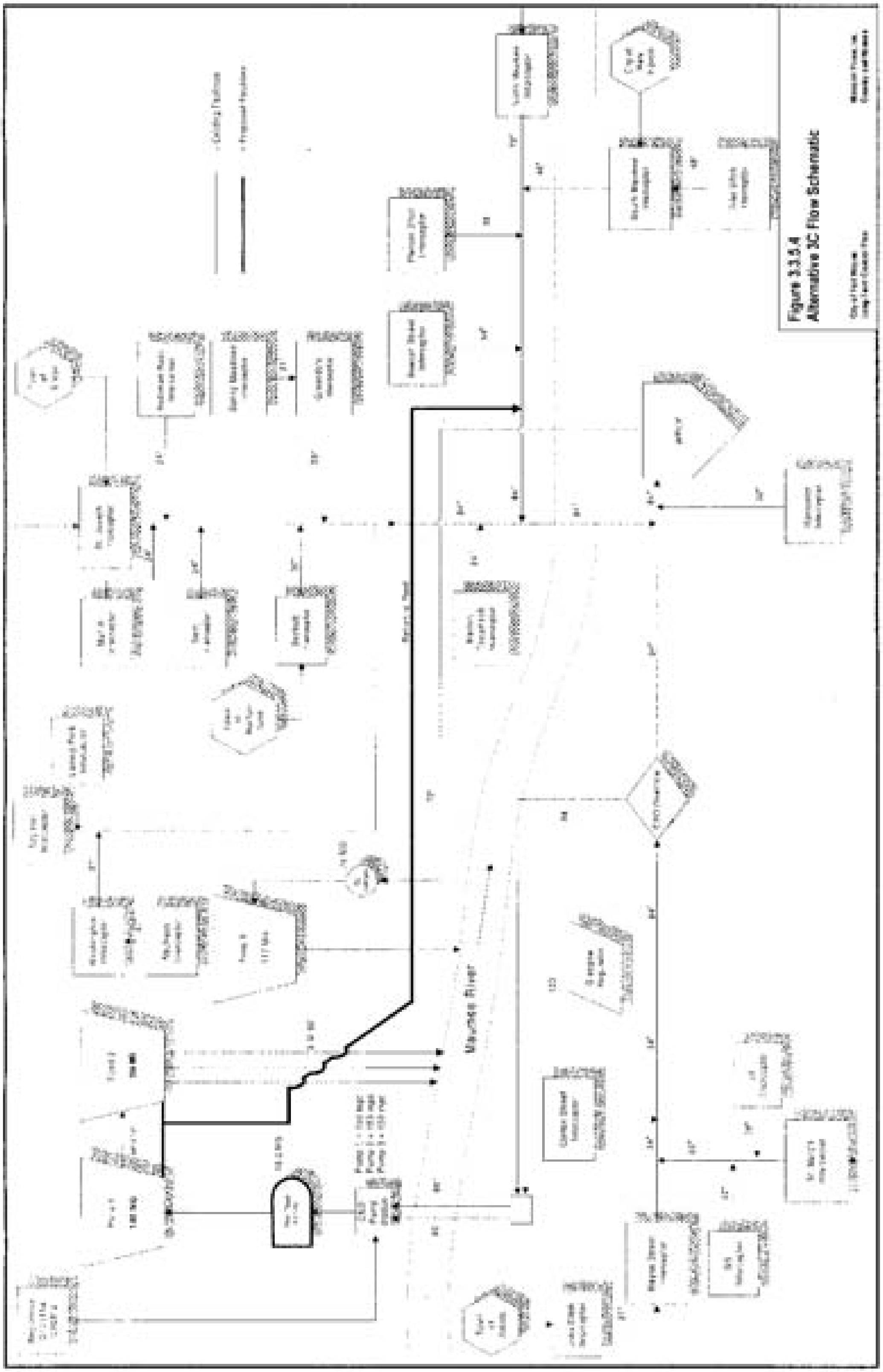


Figure 3.3.5.4
Alternative 3C Flow Schematic
Maumee River

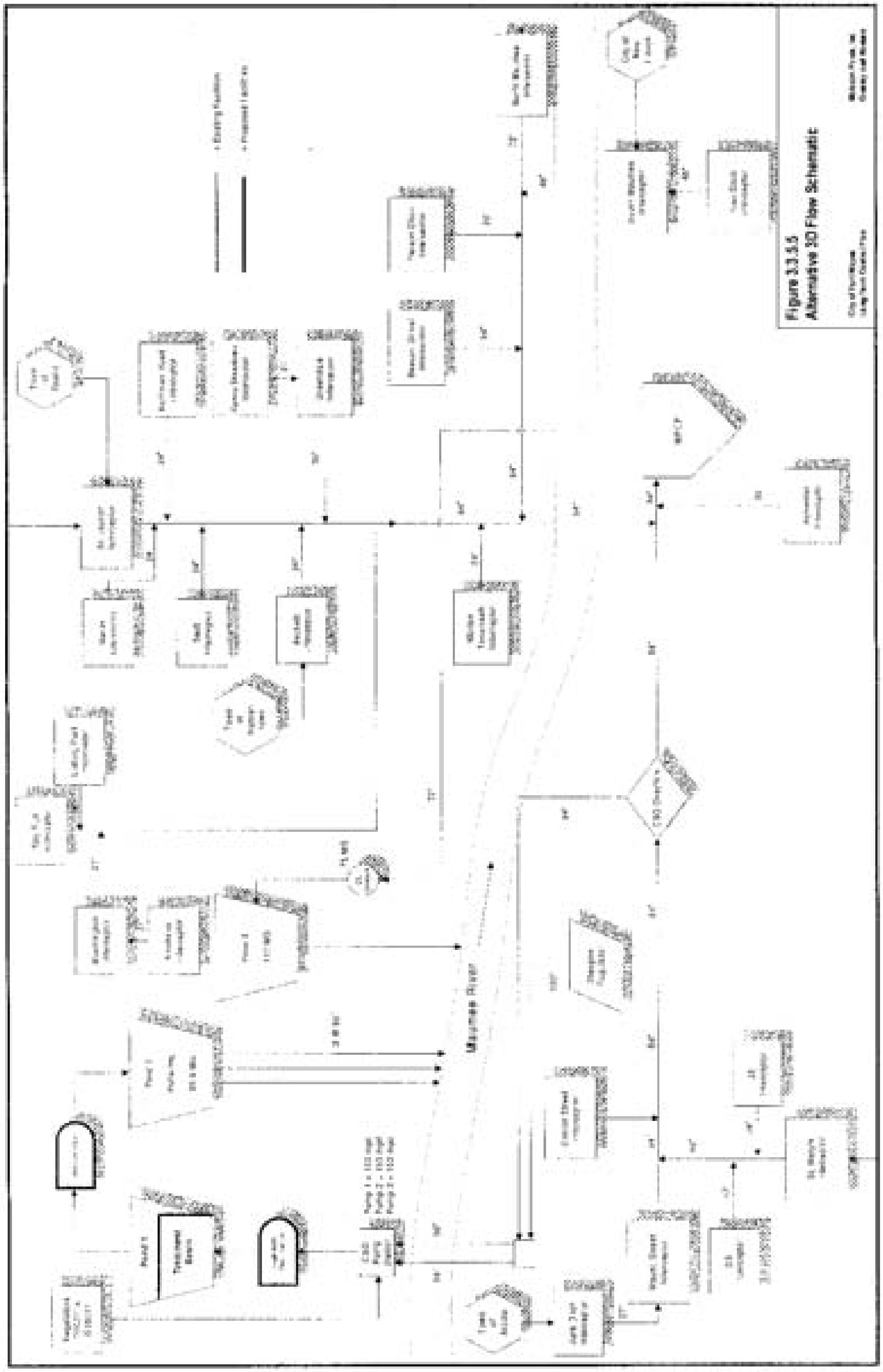


Figure 3.3.5.5
Alternative 3D Flow Schematic
Maumee River

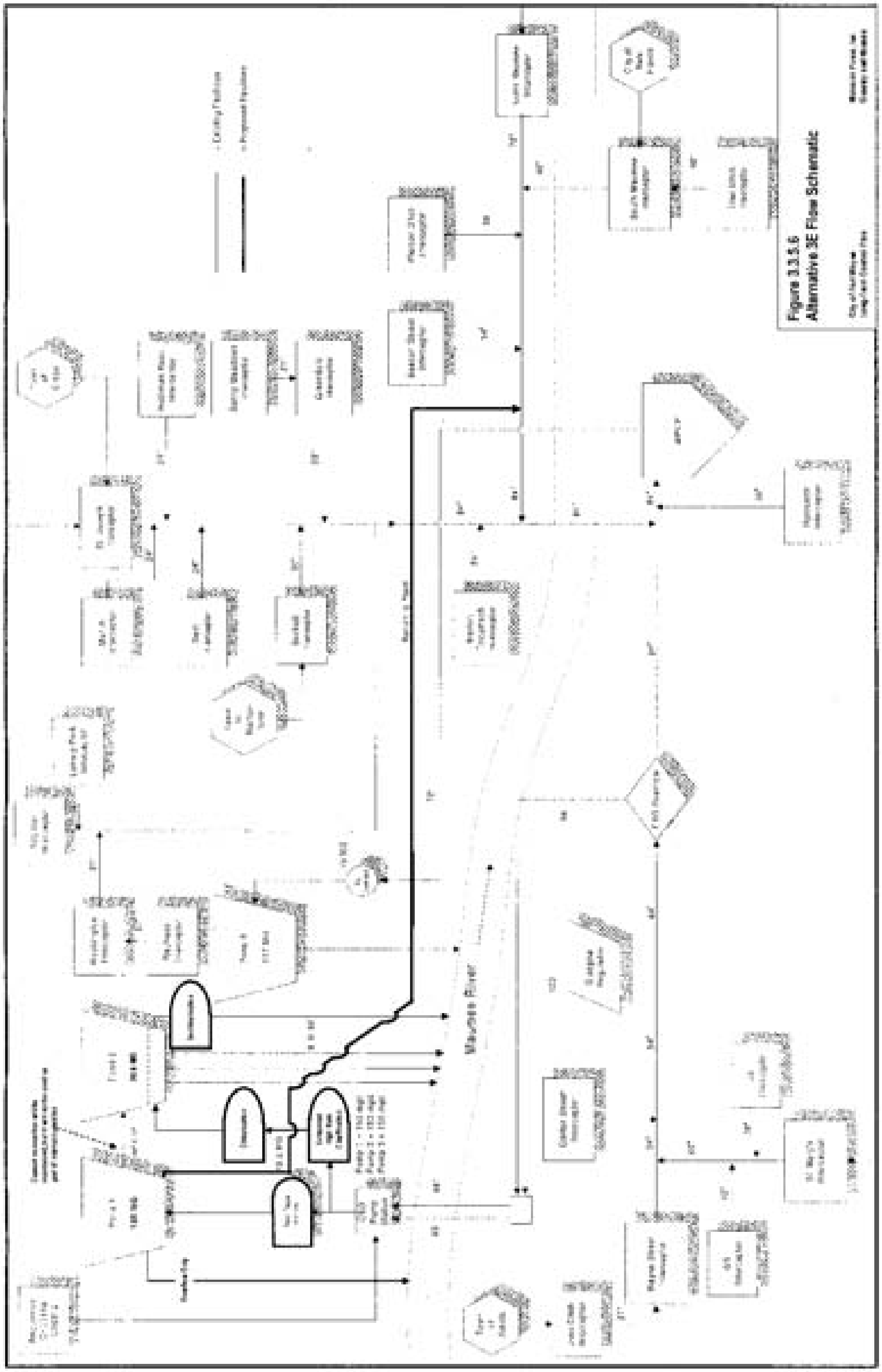
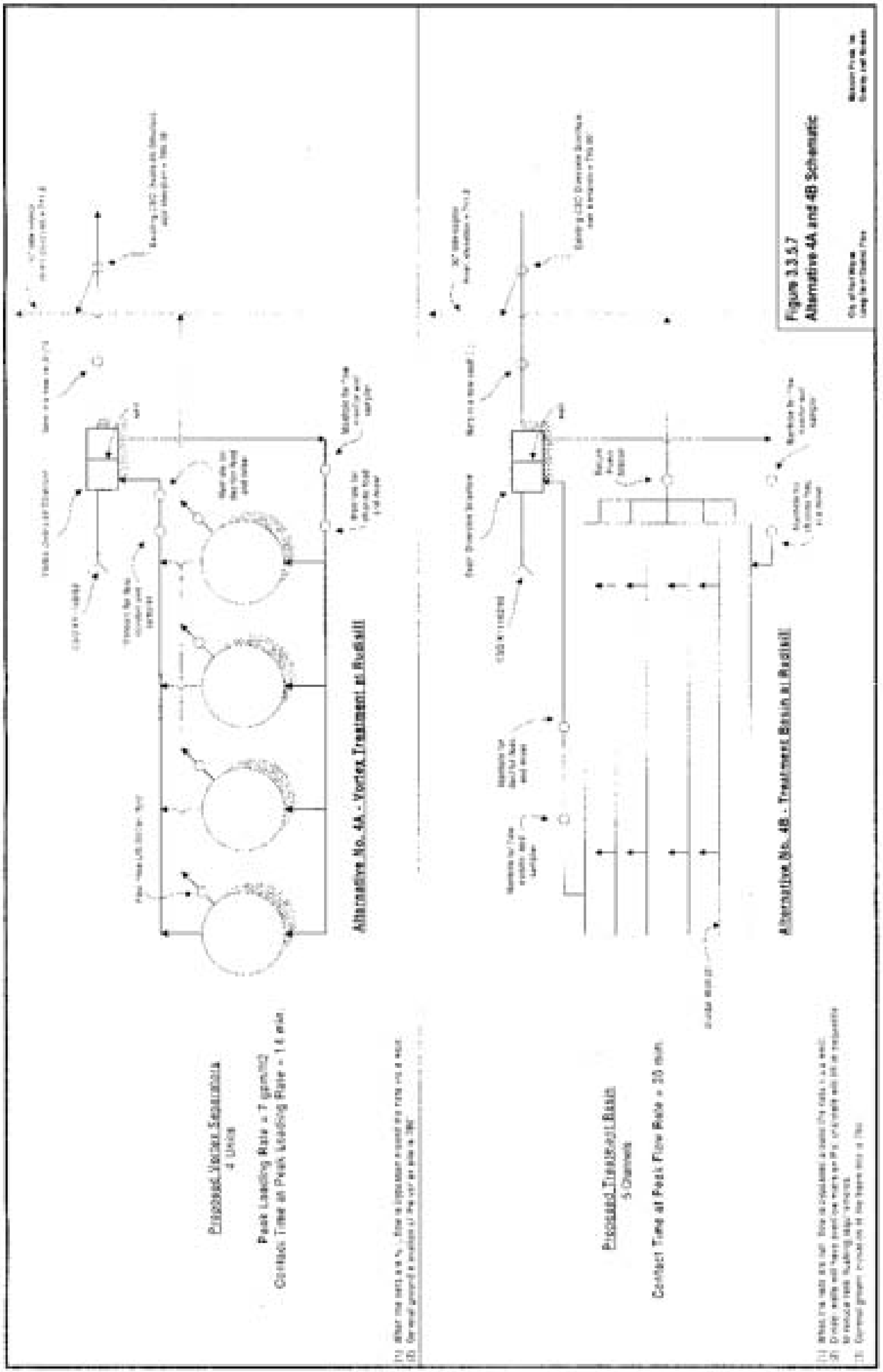


Figure 3.3.5.6
Alternative 3E Flow Schematic



Alternative No. 4A - Vortex Treatment at Rudisill
Proposed Vortex Separators
4 Units
Alternative No. 4B - Treatment Basin at Rudisill
Proposed Treatment Basin
5 Channels
Alternative 4A and 4B Schematic

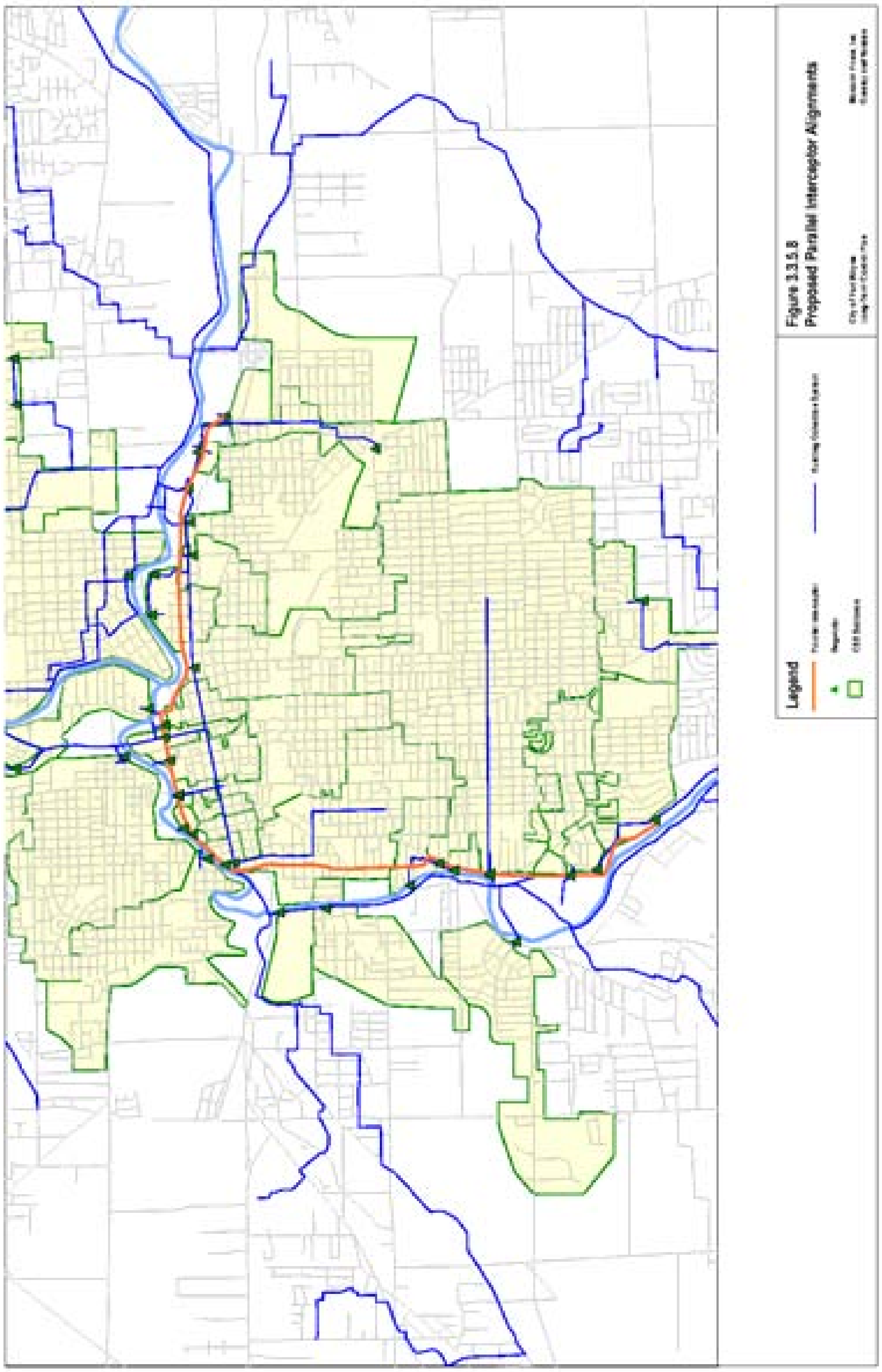


Figure 3.3.5.8
Proposed Parallel Interceptor Alignments
Legend

Figure 3.3.7.1
Preliminary Cost/Performance Curves

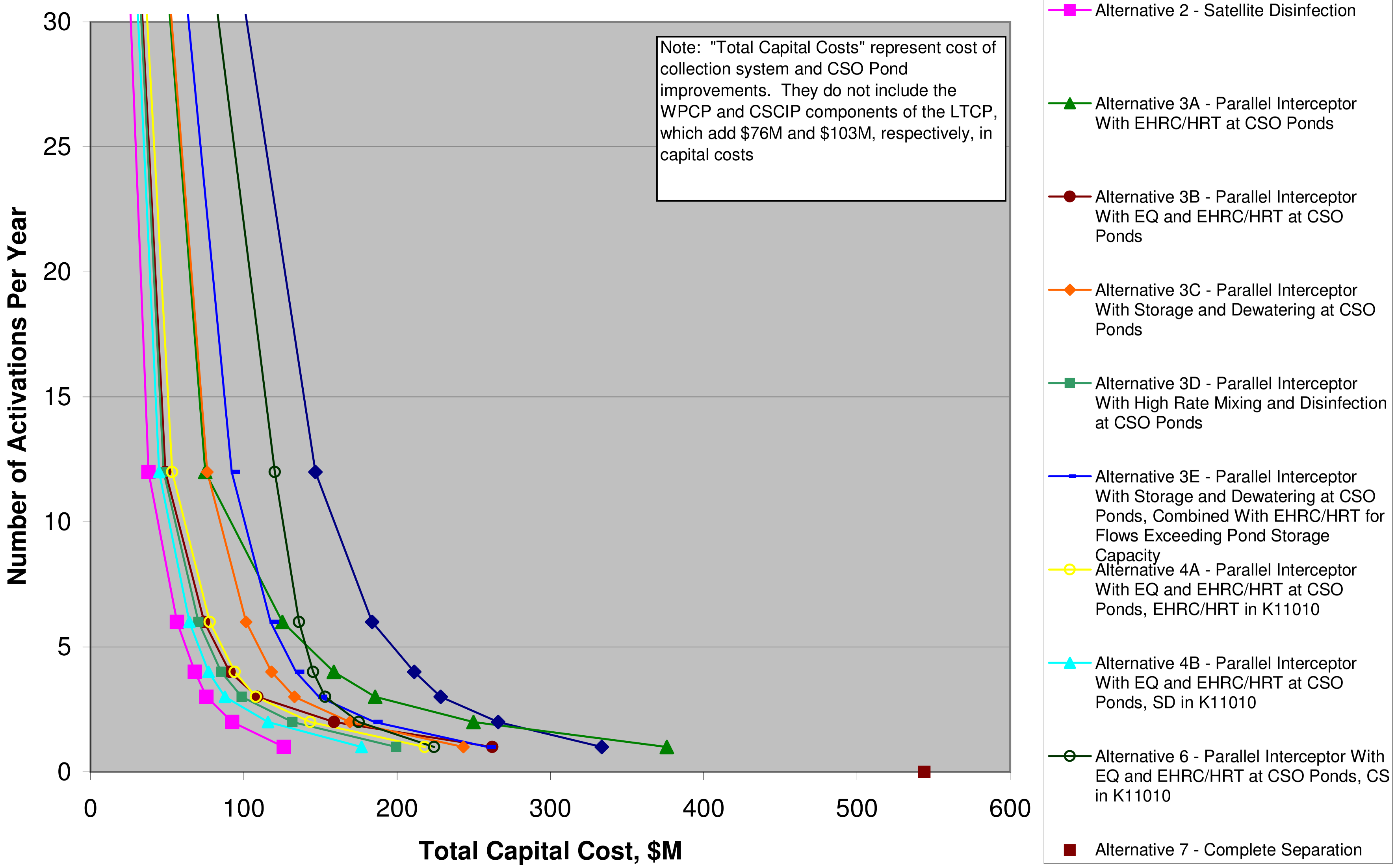


Figure 3.4.5.1
Summary of Alternative Scoring

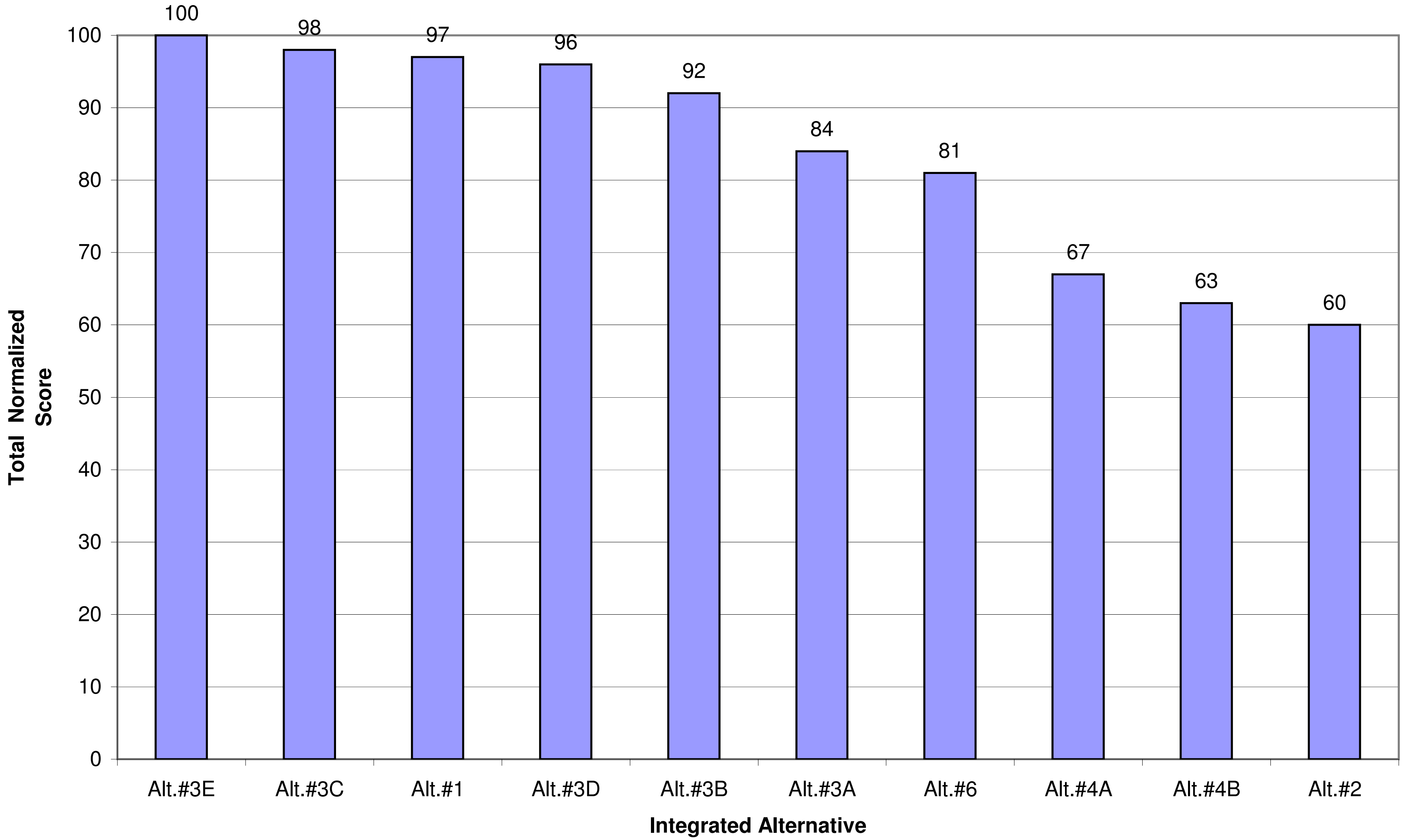


Figure 3.4.5.2
Cost/Performance Curves
Annual Activations

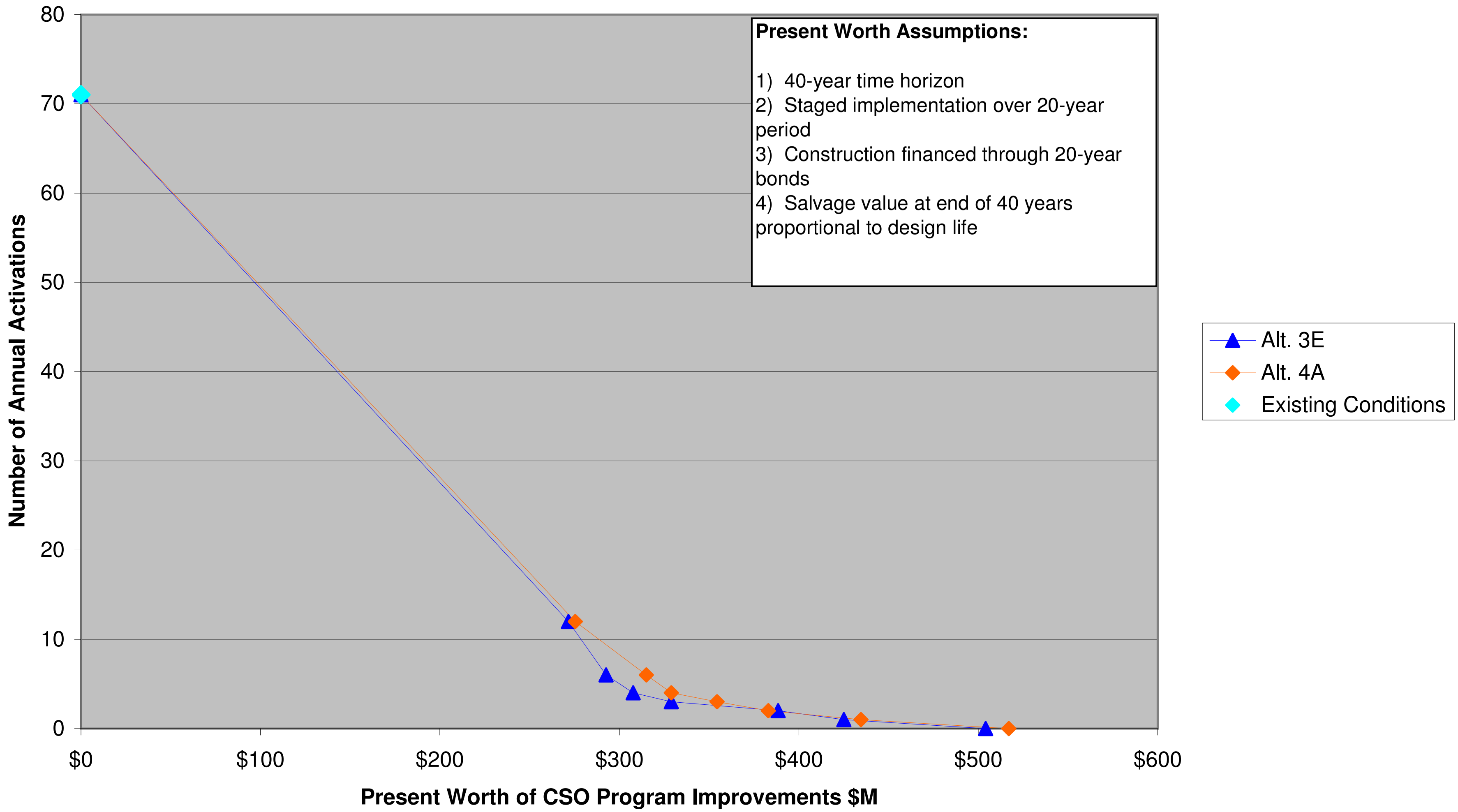


Figure 3.4.5.3
Cost/Performance Curves
Annual Overflow Volume From System CSOs

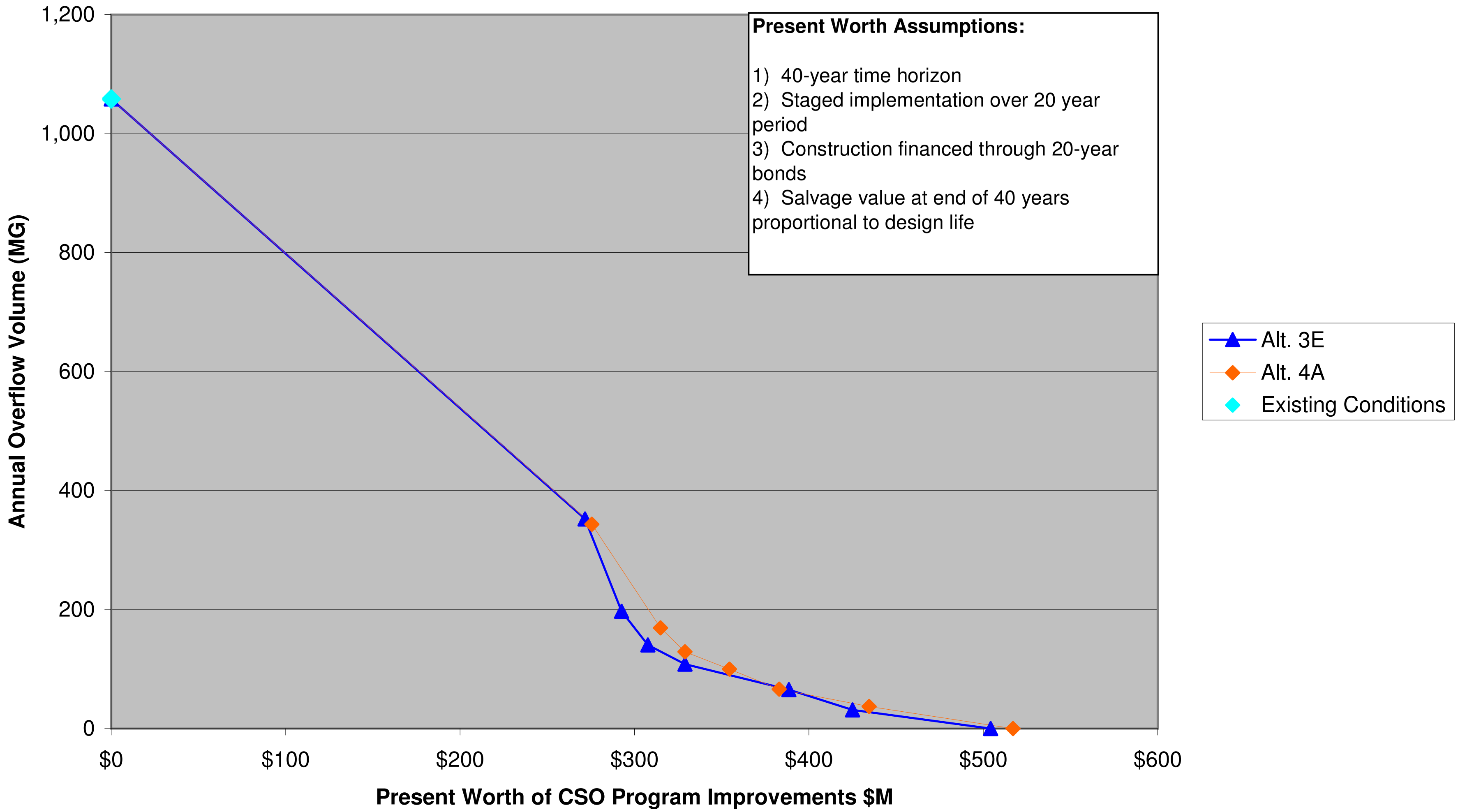


Figure 3.4.5.4
Cost/Performance Curves
Annual Days Exceeding Instream Bacteria Water Quality Standards

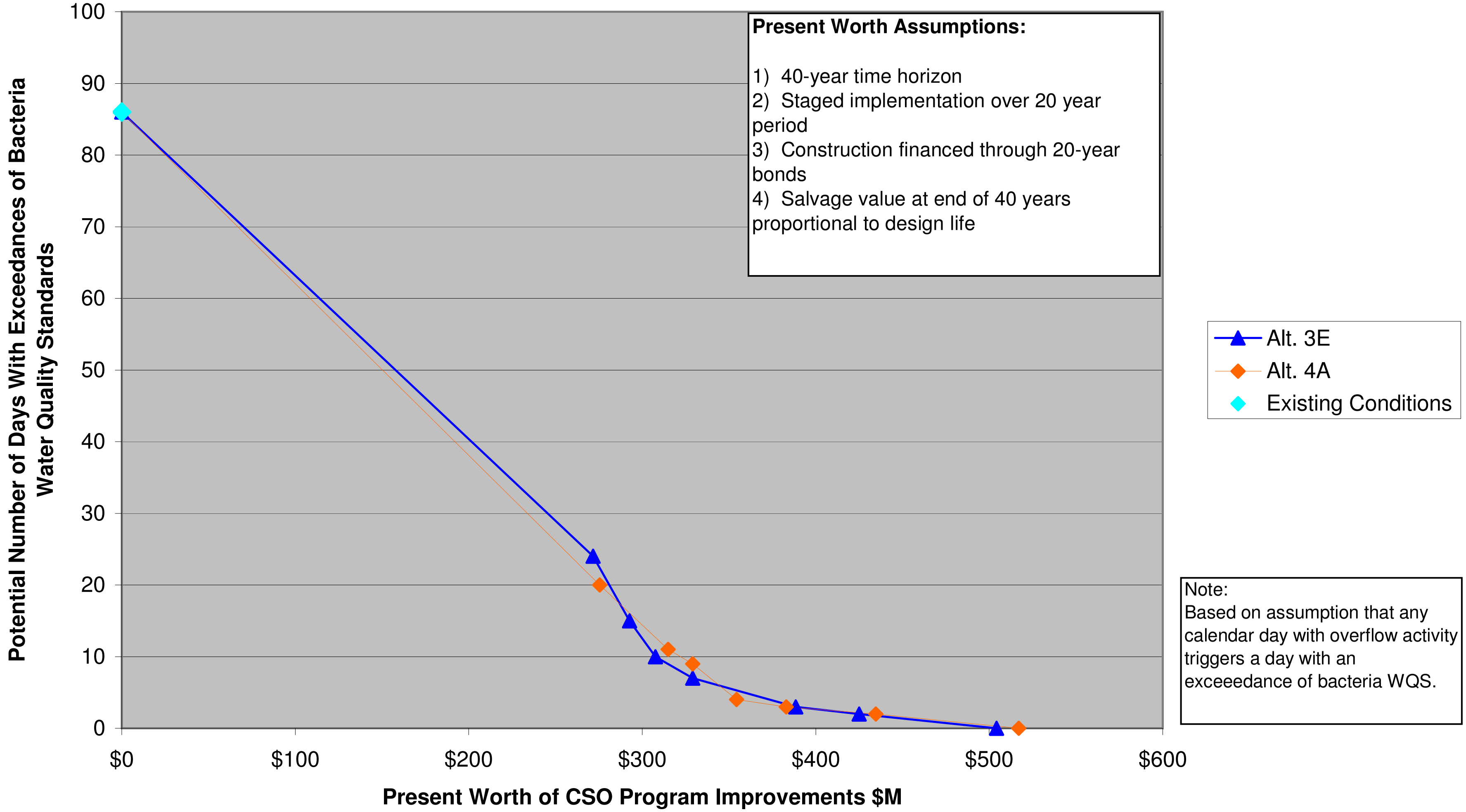
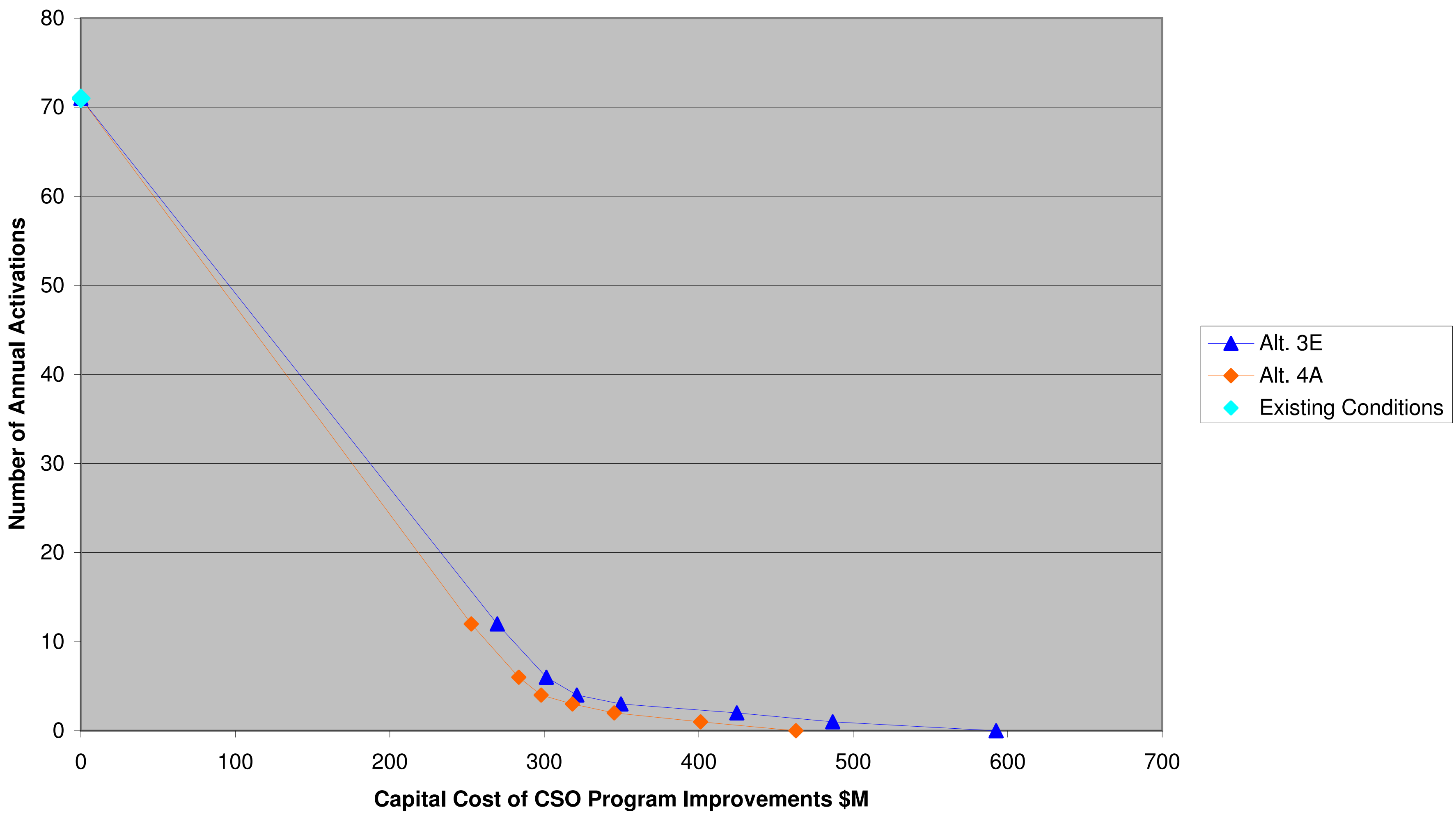


Figure 3.4.5.5
Cost/Performance Curves
Annual Activations In Terms of Capital Costs



ATTACHMENT 1

ATTACHMENT 1

CITY OF FORT WAYNE
CSO LONG TERM CONTROL PLAN
COST ESTIMATING METHODOLOGY

DECEMBER 2007

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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.

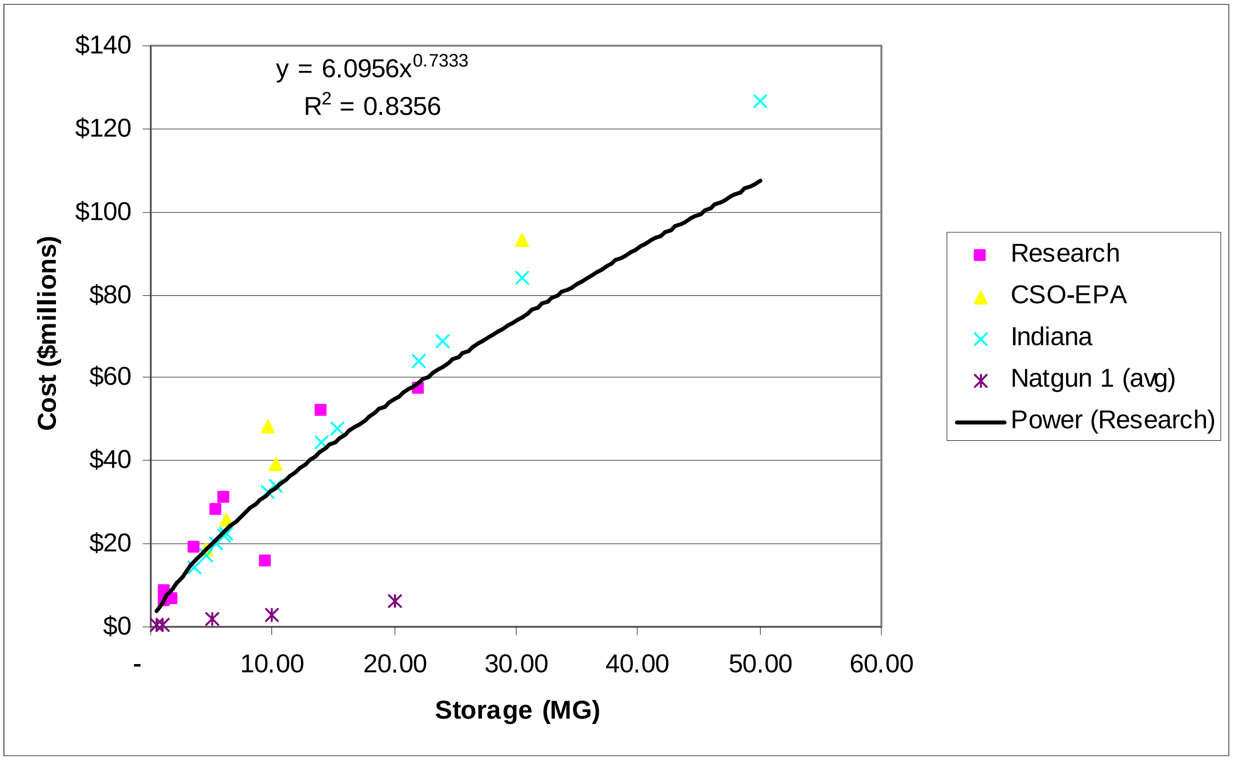
The resultant information is provided on EXHIBIT 3.15. It should be noted that an equation can be derived for the City of Columbus tank costs as follows:

$$CostofStorage = 6.0956 \times Volume^{0.7333}$$

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 x 32,147 *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.

$$Cost = V \times 122{,}997 - 332.44 \qquad \text{Equation (9)}$$

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