

October 22, 2002

Mr. Michael B. Nixon
Superintendent
City of Lancaster Water Pollution Control Department
800 Lawrence Street
Lancaster, OH 43130

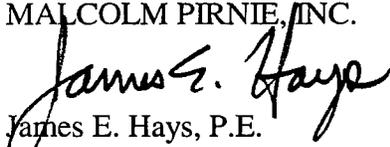
Re: City of Lancaster Department of Water Pollution Control
Combined Sewer System Long Term Control Plan
Meeting with Ohio EPA – October 8, 2002

Dear Mr. Nixon:

Enclosed is the summary for the above referenced meeting. This summary is transmitted for your review and comment. If you have any questions regarding the enclosed information, please contact me directly at 614/430-2627.

Very truly yours,

MALCOLM PIRNIE, INC.


James E. Hays, P.E.
Associate

100802Meeting Summary.LOT.doc/jeh

Enclosures

c: Kent Huston, P.E., City of Lancaster
Denise Crews, City of Lancaster
Rick Mark, City of Lancaster
Paul Menz, City of Lancaster

Paul Novak, Ohio EPA
Mike McCullough, Ohio EPA
Jan Rice, Ohio EPA
Thomas J. Bulcher, P.E., Malcolm Pirnie Inc.

0491-038

RECEIVED
CITY OF LANCASTER
OCT 22 2002
ENGINEERING DEPARTMENT
FILE No. 11.0045

**CITY OF LANCASTER OHIO
WATER POLLUTION CONTROL DEPARTMENT**

LOCATION: City of Lancaster Water Pollution Control Facility
800 Lawrence Street, Lancaster Ohio 43130

DATE: October 8, 2002

ATTENDANCE: See the attached Attendance List

SUBJECT: Lancaster Ohio Long Term Control Plan – Ohio EPA Comments

1. Opening/Introduction:

- 1) Mike Nixon/City of Lancaster opened the meeting and asked everyone present to introduce themselves.
- 2) Mike Nixon stated that the Ohio EPA had inspected the Water Pollution Control Facility in September. At that time, the subject of the status of the Long Term Control Plan (LTCP) under review by the Ohio EPA was discussed. It was decided that the Ohio EPA and the City should meet regarding the LTCP.
- 3) Mike Nixon stated that he had just received a letter late yesterday containing the Ohio EPA's comments on the LTCP. Due to the late arrival of this letter, he would not be able to address the comments at this meeting.

Paul Novak/Ohio EPA expressed surprise that the letter had not been received sooner and apologized for the delay.

2. Ohio EPA Comments:

Paul Novak stated that the Ohio EPA wanted this meeting because it plans to issue a draft NPDES permit for the Lancaster Water Pollution Control Facility within the next two weeks. Also, the Ohio EPA is aware that the City was pursuing some Master Planning for wastewater due to development occurring in the region. The purpose of the letter was to provide the agency's opinion on the LTCP so it can be considered when analyzing Master Plan options. Paul Novak provided the following summary of the agency's comments on the LTCP:

- 1) The City must reduce the volume and frequency of overflows
- 2) The City must provide priority treatment to flows from new developments such that all flow receives secondary treatment.
- 3) The City must address the health concerns posed by fecal coliforms in combined sewer overflows. If the City continues to discharge CSOs, then the frequency must be reduced to 4-6 overflow events per year and a change in fecal coliform water quality standards must be requested.

CITY OF LANCASTER
WATER POLLUTION CONTROL DEPARTMENT
October 8, 2002 Long Term Control Plan Meeting with Ohio EPA
Continued

3. Schedule:

- 1) Tom Bulcher/Malcolm Pirnie stated that a two week schedule to respond to the draft NPDES permit and the LTCP comments was unrealistic and unfair. He noted that the Ohio EPA took over two years to respond to the LTCP and is over one year late in renewing the City's NPDES permit. The Ohio EPA's comments were only received yesterday. The comments are very serious and could have significant impact on the finances of the City of Lancaster. With that background, it is impossible to respond in two weeks.

Tom Bulcher also stated that the City recognizes the Ohio EPA has the regulatory authority and the City will have to comply. However, the City of Lancaster has worked very well with the Ohio EPA over the last ten years to achieve significant improvements. The Ohio EPA should work with the City of Lancaster to address these current issues and reach a consensus rather than dictating unacceptable terms.

- 2) Mike McCullough/Ohio EPA stated that they were not intending to put specific comments from the Ohio EPA's letter into draft NPDES permit. Rather, it would be a generic comment requiring a revised Long Term Control Plan.
- 3) After much discussion, it was agreed that the City would need 24 months to revise its LTCP.

4. Current City Projects:

- 1) Denise Crews/City of Lancaster stated that the City has already completed sewer separation in the Downtown area in order to move forward with CSO reduction. The City does not want to be spending money on projects that won't ultimately satisfy the Ohio EPA. Also, the City would prefer to spend money on construction projects and not on an update to the LTCP.

Mike Nixon stated that the City has to be careful with increasing rates. Paying for the successful improvements completed to date have pushed Lancaster up above the average state-wide wastewater rate and additional rate increases are already scheduled. The City has shown a willingness to invest money where there is benefit to the environment. However, he must be careful to make sure the money is spent where there is a real benefit.

- 2) Paul Novak stated that the purpose of the letter was not to stop the City from pursuing CSO reduction projects. Rather it was to let the City know that the agency did not agree with the LTCP's conclusions.

Paul Novak stated the agency also recognizes the regional leadership role the City provides in wastewater treatment, such as in the Greenfield Township situation. However, the agency wants any planning for new sources to the City's system to not

CITY OF LANCASTER
WATER POLLUTION CONTROL DEPARTMENT
October 8, 2002 Long Term Control Plan Meeting with Ohio EPA
Continued

connect to the City's combined sewer system.

5. Long Term Control Plan

1) Status

- i) Paul Novak stated that the LTCP did not comply with the National CSO policy regarding the Presumptive Approach. The Presumptive Approach requires 85% capture and reduction of frequency to 4 to 6 overflows per year.
- ii) Jim Hays/ Malcolm Pirnie stated that the LTCP submitted to the Ohio EPA was written under the guidance of both the National CSO Policy and the Ohio EPA's March 1995 CSO Strategy. The guidance documents stated that the City could choose either the 85% capture criteria or the 4 to 6 overflows per year under the Presumptive Approach. The National Policy states that the USEPA, based on their own studies, had concluded these were equivalent. You could choose either criterion, not both.

2) Bacteria

- i) Jim Hays stated that the Lancaster LTCP started with protecting water quality and developed a plan that did that in a cost-effective manner.
- ii) Paul Novak stated that the LTCP does not meet human health standards for bacteria and the LTCP indicated that the public uses the stream for wading.
- iii) Jim Hays stated that bacteria was addressed in the LTCP. The National Policy required the economics and public input be used to guide the plan. The public involvement in the Lancaster LTCP development did not indicate that this is where the citizens wanted change. Furthermore, the Ohio EPA should not use non-local concerns with bacteria in discharges (such as bathing beaches and drinking water supplies) and apply them to Lancaster where there are no bathing beaches and little recreational use. Also, the Ohio EPA should not use a regulation acknowledged to be flawed and impractical to force major construction projects.
- iv) Paul Menz noted that there would always be bacteria in the stream from other sources not under the City's control.

3) Downstream Users:

- i) Paul Novak stated that the agency was also concerned with downstream users as well.
- ii) Mike Nixon stated that downstream users of the Hocking, such as the canoe livery operators, were invited to the public meetings, although they did not attend. They no longer call the City with complaints about the condition of the river due to discharges.
- iii) Tom Bulcher asked the Ohio EPA to submit documentation that stated how long

CITY OF LANCASTER
WATER POLLUTION CONTROL DEPARTMENT
October 8, 2002 Long Term Control Plan Meeting with Ohio EPA
Continued

bacteria live in streams so the City could understand the Ohio EPA's concern with downstream impacts.

4) Compliance:

- i) Jim Hays stated that the comments included in the Ohio EPA's letter represented a change in the Ohio EPA's policy.
- ii) Paul Novak acknowledged that the Lancaster Long Term Control Plan generally met the agency policy and guidelines at the time it was submitted. However, Paul Novak also stated that there has been a change at the Ohio EPA in terms of trying to be consistent with its application of the CSO policy and to comply with recent guidance from the Federal EPA and the Department of Justice. The City of Lancaster requested written documentation of these changes if they are to achieve compliance.
- iii) Paul Novak stated that if the City would reduce overflows to 4 to 6 times per year, the agency would change the water quality standards to state that there would be no violation for bacteria in combined sewer discharges.
- iv) Jim Hays noted that the Agency could do that right now with the LTCP as it currently is proposed. What this actually means is that the agency requires a reduction in frequency and volume of CSO discharge even if it is not required by the National CSO Policy.

Paul Menz/City of Lancaster stated that it appears that the Ohio EPA is opposed to combined sewer overflows, regardless of whether they impact aquatic life.

- v) Paul Novak responded that the agency is against combined sewer overflows but is willing to allow discharges in the 4 to 6 times per year range as an adequate protection of public health.
- vi) Jim Hays noted that allowing discharges in the range of 4 to 6 times per year does not protect the City from further action by citizen's lawsuits or changes at the Ohio EPA since even these overflows could violate bacteria standards according to the Ohio EPA.
- vii) Paul Novak stated that the City would be protected in the following manner:
 - (1) The City would have an approved LTCP
 - (2) The agency would change the water quality standards for the receiving stream such that discharges for periods when there were discharges in compliance with the plan, there would be no bacteria violation.
 - (3) The agency would also have the City sign a consent decree implementing this plan. Jim Hays asked if there would be fees associated with the consent decree. Paul Novak stated the intent would be to only assess fees if milestone dates were missed.

CITY OF LANCASTER
WATER POLLUTION CONTROL DEPARTMENT
October 8, 2002 Long Term Control Plan Meeting with Ohio EPA
Continued

6. New Sanitary Sewer Flows

- 1) Tom Bulcher stated that the focus on the Lancaster LTCP was maintaining water quality. It provided recommended projects to allow for new growth without increasing CSO discharges.
- 2) Paul Novak stated that sanitary flow from new areas must receive full treatment and not be tributary to combined sewer areas where it may overflow.
- 3) Denise Crews stated that the City has new development going on right now connecting to existing sewers.
- 4) Paul Novak stated that normal development in existing tributary areas was acceptable. The agency is primarily interested in the large, new growth areas and that they not be tied to combined sewer areas. The agency would work with the City regarding small developments of less than 50 homes
- 5) Tom Bulcher noted that explanation is not what was stated in the Ohio EPA's comment letter which indicated no new sewer service could be connected.
- 6) Jim Hays stated that requiring all new sanitary sewage to get directly to the plant was an artificial distinction. The sanitary sewage from either a combined area or new development is still sanitary sewage. This distinction may force the City into more costly alternative for no real benefit.

7. LTCP Revisions

- 1) Paul Novak stated that the revised LTCP must look at the costs of 0, 4-6 and 8-12 discharges per year and develop costs curves.
- 2) Tom Bulcher asked if the agency had reviewed the specific LTCP recommendations such as reclassifying the Baldwin Run to modified warmwater habitat. Paul Novak was unaware if this issue had been addressed.
- 3) Denise Crews noted that with the proposed schedule, it could be four years before the LTCP is approved. What should she do with the existing developer plans that are being submitted?
- 4) Paul Novak stated that there is no connection ban in Lancaster. However, he is also concerned with the schedule. That is why he would like to come to an understanding with the City regarding how it plans to serve the new growth areas even while the LTCP is being revised.
- 5) Tom Bulcher stated that the City has already done some work in anticipation of approval of its LTCP. It has closed several CSOs, separated the downtown area and funded a residential sewer separation.
- 6) Paul Novak stated the agency fully supports these types of CSO reduction projects.

CITY OF LANCASTER
WATER POLLUTION CONTROL DEPARTMENT
October 8, 2002 Long Term Control Plan Meeting with Ohio EPA
Continued

8. Public Notice

- 1) Jan Rice/Ohio EPA suggested revising the Public Notice date. Mike McCullough stated the Ohio EPA desires to issue the NPDES permit by the end of the year so the agency would not have to redo its modeling.
- 2) After much discussion, it was agreed that the agency would like to issue the draft NPDES permit for public notice by November 1st.
- 3) Tom Bulcher stated that the City would like to see the draft NPDES before it is issued for public comment. Mike McCullough agreed to email the draft to Mike Nixon and Tom Bulcher.
- 4) Tom Blucher asked about the status of the TMDL for the Hocking.
- 5) Mike McCullough stated that the original schedule had it approved by 2006, however that date will likely slip.

9. Response to Ohio EPA's Letter

- 1) Tom Bulcher asked how soon the City should respond to the Ohio EPA's letter.
- 2) Paul Novak stated there was no rush to respond. The City should also emphasize their current CSO projects.

This summary provides the writer's understanding of the significant discussion and conclusions from the referenced meeting. This is a summary only and does not reflect all remarks and conversations that occurred during this meeting. Please contact Malcolm Pirnie with any corrections or modifications to this summary.

+ + END OF MEETING SUMMARY + +

Ohio EPA Meeting
 Lancaster Long-Term Control Plan
 October 8, 2002
 Lancaster WPCF

	<u>Name</u>	<u>Affiliation</u>	<u>Phone</u>
1.	Jim Hays	Malcolm Pirnie Inc	614/882-4953
2.	Mike McBelkosh	Ohio EPA	614-644-4824
3.	Paul Navate	Ohio EPA	614-644-2035
4.	Michael B. Nixon	City of Lancaster WPCD	740 687-6664
5.	Jan Rice	CEPA/COC/OSW	614-728-3850
6.	Denise Crews	Lancaster Engineering	740-687-6614
7.	PAUL MENZ	CITY OF LANCASTER WPCD	740-687-6666
8.	Tom Bulcher	Malcolm Pirnie	614-430-2600
9.			
10.			

June 6, 2000

Michael B. Nixon
WPCD Superintendent
City of Lancaster
800 Lawrence Street
Lancaster, OH 43130

Re: City of Lancaster
Wastewater Collection System Evaluation Project
Combined Sewer System Long-Term Control Plan Report
NPDES Permit; Part I C. - Schedule of Compliance, Paragraph 6.

Dear Mr. Nixon:

Enclosed are two copies of the above referenced report. This report was delivered to the Ohio EPA Central District Office on June 1, 2000 under the letter of transmittal you provided. A copy of the letter of transmittal is included in each report.

By copy of this letter, we are also transmitting one copy of this report to Mr. Kent Huston, City Engineer.

If you have any questions regarding this report, please contact me directly (614) 430-2609 or Jim Hays at (614) 430-2627.

Very truly yours,

MALCOLM PIRNIE, INC.



Thomas J. Bulcher, P.E.
Senior Associate

RECEIVED
CITY OF LANCASTER
JUN 08 2000
ENGINEERING DEPARTMENT
FILE No. 11.0095

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Enclosure

✓ c: L. Kent Huston, City Engineer, Lancaster Ohio (w/ Enclosure)

CITY OF LANCASTER
WATER POLLUTION CONTROL DEPARTMENT

MICHAEL NIXON • *Superintendent*
PAUL MENZ • *Assistant Superintendent*

100 LAWRENCE STREET

(740) 687-6664

FAX (740) 687-6667

LANCASTER, OHIO 43130-9401

May 31, 2000

Jan A. Rice
Division of Surface Water
Ohio EPA
Central District Office
3232 Alum Creek Drive
Columbus, OH 43207-3417

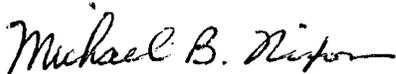
Re: City of Lancaster
NPDES Permit 4PD00001*HD
Combined Sewer System Long-Term Control Plan

Dear Mr. Rice:

We are pleased to submit two copies of the City of Lancaster Combined Sewer System Long-Term Control Plan. This report was developed to satisfy the requirements of Part I, C.- Schedule of Compliance, Paragraph 6 of the City's NPDES Permit.

We believe you will find the report satisfactory. Should you have any questions regarding the report, please feel free to contact me at (740) 687-6664 or Mr. Tom Bulcher of Malcolm Pirnie Inc. at (614) 888-4953.

Sincerely,



Michael B. Nixon
Superintendent

OEPA transmittal.doc/jeh

Enclosures

c: L. Kent Huston, City Engineer, Lancaster Ohio
Tom Bulcher, Malcolm Pirnie Inc.

"Insuring Your Right to Clean Water . . . Now and in the Future"



**CITY OF
LANCASTER, OHIO**

**WATER POLLUTION CONTROL
DEPARTMENT**

**COMBINED SEWER SYSTEM
LONG-TERM CONTROL PLAN**

JUNE 2000



INDEPENDENT ENVIRONMENTAL ENGINEERS, SCIENTISTS & CONSULTANTS

**Combined Sewer System - Long-Term Control Plan
Water Pollution Control Department
Lancaster, Ohio**

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Water Pollution Control Department
Lancaster, Ohio**

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Water Pollution Control Department
Lancaster, Ohio**

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Water Pollution Control Department
Lancaster, Ohio**

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F	Public Meeting No. 1
G	Public Meeting No. 2
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I	Not Used
J	Fairfield County Sewer Report
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Chapter 1.0 - Executive Summary

1.1 Introduction

The City of Lancaster owns and operates the Lancaster Water Pollution Control Facility (WPCF). The City is authorized to discharge pollutants from the WPCF and combined sewer overflow (CSO) structures under a National Pollution Discharge Elimination System (NPDES) permit issued by the Ohio Environmental Protection Agency (Ohio EPA), Permit No. 4PD00001*HD.

In the City's current NPDES permit which is effective December 1, 1997, the Ohio EPA required that a Combined Sewer System Long-Term Control Plan (LTCP) be completed by June 1, 2000.

The City initiated its Wastewater Collection System Evaluation in 1995 to address basement flooding issues, to evaluate sewer system capacity, and to address anticipated Ohio EPA combined sewer overflow regulations. This program included the following elements:

- ▶ A complete characterization of the combined sewer system. This characterization was supported by field measurement of system flows and CSO discharges, rainfall measurement and CSO sampling. This data was used to develop and calibrate a hydraulic model of the combined sewer system.
- ▶ An aquatic life study of Lancaster area streams. The study was used to assess the ability of Lancaster streams to attain water quality standards. The aquatic life study was used to focus the attention of the LTCP on areas where apparent water quality impairments had been identified.
- ▶ A Sewer System Extension Evaluation. The purpose of the evaluation was to determine potential increases in CSO volume resulting from additional sanitary sewers added to the collection system due to growth in and around the City of Lancaster.
- ▶ Public Participation meetings. These meetings were used to determine public concerns regarding the effects of CSO discharges on water quality and solicit opinions and ideas regarding existing stream uses and sewer rate cost implications.

1.2 Water Quality Goals

1.2.1. Ohio EPA Sampling

The Ohio Environmental Protection Agency (Ohio EPA) collects water quality samples from Ohio receiving streams. Ohio EPA has been periodically sampling the Hocking River since 1982. Its most recent sampling took place in 1995. This sampling has documented continuing improvement in aquatic life in the Hocking River and tributaries.

The most recent Ohio EPA biomonitoring identified the Hocking River to be in Full Attainment of Modified Warmwater Habitat standards upstream of the Lancaster Water Pollution Control Facility (WPCF). The Hocking River below the WPCF was found to be in Partial Attainment of Warmwater Habitat Standards. This was attributed to temporary process modifications on-going at the WPCF during the sampling season. A small section of Baldwin Run (Rivermile 0.2/0.1) was identified by Ohio EPA as being in Non-Attainment of Warmwater Habitat. This impairment was attributed, in part, to CSO discharges.

1.2.2. Lancaster Sampling

An aquatic survey, similar to the Ohio EPA's previous survey work, was included in the City's approach to developing a Combined Sewer System Long-Term Control Plan. This survey would supplement Ohio EPA's previous biomonitoring work and further define the water quality impacts, if any, from Lancaster CSOs on the local receiving streams.

The aquatic survey of the Hocking River and tributaries took place in the summer of 1998. The aquatic survey confirmed Ohio EPA's conclusion regarding the Hocking River through Lancaster and Baldwin Run upstream of the confluence of Feters Run and Ewing Run.

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In the City's survey, it was found that the Hocking River was only in Partial Attainment of water quality standards downstream of the Water Pollution Control Facility (WPCF). However, different causes were cited. A ford had been built entirely across the Hocking River for truck traffic from a local mining operation. This ford was located in the middle of the sampling location. It was concluded that it prevented normal fish migration and thus lowered the water quality scores. In the Lancaster survey, CSO impacts were also identified upstream of the WPCF on the Hocking River. These impacts were attributed to a dry weather overflow from CSO structure 1005.

The City's survey also confirmed the results of Partial Attainment of water quality standards in the lower reach of the Baldwin Run (rivermiles 0.3 to 0.0). This result was likely due, in part, to CSOs. However, the City's survey identified another contributing factor to the Partial Attainment performance. The City survey noted significant habitat modifications. These likely contribute to the water quality problems in the lower Baldwin Run. This was also the case at the upstream Baldwin Run site that was found in Non-Attainment. The habitat modifications to this site were severe. It is also a site subject to flash flooding, sediments from upstream development, and storm discharges from an adjacent parking lot. Looking quantitatively at the amount of CSO discharged above this site, relative to sites further downstream, it does not appear reasonable to associate this site's water quality problems to CSOs only. It was thus concluded that this site was significantly impacted by habitat modifications.

1.2.3 Conclusions

Conclusion made from the City's survey are summarized as follows:

- ▶ Water quality impairments that were identified in Baldwin Run are attributed to a poor habitat in the receiving water thus existing CSO discharges do not preclude attainment of water quality standards in this area. Furthermore, it is recommended that the site of impairment be reclassified from Warmwater Habitat to Modified Warmwater Habitat.

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- ▶ Water quality impairments to Hocking River that were identified downstream of the WPCF are attributed to localized habitat impairments that restricted the river flow.
- ▶ Water quality impairments to Hocking River that were identified upstream of the WPCF at rivermile 89.3 are attributed CSO discharges.
- ▶ Water quality impairments to Hocking River that were identified upstream of the WPCF at rivermile 91.8 are attributed to poor habitat and urban development.

1.3 Antidegradation Issues

As part of its implementation of the National CSO Policy, the Ohio EPA has included a Sanitary Sewer Extension Evaluation. The purpose of this evaluation is to identify the impact of future sanitary sewer extensions on CSO volume discharges.

A Sanitary Sewer Extension Evaluation was completed for the City of Lancaster. Growth and development were forecasted through the year 2020. Computer simulations were then run to determine the impacts of these new flows on CSO volumes. It was found that without CSO and/or infiltration/inflow reduction projects, there would be significant increases in CSO discharges to the City's receiving streams by the year 2020.

1.4 Recommendations

Based on the results of the water quality sampling of the receiving streams and the antidegradation analysis, the Presumptive Approach was selected for the City of Lancaster Long-Term Control Plan. The following goals were established for the Long-Term Control Plan:

- ▶ Eliminate water quality impacts in receiving streams by capturing for treatment 85% by volume of combined sewage collected in the Combined Sewer System.
- ▶ Allow for future growth in the Lancaster sewer system by eliminating sufficient CSO volume to keep CSO volumes at or below existing levels.

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Based on these goals, the City of Lancaster Combined Sewer System Long-Term Control Plan was developed and consists of the following:

1. **Reduce CSO volume to the Hocking River by abandoning CSO 1010.** This CSO is located in the central portion of the City near Mulberry Street and Hocking Street. During sewer system characterization activities, this CSO was identified as prone to river inflow and not CSO discharges since some upstream combined areas have been separated.
2. **Reduce CSO volume to the Hocking River by abandoning CSO 1005.** This CSO is located west of the WPCF and discharged to the Hocking River at approximately rivermile 89.5. This CSO is prone to frequent activation since its weir elevation is approximately 1.25 feet below the weir elevation of the next CSO downstream (CSO 1004). In addition, this CSO location had limited access, was difficult to inspect, and was prone to dry weather overflows.
3. **Reduce CSO volume to the Hocking River by cleaning interceptor.** During system flow metering, a section of the 27-inch Hocking-West interceptor was found to be plugged by grit and debris. This interceptor was cleaned to provide additional carrying and storage capacity.
4. **Reduce CSO volume to Baldwin Run by modifying CSO 1019.** This CSO is located in the southeast corner of Mary Burnham Park and discharges to Baldwin Run at approximately rivermile 0.5. This CSO is activated by small amounts of precipitation and large volumes of CSO are discharged. It is proposed to raise the weir elevation in CSO 1019 in order to increase system storage and thus reduce total CSO volume. Due to the presence of floatables in the Baldwin Run, floatables control will be added to this structure.
5. **Reduce CSO volume to the Hocking River by separating sewers.** In order to reduce CSO discharges to the Hocking River, two sewer separation projects were identified.
 - ▶ Combined sewers in the downtown area were separated as part of a Downtown Revitalization project. However, the project did not discharge the separated flows to the Hocking River. Separated flows were returned to the combined sewer system further downstream. Completion of this separation project will discharge the separated flows directly to the Hocking River.
 - ▶ The Lake/Allen/Maple Street area was selected because separation of the area would provide a significant reduction of CSO to the Hocking River. Also, separation could resolve the situation that has caused numerous flooded basements in this area in the past.

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6. **Address Habitat Impacts on Water Quality:** Based on the Ohio EPA's analysis of the Hocking River and its decision to reclassify it as Modified Warmwater Habitat, it is proposed that the Baldwin Run also be classified as Modified Warmwater Habitat.

7. **Water Quality Sampling:** To continue monitoring CSO impacts on the water quality of receiving streams, aquatic life sampling is proposed. This sampling would supplement the sampling performed by the Ohio EPA. Also, the sampling would be at the discretion of the City if the City decides it is appropriate.

8. **Reduce CSO volume to Baldwin Run by modifying CSO 1029.** This CSO structure is located near 6th Avenue and Boyd Street. CSO from this structure is discharged to Feters Run. It is recommended to modify the configuration of this CSO structure in order to reduce maintenance, prevent possible dry weather overflows, and reduce CSO volume discharged to the receiving stream. Floatables control will also be incorporated into the structure modifications.

1.5 Costs and Implementation Schedule

Below is a summary of the anticipated cost of the recommended alternatives for the average user (Table 6-1 of Chapter 6):

LANCASTER OHIO COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN FINANCIAL IMPACT

Recommended Alternative	Total Present Worth of Project Cost	Total Annualized Costs (6 %, 20 Years)	Annual Cost Per User
In-Line Storage Abandon CSOs 1005 & 1010 Modify CSOs 1019 & 1029	\$252,000	\$22,000	\$1.69
Sewer Separation Lake/Allen/Maple Streets Complete Downtown Separation	\$5,052,800	\$440,500	\$33.89
Aquatic Life Sampling	\$137,600	\$12,000	\$0.92
Total	\$5,304,800	\$462,500	\$36.49

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The implementation schedule of the recommended plan through the year 2020, assuming Ohio EPA approval of the plan in the year 2000, is shown in the attached figure (Figure 6-4 of Chapter 6).

1.6 Compliance with Presumptive Approach - National CSO Policy

In accordance with the National CSO Policy, the City of Lancaster Combined Sewer System Long-Term Control Plan has been developed using the Presumptive Approach. In this approach, it is assumed that the streams receiving CSO discharges can attain water quality designations provided the collection system captures at least 85% of the combined sewage during wet weather.

By implementing the recommended alternative, the City of Lancaster can achieve the following:

- ▶ 85% Capture of the combined sewage on an average annual basis in both the Hocking River and Baldwin Run drainage basins.
- ▶ Reduction of sufficient volume of CSO in both the Hocking River and Baldwin Run Drainage Basin to allow for anticipated future developments through the year 2020.

The City of Lancaster Long-Term Control Plan commits the City to sewer system modifications that will offset increased CSO discharge resulting from sanitary sewer extensions. In addition, the collection system modifications will result in reduction of the annual CSO volumes and presumably removal of impacts of CSO discharges that may be contributing to lack of attainment of water quality standards in the Baldwin Run and Hocking River.

+ + END OF CHAPTER 1 + +

**LANCASTER OHIO
COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
IMPLEMENTATION SCHEDULE**

Task	YEAR																						
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Submit LTCP		X																					
Abandon CSO 1010	X																						
Abandon CSO 1005	X																						
Clean 27" Interceptor	X																						
Ohio EPA Approve LTCP		X																					
Raise CSO Weir 1019																							
Downtown Sewer Separation Completion																							
Lake / Allen / Maple Street Sewer Separation																							
Reclassify Baldwin Run																							
Modify CSO 1029																							
Aquatic Life Stream Sampling																							

2

2.1 Background

The City of Lancaster, Ohio owns and operates the Lancaster Water Pollution Control Facility (WPCF). The WPCF is adjacent to the Hocking River in the City of Lancaster, approximately 1.5 miles southeast of the City's downtown area. The City's wastewater collection system has a service area of approximately 17 square miles and serves a population of approximately 36,600 (1995 Housing Plan). The wastewater collection system conveys residential, commercial, and industrial flows to the WPCF.

The oldest sections of the City's wastewater collection system have been in existence since the early 1900s and are located in the central part of Lancaster. These sewers are classified as "combined sewers" since they were designed to carry both sanitary flow and stormwater flow in the same pipe. These sewers were designed to discharge excess flow (greater than the system's capacity) during wet weather to the local receiving stream through the combined sewer overflow (CSO) structures. Over the years, the City's wastewater collection system has been modified and expanded. These modifications include the addition of separate sanitary sewer areas, interceptor sewers, and separation of storm flow from sanitary flow in some combined sewer areas. Today, the City's wastewater collection system totals over 170 miles of sanitary and combined sewers with diameters between 6 and 60 inches. The sewers are constructed of many different types of materials including brick, clay, concrete, and cast iron. Significant features of the collection system include sewers, siphons, pump stations and CSO structures. Location of these features and wastewater collection service areas are shown on Figure 2-1 at the end of this report for reference.

The City's wastewater collection system is composed of two main drainage areas: the Baldwin Run and Hocking River drainage areas. Both drainage areas contain both sanitary and combined sewers. Wastewater from the Baldwin Run drainage area in the

Chapter 2.0 - Introduction

eastern portion of the City is collected and transported to the Baldwin Run interceptors. Wastewater from in the Hocking River drainage area in the central and western portion of the City is collected and transported to the Hocking River interceptors.

During wet weather, flows greater than the sewer capacity are discharged to receiving streams through CSO structures. The City's 1997 National Pollutant Discharge Elimination System (NPDES) Permit identified thirty-one (31) separate CSO locations that can discharge excess flow from the combined sewer collection system. Of these CSOs, one discharges to the Fetters Run, five discharge to the Baldwin Run, and twenty-five (25) discharge to the Hocking River. The approximate location of each CSO structure is shown on Figure 2-1. Each structure is listed in Table 2-1 and a detailed sketch of each structure is provided in Appendix M for reference.

2.2 NPDES Permit

In October 1997, the Ohio EPA renewed the City of Lancaster's National Pollution Discharge Elimination System (NPDES) permit. The permit became effective December 1, 1997. The NPDES permit included new combined sewer overflow (CSO) requirements in accordance with the Ohio EPA's implementation of the National CSO Policy. A copy of the City's NPDES permit is provided in Appendix A for reference.

2.3 Combined Sewer System Requirements

Six significant CSO-related requirements were included in the City of Lancaster NPDES permit:

1. Implementation of Nine Minimum Controls for Combined Systems.
2. A Combined Sewer System Operational Plan.
3. A Combined Sewer System Monitoring Plan.
4. A Combined Sewer System Characterization Report.
5. A Sanitary Sewer System Extension Evaluation.
6. A Combined Sewer System Long-Term Control Plan (LTCP).

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**TABLE 2-1
COMBINED SEWER OVERFLOW STRUCTURES**

<u>CSO</u>	<u>Location</u>	<u>Notes</u>
1004	West Perimeter of WPCF	
1005	CSX RR and Hocking R. N. Bank	Abandoned 1999
1006	CSX RR and Hocking R. S. Bank	Also siphon FPD - closed 2007
1007	South Broad Street Chestnut - S. Columbus	
1008	Lincoln Avenue and Hocking River	
1009	Mulberry Street and Memorial Drive	
1010	Mulberry Street and Hocking Street	Abandoned 1998
1011	Union Street and Memorial Drive	
1012	Fifth Street and Memorial Drive	
1013	Sixth Avenue and Memorial Drive	
1014	Allen Street and Memorial Drive	
1015	North Broad Street and Fair Avenue	
1016	Sixth Avenue and North Broad Street	
1017	Fifth Street and North Broad Street	closed 2007
1018	North Broad Street and Mulberry Street	
1019	SE Corner of Mary Burnham Park	
1020	Chestnut Street and Brooks Avenue	
1021	Union Street and Garfield Avenue	
1022	Columbus Street and Wilson Avenue	
1023	High Street North of Fair Avenue	
1024	Wheeling Street and Livingston Avenue	closed 2007
1025	Fetters Run North of Frederick	Abandoned, not in permit
1026	NE Corner of Mary Burnham Park	Added to 1997 Permit
1027	Walnut Street and Whiley Avenue	Added to 1997 Permit
1028	Sixth Avenue and Pierce Avenue	Added to 1997 Permit closed 2007
1029	Sixth Avenue and Boyd Avenue	Added to 1997 Permit
1030	Walnut Street and Maple Street	Added to 1997 Permit
1031	Wheeling Street and Maple Street	Added to 1997 Permit
1032	Alley North of Main Street and Maple Street	Added to 1997 Permit
1033	Park Street and Memorial Drive	Added to 1997 Permit
1034	Baldwin Run and Lawrence Street	Added to 1997 Permit
1035	E. of Park and Columbus	Added to 1997 Permit closed 2007

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2.3.1 Nine Minimum Controls

As part of the National Combined Sewer Overflow Policy, the United States EPA identified “nine minimum control” measures to be implemented by every Combined Sewer System. These control measures are:

1. Proper operation and regular maintenance programs for the sewers system and CSO structures;
2. Maximum use of the collection system for storage of wet weather flow prior to allowing overflows;
3. Review and modification of pretreatment program to minimize the impact of non-domestic discharges from CSOs;
4. Maximization of flow to the WPCF for treatment;
5. Prohibition of dry weather overflows;
6. Control of solid and floatable materials in CSO discharges;
7. Required inspection, monitoring and reporting of CSOs;
8. Pollution prevention programs that focus on reducing the level of contaminants in CSOs; and
9. Public notification for any areas affected by CSOs, especially beaches and areas where contact recreation occurs.

2.3.2 Combined Sewer System Operational Plan

The City completed a *Combined Sewer System Operational Plan* and submitted it to the Ohio EPA in March 1998. The *Combined Sewer System Operational Plan* outlined the successful implementation of the Nine Minimum Controls (NMCs) in compliance with the City's NPDES permit and the EPA's Combined Sewer Overflow Policy. The Executive Summary of the Lancaster *Combined Sewer System Operational Plan* is provided in Appendix N for reference.

2.3.3 Combined Sewer System Monitoring Plan

The Ohio EPA required a Monitoring Plan be developed to support the implementation of the Nine Minimum Controls and the development of the Combined Sewer System Characterization Report and the Combined Sewer System Long-Term Control Plan. The plan identified combined sewer areas within the wastewater collection system, CSO flow

Chapter 2.0 - Introduction

monitoring locations, and CSO sampling locations. This Monitoring Plan was submitted to Ohio EPA in March 1998 with the *Combined Sewer System Operational Plan*.

2.3.4 Combined Sewer System Characterization Report

As part of its implementation of the National CSO policy, the Ohio EPA required all CSO communities to characterize their combined sewer collection system. The purpose of this characterization was to quantify the volume of flow and pollutant loads discharged to the Hocking River and its tributaries by the combined sewer system. The Lancaster *Combined Sewer System Characterization Report* was submitted to the Ohio EPA in December 1999 in compliance with the City's NPDES Permit. The characterization report is summarized in Chapter 3.

2.3.5 Sanitary Sewer System Extension Evaluation

The Ohio EPA included a sewer system extension evaluation in the Lancaster NPDES Permit in accordance with the Ohio CSO Strategy. The strategy includes sewer system extension evaluations in order to protect existing water quality and to ensure implementation of the antidegradation policy when increased combined sewer overflow volume would result from sanitary sewer extensions.

The sanitary sewer system extension evaluation consists of two parts. In the first part, the existing sewer capacities are determined and annual CSO volumes are estimated. In the second part, future flowrates are estimated and the impact of the new flow on the existing system and CSO discharges are estimated. The evaluation also includes recommendations to reduce CSO volumes to below current levels in order to prevent a net increase in CSO volumes which would otherwise occur as a result of new sanitary sewer flow.

2.3.6 Combined Sewer System Long-Term Control Plan

In the City of Lancaster's NPDES permit, it was required that a Combined Sewer System Long Term Control Plan be completed by June 1, 2000. The goal of the LTCP as stated in the permit is as follows:

"The goal of the plan is that discharges from combined sewer overflows shall not cause or significantly contribute to violations of water quality standards or impairment of designated uses."

This report constitutes the City of Lancaster's Combined Sewer System Long-Term Control Plan.

2.4 Stream Water Quality

As stated above, the goal of the City of Lancaster Long-Term Control Plan is to prevent water quality standard violations or impairment of designated uses caused by combined sewer overflows. The Ohio EPA periodically samples the water quality of the Hocking River and its tributaries. The most recent Ohio EPA Study was completed in 1995 and was summarized in Technical Report MAS-96-12-10, *Biological and Water Quality Study of the Upper Hocking River and Selected Tributaries*, issued in December 1997.

The 1995 study documented continued improvement of water quality in the Hocking River and its tributaries in the Lancaster area. As part of the development of the Long-Term Control Plan, the City of Lancaster completed its own water quality studies. The results of these studies, as well as a summary of the Ohio EPA's studies, are provided in Chapter 3.

2.5 Combined Sewer System Long-Term Control Plan Approach

One requirement of all Long-Term Control Plans is to provide specific, cost-effective controls that will enable the receiving stream to attain water quality criteria. Two general approaches to developing a LTCP are defined in the National CSO Control Policy: the Demonstration Approach and the Presumptive Approach.

2.5.1 Demonstration Approach

Use of the Demonstration Approach allows communities to target their CSO control efforts specifically to the individual nature and location of the water quality problem. It is called the “Demonstration Approach” because it includes provisions to measure (or demonstrate) the water quality improvements resulting from implementation of the plan.

2.5.2 Presumptive Approach

In the Presumptive Approach, it is assumed that water quality standards can be attained by achieving a specific level of control. The National CSO Policy requires achievement of at least one of the following treatment goals:

- ▶ No more than an average of four CSO events per year
- ▶ Capture for treatment of no less than 85% by volume of the combined sewage collected in the combined sewer system during precipitation events
- ▶ Elimination or removal of no less than the mass of pollutants identified as causing water quality impairment

As will be discussed in more detail in Chapter 5, the minimal amount of CSO impacts found during aquatic life sampling of the Hocking River and its tributaries led to the selection of the Presumptive Approach for the City of Lancaster’s Long-Term Control Plan.

Also, the City of Lancaster recognizes that it’s combined sewer system impacts two distinct drainage basins, the Hocking River and the Baldwin Run drainage basins. Where appropriate, the Long-Term Control Plan will address CSO impacts to the basins separately.

2.5.3 Public Participation

A significant part of the Long-Term Control Plan process is Public Participation. Public Participation was sought in the development of Long-Term Control Plan alternatives and in assessing cost impacts. The Public Participation process is described in Chapter 5.

2.6 Scope

The City of Lancaster entered into an agreement with Malcolm Pirnie Inc. in June of 1995 (subsequently amended in February and July of 1998) for provision of professional engineering services related to the City of Lancaster's wastewater collection system. Among other services, Malcolm Pirnie was to provide the following services related to the City's compliance with the Ohio EPA's Combined Sewer Overflow Strategy:

1. Develop a Combined Sewer System Operational Plan that implements the EPA's Nine Minimum Controls.
2. Develop a Combined Sewer System Characterization Report acceptable to the Ohio EPA and completed in compliance with dates stated in the City's NPDES permit.
3. Develop a Combined Sewer System Long-Term Control Plan acceptable to the Ohio EPA and completed in compliance with dates stated in the City's NPDES permit.
4. Perform a Sanitary Sewer System Extension Evaluation to determine the effect of new sanitary flows on CSO discharges.

Specific items in the scope of work included:

- ▶ Collection of Existing Data.
- ▶ Development of a Monitoring and Sample Plan.
- ▶ Monitoring and Sample Data Collection and Analysis.
- ▶ Development of a Sewer System Map and Reference Atlas.
- ▶ Development of a Sewer System Computer Model.
- ▶ Aquatic Life Use/Recreational Use Attainment Analysis (including sampling of aquatic life and bacteria in local streams).
- ▶ Public Participation Coordination.

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This report fulfills the City of Lancaster's Combined Sewer System Long-Term Control Plan requirements. The Lancaster Combined Sewer System Long-Term Control Plan contains the following elements.

- | | | |
|----|--|-----------|
| 1. | Water Quality and Combined Sewer System Characterization | Chapter 3 |
| 2. | Sanitary Sewer System Extension Evaluation | Chapter 4 |
| 3. | Public Participation | Chapter 5 |
| 4. | Sensitive Area Review | Chapter 5 |
| 5. | Alternative Evaluation | Chapter 5 |
| 6. | Cost/Performance Considerations | Chapter 5 |
| 7. | Combined Sewer System Operational Plan Review | Chapter 6 |
| 8. | Implementation Schedule | Chapter 6 |
| 9. | Compliance Monitoring | Chapter 6 |

+ + END OF CHAPTER 2 + +

3

Chapter 3.0 - System Characterization

3.1 Introduction

System Characterization, as defined by the USEPA's National Combined Sewer Overflow Policy, consists of two parts. These include a Combined Sewer System Characterization and a Receiving Water Characterization. The purpose of the Combined Sewer System Characterization is to build a baseline of data in order to implement the Nine Minimum Controls, support the development of the Combined Sewer System Long-Term Control Plan, and monitor the progress of CSO controls. The purpose of Receiving Water Characterization is to assess the current water quality, investigate areas of impairment, and determine sources of impairment.

A Combined Sewer System Characterization was required as part of Lancaster's NPDES Permit compliance schedule. A combination of flow metering, CSO sampling, computer modeling, and sewer system mapping were used to characterize the Lancaster Combined Sewer System. The *Combined Sewer System Characterization Report* was completed and submitted to Ohio EPA on December 1, 1999. The conclusions of this report are summarized later in this chapter. For reference, the Executive Summary of the *Combined Sewer System Characterization Report* is provided in Appendix C.

Characterization of Lancaster area receiving waters consisted of reviewing aquatic life data collected by the Ohio EPA since 1981 and sampling the receiving waters in the summer of 1998. This sampling was performed according to Ohio EPA protocols and examined the fish and macroinvertebrate health of all streams receiving discharges from the Lancaster Combined Sewer System. The results of this study are included in the report by EnviroScience Inc., "*City of Lancaster Water Quality Impact Study - Aquatic Survey of the Hocking River and Tributaries*" dated December 1998. A copy of the report is provided in Appendix B for reference. Sampling was also done for solid and floatable material and bacteria in CSO discharges. The conclusions of all water quality sampling efforts are summarized later in this Chapter.

Chapter 3.0 - System Characterization

3.2 Combined Sewer System Characterization

Characterization of the combined sewer system was performed to meet a requirement of the City's NPDES Permit and the National CSO Policy. In the Combined Sewer System Characterization, baseline dry weather sewer flows, CSO discharge volumes, pollutant loads, and frequency of overflow activation were established. The development of the Combined Sewer System Characterization resulted in the following:

- ▶ A characterization of the CSO volume and pollutant load to the Hocking River and its tributaries.
- ▶ A better understanding of the collection system, including improved CSO structure documentation and system mapping.
- ▶ Combined sewer system flow metering, rainfall measurement, and pollutant sampling data.
- ▶ A dynamic computer model of the Lancaster Sanitary and Combined Sewer System, based on the United States EPA's Storm Water Management Model (SWMM) model.

The *Combined Sewer System Characterization Report* was submitted to the Ohio EPA on December 1, 1999. Portions of the Combined Sewer System Characterization that are significant to the development of the Long-Term Control Plan are presented below.

3.2.1 Combined Sewer System Modeling

As part of the Combined Sewer System Characterization, a computer model of the collection system was developed. The Lancaster sewer system model was developed to support the development of both the Combined Sewer System Characterization Report and the Long-Term Control Plan. Specifically, the model was used to characterize the sewer system, determine the CSO volume during wet weather for a range of storm events, and establish the hydraulic capacity of the sewer system during dry weather and wet weather.

Chapter 3.0 - System Characterization

The Lancaster model is based on the USEPA's Storm Water Management Model (SWMM) developed in 1969 - 1970. Over the past three decades, modifications and changes have been made to increase model capabilities and user-friendliness. XP-Software Inc., has developed a graphical version of the original SWMM program that allows for graphical representation of the sewer system and graphical output. For this project, the City purchased Version 2.0 of XP-SWMM.

Modeling urban runoff for a sewer system requires various input data. This data includes the physical configuration and characteristics of the collection system, flow monitoring data, physical characteristics of the drainage areas, and rainfall data. The sewer network was constructed from record drawings showing pipe sizes, sewer lengths, sewer inverts, and ground elevations. Pump station, siphon construction, and CSO configurations were also researched and built into the model. Next, residential dry weather flow and industrial flow data were entered into the model. These flows were based on data obtained from the dry weather flow monitoring and industrial flow records.

To produce runoff in combined sewer areas due to rain events, the drainage area, imperviousness, slope, catchment width, and infiltration were determined and defined. Once the structure of the model was established, the model was calibrated using rainfall data from local rain gauges and flows measured during dry and wet weather by flow meters installed in key sewer manholes. Flow meters were used to collect data in the Lancaster sewer system from November 1995 through December 1996. The development of the Lancaster sewer system model is discussed in more detail in Chapter 4 of the *Combined Sewer System Characterization Report*.

Chapter 3.0 - System Characterization

3.2.2 Combined Sewer System Characterization Conclusions

The Lancaster sewer system model was used to characterize the sewer system. Specifically, the model was used to estimate annual CSO discharge volumes, estimate annual CSO pollutant discharge loadings, determine the CSOs with the highest frequency of activation, and determine the percent of combined sewage captured and treated during wet weather.

The annual CSO discharge volumes are based on SWMM simulations of four typical storms that occur during an average year. The typical storms were established by analyzing six years of rainfall data to determine the intensity, duration, and number of events per year. The storms analyzed were actual Lancaster area rain events occurring between May 1990 and October 1996. Only storms greater than 0.1-inches were included. The four typical storms identified are shown in Table 3-1.

**TABLE 3-1
LANCASTER OHIO
COMBINED SEWER SYSTEM CHARACTERIZATION
TYPICAL STORMS**

Storm Size (inches)	Events Per Year	Average Total (inches)	Ave. Duration (hours)	Total Rainfall (inches)
0-0.5	62.00	0.21	2.3	13.02
>0.5-1.0	12.48	0.74	6.9	9.24
>1.0-1.5	5.22	1.28	8.4	6.68
>1.5	2.87	1.85	8.6	5.31
Annual Total	----	----	----	34.25

The model was used to predict the CSO discharge volume for each typical storm. The annual discharge volume was obtained by multiplying the volume for each typical storm by its annual frequency of occurrence.

Chapter 3.0 - System Characterization

Using the storms developed from the rainfall analysis, the frequencies of activation of the various Lancaster CSOs were estimated through use of the computer model. These are shown in Figure 3-1. The Lancaster CSOs that have the highest frequency of activation are:

- ▶ Baldwin Run 1019
- ▶ Feters Run 1029
- ▶ Hocking River 1005*, 1011, 1013, 1016, 1027, 1031, 1033

*Sealed and abandoned in 1999.

In order to estimate pollutant loadings to receiving streams, samples collected from CSO discharge locations were analyzed for pollutant concentrations. It was found that Lancaster CSOs exhibit typical "first flush" pollution concentrations that decrease with time during the overflow event. Typical pollutant concentrations are shown in Figures 3-2 and 3-3. Using the annual volume of CSO estimated through use of the model, the annual pollutant loadings for each CSO within the Lancaster combined sewer system were calculated. These loadings are shown in Figure 3-4.

3.3 Receiving Water Characterization

3.3.1 Background

The Ohio EPA performed water quality studies of the Hocking River in 1985, 1991 and 1995. The purpose of these studies was to determine if the Hocking River was attaining its water quality standards, identify causes for lack of attainment, and make recommendations that would restore water quality.

In the 1985 study "gross pollution" was found in the segment of the Hocking River that flows through Lancaster. In this study, it was concluded that these impacts were due to combined sewer overflows and the effluent from the Lancaster Water Pollution Control Facility (WPCF).

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In 1991, the Ohio EPA noted significant improvement in the Hocking River. In 1985, 77% of the Hocking River between Lancaster and Enterprise exhibited “poor to very poor” conditions. However, by 1990 almost 67% of the river was in Full or Partial Attainment of warmwater habitat standards. In the 1991 Ohio EPA study, much of this improvement was attributed to upgrades at the Lancaster Water Pollution Control Facility that were completed in 1989. The 1989 upgrade of the plant not only improved the plant effluent, but it also significantly reduced the volume of CSO discharges.

In the Ohio EPA’s 1995 study, continued improvement was documented. The entire Hocking River through Lancaster was in either Full or Partial Attainment of water quality standards for the first time since the Ohio EPA began collecting data in 1982.

Figure 3-5 is a summary of the primary aquatic life indices used by the Ohio EPA to measure the health of streams. In this Figure, continued improvements in the Hocking River and its tributaries since 1982 are demonstrated.

Although the Hocking River through Lancaster had improved greatly, it was still not in Full Attainment of water quality standards. However, the Ohio EPA did not associate this lack of Full Attainment with Lancaster’s CSOs. In the 1995 sampling, the Ohio EPA found “Good” to “Medium-Good” ICI (Invertebrate Community Index) scores but only “Fair” to “Medium-Good” IBI (Index of Biotic Integrity) scores upstream of the wastewater plant where CSOs discharge. The ICI scores reflect the health of the insect population and the IBI scores reflect the health of the fish population. The Ohio EPA has concluded that a healthy insect population (good ICI scored) combined with a lagging fish population (low IBI scored) indicates impacts due to degradation of the local habitat and not from CSOs. One explanation for the poor habitat is the extensive channelization of the Hocking River through Lancaster for flood control and development purposes. It appears that this work was performed in stages over many years and has reduced the capability of the river to support a wide variety and abundance of fish species.

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As a result of these past practices, the Ohio EPA has recently changed the habitat designation of the Hocking River through Lancaster from “warmwater habitat” to “modified warmwater” habitat to reflect the modified structure of the river.

The Ohio EPA has indicated that they believe one tributary to the Hocking River is impacted by CSOs. In the 1995 study, the Ohio EPA noted apparent CSO impacts in the lower portion of the Baldwin Run, near the Lawrence Street bridge. These impacts were observed downstream of CSO 1019 which is known to activate frequently. The Baldwin Run was classified as only being in Partial Attainment in this section. However, this was still a significant improvement from previous surveys in 1982 and 1990, in which this section was found to be in Non-Attainment.

In their 1995 study, the Ohio EPA also noted other CSO impacts not associated with aquatic life. High fecal coliform levels above water quality standards were measured during rain events. Also, the Ohio EPA observed floatable debris associated with sanitary sewage throughout the CSO areas.

3.3.2 Approach

To characterize the receiving waters of the Lancaster Combined Sewer System, the following sampling of the Hocking River and its tributaries was completed to supplement the Ohio EPA’s sampling:

- ▶ **Aquatic Life Sampling:** This is sampling of the aquatic life existing in the receiving streams using procedures and protocols established by the Ohio EPA. This sampling is the same type sampling used by the Ohio EPA to determine if a stream is meeting its water quality standards and designated uses.
- ▶ **Fecal Coliform Sampling:** Sampling of fecal coliform concentrations in the local receiving streams was performed to evaluate the impact of CSO discharges on the recreational use of the streams.

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- ▶ Solids and Floatable Sampling: Limited sampling of the solids and floatable material discharged from Lancaster CSOs was performed in order to determine what solid and floatable material are present in Lancaster CSOs.

3.3.3 Aquatic Survey of the Hocking River and Tributaries

The aquatic life study of the Hocking River and its tributaries was performed in the summer of 1998. EnviroScience Inc. of Stow, Ohio was hired to perform the Stream Sampling required for the study. The results of this study are summarized in the report, *City of Lancaster Water Quality Impact Study, Aquatic Survey of the Hocking River and Tributaries, December 1998*, by EnviroScience Inc. A copy of the report is provided in Appendix B for reference.

The purpose of this study was to characterize the current aquatic life in the City of Lancaster receiving streams. The following indices established by the Ohio EPA were used to assess the overall stream condition.

- ▶ Qualitative Habitat Evaluation Index (QHEI) - This is a physical habitat index that evaluates the macrohabitat characteristics such as substrate, stream cover, bank erosion and gradient. Sites with scores greater than 60 are indicative of warmwater habitat and scores less than 60 are indicative of modified warmwater habitat.
- ▶ Index of Biotic Integrity (IBI) - This index assesses the fish community. Characteristics considered by this index are fish diversity, quantity and anomalies. Sites with scores greater than 38 (lower range 34) are indicative of attainment of Warmwater Habitat aquatic life criteria in this ecoregion. Modified Warmwater Habitats are represented by scores greater than 24 (lower range 20).
- ▶ Modified Index of Well Being (MIwb) - This index also assesses the fish community. Characteristics considered by this index are number of individuals, biomass and the Shannon Diversity Index (numbers and weights). Sites with scores greater than 7.9 (lower range 7.4) are indicative of attainment of Warmwater Habitat aquatic life criteria in this ecoregion. Scores greater than 6.2 (lower range 5.7) are indicative of Modified Warmwater Habitat.

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- ▶ Invertebrate Community Index (ICI) - This index assesses the biological integrity of the macroinvertebrate community. Characteristics considered by this index are the quantity and diversity of the collected macroinvertebrates. Sites with scores greater than 34 (lower range 30) are indicative of attainment of Warmwater Habitat aquatic life criteria in this ecoregion. Modified Warmwater Habitats are represented by scores greater than 22 (lower range 18).

3.3.3.1 Sample Sites

The aquatic study consisted of sampling nine locations. Sites were generally selected to bracket CSO discharge areas, i.e., one site upstream and one site downstream of a CSO area. Sites selected included two on the Baldwin Run, one on Ewing Run, one on Fetters Run, and five on the Hocking River. A description of each site is provided in Table 3-2. A schematic of the sample site locations is provided in Figure 3-6.

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**TABLE 3-2
AQUATIC LIFE SAMPLE SITES**

Site Number*	Stream	Location/Rivermiles	Notes
1	Ewing Run	Rainbow Drive/ 3.6	Immediately within Lancaster City Limits; Upstream of all CSO and City impacts
2	Baldwin Run	North of Main Street; Immediately West of Kroger Parking Lot/ 0.7	Downstream of CSO 1029; Upstream of remaining CSOs
3	Fetters Run	North of Fair Avenue; Immediately West of Ewing School/ 0.7 ¹	Upstream of all CSOs
4	Baldwin Run	25 meters upstream from confluence with Hocking River; Adjacent to WPCF/ 0.1	Downstream of all Baldwin Run CSOs
5	Hocking River	1 mile South of US 33 on Ety Road at Bridge/ 93.0	Upstream of all CSOs and City Impacts
6	Hocking River	West of US 33 behind Festival Foods; Upstream of Foot Bridge/ 91.8	Downstream of storm discharges from Mall; Upstream of all City CSOs
7	Hocking River	Downstream from Confluence w/Hunters Run; Downstream of Bridge in Maher Park/ 90.2	Downstream of confluence with Hunters Run; Midpoint of CSOs
8	Hocking River	100 meters Upstream of WPCF Outfall; Downstream of Railroad Bridge/ 89.0	Downstream of all Hocking River CSOs; Upstream of Water Pollution Control Facility (WPCF)
9	Hocking River	US 33 South of Lancaster across from Alley Park; Near Temporary Ford/ 87.0	Downstream of all CSOs and Water Pollution Control Facility (WPCF)

*Reference Figure 3-6

¹ From Confluence with Ewing Run

3.3.3.2 Sample Dates

As required by Ohio EPA protocols, electrofishing was performed twice (July 28 to August 8, 1998 and September 14 to 16, 1998) at all sample sites. Macroinvertebrates were also sampled at all locations using Hester-Dendy samplers. The samplers were installed during the first electrofishing sampling event (July 28 to August 8, 1998) and

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removed during the second electrofishing sampling event (September 14 to 16, 1998). Upon removal of the Hester-Dendy samplers, additional "kick" samples were collected from the river substrate to supplement the data collected by the Hester-Dendy sampler, as required by the Ohio EPA sampling protocols.

3.3.3.3 Aquatic Sampling Conclusions

Using Ohio EPA protocol and procedures, EnviroScience, Inc. analyzed the fish and macroinvertebrate samples and determined if the receiving waters were in attainment of water quality standards. Their conclusions are discussed in detail in their report included in Appendix B.

A summary of the conclusions from EnviroScience's 1998 sampling is provided in Table 3-3. Conclusions from the Ohio EPA's 1995 sampling at nearby sites are provided for reference.

In Table 3-3, five of the nine 1998 sample sites did not meet full attainment of their designated use (either Warmwater or Modified Warmwater Habitat). Of these five sites only one has been identified as a CSO related issue. This location is on the Hocking River at rivermile 89. The sample results for each site are discussed in the following section.

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**TABLE 3-3
AQUATIC LIFE SAMPLING SUMMARY - NARRATIVE RESULTS**

Site Number ^a	1995 & 1998 Sampling Location	River-mile	CONCLUSIONS	
			Ohio EPA 1995	EnviroScience 1998
Fetters Run				
Site No. 3	Fair Avenue	0.3		Full Attainment WWH
Baldwin/Ewing Run				
Site No. 1	Rainbow Drive	3.6		Full Attainment WWH
	Tiki Lane	2.7	Full Attainment WWH	
Site No. 2	Main Street	0.7		Non-Attainment WWH
	Lawrence Street	0.3	Partial Attainment	
Site No. 4	Confluence with Hocking River	0.1	Non-Attainment WWH	Partial Attainment WWH
Hocking River				
	Pickerington Road	100.2	Non-Attainment MWWH	
	Hooker Cemetery	95.2	Full Attainment MWWH	
Site No. 5	Ety Road	93		Full Attainment MWWH
	Pierce Avenue	92.2	Full Attainment MWWH	
Site No. 6	Fair Avenue	91.8		Partial Attainment MWWH
	US 22	90.8	Full Attainment MWWH	
Site No. 7	Maher Park	90.25		Full Attainment MWWH
	Upstream WPCF	89.4	Full Attainment MWWH	
Site No. 8	Upstream WPCF	89.1		Non-Attainment MWWH
	WPCF Mix Zone	89.04	N/A	
	Downstream WPCF	89	Partial Attainment WWH	
Site No. 9	US 33	87	Partial Attainment WWH	Partial Attainment WWH

Notes:

1. Blank space indicates no sample collected.
2. WWH - Warmwater Habitat, MWWH-Modified Warmwater Habitat
3. Reference Figure 3-6

FETTERS RUN

The numeric results of the 1998 sampling for Feters Run are shown in Figure 3-7. This figure includes the habitat (QHEI), fish (IBI), and macroinvertebrate (ICI) sample results. Since the drainage area for this site is less than 20 square miles, the MIwb score was not calculated in accordance with Ohio EPA sampling protocol.

FR 0.7 (Site No. 3)

Using 1998 sampling data, the Feters Run drainage area was designated as being in Full Attainment of Warmwater Habitat Criteria. As seen in Figure 3-7, this sampling location had scores for both fish and macroinvertebrates above the Warmwater Habitat criteria. The habitat score for this location was lower than the score indicative of Warmwater Habitat. Ohio EPA has not sampled this location in the past so a direct comparison to past conditions cannot be made.

BALDWIN RUN/EWING RUN

The results of the 1998 sampling for Baldwin Run are shown in Figure 3-7. This figure includes the habitat (QHEI), fish (IBI), and macroinvertebrate (ICI) sample results. Since all sites tributary to Baldwin Run/Ewing Run have drainage areas less than 20 square miles, the MIwb score was not calculated in accordance with Ohio EPA sampling protocol.

ER 3.6 (Site No. 1)

Although the Ohio EPA had previously sampled at rivermile 2.6, it was decided to sample further upstream at rivermile 3.6 due to continued City growth. As seen in Figure 3-7, this sampling location had scores for both fish and macroinvertebrates that were above the Warmwater Habitat criteria. The habitat score for this location was also indicative of Warmwater Habitat. The results from this recent sampling are in agreement

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with Ohio EPA data. However, the Ohio EPA had sampled further downstream at rivermile 2.6.

BR0.7 (Site No.2)

This sample location was chosen to bracket CSO discharge areas. This site is downstream of an active CSO (CSO 1029) but upstream of all other Baldwin Run CSOs.

An analysis of the 1998 sample data showed this site to be in Non-Attainment of Warmwater Habitat standards. This designation is primarily due to the low macroinvertebrate scores. As seen in Figure 3-7, the habitat and macroinvertebrate scores at this location were below Warmwater Habitat criteria while the fish scores were in attainment of Warmwater Habitat criteria. The Ohio EPA had not sampled at this location in the past so a direct comparison to Ohio EPA data is not possible.

There were several potential reasons identified for the very low macroinvertebrate scores at this site (see Figure 3-10 for photo of this site):

1. The stream in the area of the sample site was very shallow. EnviroScience was unable to locate any site in the flow stream with sufficient depth of flow to cover the Hester-Dendy sampler. As a result, a small pool, out of the main flow stream, where a storm pipe from the parking lot discharged had to be used. The fact that this pool was out of the main flow and in a pool created by a stormwater pipe are both factors that could contribute to low macroinvertebrate scores.
2. Construction work occurred in the stream upstream of the sample site during the sample season. The extent of the work is not known, however earth-moving equipment was used and thus it can be assumed that in-stream sediment was created. Sediment can cover the samplers for extended periods and contribute to low scores.
3. The site and its local watershed are known to be stressed by upstream development. Erosion is obviously occurring due to increased flows from upstream developments. Flash floods have occurred twice in the past five years in sufficient magnitude to flood the adjacent Kroger parking lot and close the store. Unstable streams are full of sediment and have shifting substrates which inhibit macroinvertebrate colonization. Some of the erosion occurring at this site is shown in Figure 3-10.

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4. As shown in Figure 3-6, this site received discharged from CSO 1029. However, CSO discharges appeared to be the most unlikely explanation for the non-attainment. The largest and most active CSO in the Lancaster system is CSO 1019 which is downstream from this site. CSO 1019 has a much higher volume of discharge and frequency of discharge than CSO 1029. However, the macroinvertebrate scores below CSO 1019 were almost in attainment of Warmwater Habitat standards. If CSOs had significant impacts on the macroinvertebrates in this stream, the impacts would most likely show up in the macroinvertebrates below CSO 1019.

After considering the above and revisiting the site, it was concluded that the Non Attainment was not due to CSO discharges but was due to upstream urban development and a lack of quality habitat. The support for this conclusion is provided below:

- ▶ The QHEI score given to the Baldwin Run indicates substantial loss of habitat when compared with the upstream sample locations (Fetters and Ewing Run). As shown in Figure 3-9, specific changes in habitat include in-stream cover, channel morphology, riparian zone, pool quality, and riffle quality. The channelization of the lower Baldwin Run and lack of habitat structure can be seen in Figure 3-10.
- ▶ The channelization is evident in the Baldwin Run from the confluence with the Hocking River to approximately rivermile 0.8 (confluence of Ewing Run and Fetters Run).
- ▶ Urban development in the area has increased surface runoff in the area creating noticeable erosion cracks in the stream bank and increasing the stormwater discharges during wet weather.

Past channelization, adequate fish scores, and urban development point to the conclusion that the low macroinvertebrate scores were not a result of CSO activity but due to sampler location, poor habitat, and urban development.

BR 0.1 (Site No. 4)

This sample site was selected because it was downstream of all CSOs on the Baldwin Run (rivermile 0.1). Based on the 1998 sampling work this site was found to be in Partial Attainment of Warmwater Habitat standards. As seen in Figure 3-7, this designation is due to macroinvertebrate scores slightly below the Warmwater Habitat standards. The fish scores were in attainment of Warmwater Habitat criteria.

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It is concluded that the low macroinvertebrate scores and Partial Attainment are not primarily due to CSO discharges, but are due to a lack of a sufficient habitat. The support for this conclusion is provided below:

- ▶ The QHEI score given to the Baldwin Run indicates substantial loss of habitat when compared with upstream sample locations (Fetters and Ewing Run). As shown in Figure 3-9, specific changes in habitat include in-stream cover, channel morphology, riparian zone, pool quality, and riffle quality. The channelization of the lower Baldwin Run and lack of habitat structure can be seen in Figure 3-11.
- ▶ The channelization is evident in the Baldwin Run from the confluence to approximately rivermile 0.8 (confluence of Ewing Run and Fetters Run).
- ▶ Since 1982, the Ohio EPA has repeatedly documented habitat and macroinvertebrate scores less than Warmwater Habitat criteria at rivermile 0.1. In fact, the macroinvertebrate scores since 1982 are less than Modified Warmwater Habitat Criteria.

Although this site was found to be only in Partial Attainment in 1998, the water quality at this site has improved since 1995. In 1995, the Ohio EPA found this site to be in Non-Attainment. The Ohio EPA concluded construction activities were a contributing cause of the Non-Attainment designation. It can be concluded from the 1998 survey that the low macroinvertebrate scores and the Partial Attainment designation are due to the noticeable channelization, and apparent lack of habitat at this site.

HOCKING RIVER

The results of the 1998 sampling for the Hocking River are shown in Figure 3-8. These results reflect the habitat (QHEI), fish (IBI, MIwb), and macroinvertebrate (ICI) sample results. Note that all Hocking River sites, except HR 87 (Site No. 9), will be compared to Modified Warmwater Standards. The water quality use designation of the Hocking River through the City of Lancaster was recently changed from Warmwater Habitat to Modified Warmwater Habitat. During the Ohio EPA's 1995 sampling, the Hocking River through Lancaster was still designated Warmwater Habitat.

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HR 93.0 (Site No. 5)

This sample location was chosen to provide representative samples upstream of both CSOs and urban development. This location is between two Ohio EPA sampling sites (rivermile 95 and 92.2). Analysis of the 1998 data indicated that this site is in Full Attainment of Modified Warmwater Habitat Criteria. As seen in Figure 3-8, the habitat, fish, and Macroinvertebrates all met Modified Warmwater Habitat criteria.

Rivermile 92 (Site No. 6)

This location was selected to provide a sample location upstream of CSOs and downstream of recent urban development such as the River Valley Mall. This location at rivermile 92 is between Ohio EPA sites 92.2 and 90.8. The Ohio EPA found both of these sites to be in Full Attainment in 1995. Based on the 1998 survey, it was concluded that this location was in Partial Attainment of Modified Warmwater Habitat Criteria. As seen in Figure 3-8, this designation is due to the fish scores (MIwb) being below the water quality standards. The macroinvertebrate (ICI) and fish (IBI) scores attained Modified Warmwater Habitat criteria.

It was concluded that the low fish scores and Partial Attainment are not due to CSO discharges, but are due to a lack of a sufficient habitat. The support for these conclusions is provided below:

- ▶ No CSOs in this area or upstream of this location.
- ▶ The QHEI score given to the Hocking River indicates substantial loss of habitat when compared with upstream sample locations. As seen in Figure 3-12, specific changes in habitat include substrate, channel morphology, riparian zone, pool quality, and riffle quality. The channelization of the Hocking River and lack of habitat structure can be seen in Figure 3-13 .
- ▶ Since 1982, the Ohio EPA has repeatedly documented habitat scores less than Warmwater Habitat criteria at rivermile 92.2. The Ohio EPA sampling also indicates a reduction in habitat from upstream sampling locations.

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- ▶ Since 1982, the Ohio EPA has documented a decrease in fish scores from the upstream sampling locations. The fish scores then increase further downstream indicating a localized influence.
- ▶ The channelization is evident all the way to the WPCF. This is reflected in the recent reclassification of the Hocking River upstream of the WPCF from Warmwater Habitat to Modified Warmwater Habitat.
- ▶ Recent and continuing urban development in the area, specifically along U.S. Route 33 and in and adjacent to the River Valley Mall, has increased surface runoff due to the stormwater discharges during wet weather.

The stream habitat in this section is channelized with little overhanging vegetation, thus limiting fish habitat and survival. Since there are no CSO discharges between the sample location at rivermile 93 and 92, the decrease from Full to Partial Attainment appears to be due to a reduction in habitat and urban development.

HR 90 (Site No. 7)

This location was chosen to fully bracket CSO activity along US 33 and determine potential impacts from Hunters Run. This site is between Ohio EPA sample sites at rivermile 90.8 and rivermile 89.4. The Ohio EPA found both sites to be in Full Attainment of Warmwater Habitat Criteria in 1995. Based on the 1998 sampling activities, the Hocking River near Maher Park is in Full Attainment of Modified Warmwater Habitat Criteria. As seen in Figure 3-8, this location had fish and macroinvertebrate scores above the Modified Warmwater Habitat criteria.

HR 89 (Site No. 8)

This location was chosen as a point below all CSOs on the Hocking River and is approximately 0.4 miles further downstream than the closest Ohio EPA sampling location. Based on 1998 sampling data, the Hocking River upstream of the WPCF is in Non Attainment of Modified Warmwater Habitat Criteria. As seen in Figure 3-8, this is due to the macroinvertebrate scores and fish (MIwB) scores being less than Modified Warmwater Habitat criteria.

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It is concluded that the low macroinvertebrate scores, low fish scores, and NON Attainment is due to CSO discharges. The support for this conclusion is provided below:

1. A dry weather overflow from CSO 1005 was discovered when retrieving the Hester-Dendy samplers and completing the second electrofishing activity. This CSO has been abandoned).
2. This site is downstream from three significant CSOs: CSOs 1005, 1006 and 1031. Together, 59% of the annual CSO load to the Hocking River is discharged from these CSOs.

The discrepancy between Ohio EPA sampling results and the recent sampling results (Full to Non attainment respectively) is apparently due to Ohio EPA sampling above the CSO discharges. Also, during previous sampling, this dry weather overflow may not have been active since it is believed to have developed during the 1998 sampling season.

It is known that dry weather overflows can have significant detrimental impacts on water quality. Future sampling will determine whether repair of the dry weather overflow was sufficient to restore water quality.

HR 87 (Site No. 9)

This location is downstream of all City of Lancaster CSOs and the WPCF. It is also the same location sampled previously by Ohio EPA. The Ohio EPA found this section to be in Partial attainment of Warmwater Habitat in 1995. The 1998 sampling data found this site also to be in Partial Attainment of Warmwater Habitat Criteria. As seen in Figure 3-8, this location had excellent macroinvertebrate scores, however the fish scores were less than the water quality standard.

It is concluded that the Partial Attainment is not due to CSO discharges but is due to a low-head dam near the site. The support for these conclusions is provided below:

- ▶ The QHEI score given to the Hocking River indicates an adequate habitat when compared with the upstream sample location.

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- ▶ Macroinvertebrate scores exceeded the Warmwater Habitat criteria suggesting a localized influence.
- ▶ That the low head dam (see Figure 3-14) prohibited fish from migrating through the stream and is thus responsible for the low fish score and Partial Attainment designation.

It is believed that the construction of a low head dam at this sampling location prohibited fish from migrating through the stream and is thus responsible for the low fish score and Partial Attainment designation. Future sampling after the dam is removed will serve to document the impact of this dam with regard to the Partial Attainment.

3.3.4 Fecal Coliform Sampling

In order to assess the impact of Lancaster's CSOs on the recreational use of streams in the City and support the development of the Nine Minimum Controls, Lancaster developed and implemented a fecal coliform monitoring plan during the summer of 1996. A copy of the plan is included in Appendix O.

The goal of the plan was to identify fecal coliform impacts of Lancaster's CSOs on local streams. Accordingly, the plan identified eight locations for fecal coliform sampling. These locations are shown on Figure 3-15 and listed in Table 3-4. These sites were selected in order to sample upstream and downstream of known CSOs and draw conclusions from the data about the relative impact of the known CSOs. It was beyond the scope of the plan to estimate the impact of non-CSO sources of fecal coliforms in local streams.

**TABLE 3-4
FECAL COLIFORM STREAM SAMPLING LOCATIONS**

<u>Sample Location</u>	<u>Description</u>	<u>Remarks</u>
1	Hocking River at Ety Road	Hocking River upstream of Lancaster and known CSOs
2	Fetters Run at Rainbow Dr.	Fetters Run upstream of Lancaster and known CSOs.
3	Ewing Run at Rainbow Dr.	Ewing Run upstream of Lancaster and known CSOs
4	Hunters Run at Lincoln Ave.	Hunters Run upstream of confluence with Hocking River
5	Tarhe Run at So. Broad St.	Tarhe Run upstream of confluence with Hocking River
6	Baldwin Run at Lawrence St.	Baldwin Run downstream of CSOs
7	Hocking River at So. Broad St.	Hocking River upstream of WWTP and downstream of Lancaster CSOs
8	Hocking River at Sugar Grove Rd.	Hocking River downstream of WWTP and downstream of confluence with Baldwin Run

Samples were collected during "dry" weather days of August and September 1996. Dry days were defined as days when less than 0.1-inches of rain had fallen in the past three days. The dry weather data was intended to establish the background or baseline level of fecal coliforms present in the streams.

A complete analysis of the collected data was provided in Chapter 3 of the *Combined Sewer System Operational Plan*. Conclusions from this analysis are repeated below:

- **Dry Weather:** There did not appear to be any dry weather overflows from the Lancaster combined sewer system during the sampling period. However, sources of fecal coliforms in the Hocking River sufficient to exceed water quality standards during dry weather were apparent upstream of Lancaster at Ety Road and upstream of the WPCF. The Ety Road dry weather exceedance may explain the dry weather exceedances upstream of

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the WPCF. These exceedances were not due to Lancaster's CSOs since these were checked for dry weather overflows throughout the sampling period.

- **Wet Weather:** All streams showed an increase in fecal coliform concentrations during certain wet weather events.
 - Feters Run, Ewing Run and Tarhe Run did not show a significant increase in fecal coliform concentrations due to rain events.
 - Baldwin Run, Hunter's Run and all locations on the Hocking River exhibited increases in fecal coliform concentrations due to rain events, though the concentrations dropped immediately in the days following the event. Hunter's Run appeared to respond to larger storms (0.77-inches and larger).
- **Combined Sewer Overflow Impacts:** During wet weather, discharges from Lancaster's combined sewer system impact the Baldwin Run and the Hocking River upstream and downstream of the treatment plant. These impacts are sufficient to exceed water quality standards. However, these streams also receive fecal coliforms from upstream (non-CSO) sources.
 - Feters Run and Ewing Run contribute fecal coliforms to the Baldwin Run, although the CSOs appear to be the most significant source of fecal coliforms.
 - The increase observed at the Hocking River Ety Road sample location appears to lag the rain event by one to two days, which is another indicator of upstream fecal coliform sources.
 - Hunters Run can be a significant source of fecal coliforms to the Hocking River during wet weather. Tarhe Run is also a source, however it does not appear significant.

3.3.4.1 Recreational Uses

The Hocking River through the City of Lancaster is not heavily used by the public or by business or industry. Most of the streams flow through private property. Use of the Hocking River and its tributaries within the city is limited to fishing, primarily at bridges. Boating, canoeing, wind surfing are not common on the Hocking River or its tributaries near the combined sewer area. The public is known to wade in the local streams at random times near public parks, although access to the streams is not intentionally provided or convenient.

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There are no facilities in the City of Lancaster specifically designated for public use of local streams for recreational purposes. There are two canoe liveries located downstream in Logan, Ohio. Both Liveries enter the Hocking River at the town of Rockbridge, approximately twelve miles downstream from Lancaster on the Hocking River.

3.3.5 Solids and Floatable Study

As part of the implementation of the Nine Minimum Controls and preparation of the *Combined Sewer System Operational Plan*, the City of Lancaster sampled solid and floatable material discharged from its combined sewer and storm sewer systems. A complete discussion of this effort is provide in Chapter 9 of the *Combined Sewer System Operation Plan*. A summary of the sampling and its conclusions is provided below.

In order to determine if the amount of floatables discharged from the combined sewer system was objectionable, a sampling program was performed from May 27 thru June 15, 1996. During the study, floatable material was collected from various CSO outfall locations and stormwater outfall location in order to determine the type and volume of material entering local streams.

Copatrawl® nets with a ½-inch opening were used to collect floatable material from two separate rainfall events. The Copatrawl® nets were attached to three combined sewer outfalls and two storm sewer outfalls in order to evaluate the material entering the stream from each type of sewer. After a rain event, the Copatrawl® nets were removed from each of the outfall locations and taken to the WPCF for inspection. The inspection consisted of photographing, identifying and quantifying the collected material. A summary of the collected material is presented in Table 3-4.

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As seen in Table 3-5, the collected material from the 0.13 inch rain event on June 6, 1996 consisted primarily of yard waste (i.e. grass clippings and leaves). The material collected from the 1.48 inch rain event on June 14, 1996 consisted of primarily gravel. For both events, the material collected from the combined sewers did not differ significantly from that collected from the storm sewers.

TABLE 3-5
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
SUMMARY OF COLLECTED FLOATABLE MATERIAL

Location	Date	Rainfall		Volume Collected Gallons	Material Description	Remarks
		Inches	Hours			
CSO 1027 Walnut and Hocking River 27" Combined Sewer	5/27	1.09	30	0	None.	Collection bag was split open but attached to headwall and laying in river when retrieved.
	5/29	1.27	10			
Canal at the End of High 18" Storm Sewer	6/6/96	0.13	0.25	4	98% Yard Waste-leaves, grass clippings 1% Plastic-straws, cup lids 1% Paper-Cigarette Butts	Collection bag was in water when retrieved.
Wheeling and Hocking River 24" Storm Sewer	6/6/96	0.13	0.25	1	35% Yard Waste-Leaves, grass clippings 65% Plastic-straws, cup lids Paper-Cigarette Butts	Collection bag was not in water when retrieved.
CSO 1013 6th and Hocking River 24" Combined Sewer	6/6/96	0.13	0.25	5.5	85% Yard Waste-leaves, grass clippings 15% Plastic-straws, cup lids Paper-Cigarette Butts 1 rag	Collection bag was in water when retrieved.

Chapter 3.0 - system characterization

**TABLE 3-5
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
SUMMARY OF COLLECTED FLOATABLE MATERIAL**

Location	Date	Rainfall		Volume Collected Gallons	Material Description	Remarks
		Inches	Hours			
CSO 1026 NE Corner of Mary Burnham Park 24" Combined Sewer	6/6/96	0.13	0.25	10	95% Yard Waste-leaves, grass clippings 5% Human Waste Plastic-straws, cup lids, comb Paper-Cigarette Butts	Collection bag was in water when retrieved.
Canal at the End of High 18" Storm Sewer	6/14	1.48	1.5	~12	90% Gravel, stone, asphalt 10% Aluminum and plastic cans Plastic-straws, cup lids Paper-Cigarette Butts	Collection bag was setting in mud on headwall floor when retrieved.
Wheeling and Hocking River 24" Storm Sewer	6/14	1.48	1.5	~7	70% Gravel, stone, asphalt 30% Aluminum and plastic cans, grass Plastic-straws, cup lids Paper-Cigarette Butts	Collection bag was not in water when retrieved.
CSO 1013 6th and Hocking River 24" Combined Sewer	6/14	1.48	1.5	~10	95% Gravel, stone, asphalt 5% Grass, cigarette butts	Collection bag was split open but attached to headwall and laying in river when retrieved.

Chapter 3.0 - system characterization

**TABLE 3-5
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
SUMMARY OF COLLECTED FLOATABLE MATERIAL**

Location	Date	Rainfall Inches Hours		Volume Collected Gallons	Material Description	Remarks
		1.48	1.5			
CSO 1026 NE Corner of Mary Burnham Park 27" Combined Sewer	6/14	1.48	1.5	0	Some cigarette butts and Styrofoam	Collection bag was split open but attached to headwall and laying in river when retrieved.

++ END OF CHAPTER 3 ++

**FIGURE 3-1
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
ESTIMATED ANNUAL CSO ACTIVATION**

CSO NO.	Location	Annual Estimated Overflow Events By Storm				Total Events Per Year
		0.21 inch Rainfall	0.75 inch Rainfall	1.22 inch Rainfall	1.85 inch Rainfall	
1004	West Perimeter of WWTP	0	0	5	3	8
1005	N. Bank CSX RR and Hocking River	62	13	5	3	83
1006	S. Bank CSX RR and Hocking River	0	0	5	3	8
1007	S. Broad and S. Columbus	0	0	0	0	0
1008	Lincoln and Hocking River	0	0	5	3	8
1009	Mulberry and Memorial	0	0	5	3	8
1010	Mulberry and Hocking	0	0	0	0	0
1011	Union and Memorial	62	13	5	3	83
1012	5th and Memorial	0	13	5	3	21
1013	6th and Memorial	62	13	5	3	83
1014	Allen and Memorial	0	0	5	3	8
1015	N. Broad and Fair	0	0	0	0	0
1016	6th and N. Broad	62	13	5	3	83
1017	5th and N. Broad	0	0	0	0	0
1018	N. Broad and Mulberry	0	0	0	0	0
1019	SE Corner Mary Burnham Park	62	13	5	3	83
1020	Chestnut and Brooks	0	0	0	0	0
1021	Union and Garfield	0	0	5	3	8
1022	Columbus and Wilson	0	0	0	0	0
1023	High N. of Fair	0	0	0	0	0
1024	Wheeling and Livingston	0	0	0	3	3
1026	NE Corner Mary Burnham Park	0	13	5	3	21
1027	Walnut and Whiley	62	13	5	3	83
1028	6th and Pierce	0	0	0	0	0
1029	6th and Boyd	62	13	5	3	83
1030	Walnut and Maple	0	0	0	0	0
1031	Wheeling and Maple	62	13	5	3	83
1032	Maple and Alley N. of Main	0	0	0	0	0
1033	Park and Memorial	62	13	5	3	83
1034	Baldwin Run and Lawrence	0	0	5	3	8
1035	E. of Park and Columbus	0	0	0	0	0

Note: Rainfall events developed from actual data collected during the period of January 1990 thru October

Typical Annual Storm Distribution Used in Analysis

0.21 inch storm in 2.3 hours - 62 events per year

0.74 inch storm in 6.9 hours - 12.5 events per year

1.28 inch storm in 8.4 hours - 5.22 events per year

1.85 inch storm in 8.6 hours - 2.87 events per year

FIGURE 3-2
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
POLLUTANT CONCENTRATIONS
Average of CSO Samples Collected April 1996 - October 1996

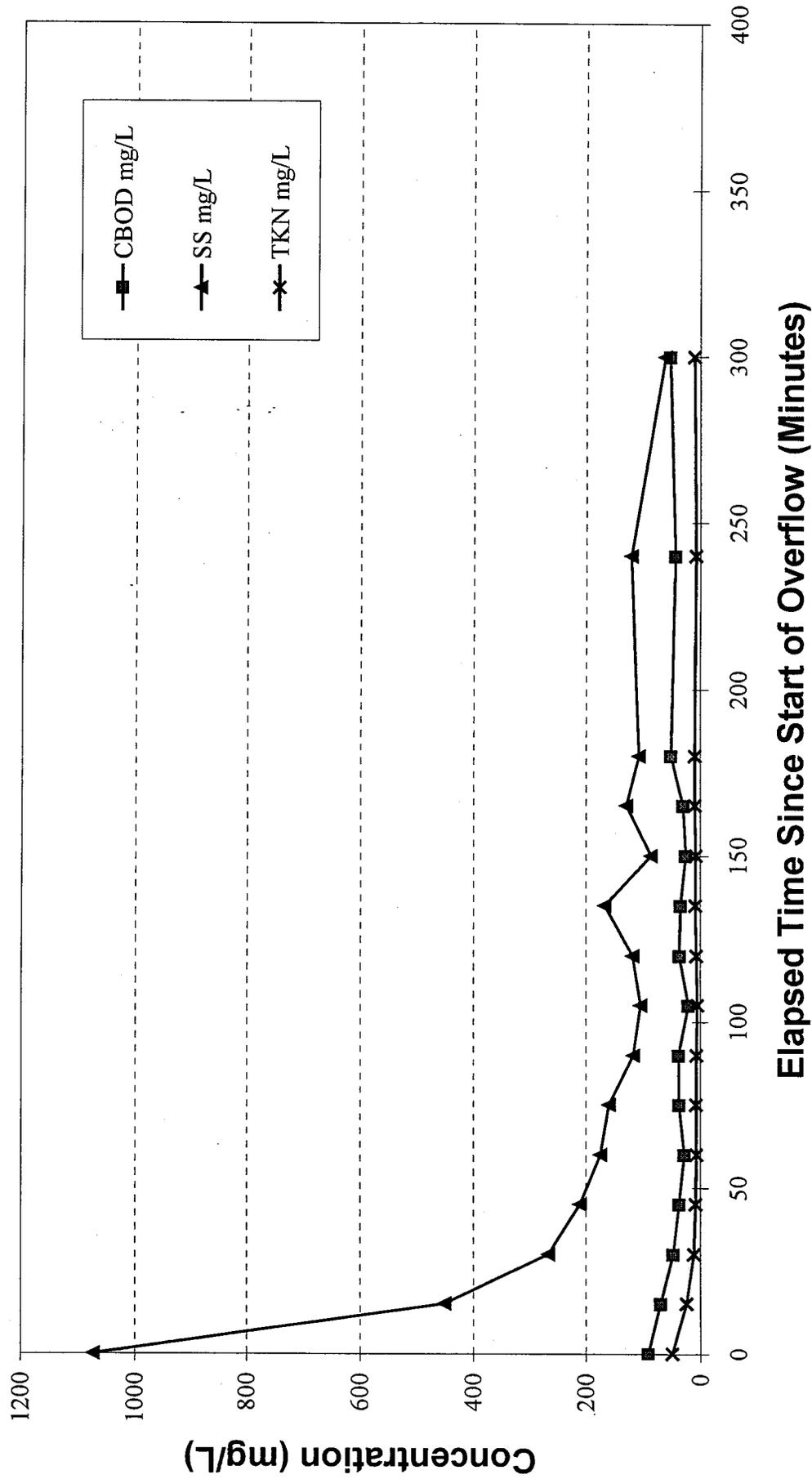
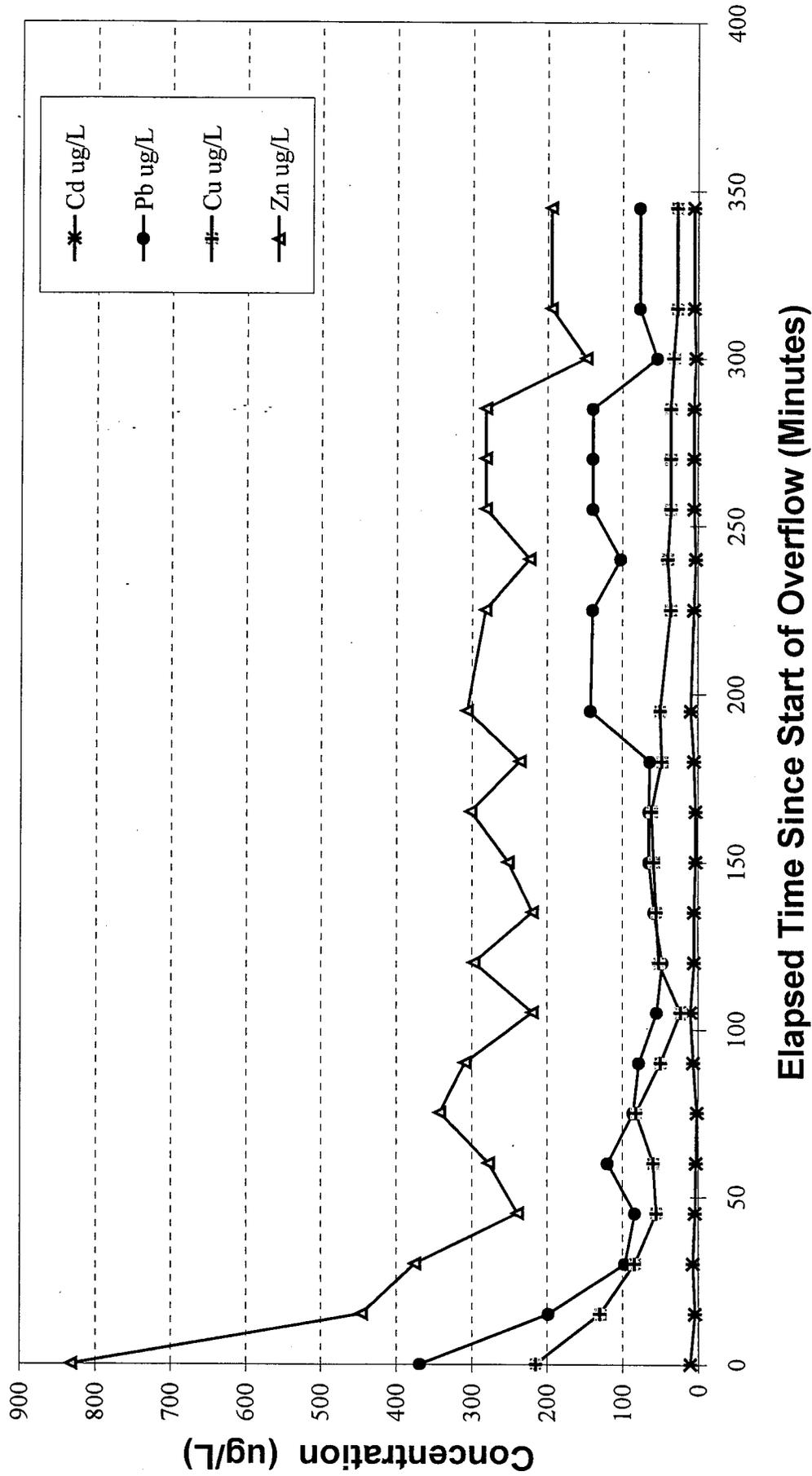


FIGURE 3-3
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
POLLUTANT CONCENTRATIONS
Average of CSO Samples Collected April 1996 - October 1996



**FIGURE 3-4
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
TYPICAL ANNUAL CSO DISCHARGE**

CSO No.	Location	Volume (Gal)	CBOD (lbs)	SS (lbs)	TKN (lbs)	Cu (lbs)	Cd (lbs)	Pb (lbs)	Zn (lbs)
1004	West Perimeter of WWTP	8,318,318	2,829	8,570	593	3.3	0.3	6.3	18.3
1005	N. Bank CSX RR and Hocking River	20,556,829	8,007	15,249	1,574	6.3	0.8	14.8	39.4
1006	S. Bank CSX RR and Hocking River	2,734,356	972	2,819	205	1.1	0.1	2.1	6.0
1007	S. Broad and S. Columbus	0	0	0	0	0.0	0.0	0.0	0.0
1008	Lincoln and Hocking River	2,729,070	927	2,620	193	1.0	0.1	2.0	5.9
1009	Mulberry and Memorial	39,221	12	66	3	0.0	0.0	0.0	0.1
1010	Mulberry and Hocking	0	0	0	0	0.0	0.0	0.0	0.0
1011	Union and Memorial	70,817	23	77	5	0.0	0.0	0.0	0.2
1012	5th and Memorial	4,004,422	1,408	3,471	289	1.4	0.2	3.0	8.5
1013	6th and Memorial	351,031	122	312	25	0.1	0.0	0.3	0.7
1014	Allen and Memorial	11,291	4	20	1	0.0	0.0	0.0	0.0
1015	N. Broad and Fair	0	0	0	0	0.0	0.0	0.0	0.0
1016	6th and N. Broad	994,150	336	918	70	0.4	0.0	0.7	2.1
1017	5th and N. Broad	0	0	0	0	0.0	0.0	0.0	0.0
1018	N. Broad and Mulberry	0	0	0	0	0.0	0.0	0.0	0.0
1019	SE Corner Mary Burnham Park	50,688,428	16,242	54,034	3,585	20.4	2.0	37.8	111.8
1020	Chestnut and Brooks	0	0	0	0	0.0	0.0	0.0	0.0
1021	Union and Garfield	25,992	8	44	2	0.0	0.0	0.0	0.1
1022	Columbus and Wilson	0	0	0	0	0.0	0.0	0.0	0.0
1023	High N. of Fair	0	0	0	0	0.0	0.0	0.0	0.0
1024	Wheeling and Livingston	3	0	0	0	0.0	0.0	0.0	0.0
1026	NE Corner Mary Burnham Park	3,159,179	1,122	3,170	239	1.2	0.1	2.5	6.9
1027	Walnut and Whiley	1,732,519	599	1,601	122	0.6	0.1	1.3	3.7
1028	6th and Pierce	0	0	0	0	0.0	0.0	0.0	0.0
1029	6th and Boyd	6,935,407	2,345	6,874	480	2.7	0.3	5.3	15.3
1030	Walnut and Maple	0	0	0	0	0.0	0.0	0.0	0.0
1031	Wheeling and Maple	6,057,401	2,088	7,028	444	2.6	0.2	4.8	13.7
1032	Maple and Alley N. of Main	0	0	0	0	0.0	0.0	0.0	0.0
1033	Park and Memorial	2,205,236	720	2,283	152	0.9	0.1	1.6	4.9
1034	Baldwin Run and Lawrence	782,621	265	897	57	0.3	0.0	0.6	1.8
1035	E. of Park and Columbus	0	0	0	0	0.0	0.0	0.0	0.0
	Annual Total	111,396,291	38,030	110,054	8,040	42.4	4.6	83.3	239.6
	Total Baldwin Run	61,565,638	19,975	64,975	4,362	24.7	2.5	46.3	135.9
	Total Hocking River	49,830,653	18,056	45,079	3,678	17.78	2.06	37.05	103.7

Note: Rainfall events developed from actual data collected during the period of January 1990 thru October 1997.

0.21 inch storm in 2.3 hours - 62 events per year

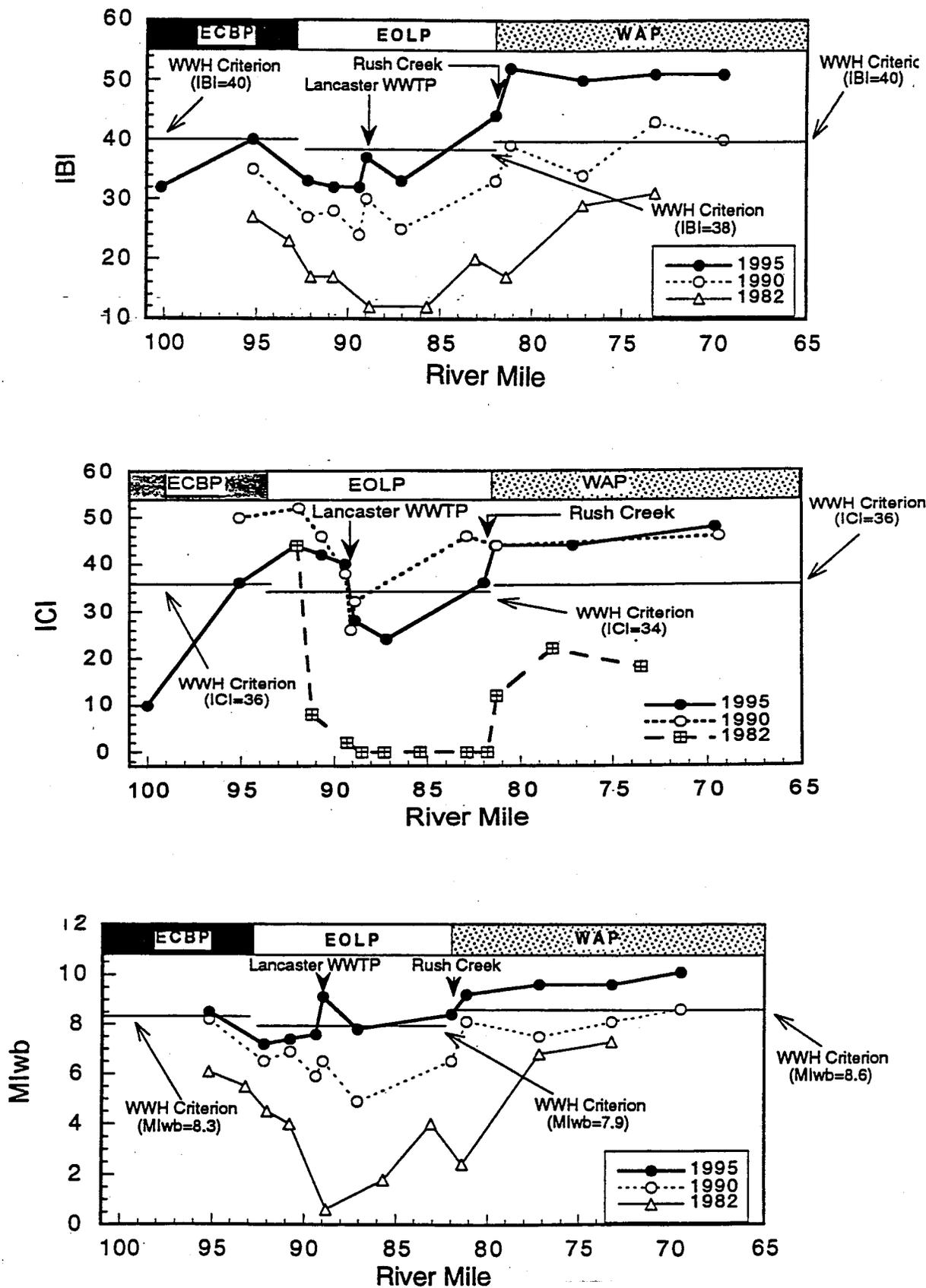
0.74 inch storm in 6.9 hours - 12.5 events per year

1.28 inch storm in 8.4 hours - 5.22 events per year

1.85 inch storm in 8.6 hours - 2.87 events per year

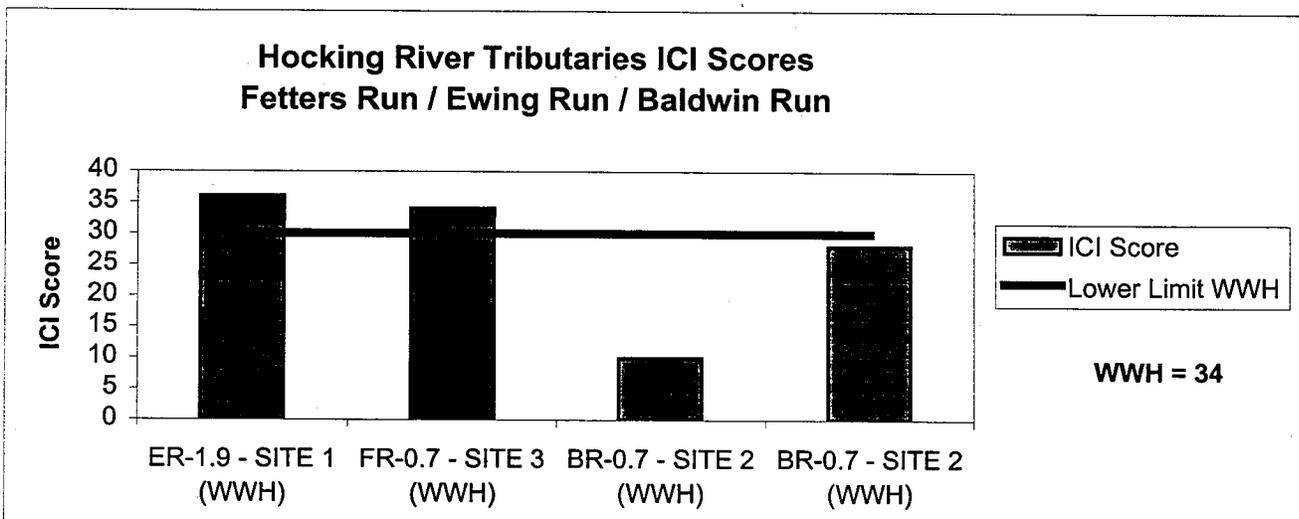
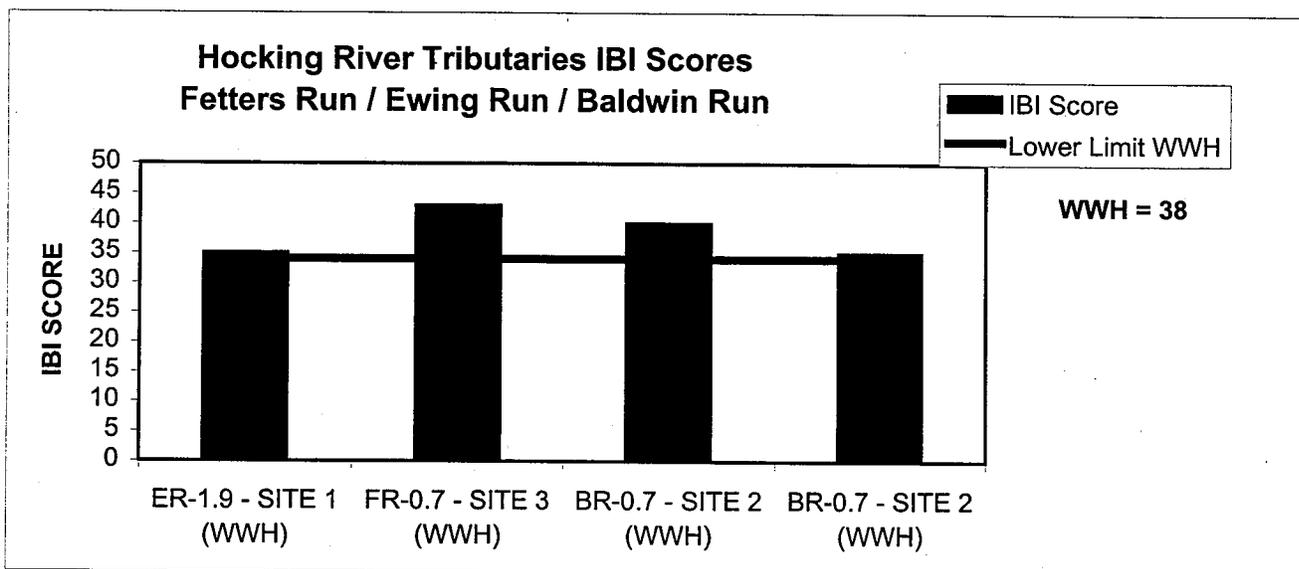
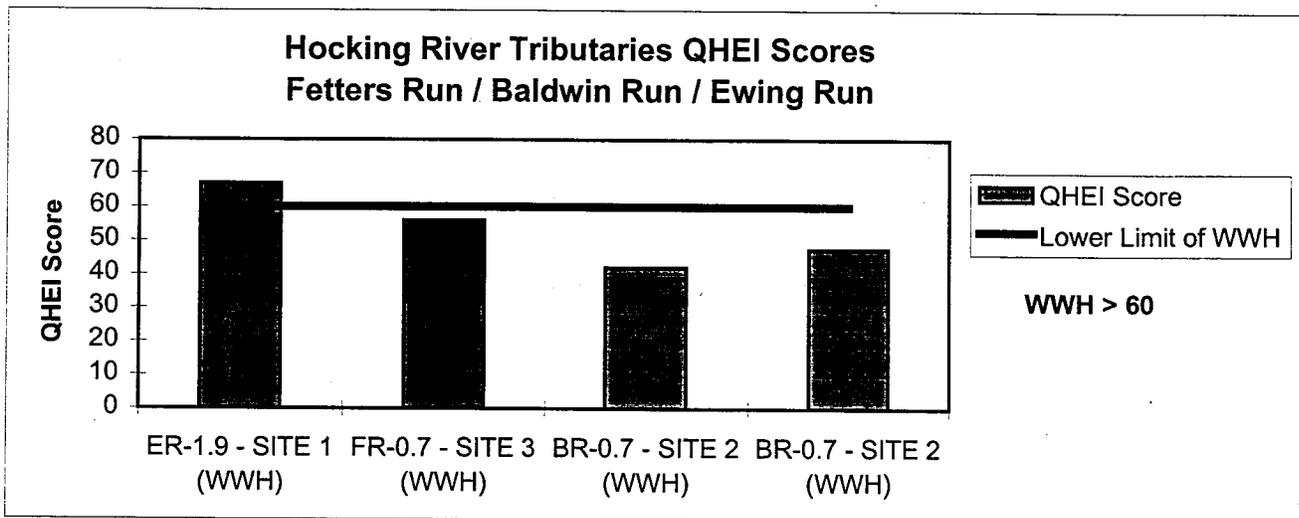
FIGURE 3-5

HISTORICAL AQUATIC LIFE SAMPLING RESULTS



SOURCE: Ohio EPA

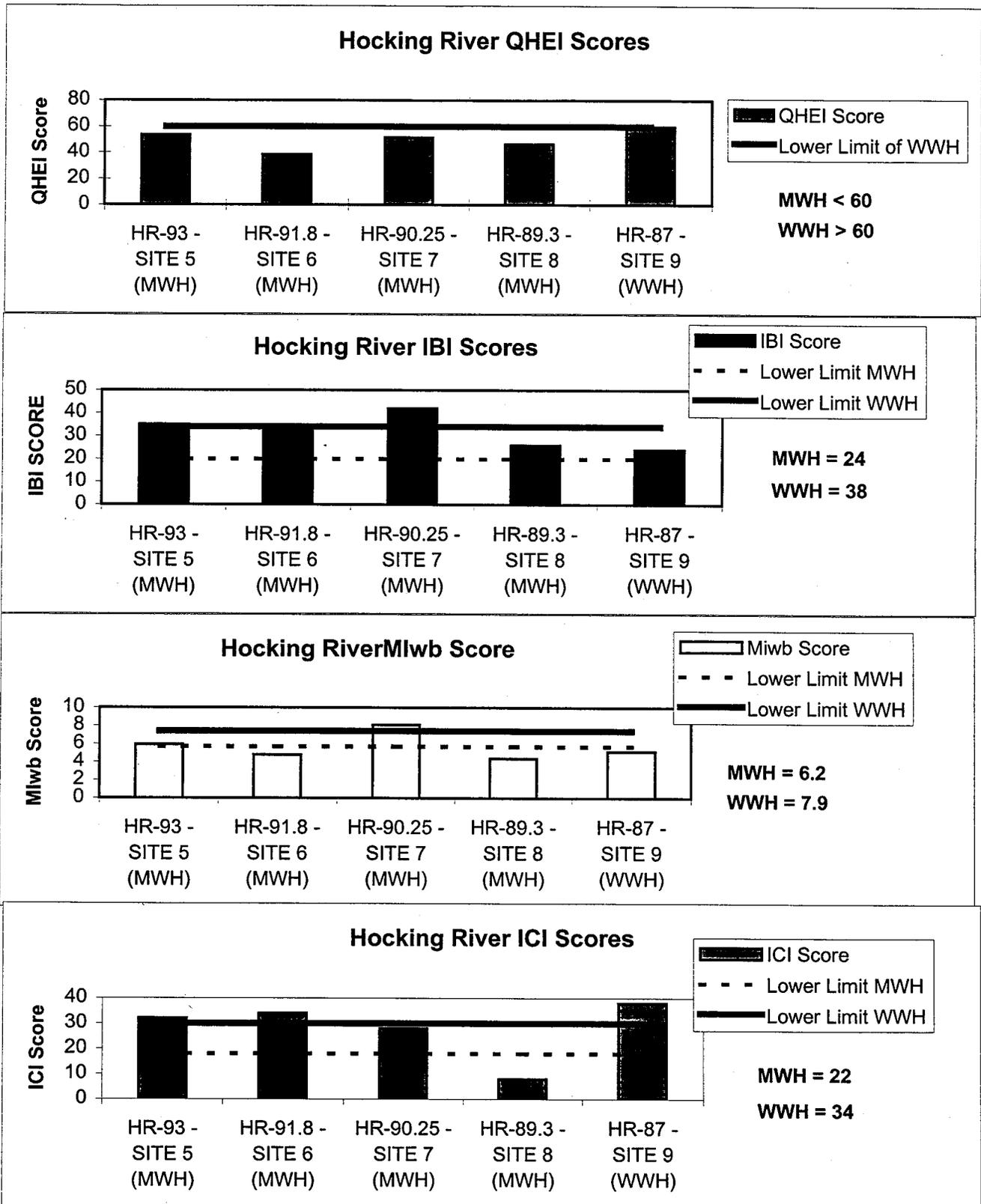
**FIGURE 3-7
1998 AQUATIC LIFE SAMPLING RESULTS**



WWH = Warmwater Habitat

SOURCE: EnviroScience Inc.
Project No. 4980102-00

**FIGURE 3-8
1998 AQUATIC LIFE SAMPLING RESULTS**



MWH = Modified Warmwater Habitat
WWH = Warmwater Habitat

SOURCE: EnviroScience Inc.
Project No. 4980102-00

FIGURE 3-9
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
HOCKING RIVER TRIBUTARIES QHEI METRIC SCORES
Fetters Run / Ewing Run / Baldwing Run

Metric	Sampling Sites				Max. Possible
	ER-1.9	FR-0.7	BR-0.7	BR-0.1	
1. Substrate	15	15	12	12	20
2. Instream Cover	13	6	3	7.5	20
3. Channel Morphology	13	12.5	9	8.5	20
4. Riparian Zone	6.5	6	6	5.5	10
5a. Pool Quality	7	4	3	5	12
5b. Riffle Quality	2.5	2.5	1	1	8
6. Gradient	10	10	8	8	10
Total	67	56	42	47.5	100

FIGURE 3-10
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN



SAMPLE SITE NO. 2
BALDWIN RUN (RIVERMILE 0.7)

FIGURE 3-11
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN

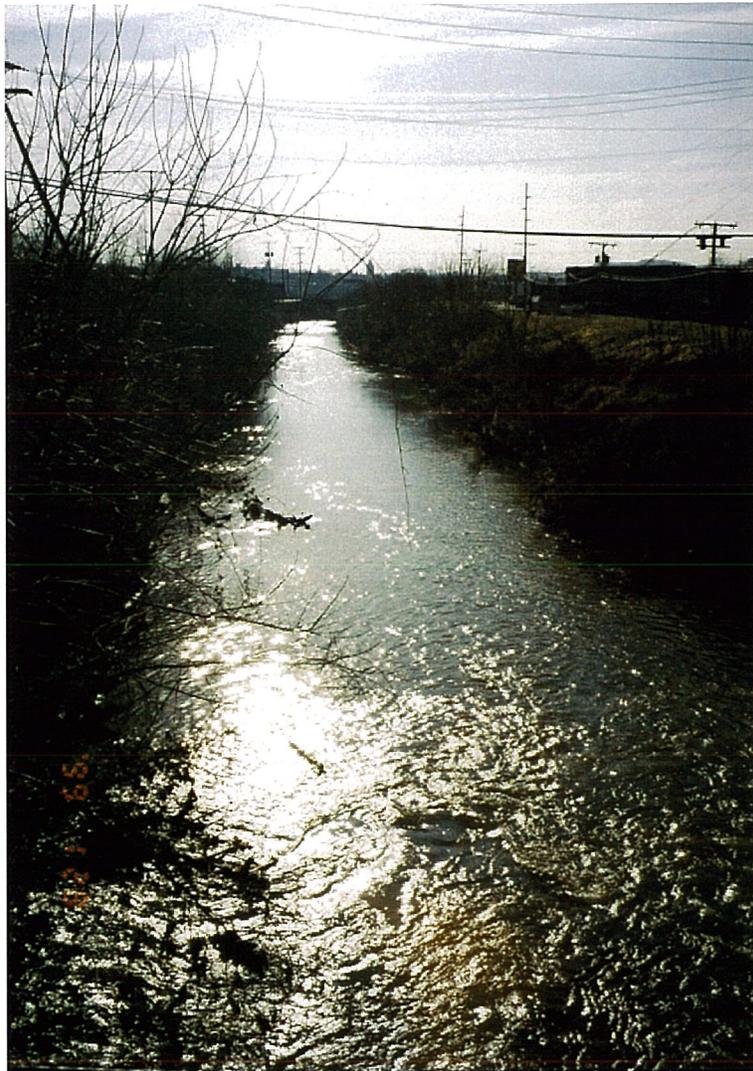


SAMPLE SITE NO. 4
BALDWIN RUN (RIVERMILE 0.1)

FIGURE 3-12
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
HOCKING RIVER QHEI METRIC SCORES

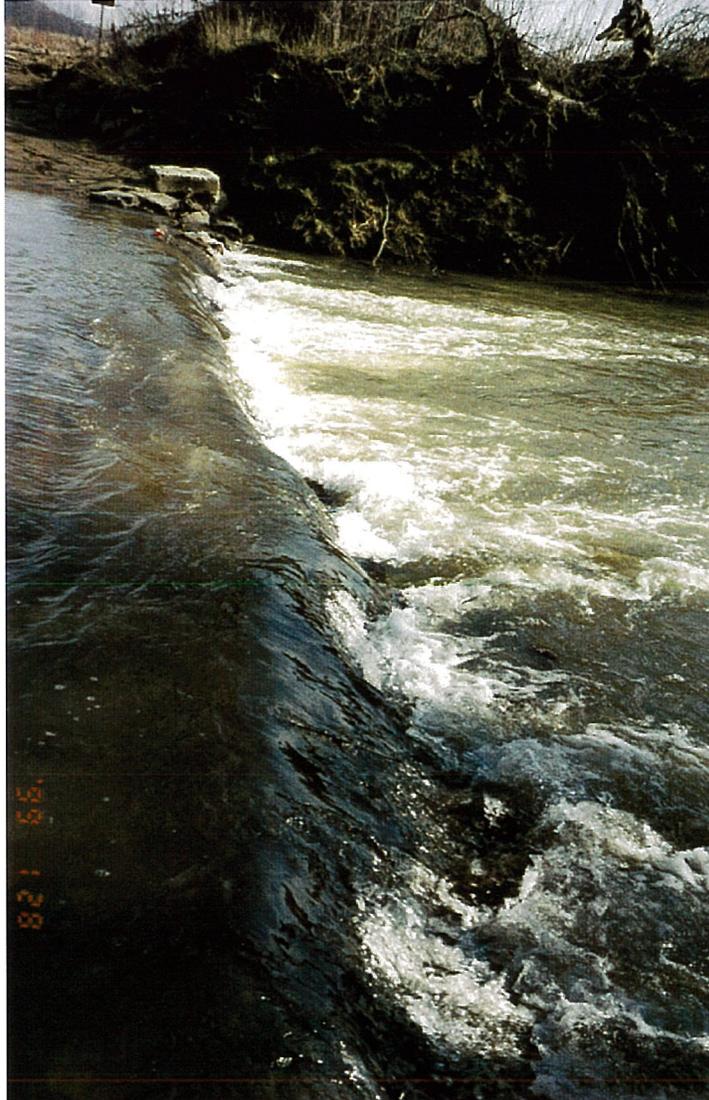
Metric	HR-93	HR-91.8	HR-90.25	HR-89.3	HR-87	Max.
1. Substrate	12	8	13	10.5	11.5	20
2. Instream Cover	8	8	6	9	11.5	20
3. Channel Morphology	9.5	7.5	11.5	7.5	13.5	20
4. Riparian Zone	7.5	5	8	4.5	7	10
5a. Pool Quality	9.5	4	5	8	10	12
5b. Riffle Quality	3	2	4	2	2.5	8
6. Gradient	4	4	4	4	4	10
Total	53.5	38.5	51.5	45.5	60	100

FIGURE 3-13
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN



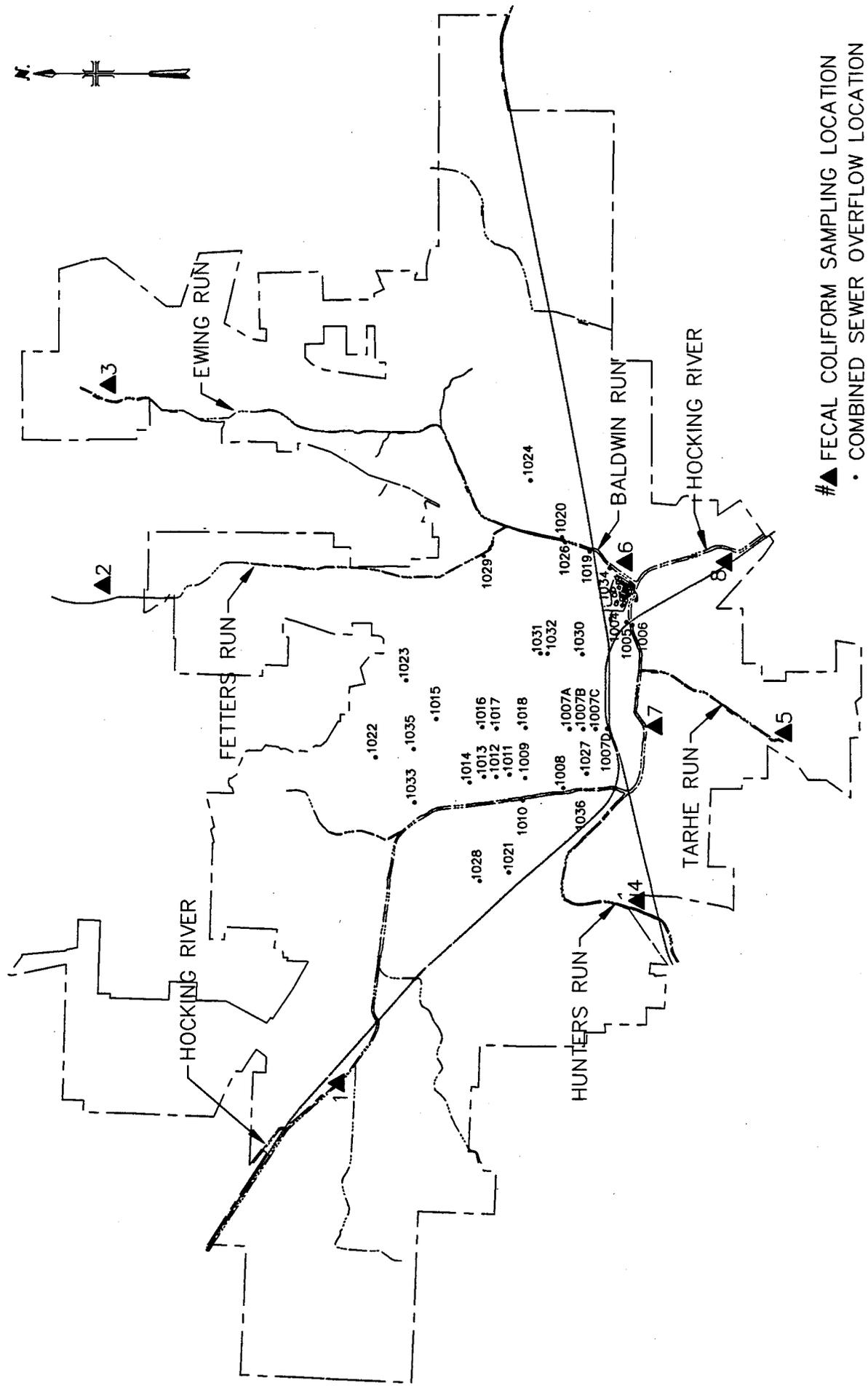
SAMPLE SITE NO. 6
HOCKING RIVER (RIVERMILE 92)

FIGURE 3-14
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN



SAMPLE SITE NO. 9
HOCKING RIVER (RIVERMILE 87)

FIGURE 3-15 LANCASTER COMBINED SEWER SYSTEM LONG TERM CONTROL PLAN FECAL COLIFORM SAMPLE LOCATIONS AND CSO STRUCTURES



- #▲ FECAL COLIFORM SAMPLING LOCATION
- COMBINED SEWER OVERFLOW LOCATION (1036--FACILITY/PROPERTY PROTECTION DEVICE)

4

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

4.1 Purpose

A Sewer System Extension Evaluation is required as part of the City of Lancaster's Combined Sewer System Long-Term Control Plan. Submittal of a Combined Sewer System Long Term Control Plan is included in the City of Lancaster's National Pollutant Discharge Elimination System (NPDES) permit (included in Appendix A for reference).

The Ohio EPA included Sewer System Extension Evaluations in the Ohio Combined Sewer Overflow (CSO) Strategy to address potential antidegradation issues. The Ohio EPA recognized that new sanitary sewer flows can cause increased combined sewer overflows, thus creating antidegradation issues. It is intended that approval of a Combined Sewer System Long-Term Control Plan (and its Sanitary Sewer Extension Evaluation) will satisfy the antidegradation analysis required for the Permit-to-Install process for new sanitary sewers.

4.2 Scope

The Sewer System Extension Evaluation will determine if an increase in the dry weather wastewater flow in the combined sewer system (due to new upstream flows) will result in an increase in CSO discharge volumes during wet weather.

The Sewer System Extension Evaluation has three main objectives.

1. Establish dry weather flow conditions in the existing sewer system.
2. Identify areas of potential growth and estimate the increases in wastewater flow resulting from the growth.
3. Determine the impact that the increased wastewater flow will have on discharges from the combined sewer system during wet weather.

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

The Ohio EPA's Antidegradation Policy requires that the impact of any additional CSOs be addressed in one of three ways:

1. **One-sixth Rule:** With this option, additional sanitary sewer flow upstream of a CSO is allowed provided the projected dry weather flow at the CSO structure is equal to or less than one-sixth of the flow required to activate the CSO.
2. **Offsetting Flow Increases:** This option allows the City to balance increases in baseline dry weather flow due to growth with infiltration and inflow reductions. The result must be no increase in CSO discharges.
3. **Complete an Antidegradation Application:** With this option, the City must show that the increase in CSO discharge volume will not prevent attainment of water quality standards and that the increased CSO volume is socially and economically acceptable. As part of the application, alternatives that discharge less pollution than the proposed project must also be evaluated.

The City of Lancaster Sewer System Extension Evaluation is based on Option 2. This option offsets increased baseline flow with reductions in infiltration and inflow in the combined sewer system such that there is no increase in annual CSO volume.

4.3 Background

4.3.1. Wastewater Collection System Evaluation

In 1995, the City initiated a Wastewater Collection System Evaluation. The purpose of the evaluation was to address areas of basement flooding and comply with upcoming Ohio EPA combined sewer overflow regulations.

As part of this project, a Storm Water Management Model (SWMM) of the City's wastewater collection system was developed. As discussed later in this chapter, flow monitoring data obtained as part of the Collection System Evaluation, in conjunction with the SWMM model, were used to estimate the impact of future sanitary flows on the annual volume of combined sewer overflows for the Sanitary Sewer System Extension Evaluation.

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

4.3.2 Drainage Areas

The City of Lancaster wastewater collection system can be divided into two major drainage basins, the Baldwin Run and the Hocking River. Together these two drainage basins have a total service area of approximately seventeen square miles. The collection areas are shown in Figure 2-1 at the end of the report.

4.3.3. Population

The population of the City of Lancaster remained relatively constant during the 1970s. However, during the 1980s and 1990s population growth began to occur, primarily related to growth in the nearby City of Columbus. Much of the growth occurred along the US Route 33 corridor that connects the City of Lancaster with the City of Columbus. Growth is expected to continue in the future. A long-planned road construction project, the US 33 Bypass, is also expected to spur light industrial and commercial as well as residential growth in and around Lancaster. Due to these two developments, the City expects population increases through the year 2020.

In 1992, the Census of the United States reported a population of 35,342. The City of Lancaster 1995 Housing Plan estimated a population of 36,600. With anticipated growth in the northern and western parts of the City, the Lancaster Planning and Development Department estimated the population in the year 2020 will be approximately 52,000. This is an increase of approximately 42%. The projected population increase is graphically shown on Figure 4-1.

4.4 Existing Conditions

The year of 1995 was selected as the baseline year for the Sanitary Sewer Extension Evaluation. In 1995, the City began its Wastewater Collection System Evaluation and began collecting sewer system flow data. Dry weather and wet weather flow data were collected and used to calibrate a computer model of the Lancaster sewer

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

system. The computer model was used to develop the City's *Combined Sewer System Characterization Report*. The *Combined Sewer System Characterization Report* is summarized in Chapter 3. The flows and annual discharge volumes developed for the Characterization Report were used to establish the existing dry weather flows and baseline CSO volumes for the Sanitary Sewer Extension Evaluation.

4.4.1 Existing Dry Weather Flow

The City's wastewater collection system computer model (SWMM) was used to establish dry weather flows and the existing capacity of the City's sewer system. The City's collection system model represents the conditions that existed in the sanitary and combined sewer areas of the City during the 1996 flow monitoring.

The collection system computer model was used to simulate typical flow during dry weather. The dry weather flow (DWF) simulation was used to generate a comparison of DWF to capacities of interceptors and large diameter sewers. This comparison is summarized in Figure 4-2.

In Figure 4-2, interceptors have been divided between the Baldwin Run drainage basin (east side) and the Hocking River drainage basin (west side). The diameter and slope of each span of sewer was used to calculate the theoretical full pipe capacity. The existing (1996) dry weather flow shown in Figure 4-2 is the peak model flow based on the 1996 flow monitoring. As shown in Figure 4-2, the existing dry weather flow for each section is less than the theoretical pipe capacity. Thus, the City's existing interceptors are adequate to convey existing dry weather flows.

4.4.2 Existing CSO Volumes

The existing annual CSO discharge volume of the Lancaster Combined Sewer System was estimated in the City's *Combined Sewer System Characterization Report* using the SWMM model of the Lancaster sewer system. Figure 4-5 shows the existing

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

annual CSO discharge volume for each structure. This data was used to establish baseline CSO volumes for the Sanitary Sewer Extension Evaluation.

Figure 4-5 shows that approximately 111.4 million gallons overflow from the combined sewer system to the Hocking River and Baldwin Run during a typical year. In addition, it is shown in Figure 4-5 that approximately 533 million gallons of combined sewage are treated at the Lancaster Water Pollution Control Facility (WPCF) during wet weather in a “typical” year. The volume of wastewater treated at the WPCF corresponds to all of the combined sewage treated during the period of the rain event. For purposes of this analysis, model simulations for typical storms were run for a minimum of 18 hours. The larger rain event simulations were run for longer times (up to 30 hours) in order to measure the full impact of the rain.

As shown in Figure 4-5, model results were categorized as follows:

- ▶ CSOs tributary to the Baldwin Run.
- ▶ CSOs tributary to the Hocking River.
- ▶ Volume of flow reaching the WPCF for treatment.

The results were separated by drainage basin since it is recognized in the City’s Long-Term Control Plan approach that each drainage basin is uniquely impacted by the combined sewer system.

4.4.3 CSO Volume Adjustments

As discussed previously, the baseline year for the Sanitary Sewer Extension Evaluation is 1995. However, the model was calibrated using wet weather data primarily from 1996. Therefore to determine the baseline 1995 annual CSO discharge volume, several adjustments to the model results had to be made.

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

There were three CSO and I/I reduction projects completed in 1995 and 1996 before collection of the flow monitoring data. Since the model was calibrated to 1996 data, the model does not reflect the amount of CSO that occurred in 1995 prior to completion of the projects. Each project is summarized below:

4.4.3.1 WPCF Upgrade

The WPCF upgrade, completed in 1996, increased the secondary treatment capacity from 12 MGD to 18 MGD. Prior to the upgrade, flows in excess of 12 MGD were diverted to a one million-gallon equalization tank. When the equalization tank was full, it overflowed to the Hocking River. The WPCF upgrade resulted in reduced use of the equalization tank and subsequently reduced overflows to the Hocking River.

Plant operations has observed a reduction in overflow from the equalization tank since the completion of the WPCF Upgrade. Particularly during small rain events (typically <0.75-inches), all flow entering the WPCF can be treated without overflowing to the Hocking River from the equalization tank. At larger storms, overflows still occasionally occur.

This operational scenario is still too new to quantify the reduction in annual overflow volume from the equalization basin. However, the City reserves the right to take credit for a reduction in CSO volume based on this project in the future, should it be necessary to document a CSO volume reduction for any reason.

4.4.3.2 South Broad Street Manhole

In the past, a stub for a future connection was installed in a manhole near the Hocking River in the South Broad Street area. The plug in the stub had deteriorated over the years, and flow from the Hocking River was observed to leak continuously into the manhole at an estimated rate of 0.35 million gallons per day. This inflow source was added to the SWMM model and simulations were run for each of the four typical rain events. The annual amount of CSO caused by this source was estimated at 1.8 million

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

gallons. This CSO volume estimate is probably low since the inflow rate would have been higher during wet weather when the river level is generally higher. When this source was discovered, it was immediately corrected and the associated inflow was not included in the flow monitoring data used to develop the SWMM computer model.

4.4.3.3 Locust Street Abandoned Siphon

As with the South Broad Street source, the computer model was used to estimate the annual increase in CSO volume that occurred as a result of the leaking siphon. Based on the model simulations for the four typical rain events, the annual volume of CSO attributable to this source was 0.17 million gallons. When this source was discovered, it was immediately corrected and the associated inflow was not included in the flow monitoring data used to develop the SWMM computer model.

4.4.4 Baseline CSO Volume

The Sanitary Sewer Extension Evaluation 1995 baseline wet weather CSO volume is summarized in Table 4-1. In Table 4-1, the 1996 model output is adjusted to include CSO volume removed when the system improvements described above were completed.

**TABLE 4-1
1995 BASELINE ANNUAL CSO DISCHARGE VOLUME**

CSO Reduction/Inflow Removal Project	Baldwin Run	Hocking River	Total System
1996 Annual CSO Volume	61.6	49.9	111.5
WPCF Upgrade	-----	-----	-----
South Broad Street Manhole	-----	1.8	1.8
Locust Street Abandoned Siphon	0.17	-----	0.17
Net 1995 Baseline Annual CSO Volume	61.8	51.7	113.5

Chapter 4.0 - Sanitary Sewer System Extension Evaluation

Table 4-1 establishes 113.5 million gallons/year as the baseline annual CSO volume for the Sanitary Sewer Extension Evaluation. The goal of the Sanitary Sewer Extension Evaluation is to keep annual CSO discharge volumes at or below 113.5 million gallons/year.

4.5 Future Conditions

4.5.1 Introduction

For purposes of this study, increases in the existing flow in the Lancaster sewer system were assumed to be caused by growth in the number of residential, commercial, and industrial customers. Future wastewater flows due to these customers were estimated and incorporated into the Lancaster computer model to estimate impacts these additional flows will have on CSO volumes. The year 2020 was selected as the “target planning year” since it provided a typical twenty-five (25) year planning period.

Note that the estimates of future growth were required to comply with the Ohio EPA Combined Sewer Overflow Strategy. These estimates do not reflect either the intent or policy of the City of Lancaster regarding the desirability or location of future growth within the City. It represents only a generalized extrapolation of current trends.

To estimate the future flow rates and CSO discharge volumes, the following tasks were completed:

- ▶ The average existing residential/commercial and industrial flows per acre per day were estimated.
- ▶ The future residential/commercial and industrial areas of development were estimated.
- ▶ The future residential/commercial and industrial average daily flows were estimated.
- ▶ The daily diurnal flow pattern of the existing system was determined.
- ▶ Future diurnal residential/commercial and constant industrial flows were entered into the model.
- ▶ The sewer system response to future flows during both dry and wet weather were simulated through use of the SWMM model.

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4.5.2 Future Sanitary Sewer Flow

4.5.2.1 Growth Areas

Twenty-two residential/commercial and ten industrial areas were identified to be developed by the year 2020. These areas are generally northeast, northwest and west of the existing City limits. The areas of expected growth were chosen based on discussions with City and County personnel familiar with planning and growth issues such as building permit approvals and future development projects. These areas are shown in Figure 4-3.

Several assumptions were made that had significant impacts on the estimated flows:

- ▶ The US 33 Bypass will be constructed.
- ▶ Fairfield County will connect sewers from six subdivisions (either currently served by package plants or on-site septic tank systems) to the City of Lancaster wastewater collection system.
- ▶ Greenfield Township will abandon their existing wastewater plant and connect to the City of Lancaster.

The most significant factor affecting the future residential/commercial and industrial flow rates is the completion of the US 33-Bypass west of the City. The proposed bypass begins south of Carroll, Ohio. It continues south on the west side of the City until it connects with US 33 a few miles south of Lancaster. The proposed location of the bypass is shown on Figure 4-3.

4.5.2.2 Future Sanitary Sewer Flow Projections

Future flow projections were calculated using three different criteria. These were:

- ▶ Existing WPCF flowrate and population.
- ▶ Number of homes per acre based on the Planning Department estimates.
- ▶ Number of homes per acre based recent development projects.

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Using a combination of the above criteria, the average residential/commercial flow was estimated to be 1,000 gallons/acre/day and the industrial flow was estimated to be 1,300 gallons/acre/day. These flow rates were expressed in terms of “fully developed” acres. However, recognizing that future development would not occur at uniform rates and that all areas identified would not be “fully developed” (the density of some developments would be greater than others) the projected wastewater flow rates used were in the following ranges:

- ▶ Residential/Commercial 350-750 gallons/acre/day
- ▶ Industrial 325-650 gallons/acre/day

Except for the Fairfield County subdivisions, these values were used with the estimated development areas shown in Figure 4-3 to calculate future wastewater flows due to growth. The estimated flows for each of the Fairfield County package plants were based on flow monitoring data for the areas that are currently served by sewers and per capita flow estimates for the areas currently served by on-site septic tank systems. These flows are summarized in a letter report to the Fairfield County Utilities Department which is provided in Appendix J for reference.

The estimated residential/commercial flows for Greenfield Township are based on a recent contractual agreement between the City and the township.

The additional sanitary sewer flow (dry weather flow) for the year 2020 due to residential/commercial and industrial growth is summarized in Table 4-2. As shown, the projected increase in average dry weather flow is approximately 3.21 MGD. The projected contribution by area is provided in Figure 4-4 for reference.

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TABLE 4-2
ADDITIONAL DRY WEATHER FLOW DUE TO GROWTH
1995 - 2020

	Residential/Commercial	Industrial	Total
Total System 1995	4.40 MGD	1.10 MGD	5.50 MGD
Baldwin Run	0.86 MGD	0.09 MGD	0.95 MGD
Hocking River	1.49 MGD	0.77 MGD	2.26 MGD
Total Additional Flow	2.35 MGD	0.86 MGD	3.21 MGD
Total System 2020	6.75 MGD	1.96 MGD	8.71 MGD

The increase in residential/commercial flow from 1995 is approximately 53%. This corresponds to the independently estimated population increase of 47%, from 35,344 in 1995 to approximately 52,000 in the year 2020. The estimated industrial flow increase represents a 78% increase above the estimated 1995 flowrate. This reflects the anticipated impact of the US 33 Bypass.

4.5.3 Modeling of Future Sanitary Flows

The Lancaster sewer model was used to evaluate the impact of projected future sanitary sewer flows on combined sewer overflow volumes. Projected wastewater flows from each area listed in Figure 4-4 were added to the sewer system model. Each residential flow value from Figure 4-4 was entered in the model in a typical wastewater diurnal flow pattern. An existing diurnal flow pattern identified during flow metering of the Lancaster collection system was used for the model. The industrial flows from Figure 4-4 were entered into the model as constant 24 hour flow rates.

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Using data from existing separate sewer areas, wet weather infiltration allowances were added to the model for all future development areas. On average, the existing separate sewer areas have an increase in daily flow volume of 30% during a 1.2 inch rainfall and an increase in peak DWF of 160%. Assuming that the future areas will be serviced by newer and tighter construction, an increase of 15% by volume and 80% by peak flowrate was assumed for each future development area.

To determine the effect of future flows on the existing collection system during wet weather, the model results from each of the four typical yearly storms discussed in Chapter 3 were used. A wet weather computer simulation was run for each typical storm including increased baseline and infiltration flow (year 2020) from future growth areas. The CSO volumes resulting from each individual storm type were converted to annual totals by multiplying the computer model output by the number of storm events per year for each type of storm. These results are shown in Figure 4-6.

4.6 Sanitary Sewer System Evaluation - Dry Weather Flow

The model's prediction of the year 2020 dry weather flow (peak rates) resulting from the increase in future sanitary sewer flow is summarized in Figure 4-2. As seen in Figure 4-2, the peak dry weather flow (DWF) rate resulting from the increase in sanitary sewer flow is still within the capacity of the existing sewers.

Although the sanitary sewer flow is below the sewer capacity, the sewer elevation in combined sewer areas was also checked. A summary of the maximum hydraulic grade line (HGL) throughout the sewer system, before and after future flows are added, is provided in Appendix H. As seen in Appendix H, the additional flow typically has a minor impact on the depth of flow during dry weather. Note that the results in Appendix H are based on the assumption that the City has implemented CSO reduction projects discussed later.

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4.7 Sanitary Sewer System Evaluation - Wet Weather

The increase in CSO volumes, as predicted by the Lancaster sewer model, was reviewed to determine both the nature and the quantity of the impact. An analysis of the additional impacts is provided below. Note that the analysis is provided to show what would happen to CSO volumes as growth occurs in the Lancaster area if no action is taken to offset the increased flows.

4.7.1 Impact of Future Sanitary Sewer Flows - CSO Volumes

The impact of the additional sanitary sewer flows on CSO volumes was estimated by comparing the baseline 1995 annual CSO volume (Table 4-1) to the year 2020 annual CSO volume (Figure 4-6). This data is summarized in Table 4-3. (Note that the CSO volume increases shown in Table 4-3 are based on the assumption that no CSO or I/I reduction projects are implemented by the City of Lancaster).

**TABLE 4-3
IMPACT OF FUTURE FLOWS ON WET WEATHER CSO VOLUMES
(ASSUMING NO CSO OR I/I REDUCTION PROJECTS)**

	1995 Baseline System (MG/YR)	2020 Future System (MG/YR)	Net Increase (MG/YR)
Baldwin Run CSO	61.8	66.5	4.7
Hocking River CSO	51.7	95.3	43.6
Total CSO Volume	113.5	161.8	48.3

MG/YR = Million gallons/Year

As discussed previously, the baseline 1995 CSO volume for the Sanitary Sewer Extension Evaluation was established as 113.5 million gallons/year. Table 4-3 demonstrates that, without CSO or I/I reduction projects, annual combined sewer overflow volumes from the Lancaster combined sewer system will increase significantly (as high as 161.8 million gallons/year) above baseline conditions due to additional sanitary sewer flow in the system.

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4.7.2 Ratio of Future Sanitary Flow to Increased CSO Volume

From the estimated future CSO discharge volume shown in Table 4-3 and the projected additional sanitary flow shown in Table 4-2, it can be seen that additional sanitary flow in the system does not result in an equal volume of CSO discharge during wet weather. In other words, an increase of one gallon of sanitary sewer flow does not cause an increase of one gallon of CSO volume. This is due primarily to the storage inherent in any collection system and the specific hydraulic characteristics of the Lancaster system

To demonstrate this, the ratio of additional sanitary flow (Table 4-2) to the resulting increase in CSO volume (Table 4-3) was calculated. The results are shown in Table 4-4.

In Table 4-4, the year 2020 additional sanitary flow (3.21 MGD) was multiplied by the annual number of rain events (82.59). This provided the additional annual flow that was present in the system on the days of rain, assuming one rain event per day, prorated for the duration of the rain period.

**TABLE 4-4
PERCENT OF ADDED FLOW DISCHARGED BY CSOs**

Drainage Area	Future Daily Flow Added (MGD)	Annual Sanitary Flow Added During Wet Weather (MG)	Increased Annual CSO Discharge (MG)	Percent of Added Flow Discharged (%)
Baldwin Run	0.95	64.4	4.7	7.3
Hocking River	2.26	153.2	43.6	28.5
System	3.21	217.6	48.3	22.1

As shown in Table 4-4, the actual increase in annual CSO discharge volume (48.3 MGD) is much less than the annual sanitary flow volume added to the collection system (217.6 MG). This means that approximately 22% of the sanitary flow added to the system exits through CSOs. In other words, almost 78% of the additional sanitary flow is captured and treated.

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4.7.3 Future CSO Volumes - Analysis by Drainage Basin

The increase in CSO volumes is much larger in the Hocking River drainage basin than the Baldwin Run drainage basin. Table 4-3 shows the Baldwin Run would have an annual CSO volume increase of approximately 4.7 million gallons while the Hocking River would have a CSO volume increase of approximately 37.6 million gallons per year. This is due to a combination of factors as follows:

- ▶ The Baldwin Run drainage basin is smaller and conveys less flow.
- ▶ As shown in Table 4-2, it is assumed that most of the future growth will occur in the Hocking River drainage basin.
- ▶ The increase in CSO volume due to new sanitary sewer flow is dependent on the way the CSOs are activated and where the CSOs are found in relation to the added flow. This is discussed below.

Baldwin Run

There are three major CSOs in the Baldwin Run drainage basin, CSOs 1019, 1026 and 1029.

The increase in flow from CSO 1019 was not as large as anticipated. However, only one future growth area was identified upstream of CSO 1019. This is area RC-9 as shown on Figure 4-3. Furthermore, CSO 1031, located upstream of CSO 1019, also relieves flow from area RC9. However, CSO 1031 is in the Hocking River drainage basin. Thus some impact of RC-9 is discharged to the Hocking River, diminishing the impact of this additional flow on CSO 1019 and the Baldwin Run.

CSOs 1026 and 1029 are located in areas where no additional sanitary sewer flow is anticipated to occur. Thus there was no additional impact on the Baldwin Run.

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Hocking River

Many CSOs in the Hocking River drainage basin showed increased discharges due to additional sanitary sewer flow. The most significant were CSOs 1004, 1005, 1006 and 1008. These CSOs are located on interceptors that would transport the future sanitary flow. Each of these CSOs is activated by the surcharging of the interceptors during rain events. In addition, the current elevation of CSO 1005* is such that even minor changes to the depth of flow in the interceptor results in increased CSO volume. Thus, the large increase in CSO volume due to the additional flow was a logical response of the system to additional sanitary sewer flow.

*CSO 1005 was abandoned in 1999

4.8 CSO and I/I Reduction Alternatives

In Section 4.4.4, the goal of the Sanitary Sewer Extension Evaluation was determined to be maintaining annual CSO discharge volumes at or below the baseline value of 113.5 million gallons/year. Various scenarios were simulated with the SWMM model of the Lancaster sewer system to estimate the infiltration/inflow (I/I) and CSO volume reductions necessary to maintain or reduce baseline annual CSO discharges as growth occurs in the Lancaster sewer system.

The I/I and CSO reduction alternatives identified were based on the experience of City personnel and knowledge gained as part of the Wastewater Collection Evaluation project. Some projects have recently been completed or are already in planning. A description of the identified projects is provided in Table 4-5.

4.8.1 CSO and I/I Reduction Model Simulations

Recognizing that the new sanitary flow would be added over a period of years, and that CSO and I/I reduction projects would also be implemented at different times, model simulations, were run for the following dates:

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- ▶ 1995 Baseline Conditions.
- ▶ 1999 with New Sanitary Flow and CSO/Inflow Reduction Projects.
- ▶ 2005 with New Sanitary Flow and CSO/Inflow Reduction Projects.
- ▶ 2020 with New Sanitary Flow and CSO/Inflow Reduction Projects.

Multiple simulations of the City's computer model were required to track sanitary flow additions and CSO volume reductions chronologically, as they were projected to occur. The projected flow increases combined with the flow removal projects for 1995, 1999, 2005, and 2020 were used to compare projected annual CSO volume with the baseline 1995 CSO volume. Results from each simulation are summarized in Figure 4-7. Model simulations of each CSO reduction alternative are provided in Appendix D for reference.

The 1995 model simulation was required to establish baseline conditions. The 1999 simulation reflected recently completed projects. The 2005 simulation reflected future projects and the year 2020 simulation showed the net impacts at the end of the planning period. The 1995 Baseline CSO volume is shown in Table 4-1. The CSO volumes for 1999, 2005, and 2020 are shown in Figures 4-8 through 4-10 respectively.

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**TABLE 4-5
CSO AND INFILTRATION/INFLOW REDUCTION PROJECTS**

Project	Remarks
1. Repair South Broad Street Inflow Source	During flowmetering in 1995, a leaking manhole stub near the South Broad Street Pump Station was discovered. Repair of this stub removed significant I/I from the wastewater collection system.
2. Remove Existing Sources of Inflow	During flowmetering in 1995, an abandoned siphon under the Baldwin Run near Locust Street was found to be leaking. Repair of this leak removed a source of I/I from the wastewater collection system.
3. Upgrade Secondary Treatment Capacity of the WPCF	In 1995, the WPCF could pump 18 MGD but its secondary treatment capacity was limited to 12 MGD. As a result, the plant bypassed flow from its equalization tank during wet weather. A 1995 project improved the secondary treatment capacity to 18 MGD, reducing equalization tank overflows. The impact of this on CSO reduction has not been quantified yet.
4. Close CSO 1010	This CSO allows river inflow to the system. Closing this CSO reduced I/I in the system during rain events.
5. Close CSO 1005	This CSO had the lowest overflow weir elevation in the system. It was also difficult to maintain and has been responsible for dry weather overflows. Closing this CSO reduced net CSO volume.
6. Clean the 27-inch Interceptor near the Miller Park Water Plant	The interceptor capacity is reduced in this area due to past discharges from the water plant. These discharges have stopped and cleaning this section has restored capacity to the interceptor.
7. Complete the Downtown Sewer Separation Project	An urban renewal program has separated part of the downtown area of the City. However, the project did not complete the separation. By completing the separation, the City can remove all the stormwater contributed by this area from the wastewater collection system.
8. Raise the weir at CSO 1019	The configuration of this CSO allows only a slight increase in depth of flow before overflows occur. Raising this weir will increase the capture of combined sewage and keep more solids and floatables and other "first flush" debris within the system.
9. Separate the Lake and Allen Streets Area	This area has historic flooded basement issues. Separating this area will reduce CSO volumes in addition to providing relief to local residents.
10. Historical Sewer System Evaluation Survey (SSES) Projects	During 1989, a sewer rehabilitation project identified 2.29 MGD of I/I throughout the City and removed 1.81 MGD primarily through disconnecting roof leaders. A copy of the letter sent to Ohio EPA documenting the I/I removal is provided in Appendix E. This source of I/I removal is being included for reference only. It does not appear necessary for the flow tradeoff scenario at this time.

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To show the net impact of the additional sanitary sewer flow and the CSO reduction projects, the results of the model simulations were put in a graphical format. Graphs representing the addition of sanitary flow and the removal of wet weather flow over time from the Baldwin Run drainage basin, Hocking River drainage basin and the total system are shown in Figures 4-11, 4-12, and 4-13. Each figure shows the CSO volume resulting from the increased sanitary flow and the offsetting I/I and CSO reduction projects. Each of these figures is discussed below:

Baldwin Run

As shown in Figure 4-11, the baseline CSO discharge to the Baldwin Run is 61.8 million gallons/year. During the 1995-2020 planning period, 0.95 MGD of additional sanitary flow is anticipated. As shown in Table 4-3, if CSO and I/I reduction projects are not implemented, the new sanitary sewer flow would cause an increase of 4.7 million gallons/year of CSO volume.

In Figure 4-11, it is shown how CSO and I/I reduction projects in the year 2005 will substantially reduce CSO discharges below existing levels, allowing for additional sanitary sewer flow. As will be discussed in the next chapter, this significant reduction in CSO volume also supports the Presumptive Approach of the Long-Term Control Plan.

Note that a slight increase in CSO volume occurs (occurred) in 1999. As discussed below, this is due to abandoning CSO 1005. Although the drainage basins are viewed separately for purposes of the Long-Term Control Plan, the collection systems are hydraulically connected. Changes in one basin can have an impact on the other basin.

Hocking River

As shown in Figure 4-12, the baseline CSO discharge to the Hocking River is 51.7 million gallons/year. During the 1995-2020 planning period, 2.26 MGD of additional sanitary sewer flow is anticipated in the Hocking River drainage basin. As shown in

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Table 4-3, if CSO and I/I reduction projects are not implemented, the new sanitary sewer flow would cause an increase of 43.6 million gallons of CSO volume per year.

In Figure 4-12, it is shown that CSO reduction and sewer separation projects offset the additional CSO volume caused by the new sanitary sewer flow. Similar to Figure 4-11, there is a slight increase of CSO volume to the Hocking River in the year 2020 caused by a CSO reduction project in the Baldwin Run drainage basin. Although the result of the project is a net reduction in CSO volume, this illustrates how changes in one drainage basin can have impacts in the other.

Total System

Figure 4-13 is a combination of Figures 4-11 and 4-12. It provides an overall summary of the net impacts of new sanitary flow and I/I and CSO reduction projects on the Lancaster combined sewer system.

4.9 Sanitary System Extension Evaluation - Conclusion

It is concluded in this evaluation that approximately 3.21 MGD of new sanitary flow will be added to the Lancaster wastewater collection system over the period 1995 through 2020. This is based on an assumption of strong growth in the Lancaster area spurred by growth in nearby Columbus and the construction of the US 33 Bypass.

It was found in this evaluation that by the year 2020, the additional baseline flow could increase annual CSO discharges to the Hocking River and Baldwin Run by more than 48 million gallons/year if CSO and I/I reduction projects are not implemented.

To comply with the antidegradation impacts that this additional flow will create, ten current and future infiltration/inflow and CSO reduction projects were identified that will more than offset the increased CSO volume caused by the new sanitary flow. As shown in Figure 4-7, these projects, when fully implemented by the year 2020, will reduce annual CSO discharges below the baseline 1995 annual CSO discharge volume by

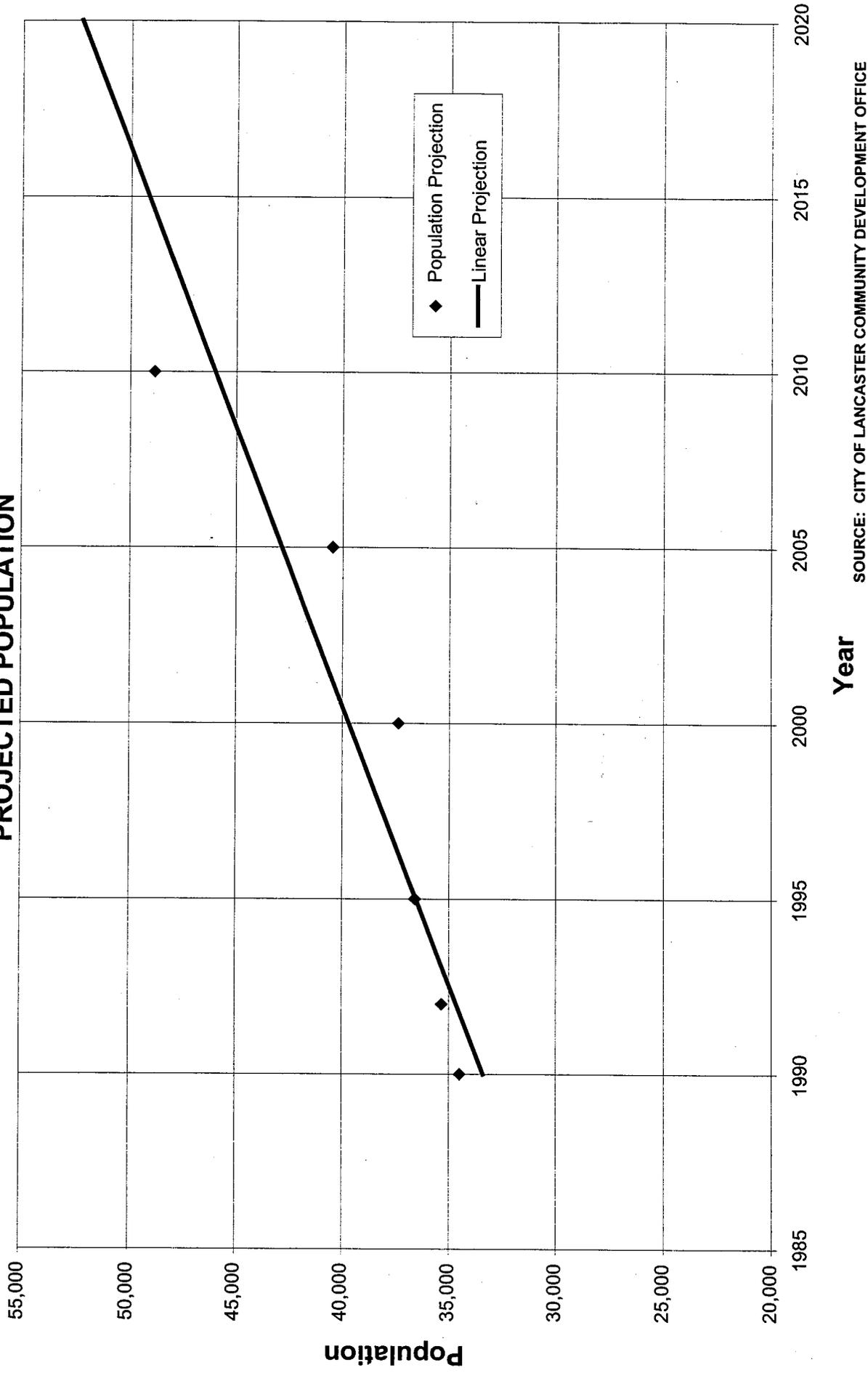
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more than 27.7 million gallons/year. This will satisfy the antidegradation concerns regarding additional sanitary sewer flow during this period.

The removal of 27.7 million of gallons/year of CSO volume below the baseline volume due to the implementation of these projects will be used to support the City's compliance with the "Presumptive Approach" of the Ohio EPA's Combined Sewer Overflow Strategy. This is discussed in detail in Chapter 5.

+ + END OF CHAPTER 4 + +

**FIGURE 4-1
CITY OF LANCASTER
PROJECTED POPULATION**

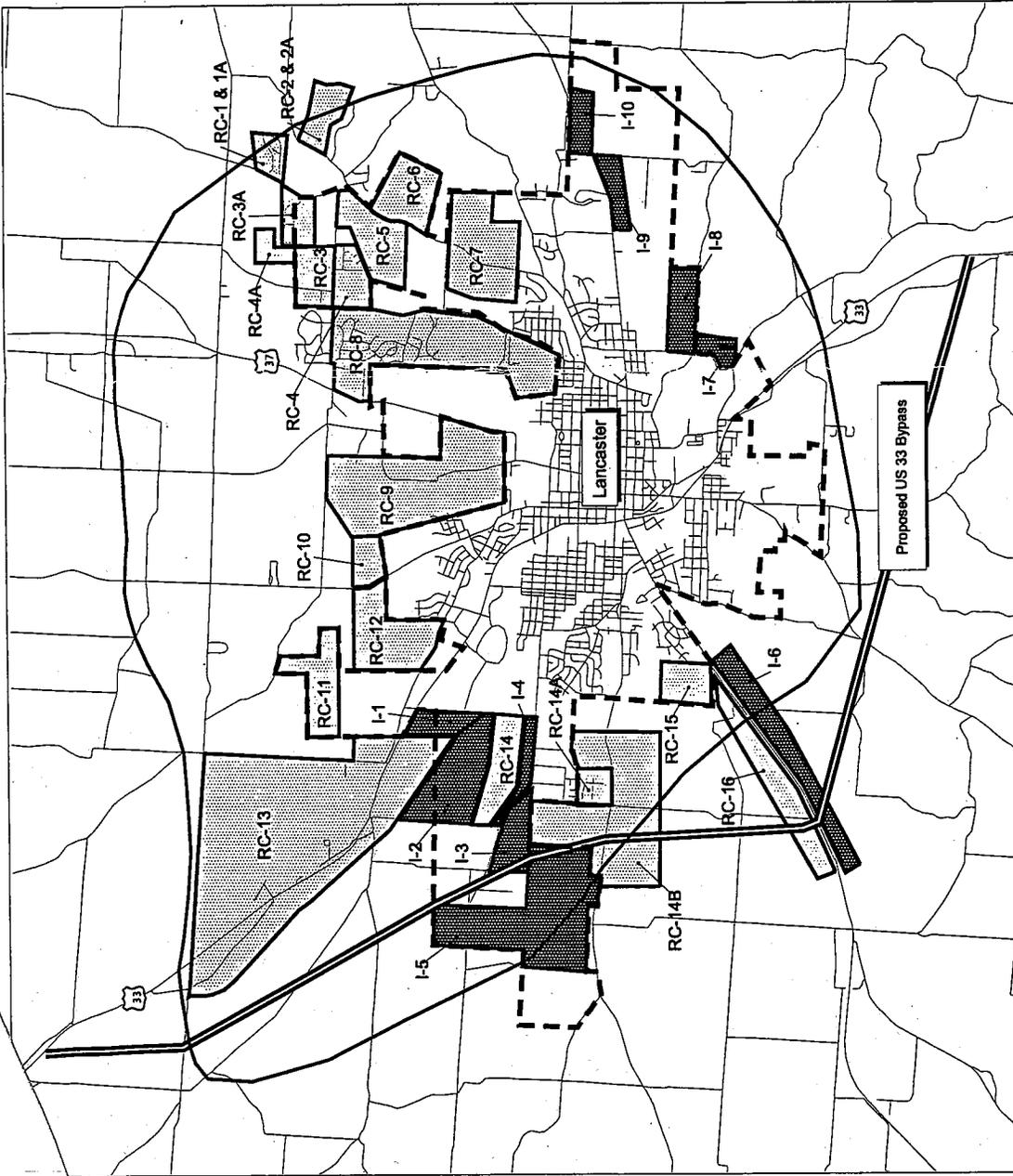


SOURCE: CITY OF LANCASTER COMMUNITY DEVELOPMENT OFFICE

**FIGURE 4-2
CITY OF LANCASTER
SANITARY SEWER EXTENSION EVALUATION
SUMMARY OF INTERCEPTOR CAPACITY AND DRY WEATHER FLOWS**

Sewer Name	Sewer Location	Diameter (feet)	Length (feet)	Slope (ft/ft)	Coef. (n)	Full Pipe Capacity (MGD) (1)	Existing Flow -1996 (MGD) (2)	Future Flow - 2020 (MGD) (2,3)
East Portion of Collection System								
24" High	Rising Park to Lake St.	2.00	1,670	0.0232	0.014	20.84	0.05	0.54
30" Lake	High St. to Maple St.	3.00	1,230	0.0024	0.021	13.32	0.06	0.36
48" Maple	Maple Street	4.00	3,010	0.0029	0.017	38.17	0.18	0.50
60" East	Wheeling to MBP	5.00	4,000	0.0028	0.015	77.60	0.53	0.84
18" Fetters	Stone Run Ct. to Granstaff	1.50	6,908	0.0050	0.014	4.48	0.02	0.27
24" Fetters	Granstaff to Baldwin Run	2.00	6,230	0.0034	0.014	7.99	0.27	0.54
21" Ewing	Rainbow to Valley Forge	1.75	2,130	0.0055	0.014	7.12	0.09	0.39
24" Ewing	Valley Forge to Baldwin Run	2.00	14,815	0.0047	0.014	9.36	0.45	0.90
36" East	Baldwin Run to MBP	3.00	2,420	0.0011	0.016	11.68	1.03	2.29
24" East	Schwilk Rd to Homestead Ct.	2.00	9,370	0.0018	0.014	5.77	0.41	0.44
30" East	Homestead Ct. to Pump Stati	2.50	990	0.0020	0.014	11.18	0.53	0.58
30" East	Pump Station to MBP	2.50	5,640	0.0039	0.014	15.34	1.15	1.49
48" East	MBP to WPCF	4.00	1,220	0.0010	0.018	20.99	2.13	3.14
West Portion of Collection System								
15" West	Corp Line to Ety Rd.	1.25	8,450	0.0038	0.014	2.40	0.15	0.19
18" West	Ety Rd to Zimmer	1.50	6,445	0.0012	0.014	2.25	0.16	0.66
12" Fair	Corp Line to Nodler	1.00	850	0.0036	0.014	1.29	0.04	1.43
18" Fair	Nodler Dr. to Shasta	1.50	4,810	0.0059	0.014	4.90	0.16	1.27
24" West	Zimmer to Shasta	2.00	6,590	0.0028	0.014	7.25	0.85	2.17
12" Scenic	Scenic Dr. to Ety Rd.	1.00	1,550	0.0083	0.014	1.97	0.27	0.67
12" North	Hubbard Dr. to Ety Rd.	1.00	1,470	0.0029	0.014	1.16	0.04	0.63
30" West	Columbus St. to Railroad	2.50	5,270	0.0037	0.014	14.97	0.42	1.38
30" West	Ety to Hocking St.	2.50	9,178	0.0014	0.014	9.11	1.80	3.91
15" North	Corp. Line to Columbus St.	1.25	1,600	0.0068	0.014	3.23	0.03	0.03
18" North	Columbus St. to Hocking St.	1.50	4,600	0.0075	0.014	5.51	0.68	1.16
36" Fair	Hocking St. to YMCA PS	3.00	1,760	0.0013	0.014	14.72	2.24	4.38
27" West	Wheeling to Walnut	2.25	1,560	0.0010	0.014	5.80	1.81	2.48
36" West	Wheeling to Walnut	3.00	1,210	0.0008	0.014	11.38	2.04	3.43
27" West	Walnut to S. Broad	2.25	3,200	0.0008	0.014	5.20	0.02	2.51
36" West	Walnut to S. Broad	3.00	3,040	0.0008	0.014	11.46	4.07	3.70
24" South	Corp. Line to SBPS	2.00	4,730	0.0059	0.014	10.52	0.45	0.56
24" Hunter	Lincoln to Pierce Ave.	2.00	3,230	0.0032	0.014	7.68	0.12	0.54
24" Hunter	Pierce Ave to Railroad	2.00	3,950	0.0023	0.014	6.49	0.39	0.78
30" West	Hunter Ave to SBPS	2.50	2,600	0.0031	0.016	12.21	1.00	1.45
27" West	S. Broad to Maple	2.25	1,980	0.0008	0.017	4.45	1.52	2.63
36" West	S. Broad to Maple	3.00	1,630	0.0012	0.018	10.76	3.59	4.87
27" West	Maple to WPCF	2.25	1,150	0.0017	0.021	5.28	0.92	1.52
42" West	Maple St. to Railroad	3.50	1,370	0.0008	0.018	13.65	4.25	6.06
48" West	Railroad to WPCF	4.00	1,330	0.0004	0.018	14.01	5.24	7.63

1. Theoretical full pipe capacity based on Manning's Equation and using overall pipe slope.
2. Peak Dry Weather Flow - Existing System
3. Peak Dry Weather Flow - Future System (with additional sanitary flow and I/I and CSO reduction projects)



LEGEND

-  Approximate City Limits
-  Approximate Planning Area
-  Residential/ Commercial Areas
-  Industrial Areas



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FIGURE 4 - 3

CITY OF LANCASTER, OHIO
COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
LANCASTER AREAS OF FUTURE GROWTH

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**FIGURE 4-4
CITY OF LANCASTER
SANITARY SEWER SYSTEM EXTENSION EVALUATION
ESTIMATE OF ADDITIONAL SANITARY SEWER FLOW BY AREA**

Industrial Flow			Flow	
Area No.	Area (ac)	Rate	Total Area	Developed Area
		Gallons/Acre/Day	Gallons/Day	Gallons/Day
1	53	1,300	69,141	34,571
2	275	1,300	357,230	178,615
3	98	1,300	126,759	63,380
4	89	1,300	115,235	57,618
5	461	1,300	599,224	299,612
6	213	1,300	276,565	138,283
7	53	1,300	69,141	17,285
8	106	1,300	138,283	34,571
9	44	1,300	57,618	14,404
10	89	1,300	115,235	28,809
Total	1,480		1,924,432	867,147

Residential Flow			Flow	
Area No.	Area (ac)	Rate	Total Area	Developed Area
		Gallons/Acre/Day	Gallons/Day	Gallons/Day
1	80	1,000	50,078	17,527
1a		Lakeside	29,700	29,700
2	142	1,000	74,128	25,945
2a		Pleasant Lea	67,700	67,700
3	98	1,000	74,598	26,109
3a		Kiester Mannor	22,909	22,909
4	62	1,000	53,383	18,684
4a		Peters	8,667	8,667
5	195	1,000	195,014	68,255
6	133	1,000	132,964	46,537
7	284	1,000	283,657	99,280
8	550	1,000	549,584	192,355
9	567	1,000	567,313	198,560
10	106	1,000	106,371	37,230
11	204	1,000	203,878	152,909
12	160	1,000	159,557	119,668
13	1,891	Greenfield Twshp	400,000	400,000
14	106	1,000	95,032	71,274
14a		Knox Acres	11,339	11,339
14b	800	1,000	711,357	533,518
15	89	1,000	88,643	66,482
16	177	1,000	177,285	132,964
Total	5,643		4,063,158	2,347,611

**FIGURE 4-5
CITY OF LANCASTER
COMBINED SEWER SYSTEM CHARACTERIZATION
1996 EXISTING CONDITIONS-ANNUAL CSO DISCHARGE VOLUME**

Name	Location	Existing 1996 CSO Volumes				Existing 1996 gal/yr
		Event 1 gal/yr	Event 2 gal/yr	Event 3 gal/yr	Event 7 gal/yr	
WWTP-A	WWTP	152,366,029	60,359,019	30,863,634	22,764,136	266,352,817
WWTP-B	WWTP	152,366,029	60,359,019	30,863,634	22,764,136	266,352,817
Combined Sewer Overflows						
CSO 1004	WWTP	0	0	2,765,990	5,549,375	8,315,365
CSO 1005	Wheat and Hocking River	1,090,764	6,647,850	6,981,353	5,876,111	20,596,078
CSO 1006	Siphon Overflow	0	0	1,305,294	1,429,077	2,734,371
CSO 1008	Lincoln and Hocking River	0	0	1,027,680	1,702,810	2,730,490
CSO 1009	Mulberry and Memorial	0	0	23,935	15,285	39,220
CSO 1010	Mulberry and Hocking	0	0	-2,667	-2,233	-4,899
CSO 1011	King and Memorial	12,939	39,364	9,293	7,385	68,980
CSO 1012	5th and Memorial	0	257,967	1,824,991	1,921,565	4,004,523
CSO 1013	6th and Memorial	3,177	80,223	128,616	139,089	351,105
CSO 1014	Allen and Memorial	0	0	6,364	4,916	11,281
CSO 1015	N Broad and Fair	0	0	0	0	0
CSO 1016	N Broad and 6th	1,057	150,442	427,159	415,398	994,056
CSO 1017	N Broad and 5th	0	0	0	0	0
CSO 1018	N Broad and Mulberry	0	0	0	0	0
CSO 1019	SE Mary Burnham Park	16,046,096	13,361,150	11,416,933	9,872,949	50,697,129
CSO 1020	Brooks and Chestnut	0	0	0	0	0
CSO 1021	Union and Garfield	0	0	13,666	12,365	26,031
CSO 1022	Columbus and Wilson	0	0	0	0	0
CSO 1023	High N. of 6th	0	0	0	0	0
CSO 1024	Wheeling and Livingston	0	0	0	3	3
CSO 1026	NE Mary Burnham Park	0	425,612	1,352,540	1,383,157	3,161,309
CSO 1027	Walnut and Whiley	78,375	517,429	604,426	533,899	1,734,130
CSO 1028	6th and Pierce	0	0	0	0	0
CSO 1029	6th and Boyd	800,682	2,039,983	2,205,686	1,873,692	6,920,043
CSO 1030	Maple and Walnut	0	0	0	0	0
CSO 1031	Maple and Wheeling	1,247,978	1,593,240	1,732,453	1,485,343	6,059,015
CSO 1032	S. of Maple and Wheeling	0	0	0	0	0
CSO 1033	Park and Memorial	691	355,768	964,036	884,680	2,205,174
CSO 1034	Baldwin Run and Lawrenc	0	0	97,341	685,675	783,016
CSO 1035	Columbus and Park	0	0	0	0	0
Total Plant Outfall		304,732,058	120,718,037	61,727,267	45,528,271	532,705,634
Total CSO Outfall		19,281,759	25,469,026	32,885,091	33,790,542	111,426,417
Tributary to Baldwin Run		16,846,778	15,826,745	15,072,500	13,815,477	61,561,499
Tributary to Hocking River		2,434,981	9,642,281	17,812,591	19,975,065	49,864,918

**FIGURE 4-6
CITY OF LANCASTER
SANITARY SEWER EXTENSION EVALUATION
ANNUAL CSO VOLUMES-
YEAR 2020
(Without I/I and CSO Reduction Projects)**

Name	Location	Year 2020 (Without I/I and CSO Reduciton Projects)				Year 2020 gal/yr
		Event 1 gal/yr	Event 2 gal/yr	Event 3 gal/yr	Event 7 gal/yr	
WWTP-A	WWTP	217,732,537	76,473,089	36,128,659	26,168,189	356,502,474
WWTP-B	WWTP	217,732,537	76,473,089	36,128,659	26,168,189	356,502,474
Combined Sewer Overflows						
CSO 1004	WWTP	0	0	5,091,546	7,569,476	12,661,022
CSO 1005	Wheat and Hocking River	19,825,740	16,297,050	10,901,532	8,273,613	55,297,935
CSO 1006	Siphon Overflow	0	820,837	1,790,241	1,764,851	4,375,929
CSO 1008	Lincoln and Hocking River	0	14,773	2,613,322	2,865,925	5,494,020
CSO 1009	Mulberry and Memorial	0	0	30,807	38,212	69,019
CSO 1010	Mulberry and Hocking	0	0	-2,667	-2,233	-4,899
CSO 1011	King and Memorial	12,939	38,990	11,401	8,694	72,024
CSO 1012	5th and Memorial	88	264,044	1,956,185	2,110,694	4,331,011
CSO 1013	6th and Memorial	1,220	79,943	133,302	104,655	319,118
CSO 1014	Allen and Memorial	0	0	6,403	4,938	11,341
CSO 1015	N Broad and Fair	0	0	0	0	0
CSO 1016	N Broad and 6th	1,340	149,694	426,378	414,969	992,380
CSO 1017	N Broad and 5th	0	0	0	0	0
CSO 1018	N Broad and Mulberry	0	0	0	0	0
CSO 1019	SE Mary Burnham Park	18,049,539	14,193,300	12,147,086	10,394,612	54,784,537
CSO 1020	Brooks and Chestnut	0	0	0	0	0
CSO 1021	Union and Garfield	0	0	13,666	11,872	25,538
CSO 1022	Columbus and Wilson	0	0	0	0	0
CSO 1023	High N. of 6th	0	0	0	0	0
CSO 1024	Wheeling and Livingston	0	0	0	2	2
CSO 1026	NE Mary Burnham Park	0	437,580	1,365,425	1,390,456	3,193,461
CSO 1027	Walnut and Whiley	80,694	518,084	661,432	1,089,481	2,349,691
CSO 1028	6th and Pierce	0	0	0	0	0
CSO 1029	6th and Boyd	817,145	2,040,170	2,104,948	1,913,622	6,875,885
CSO 1030	Maple and Walnut	0	0	0	0	0
CSO 1031	Maple and Wheeling	1,612,957	1,841,950	1,892,931	1,618,442	6,966,280
CSO 1032	S. of Maple and Wheeling	0	0	0	0	0
CSO 1033	Park and Memorial	1,892	408,782	1,015,186	931,479	2,357,339
CSO 1034	Baldwin Run and Lawrence	0	0	411,541	1,183,509	1,595,049
CSO 1035	Columbus and Park	0	0	0	0	0
Total Plant Outfall		435,465,075	152,946,178	72,257,319	52,336,377	713,004,949
Total CSO Outfall		40,403,555	37,105,195	42,570,664	41,687,269	161,766,682
Tributary to Baldwin Run		18,866,684	16,671,050	16,029,000	14,882,201	66,448,935
Tributary to Hocking River		21,536,871	20,434,145	26,541,664	26,805,068	95,317,747

FIGURE 4-7
CITY OF LANCASTER
SANITARY SEWER EXTENSION EVALUATION
SUMMARY OF I/I AND CSO REDUCTION PROJECTS
1995 through 2020

Estimated CSO Increases Resulting From Additional Sanitary Sewer Flows

<u>Simulation (2)</u>	<u>System</u>	<u>Baldwin Run</u>	<u>Hocking River</u>	<u>Project No.</u>
Baseline (1995)	113,397,417 gal/yr	61,732,499 gal/yr	51,664,918 gal/yr	
Existing 1996	111,426,417 gal/yr	61,561,499 gal/yr	49,864,918 gal/yr	1, 2 & 3
Future 1999	102,316,938 gal/yr	63,249,248 gal/yr	39,067,690 gal/yr	1, 2, 3 & 4
Future 2005	72,783,292 gal/yr	35,157,353 gal/yr	37,625,939 gal/yr	1, 2, 3, 4 & 5
Future 2020	85,735,518 gal/yr	34,350,815 gal/yr	51,384,703 gal/yr	1, 2, 3, 4, 5 & 6
Total Reduction 1995-2020	27,661,900 gal/yr	27,381,684 gal/yr	280,215 gal/yr	

Estimated I/I and CSO Removed By Project

<u>Project</u>	<u>System</u>	<u>Baldwin Run</u>	<u>Hocking River</u>
1. SB Inflow (3)	1,800,000 gal/yr	0 gal/yr	1,800,000 gal/yr
2. BR Inflow (3)	171,000 gal/yr	171,000 gal/yr	0 gal/yr
3. WPCF Upgrade	0 gal/yr	0 gal/yr	0 gal/yr
4. Close CSO 1005, Close CSO 1010 & Clean 27-inch Interceptor	13,271,000 gal/yr	-1,336,000 gal/yr (5)	14,607,000 gal/yr
5. Downtown Sewer Separation, Raise Weir at CSO 1019, Separate Lake, Allen & /Maple Streets	34,804,000 gal/yr	29,411,000 gal/yr	5,393,000 gal/yr
6. Modify CSO 1029	1,339,000 gal/yr	3,480,000 gal/yr	-2,141,000 gal/yr

Notes

1. Assume One Rain Event Occurs Per Wet Weather Day (82.89 Events / Year)
2. Model Simulations
 - Existing Outflow - Simulation of Typical Storms For Existing System (1996)
 - 2020 - Flow Addition Through 2020 With All System Modifications
 - 2005 - Flow Addition Through 2005, Does Not Include CSO 1029 Modifications
 - 1999 - Flow Addition Through 1999, Does Not Include Lake/Allen/Maple Street Separation, Downtown Sewer Separation, or Raising the Weir at CSO 1019.
3. Inflow Removal Projects: 0.35 MGD - South Broad St.; 0.035 MGD Locust Street Siphon
4. Not Used
5. Weir Raised 1.0 feet at CSO 1019; Decreases CSO Volume to Baldwin Run But Increases CSO Volume to Hocking River.

FIGURE 4-8
CITY OF LANCASTER
SANITARY SEWER EXTENSION EVALUATION
ANNUAL CSO VOLUMES-
1999

Name	Location	Year 1999				Year 1999 gal/yr
		Event 1 gal/yr	Event 2 gal/yr	Event 3 gal/yr	Event 7 gal/yr	
	Simulation Error	0.54	0.50	0.41	0.25	
WWTP-A	WWTP	159,874,304	65,696,373	33,264,313	24,413,298	283,248,288
WWTP-B	WWTP	159,874,304	65,696,373	33,264,313	24,413,298	283,248,288
Combined Sewer Overflows						
CSO 1004	WWTP	0	0	6,622,134	9,216,041	15,838,174
CSO 1005	Wheat and Hocking River	-	-	-	-	0
CSO 1006	Siphon Overflow	0	774,928	2,047,551	1,971,155	4,793,634
CSO 1008	Lincoln and Hocking River	0	0	958,569	1,814,871	2,773,440
CSO 1009	Mulberry and Memorial	0	0	27,098	23,829	50,927
CSO 1010	Mulberry and Hocking.	-	-	-	-	0
CSO 1011	King and Memorial	12,939	39,551	10,933	7,256	70,678
CSO 1012	5th and Memorial	88	257,780	1,820,306	1,953,122	4,031,296
CSO 1013	6th and Memorial	1,220	79,943	128,772	128,956	338,890
CSO 1014	Allen and Memorial	0	0	6,403	4,938	11,341
CSO 1015	N Broad and Fair	0	0	0	0	0
CSO 1016	N Broad and 6th	1,340	149,694	426,378	414,325	991,736
CSO 1017	N Broad and 5th	0	0	0	0	0
CSO 1018	N Broad and Mulberry	0	0	0	0	0
CSO 1019	SE Mary Burnham Park	16,097,110	13,435,950	11,725,394	10,117,680	51,376,133
CSO 1020	Brooks and Chestnut	0	0	0	0	0
CSO 1021	Union and Garfield	0	0	13,666	11,872	25,538
CSO 1022	Columbus and Wilson	0	0	0	0	0
CSO 1023	High N. of 6th	0	0	0	0	0
CSO 1024	Wheeling and Livingston	0	0	0	2	2
CSO 1026	NE Mary Burnham Park	0	429,165	1,361,911	1,388,310	3,179,385
CSO 1027	Walnut and Whiley	80,694	518,084	604,426	537,763	1,740,967
CSO 1028	6th and Pierce	0	0	0	0	0
CSO 1029	6th and Boyd	817,609	2,040,170	2,213,886	1,977,810	7,049,474
CSO 1030	Maple and Walnut	0	0	0	0	0
CSO 1031	Maple and Wheeling	1,261,891	1,616,615	1,763,299	1,525,488	6,167,293
CSO 1032	S. of Maple and Wheeling	0	0	0	0	0
CSO 1033	Park and Memorial	682	359,882	974,578	898,634	2,233,775
CSO 1034	Baldwin Run and Lawrence	0	0	424,035	1,220,218	1,644,254
CSO 1035	Columbus and Park	0	0	0	0	0
Total Plant Outfall		319,748,607	131,392,745	66,528,626	48,826,596	566,496,575
Total CSO Outfall		18,273,572	19,701,759	31,129,339	33,212,268	102,316,938
Tributary to Baldwin Run		16,914,718	15,905,285	15,725,225	14,704,020	63,249,248
Tributary to Hocking River		1,358,854	3,796,474	15,404,114	18,508,248	39,067,690

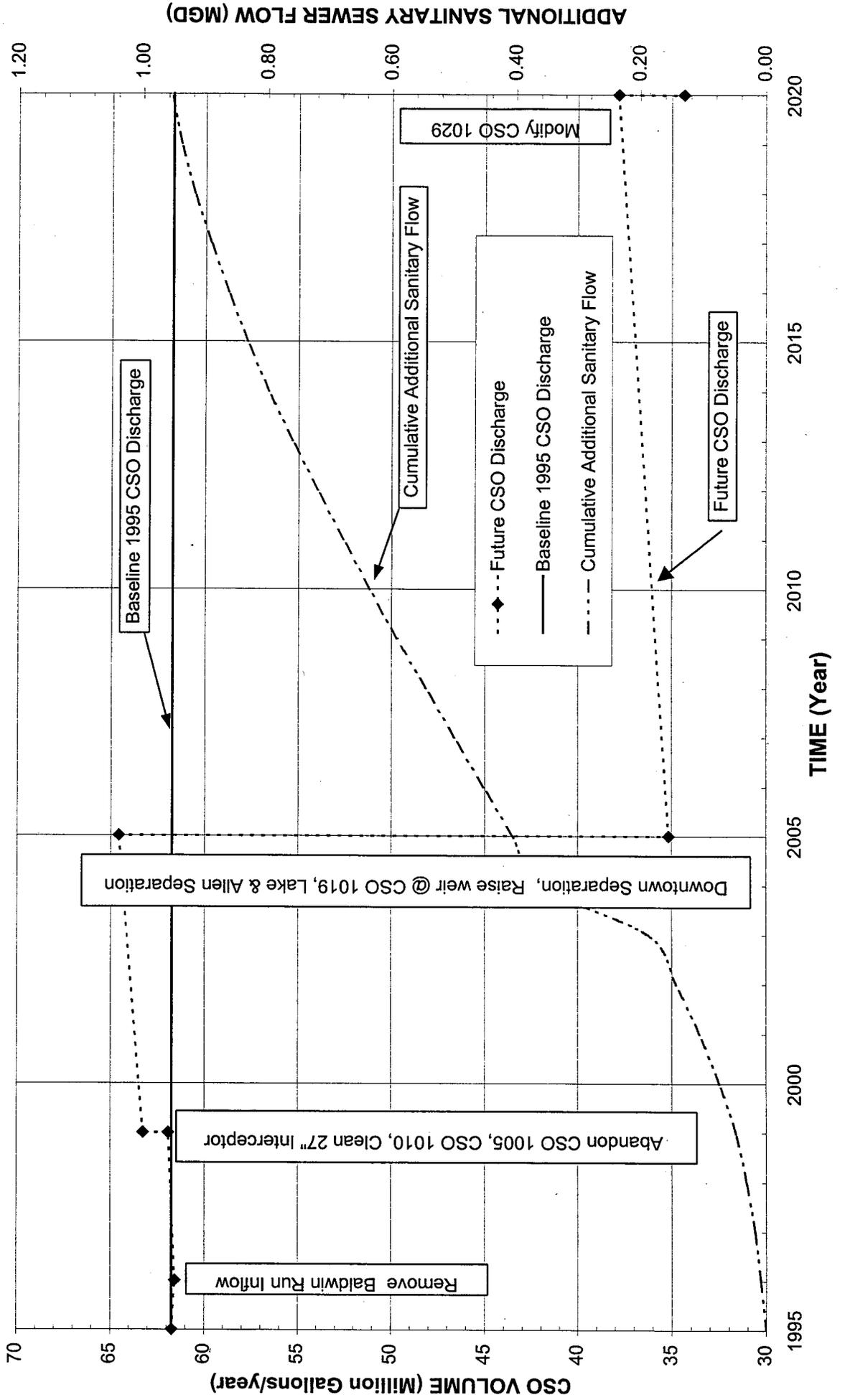
**FIGURE 4-9
CITY OF LANCASTER
SANITARY SEWER EXTENSION EVALUATION
ANNUAL CSO VOLUMES-
YEAR 2005**

Name	Location	Year 2005				Year 2005 gal/yr
		Event 1 gal/yr	Event 2 gal/yr	Event 3 gal/yr	Event 7 gal/yr	
	Simulation Error	0.48	0.52	0.42	0.29	
WWTP-A	WWTP	179,992,676	71,257,846	34,989,387	25,408,772	311,648,681
WWTP-B	WWTP	179,992,676	71,257,846	34,989,387	25,408,772	311,648,681
Combined Sewer Overflows						
CSO 1004	WWTP	0	578,765	8,082,439	10,527,711	19,188,915
CSO 1005	Wheat and Hocking River	-	-	-	-	0
CSO 1006	Siphon Overflow	0	1,680,195	2,217,790	2,101,249	5,999,234
CSO 1008	Lincoln and Hocking River	0	0	1,216,661	2,037,275	3,253,936
CSO 1009	Mulberry and Memorial	0	0	26,043	19,836	45,879
CSO 1010	Mulberry and Hocking	-	-	-	-	0
CSO 1011	King and Memorial	12,939	39,551	10,738	7,299	70,526
CSO 1012	5th and Memorial	86	257,780	1,830,848	1,973,516	4,062,230
CSO 1013	6th and Memorial	1,215	79,943	128,655	138,359	348,171
CSO 1014	Allen and Memorial	0	0	6,403	4,938	11,341
CSO 1015	N Broad and Fair	0	0	0	0	0
CSO 1016	N Broad and 6th	1,340	149,694	426,378	414,969	992,380
CSO 1017	N Broad and 5th	0	0	0	0	0
CSO 1018	N Broad and Mulberry	0	0	0	0	0
CSO 1019	SE Mary Burnham Park	2,564,593	5,585,690	7,200,009	6,697,891	22,048,183
CSO 1020	Brooks and Chestnut	0	0	0	0	0
CSO 1021	Union and Garfield	0	0	13,666	11,872	25,538
CSO 1022	Columbus and Wilson	0	0	0	0	0
CSO 1023	High N. of 6th	0	0	0	0	0
CSO 1024	Wheeling and Livingston	0	0	0	2	2
CSO 1026	NE Mary Burnham Park	57,506	627,759	1,456,010	1,457,435	3,598,711
CSO 1027	Walnut and Whiley	1,414	60,027	110,499	121,378	293,318
CSO 1028	6th and Pierce	0	0	0	0	0
CSO 1029	6th and Boyd	817,145	2,040,170	2,213,886	1,779,235	6,850,435
CSO 1030	Maple and Walnut	0	0	0	0	0
CSO 1031	Maple and Wheeling	91,361	272,927	447,853	406,811	1,218,951
CSO 1032	S. of Maple and Wheeling	0	0	0	0	0
CSO 1033	Park and Memorial	668	347,727	921,086	846,038	2,115,518
CSO 1034	Baldwin Run and Lawrenc	0	0	814,882	1,845,140	2,660,022
CSO 1035	Columbus and Park	0	0	0	0	0
Total Plant Outfall		359,985,352	142,515,692	69,978,774	50,817,545	623,297,363
Total CSO Outfall		3,548,268	11,720,225	27,123,846	30,390,953	72,783,292
Tributary to Baldwin Run		3,439,244	8,253,619	11,684,786	11,779,703	35,157,353
Tributary to Hocking River		109,023	3,466,606	15,439,060	18,611,250	37,625,939

FIGURE 4-10
CITY OF LANCASTER
SANITARY SEWER EXTENSION EVALUATION
ANNUAL CSO VOLUMES -
YEAR 2020
(with I/I and CSO Improvements)

Name	Location	Year 2020				Year 2020 gal/yr
		Event 1 gal/yr	Event 2 gal/yr	Event 3 gal/yr	Event 7 gal/yr	
	Simulation Error	0.54	0.50	0.41	0.25	
WWTP-A	WWTP	229,178,598	82,015,863	38,583,886	27,763,725	377,542,071
WWTP-B	WWTP	229,178,598	82,015,863	38,583,886	27,763,725	377,542,071
Combined Sewer Overflows						
CSO 1004	WWTP	0	5,309,865	10,714,113	12,380,365	28,404,343
CSO 1005	Wheat and Hocking River	-	-	-	-	0
CSO 1006	Siphon Overflow	0	3,216,400	2,645,339	2,365,730	8,227,469
CSO 1008	Lincoln and Hocking River	0	0	2,126,033	2,619,047	4,745,080
CSO 1009	Mulberry and Memorial	0	0	26,473	31,557	58,030
CSO 1010	Mulberry and Hocking	-	-	-	-	0
CSO 1011	King and Memorial	12,939	39,364	10,894	8,050	71,246
CSO 1012	5th and Memorial	87	258,341	1,900,740	2,084,289	4,243,456
CSO 1013	6th and Memorial	1,220	79,943	135,254	104,697	321,114
CSO 1014	Allen and Memorial	0	0	6,403	4,938	11,341
CSO 1015	N Broad and Fair	0	0	0	0	0
CSO 1016	N Broad and 6th	1,340	149,694	426,378	414,969	992,380
CSO 1017	N Broad and 5th	0	0	0	0	0
CSO 1018	N Broad and Mulberry	0	0	0	0	0
CSO 1019	SE Mary Burnham Park	3,215,712	6,684,315	7,625,606	6,983,410	24,509,043
CSO 1020	Brooks and Chestnut	0	0	0	0	0
CSO 1021	Union and Garfield	0	0	13,666	11,872	25,538
CSO 1022	Columbus and Wilson	0	0	0	0	0
CSO 1023	High N. of 6th	0	0	0	0	0
CSO 1024	Wheeling and Livingston	0	0	0	2	2
CSO 1026	NE Mary Burnham Park	64,463	672,452	1,471,238	1,466,666	3,674,819
CSO 1027	Walnut and Whiley	1,414	60,027	153,449	379,977	594,867
CSO 1028	6th and Pierce	0	0	0	0	0
CSO 1029	6th and Boyd	0	67,601	1,069,069	1,064,149	2,200,818
CSO 1030	Maple and Walnut	0	0	0	0	0
CSO 1031	Maple and Wheeling	165,562	360,069	507,593	452,537	1,485,761
CSO 1032	S. of Maple and Wheeling	0	0	0	0	0
CSO 1033	Park and Memorial	1,554	384,005	950,370	868,150	2,204,078
CSO 1034	Baldwin Run and Lawrenc	0	16,550	1,495,837	2,453,747	3,966,133
CSO 1035	Columbus and Park	0	0	0	0	0
Total Plant Outfall		458,357,196	164,031,725	77,167,772	55,527,450	755,084,143
Total CSO Outfall		3,464,290	17,298,622	31,278,454	33,694,151	85,735,518
Tributary to Baldwin Run		3,280,174	7,440,917	11,661,749	11,967,974	34,350,815
Tributary to Hocking River		184,116	9,857,705	19,616,705	21,726,177	51,384,703

**FIGURE 4-11
BALDWIN RUN CSO DISCHARGE VOLUME**



**FIGURE 4-12
HOCKING RIVER CSO DISCHARGE VOLUME**

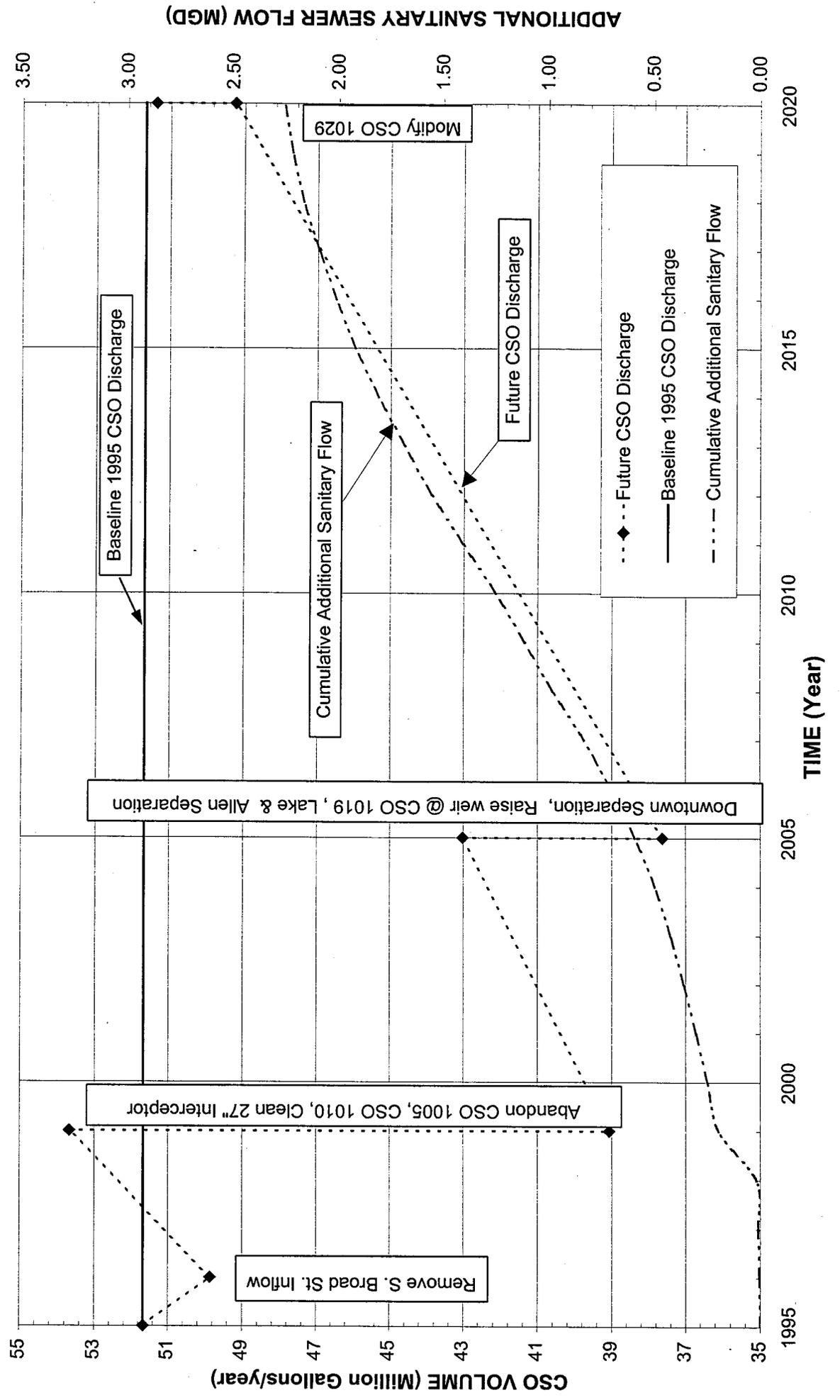
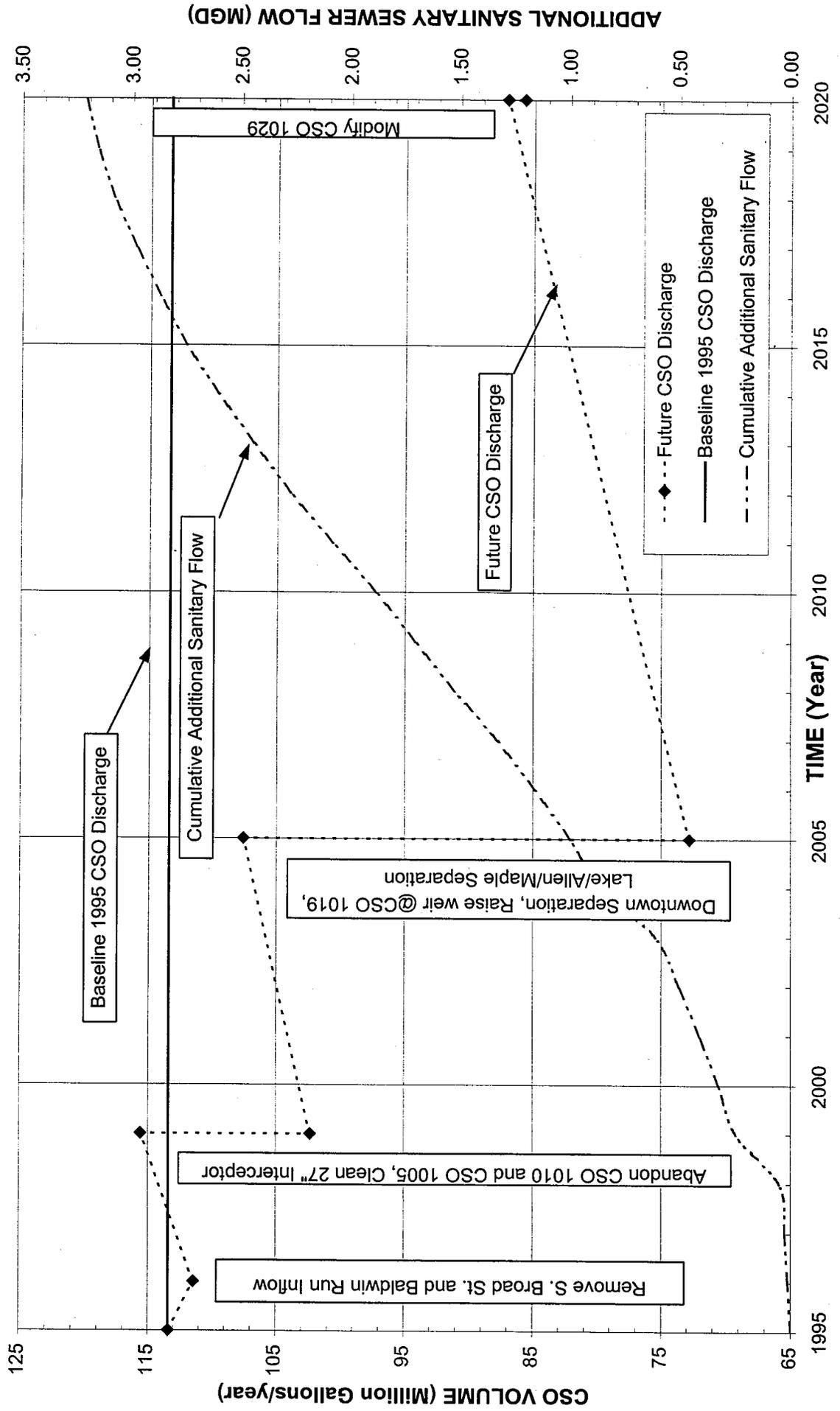


FIGURE 4-13
TOTAL COLLECTION SYSTEM CSO DISCHARGE VOLUME



5

Chapter 5.0 - Development and Evaluation of Alternatives

5.1 Long-Term Control Plan Goals

The City of Lancaster's NPDES permit required that a Combined Sewer System Long-Term Control Plan (LTCP) be completed by June 1, 2000. The goal of the LTCP as stated in the permit is as follows:

"The goal of the plan is that discharges from combined sewer overflows shall not cause or significantly contribute to violations of water quality standards or impairment of designated uses."

In addition to achieving water quality standards, the Lancaster Combined Sewer System Long-Term Control Plan must also address the antidegradation issues raised by increased combined sewer overflows caused by sanitary sewer flows from new developments in the Lancaster sewer systems.

5.1.1 Water Quality Goals

As discussed in Chapter 3.0, the Ohio EPA performed an aquatic survey of the Hocking River and its tributaries during the summer of 1995. In this study, the water quality of Lancaster area streams was evaluated. When water quality was below standards, possible causes were identified in the report. A summary of the results is provided in Figure 3-5 of Chapter 3.

The Ohio EPA concluded that the Hocking River and its tributaries continue to show significant improvement. Only one area of possible CSO impact was identified. The Ohio EPA concluded that CSOs were at least partially responsible for the Partial Attainment of the lower section of the Baldwin Run (rivermile 0.3).

The City of Lancaster performed additional water quality sampling during the summer of 1998. The purpose of the sampling was to confirm the Ohio EPA findings, document impacts that have occurred since the Ohio EPA sampling, and investigate

Chapter 5.0 - Development and Evaluation of Alternatives

additional stream segments not sampled by the Ohio EPA. The results of this sampling are shown in Figure 3-7 and Figure 3-8 of Chapter 3.

From the 1998 sampling activities, one sampling location on the Hocking River was found in Non-Attainment of the water quality criteria. This location is upstream of the Water Pollution Control Facility (WPCF) discharge. The remaining Hocking River sample sites were either in Full or Partial Attainment of the water quality criteria. Sample sites in Baldwin Run and its tributaries were in Full, Partial, and Non-Attainment of the water quality criteria. The location of Non-Attainment was at rivermile 0.7 of the Baldwin Run, below the confluence of Fetters Run and Ewing Run.

Based on the available water quality data, the Lancaster Long-Term Control Plan will address the following water quality issues:

- ▶ Hocking River: Impairment of water quality upstream of the Water Pollution Control Facility (WPCF). The impacts at this location were likely a combination of a dry weather overflow (now repaired) and CSO volume.
- ▶ Baldwin Run: Impairment of water quality from the confluence of Fetters Run/Ewing Run to the Hocking River. The impacts upstream (rivermile 0.7) are believed to be primarily due to habitat modifications.

See Chapter 3.0 for a complete description of water quality sampling results.

5.1.2 Antidegradation Goals

In its March 1995 Combined Sewer Overflow Strategy, the Ohio EPA applied antidegradation criteria to new sanitary flows that may cause increased combined sewer overflows. The Ohio EPA required that a Sanitary Sewer Extension Evaluation be completed as part of the Long-Term Control Plan in order to address this issue. The Lancaster Sanitary Sewer Extension Evaluation is presented in Chapter 4. Several infiltration/inflow and CSO reduction projects were identified based on the results of this evaluation. These projects are included in the Long-Term Control Plant in order to

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reduce combined sewer system overflows sufficiently such that additional sanitary flows do not cause increased CSOs.

5.2 Long-Term Control Plan Approach

Two different approaches that can be used to develop a LTCP are described in the USEPA's *Guidance for Long Term Control Plan*. Both the demonstrative and presumptive approaches require a complete understanding of the health of the receiving stream's aquatic life, current water quality, and operation of the combined sewer system. An understanding of the aquatic life and water quality in the Hocking River and its tributaries as well as a characterization of the combined sewer system is provided in Chapter 3.

5.2.1 The Demonstration Approach

Through use of the demonstration approach communities can target their CSO control efforts specifically to the individual nature and location of the water quality problem, if they can demonstrate their plan would attain the desired water quality standard. The approach relies on modeling and water quality sampling to demonstrate compliance.

5.2.2 Presumptive Approach

In the presumptive approach, it is assumed that water quality can be maintained with a certain level of control. As defined in the USEPA's *Guidance for Long Term Control Plan*, this approach requires fulfillment of at least one of the following:

- ▶ No more than an average of four CSO events per year.
- ▶ Capture for treatment no less than 85% by volume of the combined sewage collected in the combined sewer system during precipitation events.
- ▶ Elimination or removal of the mass of pollutants identified as causing water quality impairment.

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This approach is necessary if modeling and water quality sampling are not possible or the results are not conclusive. In this case, the level of CSO reductions sufficient to meet water quality goals are presumed. The effectiveness of the presumptions must still be confirmed by subsequent sampling.

5.2.3 Selected Approach

The Presumptive Approach was selected for development of the City of Lancaster's Long-Term Control Plan. The Presumptive Approach was selected because some water quality impacts that were found, such as dry weather overflows, are not readily quantifiable and can not be "demonstrated" or modeled. Other impacts, such as habitat modifications, were not related to combined sewer overflows. Some impacts may have been due to a combination of habitat modifications and CSO impacts.

These types of "characteristics" do not easily fit the Demonstration Approach in which modeling and sampling is used to "demonstrate" that water quality objectives can be achieved. Rather, the Presumptive Approach, in which "assumed" levels of CSO treatment are used to achieve water quality goals, is more appropriate for Lancaster.

In the Presumptive Approach, it is assumed that certain levels of CSO treatment will protect the water quality of receiving streams. These "assumed levels of treatment" were included in the US EPA's National CSO Policy. In accordance with the policy, the City of Lancaster plans to capture for treatment 85% of the combined sewage collected on a system-wide average annual basis.

5.3 General Considerations

5.3.1 Nine Minimum Controls

A complete description of the Nine Minimum Controls (NMCs) is included in the City of Lancaster's *Combined Sewer System Operation Plan* dated March 1998. The executive summary of the plan is included in this report as Appendix N for reference.

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The City of Lancaster's Nine Minimum Controls have been the primary tool for protecting the water quality of receiving streams in the City of Lancaster. In a review of the City's implementation of the NMCs for Long-Term Control Plan purposes, the following should be noted:

Minimum Control No. 5 - Prevent Dry Weather Overflows

As the City implemented its Operational Plan, it found two CSOs to be problematic in maintaining compliance with Minimum Control No. 5 - Prevent Dry Weather Overflows. Dry weather overflows have periodically occurred at combined Sewer Overflow Structures CSO 1005 and 1029 despite City efforts to prevent them. (CSO 1005 has since been abandoned). These CSOs will be considered in development of alternatives for the Long-Term Control Plan.

Minimum Control No. 6 - Control of Solid and Floatable Material

The City has successfully implemented this control. When preparing to implement the NMCs, the City found through sampling that material in CSO discharges did not differ significantly from stormwater discharges. Furthermore, the City has received few complaints of floatables in the receiving streams. The installation of notification signs at all CSO headwalls did not increase public concern with CSO floatables.

However, during the 1995 EPA sampling event, sewage solids and human hygiene products were observed in the Baldwin Run. Due to this finding and the location of two CSOs in close proximity to Mary Burnham Park along the Baldwin Run, floatables control will be considered in development of alternatives for the Long-Term Control Plan.

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5.3.2 Public Participation

Public participation was included in the development of alternatives for the Long-Term Control Plan. Two phases of public participation were completed. Each phase consisted of a presentation at a regularly scheduled City council meeting followed by a question and answer session to allow for public comment.

The first meeting occurred early in the development of the LTCP. The purpose of the meeting was to present a summary of the receiving stream water quality and the sewer system characterization data. This information was used to inform the public of the condition of the receiving waters and the impact of CSOs on the receiving waters. The characterization data along with public response was used to guide the development of LTCP alternative(s). During the second meeting, the alternatives that were developed and their associated costs were presented. The alternatives that were recommended for implementation were also presented.

Public Meeting No. 1

The first public meeting was held on June 28, 1999, at the City of Lancaster Educational Services Building in downtown Lancaster. At this meeting, a presentation was made regarding the receiving waters in the City of Lancaster, the characteristics of the Lancaster combined sewer system, and a brief summary of the Long-Term Control Plan process. This public meeting did not result in any significant comments regarding the impacts of CSOs on Lancaster receiving streams nor any recommendations for Long-Term Control Plan alternatives.

To maximize public attendance, the presentation was scheduled to coincide with the regularly scheduled City Council meeting. Also, the meeting was highlighted in the local paper, the Lancaster Eagle-Gazette and letters of invitation were sent to individuals and/or groups that had expressed interest in the water quality of the Hocking River. Interested groups include Ohio EPA officials, local industries, local citizens and City and

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County staff involved with planning and water quality. Also invited by personal invitations were members of the local watershed group, the Upper Hocking Advisory Group.

A copy of the newspaper article, the letter of invitation, and a summary of the meeting are included in Appendix F. The meeting summary includes the meeting agenda, attendance list, presentation materials, and questions and answers discussed at the meeting.

Public Meeting Number 2

A second public meeting was held on April 10, 2000 at the Lancaster City Council meeting held at the Olivedale Senior Center, Lancaster, Ohio. As with the first meeting, letters of invitation were sent to individuals and/or groups that had expressed interest in the Hocking River in the past. Three times as many letters were sent for Public Meeting No. 2 to increase public participation. In addition, the meeting was headlined in the local newspaper. A copy of the letter of invitation, the newspaper article, and the meeting summary are included in Appendix G. The meeting summary includes the meeting agenda, the meeting attendance list, the presentation materials, and questions and answers discussed at the meeting.

Malcolm Pirnie Inc. presented a brief summary of the Long-Term Control Plan development. The Long-Term Control Plan alternatives developed since the last public meeting were reviewed. The Sanitary Sewer Extension Evaluation was also presented. The recommended plan was presented along with anticipated costs per user. Public Meeting No. 2 did not result in any significant concern with the recommended LTCP alternatives nor its cost. There was no disagreement on the alternatives recommended for implementation.

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Previous Public Meetings

As part of the City's 1995 Wastewater Collection Evaluation Project, there have been several public meetings to discuss the Lancaster Wastewater Collection System, in addition to those held for the combined sewer system. The most significant concern of the public that was received from these meetings was the occurrence of flooded basements. It was determined that there are several areas which have a history of flooded basements. Thus, basement flooding will be considered when evaluating Long-Term Control Plan alternatives.

5.3.3 Ohio EPA Coordination

The regulatory agency responsible to review and approve the Lancaster Combined Sewer System Long-Term Control Plan is the Ohio Environmental Protection Agency, Central District Office (CDO). During the development of the Long Term Control Plan, the CDO was kept informed of project milestones and their input was received at several key stages of the project.

Monitoring Plan

As required by City's NPDES permit, a monitoring plan was prepared to support the following:

- ▶ Implementation of the Nine Minimum Controls
- ▶ Characterization of the Combined Sewer Systems
- ▶ Development of the Long-Term Control Plan.

To meet these goals, it was determined that a plan consisting of dry and wet weather monitoring of flows in the sewer system and sampling of combined sewer overflows was required. Later, it was concluded that bacteriological sampling of receiving streams and sampling of floatable and solids in combined sewer overflows was

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also required. All of the results from these monitoring and sampling efforts were submitted to the Ohio EPA with the *Combined Sewer System Operational Plan* in March 1998.

In addition to sampling combined sewer overflows and measuring sewer system flows, the City of Lancaster performed an aquatic life study of the CSO receiving streams. The sampling plan for the study was discussed with the Ohio EPA. Ohio EPA did not review the Aquatic Life Sampling plan but requested to be informed of the results.

A meeting with Ohio EPA CDO was held on February 25, 1999 before the Public Participation phase of the project to discuss the results of the aquatic life sampling. At this meeting, the Ohio EPA was given preliminary results from the 1998 aquatic life assessment of the Hocking River and tributaries. The proposed approach regarding sanitary sewer extensions, flow offsets, and LTCP development was also discussed at this meeting. A summary of the meeting is included in Appendix L. The Ohio EPA provided preliminary comments at the meeting on the information presented.

Public Participation

The Ohio EPA suggested holding the public meeting coincident with an already established public meeting. They had found that public meetings devoted solely to combined sewer issues tended to draw fewer number of participants than meetings that were held at regularly scheduled times. As a result, the Long-Term Control Plan public meetings were scheduled to coincide with the regularly scheduled Lancaster City Council meetings.

In addition to standard newspaper advertisement of public meetings the Ohio EPA suggested that feature articles in the local paper would be effective. The local paper featured news items announcing both meetings (see Appendices F and G).

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Lastly, the Ohio EPA suggested sending individual invitations to parties that had expressed interest in Lancaster area streams. This included a local watershed group, the Upper Hocking Advisory Group, Lancaster City officials, Fairfield County officials, teachers, private citizens and local industries. Copies of the invitation lists are provided in Appendices F and G.

5.3.4 Sensitive Areas

In the Ohio EPA's March 1995 Combined Sewer Overflow Control Strategy, three types of receiving waters were identified as governing the content of a Long-Term Control Plan. These waters were:

- ▶ State Resource Waters
- ▶ Bathing Waters
- ▶ Surface Waters within 500 yards of a Public Water Supply

The concern with these types of waters is consistent with the definition of "sensitive areas" found in the August 1995 United States Environmental Protection Agency publication, *Combined Sewer Overflows - Guidance for Long Term Control Plan*, which is repeated below for reference.

"...Outstanding National Resource Waters, National Marine Sanctuaries, waters with threatened or endangered species and their habitat, waters supporting primary contact recreation (e.g., bathing beaches), public drinking water intakes or their designated protection areas, and shellfish beds."

In the USEPA document, the concern with "primary contact" was identified as "bathing beaches," similar to the Ohio EPA's area of concern. Therefore, Lancaster CSOs do not discharge to sensitive areas.

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5.3.5 Recreational Uses

The existing recreational use of the receiving waters in the Lancaster area is primarily wading with some fishing possible at bridges in the lower portion of the Hocking River (between the confluences with Hunters Run and Baldwin Run). In this section, there are few naturally occurring pools where swimming and full-body contact can occur. This limited stream use is due primarily to the shallow nature of the streams. Based on data collected at the time of the 1998 aquatic survey, the Hocking River had average depths between 6 and 24 inches while Baldwin Run had average depths of one to two inches. Baldwin Run tributaries (Fetters Run and Ewing Run) had average depths of 8 and 10 inches respectively at the time of sampling. Below is a summary of the use of each receiving stream in the CSO area:

Hocking River

- ▶ From Ety Road to WPCF: Public access to the river is possible from four parks in this section. These are Hocking Park near Pierce Avenue, Miller Park near 6th Avenue, Maher Park near S. Broad Street, and Cenci Park near US33. Additional access can be gained from private property. Fishing occurs where access is possible, although use of the stream is primarily wading. Some pools exist between S. Broad Street and the WPCF where fishing and wading or swimming can occur.

Hunters Run

- ▶ From City limits to the confluence with the Hocking River: Access is possible from Olivedale Senior Center (Lincoln Avenue & City limit), Martens Park (Lincoln Avenue & Pierce Avenue), and private property. Use of the stream is primarily wading.

Baldwin Run

- ▶ From the confluence of Fetters Run/Ewing Run to confluence with the Hocking River: Access is possible from Mary Burnham Park (Cherry Street and Chestnut Avenue) and private property. Use of the stream is primarily wading.

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Fetters Run

- ▶ From Stringtown Road to the confluence with Baldwin Run: Access is possible from Lanreco Park (6th Avenue & Cherry Street) and private property. Use of the stream is primarily wading.

Ewing Run

- ▶ From Rainbow Drive to the confluence with Baldwin Run: Access is possible from Huffer-Durbin Park (James Road & Huffer Avenue). Additional access to Ewing Run can be gained from public and private property adjacent to the stream. Use of the stream is primarily wading.

Conclusion

The Hocking River through the City of Lancaster is not heavily used by the public or by business or industry. Use of the Hocking River and its tributaries within the City is limited to fishing, primary at bridges. The public is known to wade in the local streams at random times near public parks, although access to the streams is not intentionally provided (i.e., boat ramps or beaches) or convenient. Boating, canoeing, swimming, and wind surfing are not common on the Hocking River or its tributaries near the combined sewer area.

There are no facilities in the City of Lancaster specifically for public use of local streams for recreational purposes. There are two canoe liveries located downstream in Logan, Ohio. Both Liveries enter the Hocking River at the town of Rockbridge, approximately twelve miles downstream from Lancaster on the Hocking River.

The recreational uses of the streams in the Lancaster area include no bathing beaches or other sensitive areas. Lancaster CSOs are not a pervasive threat to the identified recreational uses.

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5.4 Development of Alternatives

5.4.1 Introduction

The following CSO-related issues have been identified for consideration in development of the Long-Term Control Plan:

Water Quality (Ref. Chapter 3)

- ▶ Hocking River: Non-Attainment of water quality standards upstream of the WPCF. This impact is likely due to a dry weather overflow (CSO 1005) and/or CSO discharge (CSOs 1005, 1006, and 1031).
- ▶ Baldwin Run: Non-Attainment to Partial Attainment due to habitat modifications. Some possible impact from CSOs (CSO 1019 and 1029).

Sanitary Sewer Extensions Evaluation (Ref. Chapter 4)

- ▶ Hocking River: Increased CSO volume above the 1995 baseline volume due to projected increases in sanitary sewer system flows.
- ▶ Baldwin Run: Increased CSO volume above the 1995 baseline volume due to projected increases in sanitary sewer system flows.

Under the Presumptive Approach, the water quality issues will be addressed by capturing 85% of the combined sewage generated.

The Sanitary Sewer Extension Evaluation issues (i.e., increased overflows) will be addressed by selecting alternatives that reduce CSO volumes such that there is no net increase of CSO volume above the 1995 baseline volume due to new sanitary sewer flow.

5.4.2 General

The various types of alternatives that can be used to meet LTCP goals fall into the following three basic categories:

- ▶ Source controls.
- ▶ Collection system controls.
- ▶ Storage/treatment technologies.

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Source Controls

Source controls or Best Management Practices (BMPs) are low cost controls that typically involve educating the public about pollution and enhancing current pollution prevention practices. Examples of BMPs are provided in Figure 5-1. Public education is already part of the Lancaster Combined Sewer System Operational Plan. None of the CSO-related issues identified can be addressed by source controls.

Collection System Controls

Collection system controls are relatively inexpensive alternatives designed to achieve Long-Term Control Plan goals. These alternatives typically consist of modifying the existing collection system to enhance system storage and reduce CSO volume. Examples of collection system controls are shown in Figure 5-1.

Storage/Treatment Technologies

Storage/Treatment technologies are usually the most expensive alternatives, but they also provide the most treatment. These alternatives typically involve the construction of storage basins and/or treatment facilities. Examples of storage/treatment technologies are provided in Figure 5-1.

5.4.3 Alternative Screening

The Long-Term Control Plan alternatives shown in Figure 5-1 were screened to eliminate those alternatives that were not applicable to the City of Lancaster's situation. Alternatives were eliminated for various reasons as follows:

- ▶ The alternative was already incorporated to the maximum practical extent in the City of Lancaster's existing operation. These are noted in Figure 5-1.
- ▶ The technology was new and unproven or unreliable and other more conventional technologies were available.

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- ▶ The initial capital costs were prohibitive based on the experience of other CSO communities.
- ▶ The operation and maintenance costs for the alternative appeared too high based on the experience of other CSO communities.
- ▶ The technology provides greater treatment or performance than required for the City's situation.

As shown in Figure 5-1, the following control options were selected for investigation:

- ▶ In-Line Storage
- ▶ Off-Line Storage
- ▶ Sewer Separation

Although not practical, complete elimination of CSOs will be investigated: It will provide an upper limit for analyzing the relative costs of CSO alternatives.

Each alternative will be reviewed for its ability or contribution to achieving the goals established for the Long-Term Control Plan, i.e., 85% capture of all combined sewage as well as reduce CSO volumes to allow for future growth must be achieved.

5.5 Alternative Development

5.5.1 In-Line Storage

Based on experience with the combined sewer system gained through flow monitoring, modeling and City operation and maintenance activities, it was determined that the following projects could be used to increase storage in the system:

- ▶ Abandon CSOs 1005 and 1010.
- ▶ Raise Weirs in CSOs 1019 and 1029.
- ▶ Clean the 27-inch Hocking-West Interceptor.

CSO 1005 & CSO 1010

CSO 1005 was targeted due to its low weir elevation and high volume of overflow. It accounts for over 40% of the CSO volume discharged to the Hocking River. CSO 1010 was included because it was found to be a source of inflow.

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As noted previously, CSO 1005 is prone to dry weather overflows. Due to past difficulties with preventing dry weather overflows from this structure, complete abandonment was considered for CSO 1005. Conversely, CSO 1010 did not act as a relief structure, rather river water flowed into the collection system (inflow). Thus, it too was considered for abandonment.

It was shown in computer model simulations of closing CSOs 1005 and 1010 that approximately 12 million gallons/year and 700,000 gallons/year respectively of CSO discharge to the Hocking River could be eliminated. This is summarized in Figure 5-2. Both projects have been completed within the City's existing sewer maintenance budget.

CSO 1019 and 1029

During flow monitoring and modeling, it was observed that both structures overflowed during small rain events. This had two implications related to the goals of the Long-Term Control Plan:

- ▶ The structures provide little storage of CSO volume.
- ▶ During small storms, when flow in the Baldwin Run has not increased significantly, the first flush from these structures may have an impact on the water quality of the Baldwin Run.

These CSOs actuate frequently and are upstream of areas found in Partial Attainment of water quality standards. Raising the weir in these CSOs will reduce CSO discharges, especially during small rain events when streams may be impacted most by CSO discharges. As discussed in Chapter 3, Baldwin Run has habitat issues that also contribute to lack of attainment of water quality standards. It should be emphasized that the goal of the Long-Term Control Plan is to remove the water quality impacts related to CSOs and not those related to poor habitat conditions.

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It was shown in computer simulations that modifying the weirs at CSO 1019 and 1029 would reduce discharges to the Baldwin Run by approximately 13 million gallons/year. This is summarized in Figure 5-2 along with estimated costs.

As discussed previously, solids and floatables were observed by the Ohio EPA during their 1995 water quality monitoring work. Although not an action item, the City of Lancaster will also include some floatable control with this alternative to reduce floatables in the lower Baldwin Run, near Mary Burnham Park. This will support the City's implementation of the required Combined Sewer System Nine Minimum Controls.

27-Interceptor

The City had found that the 27-inch Hocking-West Interceptor was nearly full of sediment. This had been caused by backwash practices from the Miller Park Water Treatment Plant. These practices have since been stopped. Flow normally carried by this interceptor was being transported by the parallel 36-inch Hocking-West interceptor. The computer model was calibrated with the 27-inch interceptor plugged, which was the actual condition during flow monitoring.

Model simulations were run to determine what impact cleaning the 27-inch interceptor would have. The result was a reduction in annual CSO volumes of approximately 786,000 gallons/year as shown in Figure 5-2. This work has already been complete within the City's existing sewer maintenance budget.

Basement Flooding

To fully evaluate the In-Line Storage alternative, the hydraulic gradeline in the system was evaluated to verify raising these weirs and CSO abandonment did not increase basement or street flooding. Due to the potential for basement flooding, computer model simulations were used to estimate the storage available in the existing trunk sewers without creating street or basement flooding conditions. For these

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simulations, CSO 1005 and CSO 1010 were abandoned, the weir elevation at CSO 1019 was raised 1.0 feet, and the configuration of CSO 1029 was revised to eliminate the leaping weir.

A comparison of the hydraulic gradeline (HGL) is provided in Appendix H for the four typical annual storms and a 10-year storm. The HGL comparison in Appendix H is for the existing system and the future system after additional sanitary sewer flows have been added and the recommended Long-Term Control Plan alternatives have been implemented. Based on this analysis, the following conclusions can be made:

- ▶ This alternative should not cause any dry weather overflows.
- ▶ This alternative should not create any basement or street flooding.

5.5.2 Off-Line Storage with Treatment

In this alternative, the construction of off-line storage basins near CSOs 1005 and 1019 is proposed. Off-line storage basins inherently provide primary treatment due to the retention time provided by the tanks. It was assumed that covered basins could be constructed near CSOs 1005 (Hocking River) and 1019 (Baldwin Run). The initial criteria used for sizing the basins was provision of at least 30 minutes of detention for all CSO before discharge to the river. The detention time was based on the peak CSO flow that would result from the largest standard typical storm. A second criteria for sizing the storage basins was provision of sufficient volume that would result in at least 15% total annual CSO volume reduction for the associated drainage basin (Hocking River or Baldwin Run). The criteria that resulted in the larger total CSO volume reduction was used to size the basins. The resulting storage basin volumes were:

- ▶ Hocking River Basin: 320,000 gallons
- ▶ Baldwin Run Basin: 290,000 gallons

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As shown in Figure 5-2, this alternative would provide a reduction in CSO discharge volume of 22 million gallons per year or 35% of the existing annual CSO volume from all CSOs tributary to the Baldwin Run and a reduction 7.7 million gallons per year or 15% of the existing annual CSO volume from all CSOs tributary to the Hocking River. The associated costs are also summarized in Figure 5-2.

5.5.3 Sewer Separation

In this alternative, sewer separation in Baldwin Run and Hocking River drainage basin areas where a history of basement flooding exists was evaluated.

For the sewer separation alternative, it was assumed that new storm sewers would be installed next to the existing combined sewer at a minimum depth of cover to capture existing stormwater sources. Clear water sources such as roof drains and street curb inlets would be connected to the new storm sewer. Due to the difficulty in removing all I/I sources, only 75% removal of stormwater from the combined sewer was assumed. It was assumed that the remaining 25% of the stormwater would remain in the combined sewer system.

Previous sewer studies were used to develop the sewer separation alternatives. Sewer separation had been identified in a previous study as an alternative to reduce basement flooding. The previous study, the City of Lancaster *Sewer System Capacity Evaluation Report - DRAFT* June 1997, was part of the City's 1995 Wastewater Collection Evaluation project. A summary of alternatives from the *Sewer System Capacity Evaluation Report* is provided in Table 5-1.

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**TABLE 5-1
SEWER SEPARATION ALTERNATIVE RANKING⁽¹⁾**

Sewer Separation Alternative	Reported Flooded Basements	Change in Surcharged Pipe (2,3) (Ft)	Change in CSO Volume (2) (Gallons)
Existing Situation	876		
Lake/Allen/Maple Streets (Alt. 1)	152	12,040	2,770,070
Chestnut Street (Alt. 2)	14	1,433	2,168,101
5th Street (Alt. 3)	18	1,190	9,245
Madison Street (Alt. 4)	23	0	625,927
Wyandot Street (Alt. 12)	0	0	Incl. w/ Alt. 4

1. Rankings taken from the *Sewer System Capacity Evaluation Report -DRAFT*, June 1997. Only Combined Sewer area projects shown.
2. Performance relative to Surge Sewer and CSO Volume Reduction are based model simulations of a 10-Year Storm (2.4-inches/5 hours)
3. Surcharged Pipe Used to Estimate Reduction in Flooded Basements

As shown in Table 5-1, it was indicated in the *Sewer System Capacity Evaluation Report* that the Lake/Allen/Maple Street sewer separation project to be the best alternative. It had the greatest CSO volume reduction and flooded basement reduction of all alternatives. The Chestnut Street sewer separation project also has potential to reduce CSO discharges. However, it had little impact on basement flooding. Thus, as will be discussed later, it was eliminated from further consideration as a Long-Term Control Plan alternative.

Coincidentally, another sewer separation project was completed in the downtown area of the City of Lancaster. The project was part of a downtown revitalization project and not directly driven by water quality or flooded basement issues. Sufficient funding was not included in the revitalization project to complete the separation. This Downtown alternative consists of a project in which a storm sewer would be constructed that would discharge the separated storm flow directly to the Hocking River instead of back to the combined sewer system.

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In computer simulations of the Downtown and the Lake/Allen/Maple Street sewer separation projects, it was shown that net reductions in CSOs to the Hocking River of approximately 16 million gallons/year would occur. These projects are included in Figure 5-2 along with estimated costs.

5.5.4 Total CSO Discharge Elimination

The goal of this alternative was to estimate the cost of eliminating large and frequent CSO discharges to the Baldwin Run and the Hocking River by eliminating approximately 80% of all CSO discharges to the Lancaster receiving streams.

For the Baldwin Run, this was accomplished with one equalization basin in the vicinity of CSO 1019. For the Hocking River, several small equalization basins throughout the system were required. The CSO structures identified in a preliminary screening to be included in this alternative were: CSOs 1004, 1005, 1006, 1008, 1012 and 1033. These overflows were selected due to their proximity to open land and because they account for approximately 80% of all CSO volume discharged to the Hocking River. It was assumed that covered basins could be constructed near the respective CSOs and that flows would be discharged back into the system within 24 hours. In addition, it is assumed that no other precipitation begins before the basin emptied.

The volume discharged from the CSO structures for the largest typical annual storm was used to size the basins. As shown in Figure 5-2, this alternative would result in the elimination of 91 million gallons of CSO discharge to the Hocking River and Baldwin Run and would cost over \$65 million dollars.

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5.6 Alternative Evaluation

5.6.1 Rating and Ranking of Alternatives

A summary of the ratings and the resultant ranking of the alternatives is provided in Figure 5-3. Each alternative was scored according to the following criteria categories:

- ▶ Capital Costs.
- ▶ O&M Cost.
- ▶ CSO Volume Reduction.
- ▶ Support NMCs.
- ▶ Environmental Benefit.
- ▶ Public Input.

Each alternative was assigned a scoring value between zero and ten for each criteria category to reflect its relative fulfillment of the given criteria category. After the alternatives were scored, a weighting factor was applied to each criteria category with the more important criteria category receiving the larger weighting factor. The weighting factors for the various criteria categories are discussed below.

For each alternative, the scoring value for each criteria category was multiplied by the weighting factor of the associated criteria category. The resulting products for the criteria categories were then summed to obtain the total score for that alternate. Using this rating process, the alternatives with the higher total score values are determined to be more desirable than alternatives with lower total values.

5.6.2 Costs

Project costs were developed for each alternative. The capital cost includes construction, land acquisition, engineering, administration, and contingency costs. The operation and maintenance (O&M) costs were also estimated. Operation and maintenance costs associated with the sewer separation include catch basin and sewer cleaning.

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The present worth and annualized costs for each alternative are shown in Figure 5-2. Present worth and annualized costs were calculated using an interest rate of 6% and a project life of 20 years. The equalization basins have large capital costs due to land requirements, equipment requirements and construction costs.

The Capital Cost and the O&M Costs criteria categories were both assigned a weighing factor of 10 because of the associated impact on the citizens of Lancaster.

5.6.3 Performance and Non-Monetary Factors

It is recognized in the Long-Term Control Plan process that there are factors other than cost to consider when analyzing different alternatives. Such factors can be summarized as performance or non-monetary factors. It is recognized that different alternatives may achieve different goals or achieve ancillary goals, not directly related to the project, but still positive. However, each alternative must include contribution to achieving the primary goals of the Long-Term Control Plan.

The selected performance criteria category is CSO Volume Reduction. In this category, the highest score was not necessarily given to the alternative that resulted in elimination of the most CSO. Rather, a high score was awarded if implementation of an alternative would, alone or in combination with other alternatives, result in achievement of the Long-Term Control Plan goal of 85% capture. If this goal could be achieved through implementation of a single alternative, that alternative would receive a higher score than those alternatives that were required to be combined with other alternatives.

This criteria category was assigned a weighting factor of 10 since it is critical to the success of the Long-Term Control Plan.

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The following non-monetary factors were also considered:

- ▶ Support of Nine Minimum Controls.
- ▶ Environmental Benefit.
- ▶ Public Input.

Support of Nine Minimum Controls

The Nine Minimum Controls (NMCs) have been implemented by the City of Lancaster in order to properly operate and maintain the combined sewer system. Implementation of the Long-Term Control Plan alternatives can help or hinder the NMCs. For example, implementation of an alternative that would result in reduction of CSO volume but that would create significant maintenance problems, could be scored lower than implementation of an alternative that would result in reduction of a known maintenance problem in the combined sewer system.

Two opportunities have been identified in which implementation of the Long-Term Control Plan can improve implementation of the NMCs.

These are:

- ▶ Eliminate or modify CSOs 1005 and 1029 to eliminate nuisance dry weather overflow occurrences.
- ▶ Include floables control with proposed modifications to CSO 1019.

Environmental Benefit

In this category, it is recognized that some alternatives may provide more environmental benefit than others, though all meet the Long-Term Control Plan goals. An example of this would be the additional solids removed by off-line storage tanks. The retention time in these tanks can be equivalent to primary treatment. Thus, there is an additional reduction of pollution to the receiving stream which is a positive benefit. However, the settlement of solids in the tanks would result in increased operation and maintenance costs assigned to these alternatives. On the other hand, In-Line Storage alternatives were considered to have less environmental benefit and were assigned a

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lower score (5 versus 8 for Off-Line Storage) because significant detention times for treatment cannot be achieved.

This category was assigned a weighting factor of 5 since it was not essential to the Long-Term Control Plan.

Public Input

This category was added to allow consideration of public opinion regarding a particular alternative. As discussed previously, the primary public input received by the City was in regards to flooded basements. This category was given a weighting factor of 5 since it, although desirable, was not a primary goal of the Long-Term Control Plan.

5.6.4 Conclusions

As shown in Figure 5-3, the In-Line Storage alternatives ranked the highest (Ranks 1, 2 & 3). This was due primarily to their low cost. It is also shown in Figure 5-3 that Sewer Separation (Ranks 4 and 5) and Off-Line Storage alternatives (Ranks 6 and 6) are both favorable options for the City of Lancaster's Long Term Control Plan.

In order of preference, the following alternatives will be considered in development of the Long-Term Control Plan:

- ▶ In-Line Storage
- ▶ Sewer Separation (Lake/Allen/Maple Street and Downtown)
- ▶ Off-Line Storage (Equalization Basins)

The Chestnut Street Sewer separation ranked fairly high and may be a desirable project. However, it relieves few flooded basements relative to other sewer separation projects. The CSO Discharge Elimination alternatives ranked fairly low due to their high cost. Their environmental benefit, however were very good.

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5.7 Alternative Selection

As shown in Figure 5-3, there are several good alternatives available to the City of Lancaster. In order to select the recommended alternatives necessary to meet the Long-Term Control Plan goals, an iterative process was completed. It was recognized that the impact of implementation of two or more alternatives together would not necessarily equal the sum of the individual impacts if each alternative was implemented alone. The highest ranked alternative(s) was/were modeled to determine its/their impact on the collection system. Additional alternatives, based on the alternative ratings, were successively added to the model until the Long-Term Control Plan goals were met.

5.7.1 Percent Capture

The percent capture of each alternative or combination of alternatives was calculated for compliance with the Presumptive Approach. The Presumptive Approach, as stated in USEPA guidance documents, requires that the *"the elimination or capture for treatment of no less than 85% by volume of the combined sewage collected in the combined sewer system during precipitation events on a system wide annual basis."*

Since the Lancaster combined sewer system discharges into two distinct drainage basins (the Hocking River and the Baldwin Run), the Lancaster Long-Term Control Plan will apply the National CSO policy goal of 85% capture to each basin separately.

The percent capture was computed using output from the City's model of the collection system. Using the following formula, the percent capture was calculated, assuming that all flow treated at the WPCF during the rain event is "captured."

$$\% \text{ Capture} = 100 \times \frac{\text{volume of combined sewage treated at WPCF}}{\text{volume of combined sewage treated at WPCF} + \text{CSO Volume}}$$

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For purposes of this analysis, models of the smallest typical storm were run for 18 hours (simulated time). Larger rain events were run for simulation times of 24 and 30 hours in order to model the full impact of the rain.

5.7.2 Existing Conditions

During alternatives analysis, both the water quality goals and the anti-degradation goals of the Lancaster Long-Term Control Plan were considered. First, the existing conditions were established to determine if the existing system met the Long-Term Control Plan goals.

The percent capture of the existing system is shown in Figure 5-4 and is summarized below:

Existing System (1995)

<u>Collection Area</u>	<u>Percent Capture</u>
Total System	82.4
Baldwin Run	73.1
Hocking River	87.6
Goal	85.0

Water Quality Issues

As shown in Figure 5-4 and above, the existing Hocking River drainage basin percent capture is adequate to meet the Long-Term Control Plan goal of 85%. This is supported by the 1995 Ohio EPA sampling from which it was found that the Hocking River was in Full Attainment. It also supports the conclusion that the water quality impairment found during the City of Lancaster 1998 sampling was most likely due to the dry weather overflow.

The Baldwin Run is below the percent capture during existing and future conditions. This also supports the finding of the Ohio EPA 1995 sampling in which CSO impacts in the lower Baldwin Run were identified.

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Antidegradation Issues

As shown in Figure 5-4, the 1995 baseline annual CSO volumes for the Lancaster Long-Term Control Plan were 51.7 million gallons/year for the Hocking River and 61.7 million gallons/year for the Baldwin Run.

5.7.3. Future Conditions

As discussed in detail in Chapter 4, it is estimated that approximately 3.21 MGD of additional sanitary sewer flow will be added to the Lancaster sewer system by the year 2020 due to growth and development in Lancaster. The percent capture of the future system if no CSO or I/I reduction projects are implemented is shown in Figure 5-5 and is summarized below:

Future System (2020)

<u>Collection Area</u>	<u>Percent Capture</u>
Total System	81.5
Baldwin Run	77.4
Hocking River	83.6
Goal	85.0

Water Quality Issues

The percent capture of the existing Hocking River basin as shown in Figure 5-4 was 87.6%, which appears adequate. However, as shown in Figure 5-5, percent capture could drop to 83.6% due to future growth in the system.

The percent capture of the Baldwin Run drainage basin was less than 85% in both existing and future scenarios.

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Antidegradation Issues

As shown in Figure 5-4, the Hocking River 1995 baseline CSO volume was 51.6 million gallons/year. As shown in Figure 5-5, the CSO volume could increase to as much as 95.3 million gallons/year by the year 2020 due to additional sanitary sewer flow in the system.

The Baldwin Run 1995 baseline CSO volume was 61.7 million gallons/year (Figure 5-4). As shown in Figure 5-5, the CSO volume could increase to 66.4 millions gallons/year by the year 2020 due to additional sanitary flow in the system.

5.7.4 Drainage Basin Considerations

Based on the above analysis, alternative selected for the Lancaster Long-Term Control Plan will have different objectives for the two drainage basins. Although the objectives are related, the focus of their goals will be different.

It appears that 85% capture in the Hocking River drainage basin is readily attainable. As shown in Figure 5-5, even at future conditions with no improvements, the percent capture is 83.6%. However, despite relatively high capture rates, the Hocking River drainage basin will be well above the 1995 baseline CSO volumes due to projected future growth. The potential increase in annual CSO volume due to growth in the Hocking River drainage basin is 43.7 million gallons. This represents a 65% increase over the 1995 CSO baseline volumes. Therefore, alternatives that significantly reduce CSO volume must be selected for implementation in the Long-Term Control Plan. CSO volume reductions will allow additional sanitary flow while simultaneously decreasing CSO volume to the Hocking River in compliance with antidegradation goals. With implementation of these alternatives, the required 85% capture can be achieved since the basin is already very close to that goal under all scenarios.

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There are similar concerns with regard to the Baldwin Run drainage basin, although they are reversed in relative magnitude from the Hocking River. The Long-Term Control Plan approach to the Baldwin Run drainage basin will be driven more by compliance with the Presumptive Approach than by antidegradation concerns. The projected future increase in annual CSO volume by the year 2020 due to future development is anticipated to be relatively small at 4.7 million gallons. This is only a 7.6% increase over the 1995 baseline CSO volume. However, for the Baldwin Run, the 85% capture is not achieved for existing or future conditions. In Figures 5-4 and 5-5, it is shown that the Baldwin Run is well below the percent capture goal for both scenarios. Although the 1995 Ohio EPA sampling documented continued improvement in water quality in the Baldwin Run, additional CSO removal is necessary to remove CSO impacts from the stream and achieve water quality goals. Therefore, in selecting alternatives for the Baldwin Run, prioritization will be given to increasing CSO capture in order to increase the percent capture to 85%. Implementation of these alternatives will also reduce CSO volumes to below the 1995 baseline levels and thus achieve compliance with antidegradation goals.

5.7.5 Alternative Analysis

Model simulations were run that included the following in-system storage options.

- ▶ Clean the 27-inch Interceptor
- ▶ Modify Weirs at CSO 1019 and 1029
- ▶ Close CSOs 1005 and 1010

The percent capture of the combined sewer system was calculated for both drainage basins. The percent capture for both the Hocking River and the Baldwin Run exceeded 85%.

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In addition, the CSO discharge volumes of each basin were compared to the respective 1995 baseline CSO volumes. It was found that the Baldwin Run future CSO volume was less than the 1995 baseline CSO volume. However, the Hocking River 1995 baseline CSO volume exceeded in the year 2020.

In accordance with the alternative screening and selection process, sewer separation projects were added to the Long Term Control Plan. The Lake/Allen/Maple Street sewer separation project and the Downtown sewer separation project were added to the computer simulation. These two were selected since they decreased CSO discharge to the Hocking River.

The model of this combination of alternatives was successful in achieving the Long-Term Control Plan goals. The final percent capture calculations for the Baldwin Run and Hocking River are shown in Figure 5-6. Chronological timelines of the net impact of the selected alternatives and the annual CSO discharge volumes relative to the 1995 CSO baseline volumes are shown in Figures 4-11 and 4-12 of Chapter 4.

5.8 Financial Capability

The success of the implementation of the Long-Term Control Plan is dependent upon the City's ability to fund the project. The total revenue for the City of Lancaster Water Pollution Control Department for the 1999 calendar year was approximately \$5,245,000 dollars. This total includes Water Pollution Control Facility operation, sewer maintenance, sewer administration and debt retirement. The City uses an "enterprise" fund accounting to finance its sewage collection and treatment operations. All costs are paid by the fees charged, proportionally, to users. Currently, the Lancaster sewer system has approximately 13,000 users (or customers).

As reported in a recent survey of 312 Ohio communities, the average annual sewer fees in Ohio were \$388. The current average annual fee for the City of Lancaster is \$402. Thus, Lancaster's current rate structure appears to be reasonable. However, if the

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recommended alternative is implemented immediately, an increase of more than 12% in existing users fees would be required. This would be in addition to the scheduled 5% annual fee increase that finances existing debt and operation and maintenance cost increases and would result in a total increase of 17 percent.

In the 1990 census, it was reported that the City of Lancaster's median income was in the low-to-moderate income bracket. Thus, a user fee increase of 17% is significant. The Long-Term Control Plan must take into account the impact it will have on the citizens of Lancaster.

To address the financial capability of the City to implement the recommended alternatives, the following items will be included as part of the Long-Term Control Plan:

- ▶ Implementation of the selected alternatives over a 20-year period (2000 to 2020) to ease the impact of user fee increases.
- ▶ Pursuance of grants and state revolving loan funds when available.
- ▶ Revision of the Long-Term Control Plan if additional water quality sampling or other data suggests changes are necessary, even if that means reduced projects.

The impact of user fees and the implementation schedule of the recommended alternative will be discussed in more detail in Chapter 6.

++ END OF CHAPTER 5 ++

**FIGURE 5-1
LANCASTER COMBINED SEWER SYSTEM
LONG-TERM CONTROL PLAN
ALTERNATIVE SCREENING**

Control Options	Part of Existing O&M Program
Source Controls (Including Best Management Practices or BMPs)	
1.0 Flow Detention	
2.0 Area Drain/Roof Leader Disconnection	X
3.0 Infiltration Ponds	
4.0 Solid Waste Management	
4.1 Public Education Programs	X
5.0 Street Sweeping	X
6.0 Catch Basin Cleaning	X
7.0 Commercial/Industrial Runoff Control	
8.0 Household Hazardous Waste Program	X
Collection System Controls	
1.0 Regular Sewer Cleaning	X
2.0 Maximize Use of Sewer System	X
3.0 Sewer Separation	
4.0 Infiltration/inflow Control	
4.1 Replace Perforated Manhole Covers	
4.2 Restrict Flow at Catch Basins	
5.0 Flow Diversion	
6.0 Real Time Control	
Storage / Treatment Technologies	
1.0 In-Line Storage	
1.1 Weir Modification	
1.2 CSO Abandonment	
1.3 Install Flap Gates	X
2.0 Off-Line Storage	
3.0 Deep Tunnels	
4.0 Swirl/Vortex Technology	
5.0 Disinfection/Dechlorination	
6.0 Wetland Storage and Treatment	
7.0 Sedimentation Devices	
8.0 In-System Aeration to Increase Dissolved Oxygen	

 Selected Alternatives

**FIGURE 5-2
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
ALTERNATIVE SUMMARY**

Alternative	CSO Volume Reduction (1,2)		Project Costs		Total Present Worth of Project Costs (\$)
	Hocking River (gal/yr)	Baldwin Run (gal/yr)	Total Capital Costs (\$)	Annual O&M Costs (\$/Year)	
In-Line Storage					
Abandon CSO 1005 & 1010	12,700,000		\$0	\$0 (1)	\$0
Raise Weir at CSOs 1019 & 1029		13,000,000	\$149,500	\$7,400	\$252,400
Clean 27-inch Interceptor	786,000		\$0	\$0 (1)	\$0
Off-Line Storage w/Treatment					
Hocking River Equalization Basin (CSO 1005)	7,700,000		\$3,500,000	\$67,000	\$4,268,500
Baldwin Run Equalization Basin (CSO 1019)		21,900,000	\$3,200,000	\$64,400	\$3,938,700
Sewer Separation					
Lake / Allen/ Maple Street	13,600,000		\$3,400,000	\$3,600	\$3,441,300
Downtown	2,500,000		\$1,600,000	\$1,000	\$1,611,500
CSO Discharge Elimination					
Hocking River Equalization Basin	40,500,000		\$25,200,000	\$162,000	\$27,058,100
Baldwin Run Equalization Basin		50,600,000	\$40,100,000	\$200,400	\$42,398,600

- (1) Within Existing Budget
- (2) All volume estimates are based on computer simulations of individual improvements
- (3) Volume reductions are relative to existing system annual CSO discharges (1996)

**FIGURE 5-3
LANCASTER COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
ALTERNATIVE RATING**

Alternative	CSO Volume Reduction	Capital Cost	O&M Costs	Support NMCs	Environmental Benefit	Public Input	Total Score	Alternative Rank
Weighting Factor	10	10	10	5	5	5		
Scoring Value Range	1-10	1-10	1-10	1-10	1-10	1-10		
In-Line Storage								
Abandon CSOs 1005 & 1010	5	10	10	10	5	0	325	1
Raise Weirs CSOs 1019 & 1029	5	10	8	10	5	0	305	3
Clean 27-inch Interceptor	4	10	10	10	5	0	315	2
Off-Line Storage								
CSO 1005 Equalization Basin-Hocking River	6	5	5	10	8	0	250	6
CSO 1019 Equalization Basin-Baldwin Run	6	5	5	10	8	0	250	6
Sewer Separation								
Lake/Allen/Maple Sts. Separation	8	5	10	0	0	10	280	4
Chestnut Street Sewer Separation	8	5	10	0	0	3	245	8
5th/Broad Sewer Separation	1	5	10	0	0	5	185	12
Madison Street Sewer Separation	3	5	10	0	0	5	205	9
Wyandot Street Sewer Separation	3	5	10	0	0	0	180	13
Downtown Sewer Separation	4	8	10	0	0	10	270	5
CSO Discharge Elimination								
Hocking River Equalization Basin	10	0	0	10	10	0	200	10
Baldwin Run Equalization Basin	10	0	0	10	10	0	200	10

**FIGURE 5-4
CITY OF LANCASTER LONG-TERM CONTROL PLAN
EXISTING SYSTEM PERCENT CAPTURE - 1995**

Total System

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	657,090			4,915,033	304,732,058
Rain2	12.5		1,291,102		9,657,443	120,718,037
Rain3	5.22		1,580,902		11,825,147	61,727,267
Rain4	2.87			2,120,790	15,863,509	45,528,271
Annual Volume						532,705,634

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	41,577	310,996	19,281,759
Rain2	12.5	272,396	2,037,522	25,469,026
Rain3	5.22	842,223	6,299,826	32,885,091
Rain4	2.87	1,574,025	11,773,708	33,790,542
Annual Volume				111,426,417
Final Adjusted Volume				113,397,417

**Total System
Percent Capture**

% Capture = 82.4
% Required = 85.0

Baldwin Run

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	208,133			1,556,835	96,523,760
Rain2	12.5		398,503		2,980,802	37,260,031
Rain3	5.22		495,903		3,709,354	19,362,830
Rain4	2.87			666,258	4,983,610	14,302,960
Annual Volume						167,449,581

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	36,327	271,722	16,846,778
Rain2	12.5	169,270	1,266,140	15,826,745
Rain3	5.22	386,023	2,887,452	15,072,500
Rain4	2.87	643,550	4,813,755	13,815,477
Annual Volume				61,561,499
Final Adjusted Volume				61,732,499

**Baldwin Run
Percent Capture**

% Capture = 73.1
% Required = 85.0

BASELINE CSO VOLUME

Hocking River

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	448,847			3,357,376	208,157,285
Rain2	12.5		892,990		6,679,565	83,494,565
Rain3	5.22		1,085,790		8,121,709	42,395,322
Rain4	2.87			1,455,194	10,884,851	31,239,523
Annual Volume						365,286,694

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	5,251	39,274	2,434,981
Rain2	12.5	103,126	771,382	9,642,281
Rain3	5.22	456,200	3,412,374	17,812,591
Rain4	2.87	930,475	6,959,953	19,975,065
Annual Volume				49,864,918
Final Adjusted Volume				51,664,918

**Hocking River
Percent Capture**

% Capture = 87.6
% Required = 85.0

BASELINE CSO VOLUME

WPCF = Flow Treated at the Water Pollution Control Facility
WWF = Wet Weather Flow Treated at the Water Pollution Control Facility
CSO Volume = Combined Sewer Overflow Volume Discharged to Receiving Streams

**FIGURE 5-5
CITY OF LANCASTER LONG-TERM CONTROL PLAN
FUTURE SYSTEM PERCENT CAPTURE - 2020
(With No CSO and I/I Reduction Improvements)**

Total System

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	938,988			7,023,630	435,465,075
Rain2	12.5		1,635,788		12,235,694	152,946,178
Rain3	5.22		1,850,588		13,842,398	72,257,319
Rain4	2.87			2,437,924	18,235,672	52,336,377
Annual Volume						713,004,949

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	87,122	651,670	40,403,555
Rain2	12.5	396,847	2,968,416	37,105,195
Rain3	5.22	1,090,281	8,155,300	42,570,664
Rain4	2.87	1,941,869	14,525,181	41,687,269
Annual Volume				161,766,682

**Total System
Percent Capture**

% Capture = 81.5
% Required = 85.0

Baldwin Run

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	296,210			2,215,651	137,370,350
Rain2	12.5		520,510		3,893,415	48,667,685
Rain3	5.22		611,210		4,571,851	23,865,061
Rain4	2.87			809,517	6,055,187	17,378,387
Annual Volume						227,281,483

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	40,682	304,301	18,866,684
Rain2	12.5	178,300	1,333,684	16,671,050
Rain3	5.22	410,520	3,070,690	16,029,000
Rain4	2.87	693,240	5,185,436	14,882,201
Annual Volume				66,448,935

**Baldwin Run
Percent Capture**

% Capture = 77.4
% Required = 85.0

Hocking River

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	642,499			4,805,893	297,965,336
Rain2	12.5		1,115,699		8,345,429	104,317,857
Rain3	5.22		1,238,699		9,265,469	48,365,746
Rain4	2.87			1,638,240	12,254,035	35,169,081
Annual Volume						485,818,019

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	46,440	347,369	21,536,871
Rain2	12.5	218,547	1,634,732	20,434,145
Rain3	5.22	679,761	5,084,610	26,541,664
Rain4	2.87	1,248,629	9,339,745	26,805,068
Annual Volume				95,317,747

**Hocking River
Percent Capture**

% Capture = 83.6
% Required = 85.0

WPCF = Flow Treated at the Water Pollution Control Facility
WWF = Wet Weather Flow Treated at the Water Pollution Control Facility
CSO Volume = Combined Sewer Overflow Volume Discharged to Receiving Streams

**FIGURE 5-6
CITY OF LANCASTER LONG-TERM CONTROL PLAN
FUTURE SYSTEM PERCENT CAPTURE - 2020**

Total System

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	988,350			7,392,858	458,357,196
Rain2	12.5		1,754,350		13,122,538	164,031,725
Rain3	5.22		1,976,350		14,783,098	77,167,772
Rain4	2.87			2,586,570	19,347,544	55,527,450
Annual Volume						755,084,143

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	7,470	55,876	3,464,290
Rain2	12.5	185,012	1,383,890	17,298,622
Rain3	5.22	801,075	5,992,041	31,278,454
Rain4	2.87	1,569,535	11,740,122	33,694,151
Annual Volume				85,735,518

**Total System
Percent Capture**

% Capture = 89.8
% Required = 85.0

Baldwin Run

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	315,789			2,362,102	146,450,307
Rain2	12.5		568,289		4,250,802	53,135,022
Rain3	5.22		637,889		4,771,410	24,906,759
Rain4	2.87			825,374	6,173,798	17,718,799
Annual Volume						242,210,886

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	7,073	52,906	3,280,174
Rain2	12.5	79,582	595,273	7,440,917
Rain3	5.22	298,670	2,234,052	11,661,749
Rain4	2.87	557,490	4,170,026	11,967,974
Annual Volume				34,350,815

**Baldwin Run
Percent Capture**

% Capture = 87.6
% Required = 85.0

Hocking River

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	672,417			5,029,679	311,840,108
Rain2	12.5		1,186,817		8,877,391	110,967,390
Rain3	5.22		1,339,817		10,021,831	52,313,959
Rain4	2.87			1,761,555	13,176,431	37,816,358
Annual Volume						512,937,814

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	397	2,970	184,116
Rain2	12.5	105,430	788,616	9,857,705
Rain3	5.22	502,405	3,757,989	19,616,705
Rain4	2.87	1,012,045	7,570,097	21,726,177
Annual Volume				51,384,703

**Hocking River
Percent Capture**

% Capture = 90.9
% Required = 85.0

WPCF = Flow Treated at the Water Pollution Control Facility
 WWF = Wet Weather Flow Treated at the Water Pollution Control Facility
 CSO Volume = Combined Sewer Overflow Volume Discharged to Receiving Streams

6

Chapter 6.0 - Selection and Implementation of the Long-Term Control Plan

6.1 Selection of Recommended Plan

6.1.1. Introduction

The City of Lancaster Long-Term Control Plan established the following objectives:

- ▶ Eliminate water quality impacts in receiving streams by capturing for treatment 85% by volume of combined sewage collected in the Combined Sewer System.
- ▶ Allow for future growth in the Lancaster sewer system by eliminating sufficient CSO volume to keep CSO volumes at or below existing levels.

Wastewater from the Lancaster combined sewer system is discharged into two distinct drainage basins, the Hocking River drainage basin and the Baldwin Run drainage basin. It was found that the impacts of the Lancaster combined sewer system is different in the two drainage basins.

The Baldwin Run is the smaller drainage area and lower flows than the Hocking River drainage basin. It was concluded that there were water quality impacts from CSOs in the lower segments (rivermile 0.3) of the Baldwin Run. There were suspected impacts at the upper segments, near rivermile 0.7. Although the impacts were noted, they still represented an improvement over historical sampling results that documented severe CSO impacts. In addition to the CSO impacts, significant habitat modifications were observed. These habitat modifications appear in the stream significant enough to impact potential attainment of water quality standards in the streams. The current water quality designation of the Baldwin Run is Warmwater Habitat. When future growth in the system is considered, it is projected that only a small percentage of new growth will occur in the Baldwin Run drainage basin. Thus, new growth will not significantly increase CSO volumes.

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The Hocking River drainage basin was found to have very little impact from CSOs. Like the Baldwin Run, there have been significant habitat modifications that have resulted in water quality impairment. The Ohio EPA recognized the permanence of the habitat modifications and recently changed the water quality designation of the Hocking River to Modified Warmwater Habitat. When future growth is considered, it is projected that most of the growth will occur in areas tributary to the Hocking River. This could greatly increase the annual CSO discharge to the Hocking River.

Based on these findings, the following alternatives were recommended for the Lancaster Combined Sewer System Long-Term Control Plan:

- ▶ Increase in-system storage by:
 - Eliminating CSOs 1005 and 1010
 - Modify CSOs 1019 and 1029
 - Clean the 27-inch Interceptor.
- ▶ Reduce CSO discharges by separating sewers in the Lake/Allen/Maple Street area and completing the Downtown sewer separation project.

These tasks, when completed, will result in removal of CSO impacts from Lancaster area receiving streams and allowance for additional growth in the Lancaster sewer system without increasing CSO volume above existing levels.

6.2 Other Considerations

6.2.1. Nine Minimum Controls

The following opportunities to support use of the Nine Minimum Controls as required by the Ohio EPA were identified:

1. **Prevent Dry Weather Overflows:** Two structures to be modified to increase in-system storage will also help eliminate potential dry weather overflows. Both structures CSO 1005 and 1029 have had occurrences of dry weather overflows despite numerous attempts by maintenance personnel to repair and maintain them.

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2. Control Solids and Floatable Material: Although no floatables problems were identified when the City implemented the Nine Minimum Controls, the Ohio EPA noted the presence of sewage solids and human hygiene products in the Baldwin Run during their 1995 sampling. As a result, floatables reduction is proposed for two CSO structures:
 - ▶ **CSO 1019:** The debris reported by the Ohio EPA was most likely due to overflows from CSO structure CSO 1019. This is the largest overflow (by volume) in the Lancaster sewer system. This structure is located in the southeast corner of Mary Burnham Park, near rivermile 0.3. It overflows very frequently, only requiring an increase in depth of 6-inches to activate. Due to its design, it has the potential to discharge floatable material. Since modifications to this structure are recommended in order to increase system storage, the modifications will also include some type of floatable material control.

6.2.2. Habitat Modifications

A significant finding of the Long-Term Control Plan was that habitat modifications exist in both the Baldwin Run and the Hocking River. These modifications are significant enough to prevent attainment of water quality standards. The Ohio EPA has recognized the habitat modifications in the Hocking River and their impact on water quality. In 1998, the Ohio EPA reclassified the Hocking River from Warmwater Habitat to Modified Warmwater Habitat.

It is concluded that the same habitat modifications impacting the Hocking River also impact the Baldwin Run. These findings are discussed in detail in Chapter 3. It is also concluded that the water quality impacts identified in the Baldwin Run were due to a combination of CSO impacts and habitat modifications. As a result, it is recommended that the Ohio EPA change the designation of the Baldwin Run from Warmwater Habitat to Modified Warmwater Habitat.

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6.2.3. Aquatic Life Sampling

The Presumptive Approach includes the assumption that the capture or elimination of 85% of combined sewage collected during precipitation events in a year will resolve CSO-related water quality impacts. This criterion was developed by the USEPA during the development of the CSO regulations. It represents a consensus of those involved in the development of the regulations on a national level. It is anticipated that this criterion is applicable locally to the City of Lancaster's situation. However, in order to validate the assumption, it is recommended that periodic aquatic life sampling in receiving streams be completed.

This type of sampling is described in Chapter 3 and is typically performed by the Ohio EPA in the Hocking River basin every five years. Stream sampling of aquatic life and water quality parameters has historically been the Ohio EPA's primary tool for determining compliance and identifying action items. The next scheduled survey will be in the year 2000. However, due to the Ohio EPA's funding uncertainty, it is not known when the Ohio EPA will actually sample the receiving streams again. Thus, to assure validation of the assumptions made for the Long-Term Control Plan, provisions are included for the City of Lancaster to supplement the Ohio EPA's sampling. This is a voluntary measure since there is no requirement in the CSO regulations that this type of sampling be done. Thus, the City will implement this measure at its own discretion. This sampling will have the further advantage of identifying any unexpected new developments in the condition of the receiving streams.

6.3 Long-Term Control Plan Goals

6.3.1 Compliance with Presumptive Approach

For the City to meet the Presumptive Approach criteria, 85% of the wet weather combined sewage must be captured and treated at the Water Pollution Control Facility (WPCF). In the Chapter 4 Sewer System Extension Evaluation, the 1995 dry weather

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base flow would increase by 3.21 MGD by the year 2020. Since this increase in dry weather base flow is projected to cause an increase in the annual CSO volume, collection system modification projects to offset increases in CSO volume were proposed in Chapter 4. These improvements, along with sewer separation projects discussed in Chapter 5, were used to estimate the future percent capture. The anticipated percent capture in the year 2020 is shown in Figure 5-6 of Chapter 5 and is summarized below:

<u>Collection Area</u>	<u>Percent Capture</u>
System	89.8
Baldwin Run	87.6
Hocking River	90.9
Goal	85.0

As seen by the above summary, it is projected that the City of Lancaster will attain 85% capture of combined sewage. The City will thus be in compliance with the Presumptive Approach by the year 2020, provided sewer system improvements are implemented and future growth occurs as projected.

6.3.2. Antidegradation Goals

The Ohio EPA required that the Lancaster Long-Term Control Plan address future growth in the system and include measures to prevent increases in CSO discharges due to new growth. In development of the Long-Term Control Plan, it was found that the baseline CSO discharges for the Lancaster combined sewer system were as follows:

Annual Baseline CSO Volume - Existing System (1995)

Baldwin Run	61.8 million gallons / year
<u>Hocking River</u>	<u>51.7 million gallons / year</u>
Total System	113.5 million gallons / year

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Implementation of the projects identified in Section 6.1 will reduce CSO volume sufficiently to keep annual discharge volumes below 1995 levels. The projected level of CSO discharges in the year 2020 are anticipated to be:

Annual CSO Volume - Future System (2020)

Baldwin Run	34.3 million gallons / year
<u>Hocking River</u>	<u>51.4</u> million gallons / year
Total System	85.7 million gallons / year

6.4 Financial Implications

Based on current City records, the Lancaster Water Pollution Control Department (WPCF) has approximately 13,000 customers. Using the annual project costs presented in Figure 5-2 of Chapter 5 (both construction and operational costs), the additional cost per user for the recommended alternatives was estimated and is shown in Table 6-1.

**TABLE 6-1
LANCASTER OHIO
COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
FINANCIAL IMPACT**

Recommended Alternative	Total Present Worth of Project Cost	Total Annualized Costs (6 %, 20 Years)	Annual Cost Per User
In-Line Storage Abandon CSOs 1005 & 1010 Raise Weirs in CSOs 1019 & 1029 Modify CSO 1026	\$252,000	\$22,000	\$1.69
Sewer Separation Lake/Allen/Maple Streets Complete Downtown Separation	\$5,052,800	\$440,500	\$33.89
Aquatic Life Sampling	\$137,600	\$12,000	\$0.92
Total	\$5,304,800	\$462,500	\$36.49

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If implemented immediately, the cost increase of \$36.49/year/customer would represent an increase of 12% (17% total including other projected increased) in user fees for wastewater collection and treatment. In order to fund the recommended alternatives, the City will pursue low interest loans, grants and bonds. Also, the improvements will be spread out over a twenty-year period to minimize user fee impacts. The exact increase in user fees will depend on when the recommended alternative is implemented by the City and the actual project cost of the alternative.

6.5 Implementation Schedule

As discussed above, the recommended alternative will be implemented over a twenty-year period. For purposes of this report, it is assumed that the period begins in the year 2000. However, the actual time of initiation will depend on approval of the Long-Term Control Plan by the Ohio EPA.

The implementation of the Long-Term Control Plan will be presented in four periods:

- ▶ Period 1 - Year 1995 - This is the baseline year used to establish baseline CSO volumes for antidegradation purposes.
- ▶ Period 2 - 1995 to 1999-This represents work completed to date, including significant modifications to the combined sewer system that occurred.
- ▶ Period 3 - 1999 to 2005 - This represents completion of most of the recommended Long-Term Control Plan including modification of the weir in CSO 1019 in order to increase storage and sewer separation projects.
- ▶ Period 4 - 2005 to 2020 - This period represents the final status of the system through the end of the planning period. It represents completion of recommended modifications to CSO 1029. It also shows the net impact of the additional sanitary sewer flows due to development in Lancaster and the implementation of the recommended Long-Term Control Plan alternative.

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For each period, the percent capture, CSO volume and wet weather flow treated at the WPCF is calculated for reference purposes. See Figures 6-1, 6-2 and 6-3. Also, refer to Figures 4-10, 4-11 and 4-12 of Chapter 4 for timelines that show the cumulative impact of the implementation of the Long-Term Control Plan.

Period 1 - 1995

The percent capture of the existing system is calculated in Figure 5-4 of Chapter 5 and repeated below:

Existing System (1995)

<u>Collection Area</u>	<u>Percent Capture</u>
Total System	82.4
Baldwin Run	73.1
Hocking River	87.6

As can be seen, the Baldwin Run is substantially below the percent capture target. However, the Hocking River is above the target.

Period 2 - 1995 to 1999

One advantage of the recommended plan is that several items had already been completed for little cost, but substantial improvement to the combined sewer system has resulted. These items were:

- ▶ Abandon CSO 1005
- ▶ Abandon CSO 1010
- ▶ Clean the 27-inch Interceptor

The impact of these actions is shown in Figures 4-11, 4-12, and 4-13. The additional sanitary flow associated with future growth is projected to increase 0.24 MGD (Baldwin Run - 0.05 MGD, Hocking River - 0.19 MGD) between 1995 and 1999.

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During this period, CSOs 1005 and CSO 1010 were abandoned and the 27-inch interceptor was cleaned. Based on computer modeling of these events, the annual total CSO discharge volume decreased from 113 million gallons per year to approximately 102 million gallons per year. Note that these improvements greatly reduced CSO volume to the Hocking River. However, because the two systems are linked hydraulically, closing CSO 1005 increased CSO discharge to the Baldwin Run. However, the net reduction in CSO volume was still significant.

Also during this time, several historical projects were completed that were not part of the Long-Term Control Plan but that did substantially reduce CSO volume. These are discussed in Chapter 4 and summarized below:

- ▶ Upgrade of the Water Pollution Control Facility's secondary treatment capacity from 12 MGD to 18 MGD.
- ▶ Removal of the South Broad Street Inflow source.
- ▶ Removal of the Locust Street Siphon Inflow source.

In addition, through the model simulations it was estimated that approximately 566.5 million gallons of combined sewage will be captured at the Water Pollution Control Facility (WPCF) by 1999 based on typical year conditions. A summary of the percent capture for the system and each drainage area is provided in Figure 6-1 and summarized below.

<u>Collection Area</u>	1999 <u>Percent Capture</u>
System	84.7
Baldwin Run	73.1
Hocking River	91.0

Period 3 - 1999 to 2005

As seen in Figures 4-11, 4-12, and 4-13, the additional sanitary flow associated with growth in Lancaster is projected to increase by 1.00 MGD (Baldwin Run - 0.41 MGD, Hocking River - 0.59 MGD) since 1995.

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As part of the implementation of the Long-Term Control Plan, the following projects will be completed by 2005:

- ▶ Raise the weir at CSO 1019
- ▶ Separate Sewers in the Lake/Allen/Maple Street areas
- ▶ Complete the separation of sewers associated with the Downtown revitalization project

From the model results, it is projected that implementation of these projects will reduce annual CSO discharges to 72.8 million gallons by 2005 based on typical year conditions. In addition, approximately 623 million gallons of combined sewage will be captured at the WPCF during 2005 based on typical year conditions. A summary of the percent capture for the system and each drainage area is provided in Figure 6-2 and summarized below.

<u>Collection Area</u>	<u>2005 Percent Capture</u>
System	89.5
Baldwin Run	85.4
Hocking River	91.7

As can be seen, the Long-Term Control Plan goals will be achieved by the year 2005.

Period 4 - 2005 to 2020

As seen in Figures 4-11, 4-12, and 4-13, the additional sanitary flow associated with future sewer system expansion is projected to increase 3.21 MGD (Baldwin Run - 0.95 MGD, Hocking River - 2.26 MGD) since 1995.

Through the model simulations for the year 2020, it is shown that the improvements recommended for completion in 2005 were sufficient to maintain compliance with the percent capture goals and antidegradation goals until the year 2020. Modifications to CSO 1029 are still included due to the additional percent capture that modifying this CSO will provide and the elimination of potential dry weather overflows.

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This project is shown in the year 2020 because it is not required prior to that date. In practical terms, the City will likely implement this project when the other CSO modifications are completed.

By the year 2020, approximately 755 million gallons of combined sewage will be captured at the WPCF based on typical year conditions. A summary of the percent capture for the system and each drainage area is provided in Figure 6-3 and summarized below.

<u>Collection Area</u>	<u>2020 Percent Capture</u>
System	89.8
Baldwin Run	87.6
Hocking River	90.9

As seen by the above percent capture summaries, the City of Lancaster collection system percent capture continues to improve even with the additional sanitary flow resulting from sewer system extensions. It is projected that the City of Lancaster can attain the 85% criteria established in the Presumptive Approach through the year 2020.

6.5.1 Schedule

A graphical implementation schedule is provided in Figure 6-4. It is assumed that implementation of the Long-Term Control Plan will begin upon approval of the Plan by the Ohio EPA. For purposes of this report, the initial year is assumed to be 2000.

Although this schedule will not begin until approved by the Ohio EPA, the City reserves the right to pursue these improvements to its combined sewer system ahead of schedule as it may deem necessary.

The primary elements of the Lancaster Long-Term Control Plan are listed below:

- ▶ Abandon CSOs 1005 and 1010
- ▶ Clean the 27-inch Interceptor
- ▶ Raise the weir in CSO 1019/Addition of floatable control

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- ▶ Complete the sewer separation for the Downtown Revitalization Project
- ▶ Separate sewers on Lake/Allen/Maple Streets
- ▶ Reclassify the Baldwin Run from Warmwater Habitat to Modified Warmwater Habitat
- ▶ Review Ohio EPA aquatic sampling for the year 2000. (If a study has not been performed by Ohio EPA by the next cycle year 2005 (five years) the City of Lancaster may complete an aquatic life study of its own).
- ▶ Modify CSO structure 1029

6.6 Operational Plan

The City of Lancaster *Combined Sewer System Operational Plan* was submitted to the Ohio EPA in March 1998. It has not been approved by the Ohio EPA as of the date of this writing. The City is using the *Operational Plan* to operate and maintain its combined sewer system.

Elements of the *Operational Plan* as they applied to implementing the Nine Minimum Controls have been incorporated in the recommended Long-Term Control Plan alternatives . Specifically, the recommended alternatives support preventing dry weather overflows through the elimination and/or reconstruction of CSO structures CSO 1005 and 1029. Additional floatable removal will be obtained by modifying CSO structure 1019 to retain more floatables in the system.

6.7 Post Construction Compliance Monitoring

The City of Lancaster's Long-Term Control Plan includes continued monitoring of the water quality in local receiving streams in order to verify that existing water quality is maintained. The primary party responsible for performing this task is the Ohio EPA since it has historically filled this role. However, the City of Lancaster reserves the right to supplement the Ohio EPA's sampling with its own sampling as it may deem necessary to monitor water quality in its receiving streams.

++ END OF CHAPTER 6 ++

**FIGURE 6-1
CITY OF LANCASTER LONG-TERM CONTROL PLAN
FUTURE SYSTEM PERCENT CAPTURE - 1999**

Total System

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	689,470			5,157,236	319,748,607
Rain2	12.5		1,405,270		10,511,420	131,392,745
Rain3	5.22		1,703,870		12,744,948	66,528,626
Rain4	2.87			2,274,432	17,012,751	48,826,596
Annual Volume						566,496,575

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	39,403	294,735	18,273,572
Rain2	12.5	210,714	1,576,141	19,701,759
Rain3	5.22	797,256	5,963,475	31,129,339
Rain4	2.87	1,547,088	11,572,219	33,212,268
Annual Volume				102,316,938

**Total System
Percent Capture**

% Capture = 84.7
% Required = 85.0

Baldwin Run

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	215,465			1,611,678	99,924,048
Rain2	12.5		409,465		3,062,798	38,284,978
Rain3	5.22		495,365		3,705,330	19,341,824
Rain4	2.87			655,643	4,904,210	14,075,082
Annual Volume						171,625,931

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	36,473	272,818	16,914,718
Rain2	12.5	170,110	1,272,423	15,905,285
Rain3	5.22	402,740	3,012,495	15,725,225
Rain4	2.87	684,940	5,123,352	14,704,020
Annual Volume				63,249,248

**Baldwin Run
Percent Capture**

% Capture = 73.1
% Required = 85.0

Hocking River

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	473,781			3,543,882	219,720,677
Rain2	12.5		996,281		7,452,182	93,152,274
Rain3	5.22		1,209,281		9,045,422	47,217,102
Rain4	2.87			1,619,919	12,116,994	34,775,773
Annual Volume						394,865,825

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	2,930	21,917	1,358,854
Rain2	12.5	40,604	303,718	3,796,474
Rain3	5.22	394,516	2,950,980	15,404,114
Rain4	2.87	862,148	6,448,867	18,508,248
Annual Volume				39,067,690

**Hocking River
Percent Capture**

% Capture = 91.0
% Required = 85.0

WPCF = Flow Treated at the Water Pollution Control Facility
WWF = Wet Weather Flow Treated at the Water Pollution Control Facility
CSO Volume = Combined Sewer Overflow Volume Discharged to Receiving Streams

**FIGURE 6-2
CITY OF LANCASTER LONG-TERM CONTROL PLAN
FUTURE SYSTEM PERCENT CAPTURE - 2005**

Total System

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	776,232			5,806,215	359,985,352
Rain2	12.5		1,524,232		11,401,255	142,515,692
Rain3	5.22		1,792,232		13,405,895	69,978,774
Rain4	2.87			2,367,174	17,706,462	50,817,545
Annual Volume						623,297,363

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	7,651	57,230	3,548,268
Rain2	12.5	125,350	937,618	11,720,225
Rain3	5.22	694,671	5,196,139	27,123,846
Rain4	2.87	1,415,666	10,589,182	30,390,953
Annual Volume				72,783,292

**Total System
Percent Capture**

% Capture = 89.5
% Required = 85.0

Baldwin Run

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	263,371			1,970,015	122,140,935
Rain2	12.5		489,471		3,661,243	45,765,539
Rain3	5.22		567,471		4,244,683	22,157,246
Rain4	2.87			743,907	5,564,424	15,969,898
Annual Volume						206,033,617

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	7,416	55,472	3,439,244
Rain2	12.5	88,274	660,290	8,253,619
Rain3	5.22	299,260	2,238,465	11,684,786
Rain4	2.87	548,720	4,104,426	11,779,703
Annual Volume				35,157,353

**Baldwin Run
Percent Capture**

% Capture = 85.4
% Required = 85.0

Hocking River

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	512,702			3,835,011	237,770,680
Rain2	12.5		1,034,802		7,740,319	96,753,987
Rain3	5.22		1,224,802		9,161,519	47,823,129
Rain4	2.87			1,625,194	12,156,451	34,889,015
Annual Volume						417,236,810

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	235	1,758	109,023
Rain2	12.5	37,076	277,328	3,466,606
Rain3	5.22	395,411	2,957,674	15,439,060
Rain4	2.87	866,946	6,484,756	18,611,250
Annual Volume				37,625,939

**Hocking River
Percent Capture**

% Capture = 91.7
% Required = 85.0

WPCF = Flow Treated at the Water Pollution Control Facility
WWF = Wet Weather Flow Treated at the Water Pollution Control Facility
CSO Volume = Combined Sewer Overflow Volume Discharged to Receiving Streams

**FIGURE 6-3
CITY OF LANCASTER LONG-TERM CONTROL PLAN
FUTURE SYSTEM PERCENT CAPTURE - 2020**

Total System

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	988,350			7,392,858	458,357,196
Rain2	12.5		1,754,350		13,122,538	164,031,725
Rain3	5.22		1,976,350		14,783,098	77,167,772
Rain4	2.87			2,586,570	19,347,544	55,527,450
Annual Volume						755,084,143

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	7,470	55,876	3,464,290
Rain2	12.5	185,012	1,383,890	17,298,622
Rain3	5.22	801,075	5,992,041	31,278,454
Rain4	2.87	1,569,535	11,740,122	33,694,151
Annual Volume				85,735,518

**Total System
Percent Capture**

% Capture = 89.8
% Required = 85.0

Baldwin Run

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	315,789			2,362,102	146,450,307
Rain2	12.5		568,289		4,250,802	53,135,022
Rain3	5.22		637,889		4,771,410	24,906,759
Rain4	2.87			825,374	6,173,798	17,718,799
Annual Volume						242,210,886

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	7,073	52,906	3,280,174
Rain2	12.5	79,582	595,273	7,440,917
Rain3	5.22	298,670	2,234,052	11,661,749
Rain4	2.87	557,490	4,170,026	11,967,974
Annual Volume				34,350,815

**Baldwin Run
Percent Capture**

% Capture = 87.6
% Required = 85.0

Hocking River

	# of Events/yr	WPCF Volume			WWF Volume	
		18 hr (cf)	24 hr (cf)	30 hr (cf)	Event (gal)	Total (gal)
Rain1	62	672,417			5,029,679	311,840,108
Rain2	12.5		1,186,817		8,877,391	110,967,390
Rain3	5.22		1,339,817		10,021,831	52,313,959
Rain4	2.87			1,761,555	13,176,431	37,816,358
Annual Volume						512,937,814

	# of Events/yr	CSO Volume		Total (gal)
		(cf)	(gal)	
Rain1	62	397	2,970	184,116
Rain2	12.5	105,430	788,616	9,857,705
Rain3	5.22	502,405	3,757,989	19,616,705
Rain4	2.87	1,012,045	7,570,097	21,726,177
Annual Volume				51,384,703

**Hocking River
Percent Capture**

% Capture = 90.9
% Required = 85.0

WPCF = Flow Treated at the Water Pollution Control Facility
WWF = Wet Weather Flow Treated at the Water Pollution Control Facility
CSO Volume = Combined Sewer Overflow Volume Discharged to Receiving Streams

**FIGURE 6-4
LANCASTER OHIO
COMBINED SEWER SYSTEM LONG-TERM CONTROL PLAN
IMPLEMENTATION SCHEDULE**

Task	YEAR																						
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	
Submit LTCP		X																					
Abandon CSO 1010	X																						
Abandon CSO 1005	X																						
Clean 27" Interceptor	X																						
Ohio EPA Approve LTCP		X																					
Raise CSO Weir 1019							█																
Downtown Sewer Separation Completion							█																
Lake / Allen / Maple Street Sewer Separation							█																
Reclassify Baldwin Run							█																
Modify CSO 1029																							
Aquatic Life Stream Sampling												█											