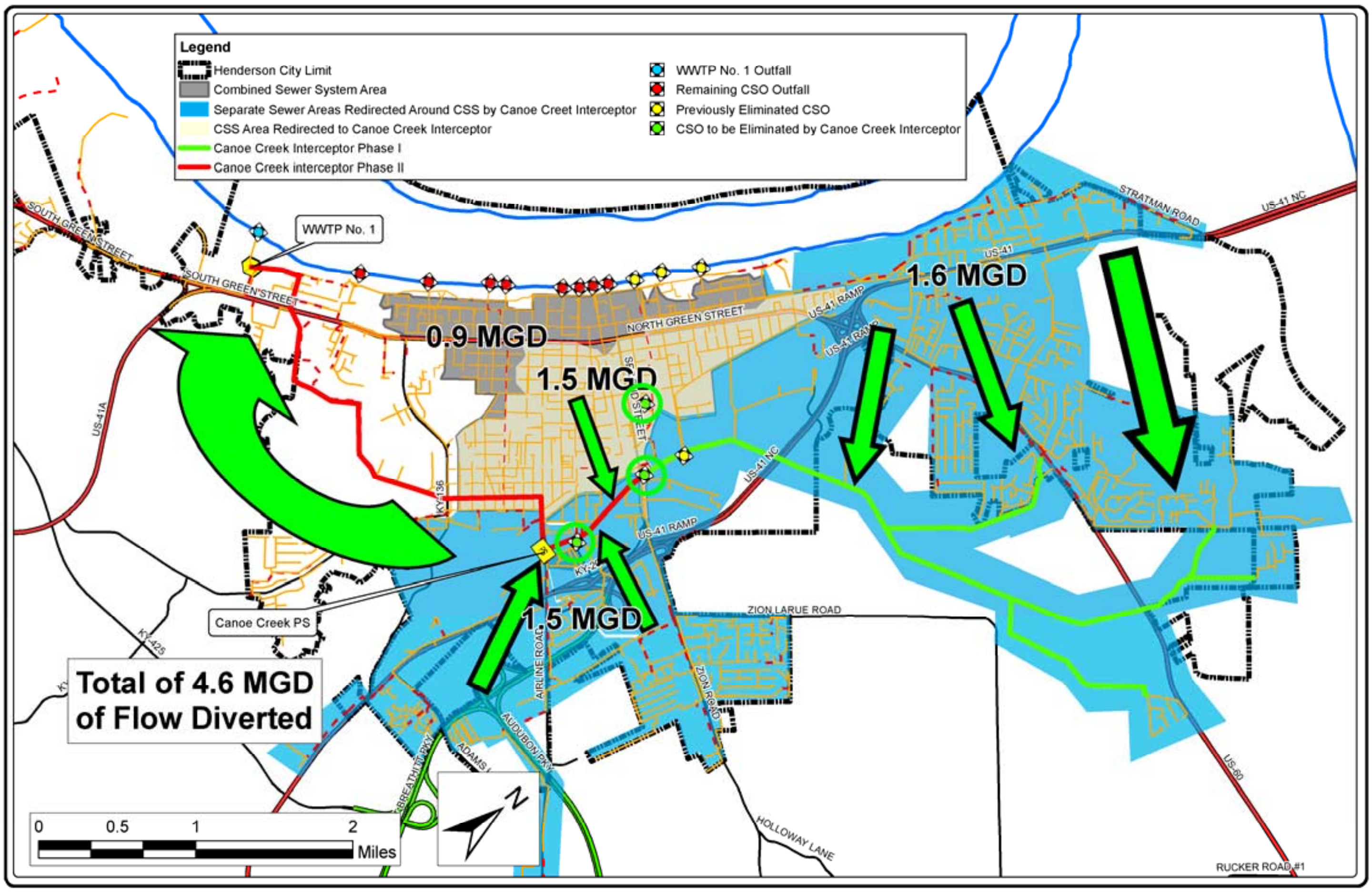
Henderson Water Utility
Combined Sewer Overflow
Long-Term Control Plan
(LTCP)



March 2009

Prepared By:

Henderson Water Utility
111 Fifth Street
Henderson, KY 42420
www.hkywater.org

STRAND ASSOCIATES, INC.®
325 West Main Street, Suite 710
Louisville, KY 40202
www.strand.com

HENDERSON WATER UTILITY

Water • Wastewater • Stormwater

MANAGED BY THE CITY OF HENDERSON WATER & SEWER COMMISSION

BRUCE SHIPLEY, P.E.
GENERAL MANAGER

March 27, 2009

COPY

Douglas F. Mundrick, P.E., Chief
Water Programs Enforcement Branch
Water Management Division
U.S. Environmental Protection Agency, Region 4
61 Forsyth Street, S.W.
Atlanta, Georgia 30303-8960

Ref: U.S. EPA Administrative Order – Docket No. CWA-04-2008-4757
Kentucky Division of Water: Consent Judgment – Civil Action No. 07-CI-1250
Combined Sewer Overflow Long-Term Control Plan (LTCP)
Original Due Date: February 28, 2009 (Within 18 months of entry of Consent Judgment)
Revised Due Date: March 31, 2009 (Granted 1-month extension)

Dear Mr. Mundrick:

In compliance with the terms of the Administrative Order between the U.S. Environmental Protection Agency, Plaintiff, and the City of Henderson and Henderson Water Utility, Defendants; Henderson Water Utility (HWU) hereby submits Henderson's Combined Sewer Overflow Long-Term Control Plan (LTCP).

As we have previously discussed with the Kentucky Department of Environmental Protection, this LTCP has been prepared using the *Presumptive Approach*, following the guidance provided in *the Long-Term Control Plan-EZ (LTCP-EZ) Template: A Planning Tool for CSO Control in Small Communities* (EPA-833-R-07-005) and supplemented with extensive narratives and other supporting information.

On March 10, 2009 at a regularly scheduled public meeting, this LTCP was presented to the community, Henderson City Commission, and the Henderson Water & Sewer Commission.

On March 16, 2009, Henderson Water and Sewer Commission passed a resolution approving this LTCP as to form. On March 24, 2009, the Henderson City Commission passed a resolution approving this LTCP as to form. The two resolutions are attached for your records.

111 Fifth Street • Henderson, Kentucky 42420 • Phone (270) 826-2421 • Fax (270) 826-2428 • www.hkywater.org

Certification of Submission: I certify under penalty of law that this document and all attachments were prepared in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering such information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Bruce L. Shipley, P.E.
General Manager, Henderson Water Utility

We look forward to your review and approval of Henderson's Combined Sewer Overflow Long-Term Control Plan (LTCP).

Respectfully Submitted,

Thomas E. Davis
Mayor
City of Henderson

CC: Mr. Jeff Cummins, Director, Division of Enforcement, Kentucky Division of Water
Henderson City Clerk
Henderson City Attorney
Chairman HWU Board
Mr. John T. Lyons (Strand Associates, Inc.)
File

Attachments: (2) Resolutions

HENDERSON WATER AND SEWER COMMISSION
RESOLUTION OF THE BOARD

COPY

The following Resolution was duly adopted by the Board of the Henderson Water & Sewer Commission at a meeting duly called and held on Monday March 16, 2009, at which a quorum was present.

WHEREAS, the City of Henderson and the Henderson Water Utility entered in a Consent Judgment dated August 30, 2007, with the Commonwealth of Kentucky Environmental and Public Protection Cabinet governing the development and implementation of a Long Term Combined Sewer Overflow Control Plan, sometimes known as the "LTCP"; and

WHEREAS, the Henderson Water Utility has prepared the LTCP for submission to the Kentucky Division of Water and the Environmental Protection Agency Region 4 pursuant to the Consent Judgment; and

WHEREAS, on March 3, 2009, the LTCP Plan to be submitted to the Kentucky Division of Water and the Environmental Protection Agency Region 4 was submitted to the Board Members of the Henderson Water and Sewer Commission for review; and

WHEREAS, on March 10, 2009, the LTCP was formerly presented to the Henderson City Commission which meeting was attended by the Board Members of the Henderson Water and Sewer Commission: and

NOW, THEREFORE, BE IT

RESOLVED, that the Henderson Water Utility Combined Sewer Overflow Long Term Control Plan submitted to the Board for review on March 3, 2009, and formally reviewed before the Henderson City Commission on March 10, 2009, be and is hereby approved by this

Board as to form, and the General Manager of the Henderson Water Utility be and is hereby authorized to submit the Henderson Water Utility Combined Sewer Overflow Long Term Control Plan to the Kentucky Division of Water, and to the Environmental Protection Agency Region 4, following approval of the Plan by the Henderson City Commission on March 24, 2009.

IN WITNESS WHEREOF, having come before the Water & Sewer Commission on March 16, 2009, and upon Motion made by Commissioner George Jones, seconded by Commissioner Laffoon "Chip" Williams, the Board of Commissioners voted as follows:

	AYE	NAY
Commissioner, Steve Austin	X	
Commissioner, George Jones	X	
Commissioner, Roger Bird	X	
Commissioner, Chip Williams	X	

Bruce L. Shipley

Bruce Shipley.
General Manager
Henderson Water Utility

COPY

CERTIFICATE OF CITY CLERK

I, Maree Collins, hereby certify that I am the duly qualified and acting City Clerk of the City of Henderson, Henderson County, Kentucky, and that the attached is a true and accurate copy of Resolution No. 19-09, duly adopted, passed, read and signed, as prescribed by the Kentucky Revised Statutes at a regular meeting of the City Commission of the City of Henderson, Kentucky, held at the regular meeting place on the 24th day of March, 2009, approving and authorizing submittal of the Henderson Water utility Combined Sewer Overflow Long-Term Control Plan (LTCP) to the Commonwealth of Kentucky, Environmental and Public Protection Cabinet, pursuant to the Consent Judgment entered in the Franklin Circuit Court, and that the foregoing Resolution has been duly recorded in the official records of said City.

IN WITNESS WHEREOF, I have hereunto set my hand as Acting City Clerk and affixed hereto the official seal of said City, this the 27th day of March, 2009.

CITY OF HENDERSON KENTUCKY

(City Seal)

Maree Collins, Acting City Clerk

RESOLUTION NO. 19-09

COPY

RESOLUTION APPROVING AND AUTHORIZING SUBMITTAL OF HENDERSON WATER UTILITY COMBINED SEWER OVERFLOW LONG-TERM CONTROL PLAN (LTCP) TO COMMONWEALTH OF KENTUCKY, ENVIRONMENTAL AND PUBLIC PROTECTION CABINET, PURSUANT TO CONSENT JUDGMENT IN CASE AGAINST CITY OF HENDERSON AND HENDERSON WATER UTILITY, AND SUBMITTAL ALSO TO U.S. EPA REGION 4

WHEREAS, pursuant to the Consent Judgment entered in the Franklin Circuit Court in the case of The Commonwealth of Kentucky, Environmental and Public Protection Cabinet vs. City of Henderson and Henderson Water Utility, regarding the City's combined sewer system and related matters, the City of Henderson and Henderson Water Utility must submit a Long-Term Control Plan (LTCP) setting forth plans to address combined sewer overflows; and

WHEREAS, the professional consultants for the project have prepared and recommend the submittal of the Long-Term Control Plan (LTCP), a copy of which is attached hereto and made a part hereof by reference, marked Exhibit "A"; and

WHEREAS, the Water and Sewer Commission on behalf of Henderson Water Utility has formally approved the plan and recommend that it be submitted.

NOW, THEREFORE, BE IT RESOLVED by the City of Henderson, Kentucky, that the attached Henderson Water Utility Combined Sewer Overflow Long-Term Control Plan (LTCP) designated as Exhibit "A" hereto, is hereby approved and authorized to be submitted to the Kentucky Environmental and Public Protection Cabinet pursuant to the Consent Judgment entered in the aforesaid case, and to be submitted also to U.S. EPA Region 4.

On motion of Commissioner Jim White, seconded by Commissioner Robert N. Pruitt, that the foregoing Resolution be adopted, the vote was called. On roll call the vote stood:

Commissioner Farmer:	ABSENT	Commissioner White:	AYE
Commissioner Mills:	ABSENT	Mayor Davis:	AYE
Commissioner Pruitt:	AYE		

WHEREUPON, Mayor Davis declared the Resolution adopted, affixed his signature and the date thereto and ordered that the same be recorded.

Thomas E. Davis, Mayor

Date: March 24, 2009

ATTEST:

~~Carolyn Williams~~, City Clerk
Maree Collins, Acting

APPROVED AS TO FORM AND LEGALITY THIS 20th DAY OF MARCH, 2009.

By:
Joseph E. Ternes, Jr.
City Attorney

HENDERSON WATER UTILITY **Water • Wastewater • Stormwater**

MANAGED BY THE CITY OF HENDERSON WATER & SEWER COMMISSION

BRUCE SHIPLEY, P.E.
GENERAL MANAGER

March 27, 2009

Mr. Jeff Cummins
Director, Division of Enforcement
300 Fair Oaks Lane
Frankfort, KY 40601

COPY

Ref: Henderson Consent Judgment – Civil Action No. 07-CI-1250
Combined Sewer Overflow Long-Term Control Plan (LTCP)
Original Due Date: February 28, 2009 (Within 18 months of entry of Consent Judgment)
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Dear Mr. Cummins:

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As we have previously discussed with the Kentucky Department of Environmental Protection, this LTCP has been prepared using the *Presumptive Approach*, following the guidance provided in *the Long-Term Control Plan-EZ (LTCP-EZ) Template: A Planning Tool for CSO Control in Small Communities* (EPA-833-R-07-005) and supplemented with extensive narratives and other supporting information.

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Bruce L. Shipley

Bruce L. Shipley, P.E.
General Manager, Henderson Water Utility

We look forward to your review and approval of Henderson's Combined Sewer Overflow Long-Term Control Plan (LTCP).

Respectfully Submitted,

Thomas E. Davis
Mayor
City of Henderson

CC: Douglas F. Mundrick, P.E., U.S. EPA
Henderson City Clerk
Henderson City Attorney
Chairman HWU Board
Mr. John T. Lyons (Strand Associates, Inc.)
File

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	AYE	NAY
Commissioner, Steve Austin	X	
Commissioner, George Jones	X	
Commissioner, Roger Bird	X	
Commissioner, Chip Williams	X	

Bruce L. Shipley

Bruce Shipley.
General Manager
Henderson Water Utility

COPY

CERTIFICATE OF CITY CLERK

I, Maree Collins, hereby certify that I am the duly qualified and acting City Clerk of the City of Henderson, Henderson County, Kentucky, and that the attached is a true and accurate copy of Resolution No. 19-09, duly adopted, passed, read and signed, as prescribed by the Kentucky Revised Statutes at a regular meeting of the City Commission of the City of Henderson, Kentucky, held at the regular meeting place on the 24th day of March, 2009, approving and authorizing submittal of the Henderson Water utility Combined Sewer Overflow Long-Term Control Plan (LTCP) to the Commonwealth of Kentucky, Environmental and Public Protection Cabinet, pursuant to the Consent Judgment entered in the Franklin Circuit Court, and that the foregoing Resolution has been duly recorded in the official records of said City.

IN WITNESS WHEREOF, I have hereunto set my hand as Acting City Clerk and affixed hereto the official seal of said City, this the 27th day of March, 2009.

CITY OF HENDERSON KENTUCKY

(City Seal)

Maree Collins

Maree Collins, Acting City Clerk

COPY

RESOLUTION NO. 19-09

RESOLUTION APPROVING AND AUTHORIZING SUBMITTAL OF HENDERSON WATER UTILITY COMBINED SEWER OVERFLOW LONG-TERM CONTROL PLAN (LTCP) TO COMMONWEALTH OF KENTUCKY, ENVIRONMENTAL AND PUBLIC PROTECTION CABINET, PURSUANT TO CONSENT JUDGMENT IN CASE AGAINST CITY OF HENDERSON AND HENDERSON WATER UTILITY, AND SUBMITTAL ALSO TO U.S. EPA REGION 4

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WHEREAS, the professional consultants for the project have prepared and recommend the submittal of the Long-Term Control Plan (LTCP), a copy of which is attached hereto and made a part hereof by reference, marked Exhibit "A"; and

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Commissioner Farmer:	ABSENT	Commissioner White:	AYE
Commissioner Mills:	ABSENT	Mayor Davis:	AYE
Commissioner Pruitt:	AYE		

WHEREUPON, Mayor Davis declared the Resolution adopted, affixed his signature and the date thereto and ordered that the same be recorded.

Thomas E. Davis, Mayor

Date: March 24, 2009

ATTEST:

~~Carolyn Williams~~, City Clerk
Maree Collins, Acting

APPROVED AS TO FORM AND LEGALITY THIS 20th DAY OF MARCH, 2009.

By:
Joseph E. Ternes, Jr.
City Attorney

Henderson Water Utility, Kentucky

Combined Sewer Overflow
Long-Term Control Plan

Prepared by:

STRAND ASSOCIATES, INC.®
325 West Main Street, Suite 710
Louisville, KY 40202
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In Partnership with:

Henderson Water Utility
111 Fifth Street
Henderson, KY 42420
www.hkywater.org

March 2009

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EXECUTIVE SUMMARY

The Henderson Water Utility (HWU) operates a combined sewer system (CSS) with 16 permitted combined sewer overflows (CSO). The United States Environmental Protection Agency (USEPA) and Kentucky Division of Water (KDOW) standards contained in HWU's Kentucky Pollutant Discharge Elimination System (KPDES) permit, the Consent Judgment entered on August 30, 2007, and the CSO Control Policy require HWU to prepare a Long-Term Control Plan (LTCP) that demonstrates mitigation of CSOs in conformance with the CSO Control Policy and meets the following goals:

1. Ensure that CSOs, if they occur, are only the result of wet weather.

2. Bring all wet weather CSO discharge points into compliance with the Clean Water Act and Kentucky Revised Statute Chapter 224.

3. Minimize the impacts of CSOs on water quality, aquatic biota, and human health.

LONG-TERM CONTROL PLAN APPROACH

This LTCP has been prepared using the *Presumptive Approach*, following the guidance provided in *the Long-Term Control Plan-EZ (LTCP-EZ) Template: A Planning Tool for CSO Control in Small Communities* (EPA-833-R-07-005). The template outlines LTCP requirements for communities of fewer than 75,000 residents. HWU Wastewater Treatment Plant No. 1 (WWTP) serves a population of approximately 25,000 residents. This report consists of the following sections:

<u>Section 2: Nine Minimum Controls</u>

This section describes HWU's ongoing operation and maintenance (O&M) program to help minimize CSOs. All CSO communities are required to adhere to and document their implementation of the Nine Minimum Controls (NMC). HWU is currently in compliance with the requirements of the NMC program.

<u>Section 3: Sensitive Areas</u>

This section concludes there are no sensitive areas as defined by the *LTCP-EZ* guidance. HWU's drinking water inlet is upstream of all CSO discharges. Areas likely to be used for recreation are either upstream or downstream of all CSO discharges making CSO abatement priority for all Ohio River CSOs equal. HWU has prioritized their improvement strategy to focus on Canoe Creek discharges because of the lower dilution afforded by Canoe Creek.

<u>Section 4: System Characterization</u>

This section provides a description of the CSS and how it operates during wet weather.

<u>Section 5: Public Participation</u>

This section documents the extensive efforts of HWU to fulfill public participation and involvement requirements.

Section 6: CSO Volume and Evaluation of Controls

This section covers two important steps in the LTCP process: (1) explains the methodology and creation of a spreadsheet tool to better predict the efficacy of CSO controls; and (2) evaluates the effectiveness (as judged by percent capture of CSO flows) of HWU's strategy to control CSOs.

Section 7: Affordability

This section evaluates HWU's larger financial picture to determine how the proposed projects will impact HWU's customers and its ability to finance the proposed projects.

Section 8: Recommended CSO Control Plan

This section identifies an affordable long-term approach to HWU's CSO abatement plan that conforms to the CSO Control Policy and provides suggestions for further action.

Narratives providing additional detail have been developed to augment the templates included in the *LTCP-EZ* guidance. Copies of the templates are included in Appendix A. In lieu of the simplified, event-based calculations used as part of the standard *LTCP-EZ* approach, HWU has elected to create a customized spreadsheet tool to estimate the volume reductions that can be anticipated as a result of CSO control through their recommended plan.

RECOMMENDED CSO CONTROL PLAN

HWU has adopted a proactive approach to CSO control. Since 1995 and consistent with the 1994 CSO Control Policy, HWU has been actively engaged in sewer separation projects and other improvements to reduce CSO volumes and occurrences. HWU has developed a threefold approach to CSO abatement:

1. Separate sewers in the older developed areas to reduce the amount of stormwater entering the CSS.

2. Reroute flows that currently flow through the Downtown Interceptor away from the downtown area to increase available capacity within the CSS.

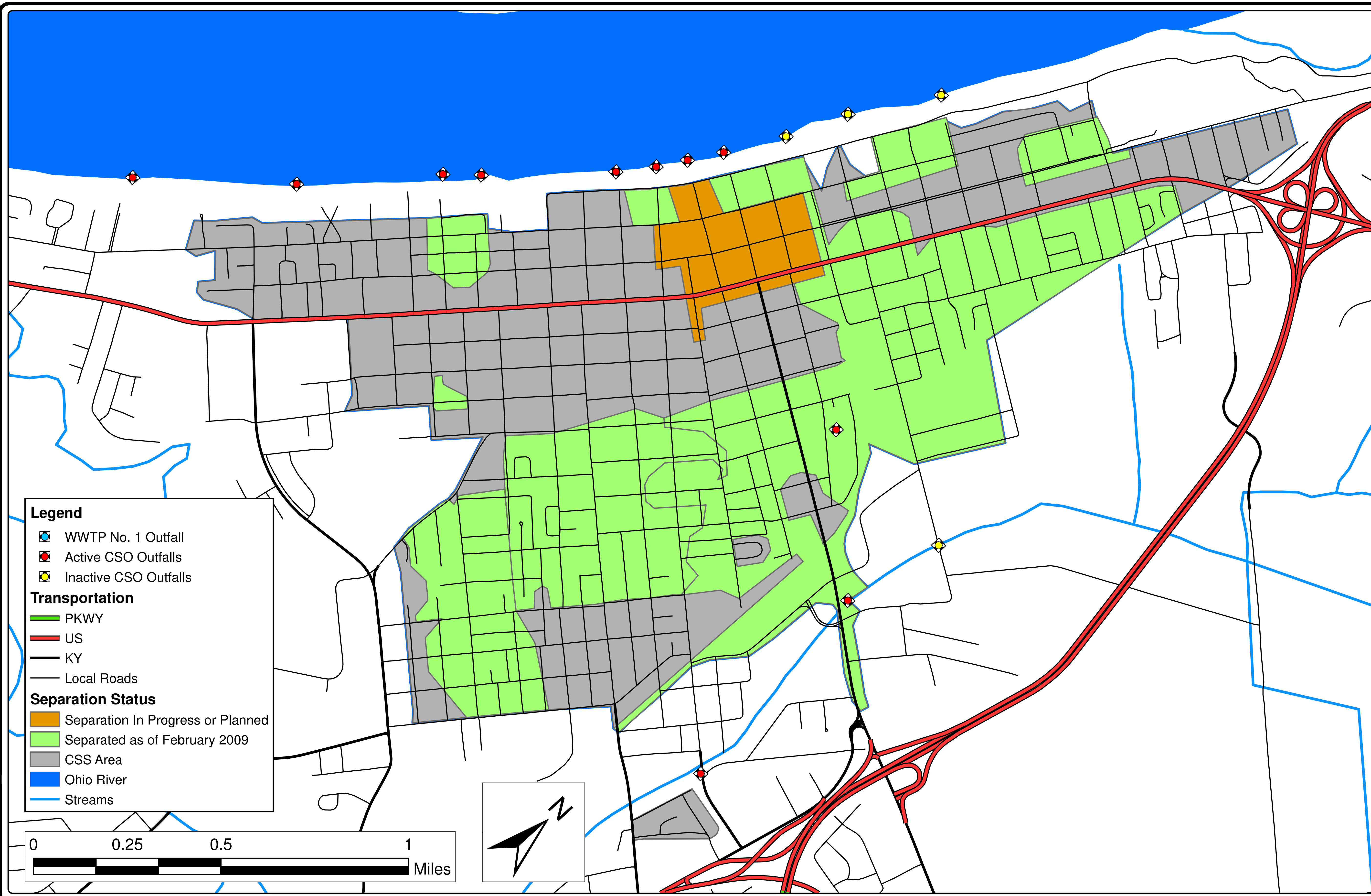
3. Make improvements to the WWTP headworks so the higher peak flow rates being captured and transported to the WWTP.

Figure ES-01 shows the areas within the CSS that have been separated since 1995 and the areas where future separation projects were previously planned. In all, HWU will have separated 56 percent of their CSS providing a substantial relief to the Downtown Interceptor that currently conveys the majority of flow from Henderson to the WWTP. These efforts form the baseline CSO control on which the LTCP is founded.

Figure ES-02 shows the second phase of HWU's plan established in this LTCP.

COMBINED SEWER SEPARATION AREAS - COMPLETED AND PLANNED

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY



STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE ES-01
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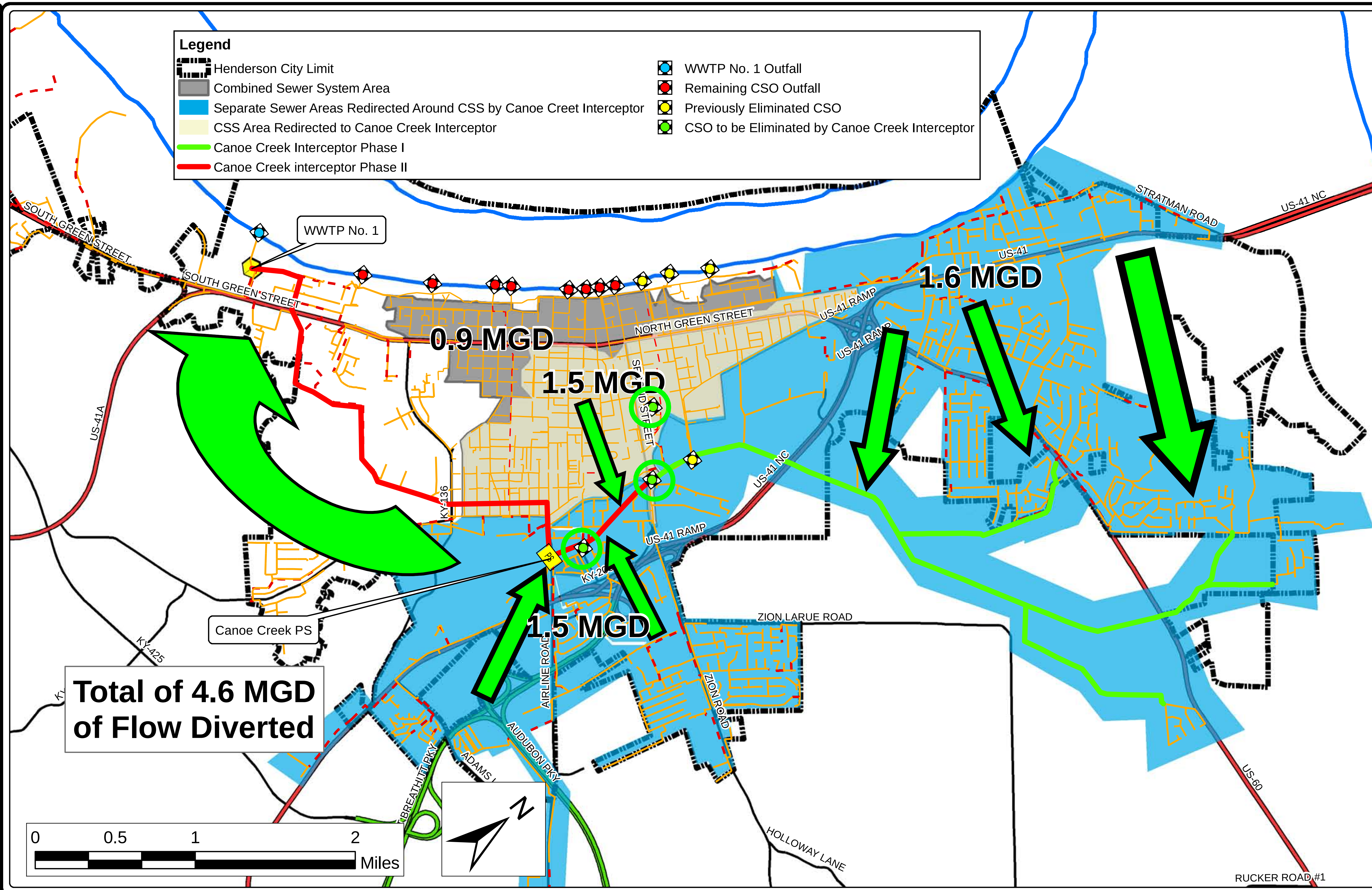

COMPLETE IMPLEMENTATION OF CSO CONTROLS
COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE ES-02
5454.002

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The Canoe Creek Interceptor will provide a conveyance system to redirect flows that normally travel through the CSS and the Downtown Interceptor to a new pumping station and force main where they will be pumped directly to the WWTP. Separate sanitary flow from outside the CSS and a significant portion of the downtown area will be redirected to the Canoe Creek Interceptor. Overall, 77 percent of the contributing area of CSO flows will be disconnected from the CSS through separation and redirection of flows.

Based on the analysis described in Section 6 of this report, HWU's control program will achieve the 85 percent capture threshold required by the presumptive approach. Simulating performance of the improved CSS using the past 60 years of historical rainfall in Henderson resulted in 92 percent of wet weather flows (by volume) being captured for treatment. The limits of modeling and precision of the spreadsheet tool allow for some uncertainty in the predicted versus actual results; however, every effort has been made to take a conservative approach and lean towards underestimating volume capture. Postconstruction monitoring of CSO volumes will verify the efficacy of CSO controls, and the implementation schedule allows for revisions to the abatement plan, if warranted, to conform to the CSO Policy's presumptive approach.

CSO ABATEMENT COSTS

Future costs to the community to implement CSO controls will be extensive. Preliminary opinions of probable construction cost for the major components of HWU's plan total over $34 million as shown in Table ES-01.

Project	Cost Opinion
Canoe Creek Pumping Station and Interceptor (Phase 2)	$8,500,000
Canoe Creek Pumping Station and Interceptor (Phase 3)	$2,000,000
Canoe Creek Pumping Station and Interceptor (Phase 4)	$1,500,000
Center and Julia Separation Project (Phase III)	$2,600,000
Downtown Area Separation Project	$10,100,000
WWTP Improvements (Headworks)	$8,200,000
Ershig Stormwater Line (Ragan and Green Streets)	$100,000
TOTAL	$33,000,000

Table ES-01 Preliminary Opinions of Probable Construction Cost

These costs are in addition to the over $17.3 million HWU has already spent on CSO control since 1995. Section 7 shows the financial impact associated with implementation of the LTCP falls within the mid range of financial burden, but several key indicators are on the borderline between medium and high burden, and any shifts in the local economy could have a dramatic influence on affordability.

While the Henderson community is committed and capable of implementing its plan for CSO control, economic factors outside its control may warrant ongoing evaluation of the financial capacity and potential adjustment to schedule.

This LTCP represents an analysis of projects required to meet the presumptive standard of the National CSO Control Policy and recommendations to address Henderson's CSOs in a cost-effective manner.

Primary recommendations of this LTCP include the following elements:

1. Maintain compliance with the state's Consent Judgment.

2. Continue implementation of HWU's CSO control plan including targeted separation projects, construction of the Canoe Creek Interceptor, pumping station, force main, and expansion of the WWTP headworks capacity according to the implementation schedule listed in Table ES-02. HWU anticipates completing planned LTCP projects by mid-year 2016.

Project	Project Status	Anticipated Completion Date
Canoe Creek Pumping Station and Interceptor (Phase 2)	Under Design	End of 2012
Canoe Creek Pumping Station and Interceptor (Phase 3)	Under Design	First Q 2014
Canoe Creek Pumping Station and Interceptor (Phase 4)	Under Design	Mid 2016
Center and Julia Separation Project (Phase III)	Planning Stage	First Q 2012
Downtown Area Separation Project	Design Complete	First Q 2013
WWTP Improvements (Headworks)	Planning Stage	Spring 2014
Ershig Stormwater Line (Ragan and Green Streets)	Under Construction	First Q 2011

Table ES-02 CSO Control Plan Implementation Schedule

3. Implement a comprehensive flow metering program of HWU's active CSOs to track the effectiveness of CSO controls on reducing overflow volumes.

4. Evaluate the reduction of CSO volumes in comparison to annual rainfall totals on a regular basis to determine if CSO controls are achieving the anticipated results based on comparison to a historically normal year.

5. Meet with KDOW staff to facilitate their acceptance and approval of the LTCP recommendations. Provide an annual update of progress to KDOW on the LTCP projects in accordance with the Consent Judgment.

6. Contact the Kentucky congressional delegation, USEPA, the Kentucky Infrastructure Authority, KDOW, and other potential funding agencies on a regular basis to pursue grant funding for system improvement projects.

SECTION 1

INTRODUCTION

1.01 BACKGROUND

The Henderson Water Utility (HWU) provides sewer service to areas in and around Henderson, Kentucky. Henderson is located on the Ohio River approximately 30 miles west of Owensboro, Kentucky, and directly south of Evansville, Indiana. See Figure 1.01-1.

Figure 1.01-1 Location of Henderson, Kentucky

HWU is responsible for wastewater collection and disposal from approximately 10,800 acres located mostly within the Henderson city limits. The location of the HWU sewer system is shown in Figure 1.01-2. Nearly 9,000 households out of 11,000 service connections are served by HWU. Table 1.01-1 includes demographic information on the City of Henderson from the United States Census Bureau (unless otherwise noted, all information is from the 2000 census).

Population (2006 estimate)	27,915
Population Between 18 and 65 Years Old	69.8%
Male	47.2%
Female	52.8%
White	87.3%
Black	10.5%
Native American	0.2%
Asian	0.4%
Native Hawaiian or Pacific Islander	0%
Multirace	1.0%
Hispanic or Latino	1.3%
High School Graduates	76.6%
College Graduates	14%
Persons Below Poverty (1999)	16.5%

Table 1.01-1 City of Henderson Demographic Data

The older portions of the sewer system are largely served by single sewers consisting of storm and sanitary connections, thus, the HWU system is classified as a combined sewer system (CSS). Approximately 13 percent, or 1,440 acres, of HWU's service area is classified as a CSS. The remaining area (9,360 acres or 87 percent of the total service area) is served with separate storm and sanitary sewers (SSS). Wastewater from the CSS is conveyed to Wastewater Treatment Plant No. 1 (WWTP) on the west side of Henderson.

As a result of stormwater contributions, a CSS receives very high flows during wet weather with flows greatly exceeding the carrying and treatment capacity of the sewer system and treatment facilities. At such times, combined sewer overflows (CSOs) can occur and result in the discharge of untreated wastewater to local waterways. Although flows in the CSS during rain events are relatively dilute as a result of the large percentage of stormwater in the system, CSOs contain solids, bacteria, and other constituents that may impair water quality, in particular, bacteria standards. CSOs, together with other point and nonpoint sources of pollution, interfere with designated uses and water quality standards during and following wet weather. The HWU CSS contains 12 active permitted relief points where CSOs may occur and 4 inactive (inactive means that CSOs are no longer expected or designed to occur) relief points. Figure 1.01-3 displays a map of the HWU sewer system showing the original extent of the combined portion of the system located in the central downtown area.

The United States Environmental Protection Agency (USEPA) is the federal agency responsible for administration and enforcement of water quality regulations. In Kentucky, this responsibility has been delegated to the Kentucky Division of Water (KDOW). The USEPA's *CSO Control Policy* dated April 19, 1994 (59 *Federal Register* 18688), as incorporated into the Clean Water Act, establishes policy requirements regarding the reduction of CSOs. National requirements and specific requirements contained in HWU's Kentucky Pollutant Discharge Elimination System (KPDES) permit require HWU to prepare a Long-Term Control Plan (LTCP). USEPA and KDOW regulations require the abatement of CSOs as provided in the *CSO Control Policy*.

The end purpose of the LTCP is to develop a series of prioritized, phased, projects for controlling CSOs in conformance with the *CSO Control Policy*. The LTCP gives priority to lower cost projects that would have the most immediate water quality benefit. There are two general approaches to determining the "design standard" for developing a LTCP:

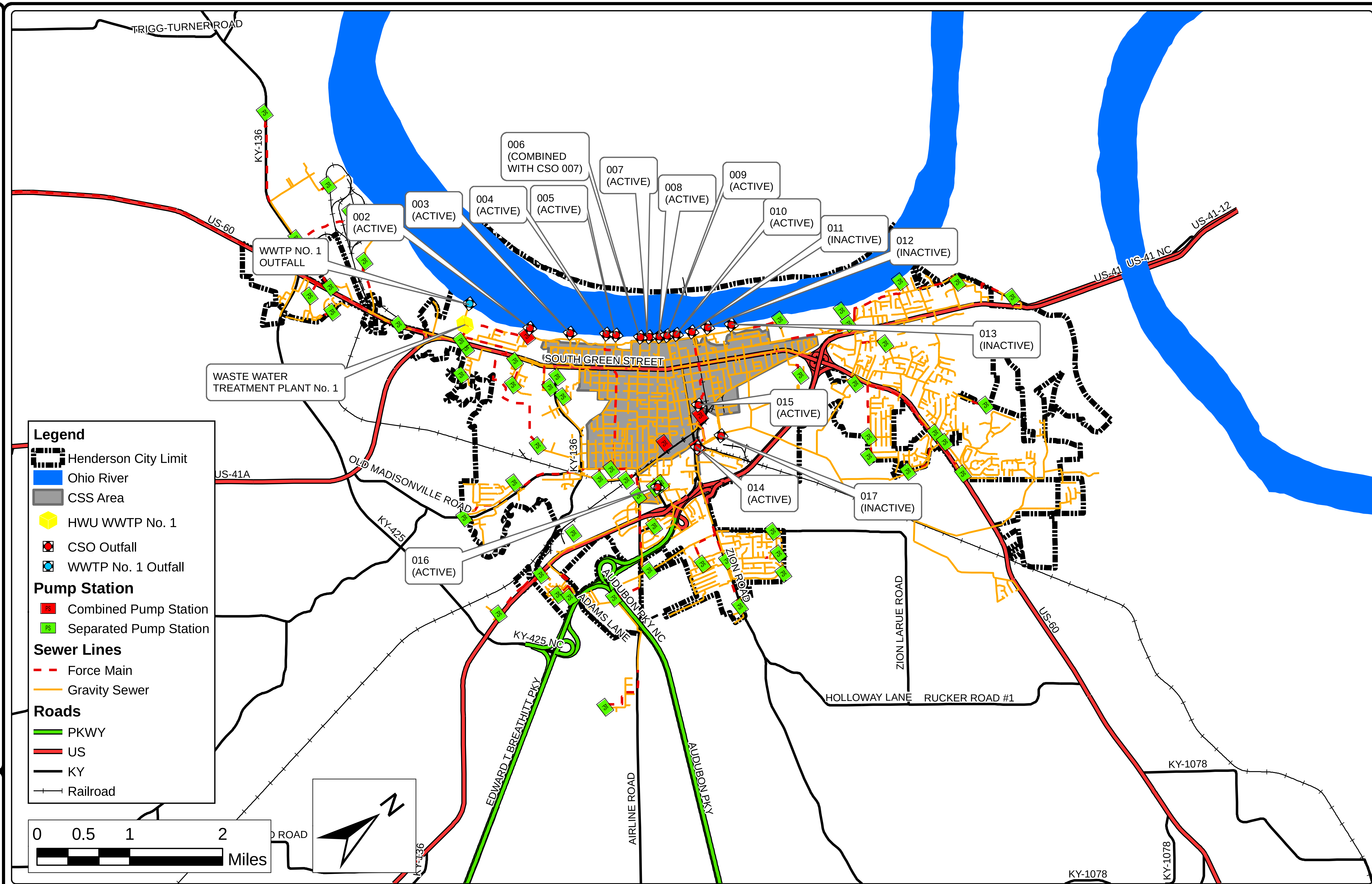
1. A ***Presumptive Approach*** where CSOs are controlled to limit CSOs to four to six events per year or to maintain treatment of over 85 percent by volume of flow or by mass of pollutants captured during wet weather events.

2. A ***Demonstrative Approach*** that provides a level of control that can be shown to achieve water quality standards and support designated uses.

1.02 COMMUNITY INFORMATION

Henderson Water Utility
111 5th Street
Henderson, KY 42420
Phone: (270) 826-2421
Fax: (270) 826-9343
Email: shipleyb@hkywater.org
NPDES Permit Number KY 0020711

HENDERSON WATER UTILITY SEWER SYSTEM
COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY



STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 1.01-2
5454.002

COMBINED SEWER SYSTEM IN THE CENTRAL DOWNTOWN AREA
COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

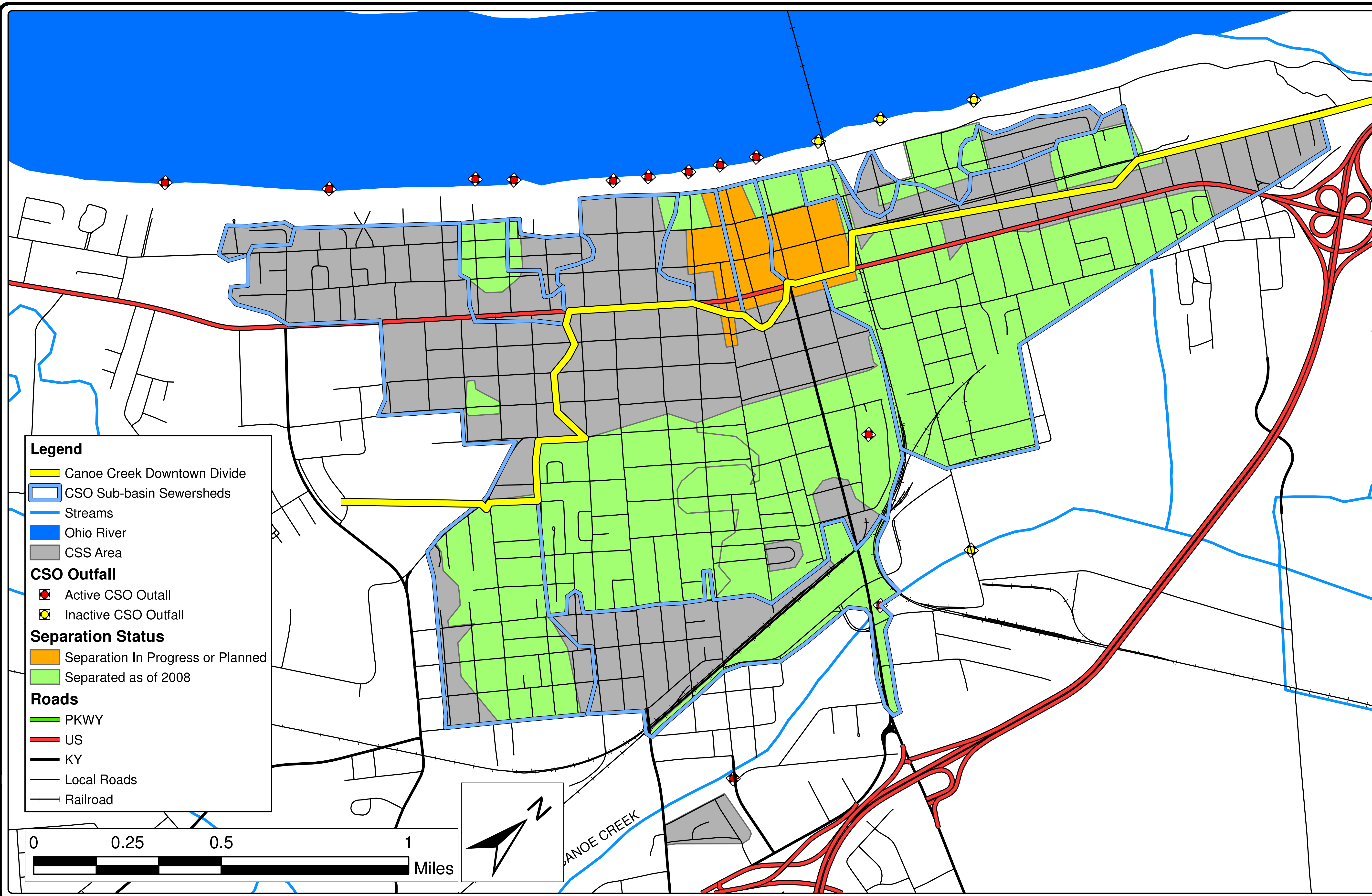


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FIGURE 1.01-3
5454.002

1.03 COMMUNICATION WITH KDOW

On December 18, 2008, HWU and Strand Associates gave a presentation to KDOW to provide an advance preview of the LTCP while it was in its development stages. The major items covered in the presentation include the following items:

A. Notification of HWU's intent to utilize the *LTCP EZ* guidance in preparing the plan (the EZ templates will be augmented through supporting narratives).

B. Description of the spreadsheet tool to assess the effectiveness of CSO controls.

C. Use of 1995 overflow volumes as the beginning date to meet the 85 percent capture level required by the presumptive approach.

D. Documentation that there are no sensitive areas and therefore no priority areas or CSOs.

E. Introduction to HWU's plan to separate and redirect flows away from the CSS to reduce CSO volume.

F. Concern that financial burden of CSO control is nearing the hardship threshold for the community and that implementation will be dependent on economic factors.

Feedback from KDOW during and after the presentation was positive. KDOW supported HWU's approach and preliminary conclusions pending submittal of this LTCP.

1.04 DEFINITIONS

CCTV	closed circuit television
cfs	cubic feet per second
CMOM	Compliance, Management, Operations, and Maintenance
CPI	consumer price index
CSO	combined sewer overflow
CSOP	combined sewer operational plan
CSS	combined sewer system
CS1	Control Structure No. 1
CS2	Control Structure No. 2
DWO	dry weather overflow
FOG	fats, oils, and greases
GIS	geographical information system
GPS	global positioning system
HWU	Henderson Water Utility
IU	industrial user
KDOW	Kentucky Division of Water
KPDES	Kentucky Pollutant Discharge Elimination System
LTCP	Long-Term Control Plan
mgd	million gallons per day
MHI	median household income
mil gal	million gallons
MPV	market property value
NLCD01	National Land Cover Database 2001
NMC	Nine Minimum Controls
NPDES	National Pollutant Discharge Elimination System
NWWTP	North Wastewater Treatment Plant
O&M	operation and maintenance
ORSANCO	Ohio River Valley Water Sanitation Commission
POTW	publicly owned treatment works
RCP	reinforced concrete pipe
RI	recurring interval
S&F	solids and floatables
SCADA	supervisory control and data acquisition
SORP	sewer overflow response plan
SSO	sanitary sewer overflow
SUO	sewer use ordinance
USEPA	United States Environmental Protection Agency
VCP	vitrified clay pipe
WWTP	wastewater treatment plant – synonymous with NWWTP (North WWTP)

SECTION 2

NINE MINIMUM CONTROLS

2.01 EXECUTION OF NINE MINIMUM CONTROLS

Line 5 and Schedule 1 of the *LTCP-EZ* require information on the city's execution of the Nine Minimum Controls (NMC).

HWU recently submitted the NMC report to KDOW. KDOW is in the process of reviewing the report. Updates will be made to the NMC report based on comments received from KDOW. This section updates the original NMC Compliance Submittal sent to KDOW.

The following documents contribute toward Henderson's NMC program and are included in this report as appendices:

A. Appendix B: *Nine Minimum Controls Compliance Report,* August 2008.

B. Appendix C: *Henderson Water and Sewer Utility Combined Sewer System Operation Plan,* February 1996.

C. Appendix D: Combined Sewer Operation Plan Annual Updates submitted 1997 to 2006.

D. Appendix E: 308 Requested Letter from USEPA.

E. Appendix F: Sewer Overflow Response Plan (SORP)

2.02 NMC1: PROPER OPERATION AND REGULAR MAINTENANCE PROGRAMS

A. General

The first minimum control is to establish and maintain a formal operation and maintenance (O&M) program that provides effective operation of the CSS. This control includes developing and routinely updating a written operation and maintenance manual for maintaining the CSS to perform its proper function, and documentation of procedures and practices for regular maintenance and inspection of critical facilities, record keeping, training, and budgeting procedures.

B. Current Status of Control Measures

Generally, proper O&M can be demonstrated through providing a thorough O&M manual, including procedures and policies for each of the mentioned controls, along with documentation showing the procedures within the O&M manual are being implemented. HWU follows procedures outlined in the O&M manual, which consists of a series of standard operating procedures (SOPs). HWU also recently submitted a comprehensive checklist of O&M activities and procedures as part of the Capacity, *Management, Operation and Maintenance* (CMOM) submittal to KDOW and USEPA.

1. Organizational Structure

"The organizations and people responsible for various aspects of the O&M program." (*Guidance for Nine Minimum Controls*)

HWU included an administration organizational chart in the CSOP developed in 1996. HWU has also developed an organizational chart that shows the overall personnel structure for the collection system, including O&M staff. There are organizational charts that show functional groups and classifications. Up-to-date job descriptions that describe responsibilities and authority for each position have been developed. Job descriptions include the following:

a. Nature of work to be performed.
b. Minimum requirements for the position.
c. Necessary special qualifications or certifications.
d. Examples of types of work.
e. List of licenses required for the position.

A monthly report is given to the HWU Board that documents positions in the utility that are vacant and positions that have been recently filled. Typically, O&M positions are filled within one month.

2. Resources Allocated to O&M Activities

"The resources (i.e. people and dollars) allocated to O&M activities." (*Guidance for Nine Minimum Controls*)

HWU develops a budget for annual operating costs. The budget is prepared with line items for labor, materials, and equipment. O&M staff is actively involved in the budget preparation process, and all O&M managers have the current O&M budget data.

The collection system actual O&M cost for FY 2007-2008 was $2,442,213. HWU also has a Capital Improvement Plan that provides for system repair/replacement on a prioritized basis.

HWU has full-time crews that operate a vactor truck with high pressure wash unit, a sewer wash truck, and closed circuit television (CCTV) equipment. Not only are the lines televised on a routine basis, they are also evaluated and information is entered into the Hansen Asset Management System. If problems are detected that can be corrected by flushing or cleaning the line, a work order is created. Typically, the entire CSS is flushed or cleaned at least once every year.

3. Critical Facilities

"A list of facilities (e.g., tide gates, overflow weirs) critical to the performance of the CSS." (*Guidance for Nine Minimum Controls*)

In accordance with the requirements of the Consent Judgment, HWU has submitted a map of its collection system showing all public sewer lines (except laterals) and the direction of flow and size of each line, manholes, pumping stations, CSO outfalls, and regulator structures. All critical facilities are in our Asset Management System and geographical information system (GIS).

4. Procedures for Routine Maintenance

"Written procedures and schedules for routine, periodic maintenance of major items of equipment and CSO diversion facilities, as well as written procedures to ensure that regular maintenance is provided." (*Guidance for Nine Minimum Controls*)

HWU crews perform CCTV inspections of approximately 10 percent of the entire collection system annually. There is a full-time two-man crew that is dedicated to CCTV activities year round. Every year, HWU crews clean and vacuum out every stormwater intake at least once and wash out approximately 50 percent of the separate sanitary sewer lines. HWU maintenance crews clean out and televise approximately 30 percent of the CSS every year. Problem areas are scheduled for more frequent cleaning. Root cleaning is performed on an as needed basis. HWU has two full-time cleaning crews dedicated to collection system cleaning. The number of stoppages has decreased dramatically over recent years because of the routine cleaning program.

Pumping stations have a dedicated, four-man maintenance crew.

The Hansen Asset Management System is used to track maintenance work and user complaints. This provides documentation of maintenance work performed in the CSS and helps to identify problem areas that need extra maintenance or repairs.

5. Nonroutine Maintenance and Emergency Situations

"Written procedures, including procurement procedures, if applicable, for responding to emergency situations." (*Guidance for Nine Minimum Controls*)

Nonroutine maintenance, such as replacement of failed sewers and pumping station maintenance, is handled through the Hansen Asset Management System work orders. Emergency response for pumping stations is handled by a maintenance staff member through an on-call pager system. When complaints from customers are received or alarms from our SCADA system are received, a maintenance crew is dispatched to investigate the complaint and initiate any repairs.

HWU recently submitted an updated sewer overflow response protocol (SORP) that details the procedures to be followed in the event of a sewer overflow. The SORP also describes the procedures to be followed in emergency situations. The SORP was submitted to the state for review in May, in accordance with the requirements of the Consent Judgment. The SORP submittal received a favorable review and comments.

6. Inspections

"A process for periodic inspections of the facilities listed previously." (*Guidance for Nine Minimum Controls*)

Pumping stations are visited weekly by HWU staff, and are monitored continuously via the supervisory control and data acquisition (SCADA) system. A checklist is utilized for inspections, and records are maintained for each inspection. The collection system is routinely inspected by a full-time CCTV crew. CCTV inspections are performed annually for approximately 10 miles of sewer lines.

When problems are observed, work orders are created and tracked through HWU's Hansen Asset Management system. If necessary, direct communication from maintenance staff to management is encouraged and expected to initiate repair procedures expediently.

7. Training

"Policies and procedures for training O&M personnel." (*Guidance for Nine Minimum Controls*)

A documented formal training program has been developed. The training program addresses the fundamental mission, goals, and policies of the HWU. Formal classroom training is provided for the following topics:

a. Safety.
b. Confined space entry.
c. Traffic control.
d. Record keeping.
e. CCTV.
f. Trench/shoring.

In addition to classroom training, on-the-job training is used in the following areas:

a. Routine line maintenance.
b. Electrical and instrumentation.
c. Pipe repair.
d. Bursting/cured-in-place pipe
e. Public relations.
f. SSO/emergency response.
g. Pumping station O&M.

On-the-job training uses standard operating and standard maintenance procedures. There are mandatory training requirements at all staff levels. Periodic testing and demonstrations in the field are used to estimate the effectiveness of training programs. The annual review process incorporates a measurement of on-the-job training progress and performance.

8. Periodic Review

"A process for periodic review and revision of the O&M program." (*Guidance for Nine Minimum Controls*)

O&M budgets are reviewed on an annual basis, during the budgeting process. Line employees and O&M supervisors provide input regarding needed equipment and training, as well as problem areas identified as needing repair or replacement through the Capital Improvement Project Budget. O&M supervisors meet monthly with senior management to discuss O&M issues within their specific areas.

2.03 NMC2: MAXIMIZATION OF STORAGE IN THE COLLECTION SYSTEM

A. General

The second minimum control is to maximize storage of wastewater in the collection system where possible. Efforts included in this minimum control begin with inspection and brief analysis of the collection system to identify locations where storage within the system can be increased. Additional work related to this NMC will be an important consideration in the LTCP.

B. Current Status of Control Measures

HWU has pumping stations within the CSS that maximize the available storage within the system during a storm event. HWU has completed several projects in the CSS to maximize storage in the collection system. It is important to periodically review these measures to ensure that maximum storage is being obtained.

The Center/Julia Street stormwater project is in the final stages of completion. The project includes the installation of new stormwater piping within the entire drainage area of an older part of town. Approximately 185 acres have been separated from the CSS as a result of this project. The project eliminated the stormwater runoff in this area that previously entered the CSS, which added significant storage capacity in the current system. There are approximately six miles of combined sewers in this area.

The downtown separation project is designed to completely renew the entire downtown area, which is a 16-square-block area. This project will include new water lines, new separate sanitary sewers, and a new stormwater system. The project will also significantly reduce discharges from three CSO points on the Ohio River.

Other significant separation or removal projects are being considered as part of the LTCP. Combined sewer separation and CSO treatment projects will be reviewed in the LTCP. HWU's goal is to separate sewers where physically and economically feasible.

Another area where maximizing storage is realized is in the 50 percent acreage that has been removed from the CSS.

1. Collection System Inspection

"This will enable identification of serious deficiencies that restrict the use of the system's available storage capacity." (*Guidance for Nine Minimum Controls*)

HWU has performed smoke testing to identify major defects and illicit connections. The smoke testing program is active approximately three months out of each year. For example, in 2006, 600 hours were devoted to smoke testing in the CSS. Furthermore, customer complaints, work crew observations, and pumping station run times are also used to identify and prioritize problem areas. HWU also has full-time crews that operate a vactor truck, a wash truck, and a CCTV system. Repair work orders are generated and tracked within an asset management system that keeps track of completed and pending work. HWU uses typical methods for the remedy of hydraulic deficiencies, including but not limited to repair of sewers, replacement of sewers, installation of hydraulic relief sewers, and root control. See additional information under Section 3.02(D).

2. Tide Gate Maintenance and Repair

"Leaking tide gates can admit significant volumes of water into the conveyance system." (*Guidance for Nine Minimum Controls*)

One of the CSO outfalls has a flap gate to prevent Ohio River backwater from entering the CSS. The flap gate is effective in preventing backwater from flowing into the CSS during periods when the Ohio River level is high. Flap gates at other locations are not necessary to keep backwater from entering the system.

3. Adjustment of Regulator Settings

"Many regulating devices, with simple modifications can be used to increase in-system storage of wet weather flows." (*Guidance for Nine Minimum Controls*)

Figure 2.03-1 Flap Gates at KPDES No. 014

HWU has been proactive at making adjustments to increase in-system storage of wet weather flows. The best example of this is the recent modifications made at the Second Street Pumping Station, KPDES CSO No. 014. This station overflows directly to Canoe Creek via an attached structure fitted with two flap gates. Based on the hydraulics of the large interceptor that conveys flow to the pumping station, HWU discovered an opportunity to maximize storage in the collection system by sealing the two flap gates at the pumping station. In April 2008, HWU sealed the flap gates resulting in zero overflows in the four and a half months since (from mid-April through the end of August). In the three months prior to sealing the flap gates, this pumping station had an overflow volume of 86 million gallons. The improvement at the pumping station has resulted in a significant improvement in the CSS. Figure 2.03-1 is a picture of the two flap gates at the Second Street Pumping Station.

4. Retard Inflows

"O&M staff can modify catch basin inlets to restrict the rate at which surface runoff is permitted to enter the system." (*Guidance for Nine Minimum Controls*)

As the result of smoke testing performed within the CSS, several downspouts were disconnected from the CSS. HWU has a program for reducing stormwater inflow by requiring disconnection of area drains, foundation drains, and roof leaders. Also, the Sewer Use Ordinance includes legal procedures for addressing illegal connections.

In 2003, HWU removed a stormwater intake from the 900 block of First Street and tied it into stormwater box culverts that lead to the Third Street CSO Basin. With the installation of over 1,020 feet of pipe and repairs to a ditch along Fifth Street, HWU also removed eight stormwater inlets along Center Street.

In 2004, HWU continued efforts to prevent stormwater flow from entering the CSS. Crews removed six stormwater intakes from the area around the 100 block of North Alvasia Street and tied them into stormwater box culverts that lead to the Third Street primary treatment CSO Basin. This project also involved laying approximately 300 feet of 18-inch storm sewer pipe, and approximately 175 feet of 12-inch storm sewer pipe. HWU crews removed the CSS intake near the intersection of Fifth Street and Water Street diverting stormwater away from the CSS and directly into the river. Also in 2004, Henderson's Public Works Department installed a 24-inch stormwater line and several intakes along North Adams Street diverting stormwater away from the CSS and into a ditch.

In 2005, HWU continued efforts to prevent stormwater flow from entering the CSS. Crews removed a stormwater intake under the Second Street Overpass, and another intake on Heilman Avenue. The runoff that would have entered the CSS at these two intakes now flows to a ditch and into Canoe Creek.

In 2006, crews began construction of a stormwater separation project in the area around Center and Julia Streets. Also, ten manholes were rebuilt to prevent direct inflow of stormwater from entering into the CSS. One manhole is in the combined system on the 500 block of Ninth Street, while the other nine manholes are in the separate system and flow through the CSS on its way to the WWTP. By removing the inflow of stormwater from these nine sanitary sewer system manholes, more capacity has been restored to the CSS.

In 2008, HWU eliminated stormwater inflow from Short Seventh Street.

5. Localized Upstream Detention

"Using localized detention in appropriate upstream areas could provide effective short-term storage." (*Guidance for Nine Minimum Controls*)

The Third Street Storage Basin was constructed to hold stormwater during wet weather and thereby allow more capacity in the combined sewers. The basin provides primary treatment and has a capacity of 15 million gallons.

Development projects within the CSS area are required to provide on-site detention for parking lot and roof drainage.

6. Upgrade/Adjustment of Pump Operations at Interceptor Lift Stations

"Increased pumping rates might be possible through repair, modification, or augmentation of lift stations." (*Guidance for Nine Minimum Controls*)

Lift stations are monitored through weekly inspections and the 24/7 SCADA system. This system allows for maximization of storage through ensuring that critical operating characteristics are running properly within recommended ranges. Operating characteristics include low water level, high water level, overflow alarms, seal failure, temperature failure, run times, and wet well levels.

7. Removal of Obstructions to Flow

"This can include maintenance activities to remove and prevent accumulations of debris and sediment that restricts flow." (*Guidance for Nine Minimum Controls*)

HWU implemented an annual leaf collection program that alleviates seasonal backups of the CSS and also serves as a Public Education and Outreach program for the Municipal Separate Storm Sewer System Stormwater Phase II campaign. This program consists of distributing large plastic garbage bags and information packages to city residents, and pick-up and disposal of the bags after they have been filled with leaves. The packets include information regarding the importance of keeping leaves out of stormwater intakes as well as general information regarding stormwater quality. As already indicated, HWU also has full-time crews that operate a vactor truck, a wash truck, and a CCTV system to investigate and clean the collection system.

2.04 NMC3: REVIEW AND MODIFICATION OF PRETREATMENT REQUIREMENTS

A. General

Pretreatment programs are included as one of the NMCs for several reasons. Many nondomestic dischargers can potentially release higher strength wastes or significant flows to the combined system, and in some cases, these discharges have direct impacts on CSO volumes and pollutant loadings. In addition, in some cases nondomestic dischargers are able to make simple changes to use existing facilities in ways that reduce discharges during CSO events. In other cases it may be in the interest of both the CSS operator and the discharger to make more substantial changes for reductions in CSO discharges and ultimately improvements in water quality. According to USEPA's *Guidance for Nine Minimum Controls*, "The objective of this control is to minimize impacts of discharges into the CSS from nondomestic sources during wet weather events, and to minimize CSO occurrences by modifying inspection reporting and oversight procedures within the approved pretreatment program."

B. Current Status of Control Measures

As the owner of a publicly owned treatment works (POTW), HWU has a federally mandated pretreatment program. The program regulates and enforces approved local permit limits on Industrial Users (IUs) within HWU's collection system. The pretreatment program is used to permit and monitor nondomestic discharges to the collection system and has proven to be very effective.

The main purpose of HWU's pretreatment program is to protect the POTW by consistently tracking the IUs listed in the program. The IUs are inspected and sampled regularly by HWU as part of the pretreatment program. All IUs in the program are also required to submit self-monitoring analyses on their effluent wastes. These results are submitted to the HWU Pretreatment Coordinator on a scheduled basis each year as listed in each IU discharge permit. This inspection and sampling requirement is enforced to monitor the consistency of the industry's wastewater discharge and routinely evaluate the quality of the discharge. For the sake of neutrality, HWU contracts an outside laboratory to perform the monitoring of IU effluent. The state of Kentucky also requires three reports per year from HWU that show the status of all industries in the pretreatment program as well as a thorough annual laboratory scan on the WWTP influent, effluent, and biosolids that these industries discharge to.

HWU has an industrial waste permit application to obtain information that can be used to take appropriate actions to protect the integrity of the wastewater treatment facilities. The application is used to collect information that will be included for each IU permit. Data obtained in the application is used by HWU to formulate, revise, or reissue IU discharge permits. A copy of the industrial waste permit application is included in the appendix of the LTCP report (Appendix B).

HWU has an entire section (Section 23-31) of the adopted sewer use ordinance dedicated to pretreatment program requirements. The sewer use ordinance details the process for obtaining IU permits, discharge limits, periodic compliance reports, and monitoring. As required in the sewer use ordinance, all significant IUs must submit to the Pretreatment Coordinator at least once every six months or on dates specified in the IU Permit, a report indicating, at a minimum, the nature and concentration of pollutants in the effluent limited by pretreatment standards or the discharge permit. The report must also include a record of all daily flows that exceeded the average daily flow during the reporting period.

Since the development of the pretreatment program and inclusion of requirements listed in the sewer use ordinance, HWU has continued to enforce the pretreatment program. HWU has a process for periodic review of the pretreatment program.

1. Inventory Nondomestic Dischargers to the Combined Sewer System

"The municipality should first prepare an inventory of all nondomestic dischargers to the collection system." (*Guidance for Nine Minimum Controls*)

Currently, HWU has 24 permits to regulate and track, including local septage haulers. Some of the users that are permitted are large entities, while others are small family businesses. HWU has identified IUs whose discharge could reach CSOs.

HWU has conducted an inventory of each business and restaurant in the downtown area included in the downtown sewer separation project. This area is upstream from three CSOs along the Ohio River. HWU has not inventoried every nondomestic discharger in the CSS, but this information can be compiled from several of HWU's databases, including GIS.

2. Assess the Impact of Nondomestic Discharges on Combined Sewer Overflows

"Identification of nondomestic sources that are significant contributors of specific pollutants implicated in water quality problems." (*Guidance for Nine Minimum Controls*)

HWU has determined that discharges from nondomestic sources do not appear to significantly affect the CSS. The major contaminant in the CSS' receiving waters is bacteria, which is not a primary component of nondomestic discharges.

3. Evaluate Feasible Modifications

"Evaluate feasible modifications to the approved pretreatment program if the assessment indicates that nondomestic sources might contribute significantly to CSOs." (*Guidance for Nine Minimum Controls*)

Industry discharges have not as yet caused any serious or significant impact to the CSO area. Therefore, HWU has not performed an evaluation of how pretreatment programs could or should be modified. The pretreatment program and requirements listed in the sewer use ordinance have been effective at monitoring and evaluating the effluent from all permitted IUs.

HWU requires all new restaurants to install a grease trap, new garages, and gas stations to install a sand/oil separator. In anticipation of changes with the sewer use ordinance, HWU expects to see some improvement in the collection system and a reduction in fats, oils, and greases (FOG). Most of the existing problems relating to FOG are in locations outside the CSS.

2.05 NMC4: MAXIMIZE FLOW TO THE PUBLICLY OWNED TREATMENT WORKS

A. General

Maximization of flow and treatment at the POTW is an effective way to reduce CSO magnitude and frequency. This control focuses on measures to understand, effectively use, and maximize available POTW resources.

B. Current Status of Control Measures

HWU has made significant upgrades to the WWTP to increase performance. The design capacity for primary and secondary treatment at the WWTP is 15 million gallons per day (mgd), and the peak flow capacity for primary and secondary treatment is 22.5 mgd.

1. Determine Collection System Capacity

"Determine the capacity of major interceptors and pumping stations that deliver flow to the treatment plant. Ensure that full capacity is available." (*Guidance for Nine Minimum Controls*)

The WWTP expansions in 1998 increased the design capacity and peak flow capacity for the WWTP. Maximum capacity at the WWTP is not exceeded during rain events. HWU can treat all of the wastewater that reaches the WWTP and does not bypass treatment during rain events.

HWU has determined the hydraulic capacity of each pumping station as well as the hydraulic capacities of the influent sewers. The Janalee Drive Pumping Station, which is the only pumping station in the CSS that pumps to the WWTP, has a capacity of 11.5 mgd. Drawdown testing was performed in the past to determine effective capacities of pumping stations and Janalee Drive Pumping Station pumps at maximum capacity during storm events.

The Canoe Creek Interceptor Project will maximize separate sanitary flow to the WWTP and will greatly benefit the CSS by allowing more storage (4.7 mgd) as a result of flow diversion. This will also allow the existing Janalee Drive Pumping Station to pump more storm flow to the WWTP before a CSO occurs.

2. Determine Relationship Between Performance and Flow

"Compare flows processed by the plant during wet weather events and dry periods and determine the relationships between performance and flow." (*Guidance for Nine Minimum Controls*)

CSO events occur when the WWTP flow rate is below maximum capacity. The ratio of maximum wet weather flow to average dry weather flow is 2.23. As stated above, the Canoe Creek Interceptor Project will allow the existing Janalee Drive Pumping Station to pump more storm flow and increase wet weather flow to the plant.

The Third Street stormwater primary treatment basin captures 15 million gallons of first flush combined sewer flow and pumps it back to the WWTP after a storm event, thereby significantly increasing treatment of combined sewer flows.

3. Identify Locations of Available Excess Capacity

"Compare the current flows with the design capacity of the overall facility, as well as the capacity of individual unit processes." (*Guidance for Nine Minimum Controls*)

The upgrades at the WWTP have been effective at increasing the capacity of the treatment plant. Therefore, HWU has looked at other locations in the collection system for excess capacity.

As previously discussed with NMC2, HWU has made recent modifications at the Second Street Pumping Station, KPDES No. 014, to increase in-system storage of wet weather flows and convey more flow to the WWTP for treatment. This station overflows directly to Canoe Creek via an attached structure fitted with two flap gates. Based on the hydraulics of the large interceptor that conveys flow to the pumping station, HWU discovered an opportunity to maximize storage in the collection system by sealing the two flap gates at the pumping station. In April 2008, HWU sealed the flap gates, which has resulted in zero overflows. In the three months prior to sealing the flap gates, this pumping station had an overflow volume of 86 million gallons. The sealing of the flap gates has resulted in additional flow conveyed to the WWTP for treatment during rain events.

2.06 NMC5: ELIMINATION OF COMBINED SEWER OVERFLOWS DURING DRY WEATHER

A. <u>General</u>

The elimination of dry weather overflows (DWO) is driven by KPDES permit program requirements prohibiting DWOs, and is enforceable independent of CSO control policies. DWOs can usually be reduced or eliminated by modifications to O&M programs and minor modifications to the regulator structures such as repairs or modifications of the regulators. Important components of this minimum control include identifying all DWOs, the means of correcting DWOs, and the procedures to notify the KPDES permitting authority that a DWO has occurred. HWU, in partnership with the U.S. Geological Survey, recently installed a river gage and rain gage on the Ohio River in downtown Henderson. Readings from this instrumentation will help distinguish DWOs from other overflow events.

B. <u>Current Status of Control Measures</u>

The ongoing activities initiated to date by HWU for the elimination of CSOs during dry weather are generally adequate. As described below, HWU consistently monitors the flow in eight CSO discharge points by using flow meters or other methods, and also monitors all pumping stations in the collection system using SCADA. The collected flow data and visual observations indicate the collection system operates properly under dry weather conditions. The current flow monitoring and inspection program, along with prompt response and notification when DWOs are discovered, meets the expectations of this control measure.

1. Inspection to Identify Dry Weather Overflows

"In order to record and enumerate DWOs, a visual inspection program of sufficient scope and frequency is needed." (*Guidance for Nine Minimum Controls*)

Several CSOs in HWU's collection system are not very accessible and present a safety issue for any type of routine or frequent visual observation. Therefore, visual inspection of the CSO outfalls is limited. As a result, HWU decided to use automatic measurements to collect information on the characteristics of CSOs. HWU has implemented quarterly visual inspection of its CSO outfall locations.

HWU has 24-hour operators to monitor pumping station performance using SCADA equipment. With a 30-minute response time for personnel, a list of standard operating procedures and proper equipment, DWOs can be avoided by watching for signs of pump problems. No DWOs have occurred during the past five years that were not the direct result of a mechanical failure at a pumping station or a power outage. Power outages and pump failures are the only causes of DWOs in HWU's collection system, and HWU's monitoring system allows them to quickly respond and limit potential DWOs.

HWU has installed Teledyne-ISCO 2150 Area Velocity Flow Modules in seven CSO discharge points in the following locations:

a. KPDES No. 003 (Ragan Street)
b. KPDES No. 004 (Jackson Street)
c. KPDES No. 005 (Towles Street)
d. KPDES No. 007 (Powell Street)
e. KPDES No. 008 (Washington Street)
f. KPDES No. 009 (First Street)
g. KPDES No. 010 (Second Street)

The Janalee Drive P.S. is measured via weir and ultrasonic level equipment.

Flow data is collected from each flow module and analyzed by HWU personnel on a weekly basis. The modules use continuous wave Doppler technology to measure mean velocity. The SCADA equipment at the pumping stations and the flow modules at the CSO discharge points allow HWU to closely monitor and inspect the collection system to reduce DWOs.

2. Correction of Dry Weather Overflows

"Dry weather overflows caused by operational problems can generally be alleviated by one or several methods." (*Guidance for Nine Minimum Controls*)

HWU's CSS operates properly under dry weather conditions. Over the past several years, there have not been any dry weather overflows that were the result of operational problems. If any DWOs occur because of power outages or pump failures, portable backup hydraulic pumping systems allow HWU to address issues related to power outages or pump failures.

3. Notification

"Establish a procedure to promptly notify the National Pollution Discharge Elimination System (NPDES) permitting authority that a dry weather overflow has occurred." (*Guidance for Nine Minimum Controls*)

HWU currently reports all overflows, during both dry weather and wet weather, to KDOW. HWU has recently updated the SORP that includes procedures for proper public notification and agency notification not only for dry weather overflows, but any type of sewer overflow. The measures taken to correct any DWOs will continue to be well documented, and HWU will continue to adhere to the procedures developed to establish prompt notification.

2.07 NMC6: CONTROL OF SOLID AND FLOATABLE MATERIALS IN CSOs

A. <u>General</u>

Control of solid and floatable (S&F) materials discharged to receiving streams can result in noticeably visual improvements in water quality by limiting trash and other objectionable materials observed by the public in waterways. Control of S&F materials is intended to reduce visible floatables and solids using relatively simple measures. The measures in this control focus on technology-based controls of various methods, most of which trap floatables within the collection system or collect them at the discharge location, before they are released in the environment.

B. Current Status of Control Measures

HWU has initiated several simple measures to help control S&F materials in CSOs. Bar screens at several locations within the collection system help prevent S&F materials from discharging from the collection system. HWU attempts to capture the "first flush" and send it to the treatment plant for proper treatment before overflows occur. As described below, HWU also initiates ongoing activities to prevent S&F materials from entering the CSS.

1. Methods for Removing Solids and Floatables from Combined Sewage

"Simple measures can be used to remove S&Fs from combined sewage before they reach the receiving stream." (*Guidance for Nine Minimum Controls*)

HWU has installed bar screens at the Third Street Basin, Second Street Pumping Station, and the headworks of the WWTP to remove S&Fs that have entered the collection system. The Hansen Asset Management System documents all work orders and can be utilized to document how often these bar screens are cleaned. The Third Street Basin, which includes primary treatment, utilizes a culvert to self-cleanse the basin and prevent any objectionable materials from surfacing at the basin. HWU makes quarterly inspections of all outfalls.

2. Methods for Removing Floatables from the Surface of the Receiving Water Body

"S&Fs can also be removed from the receiving water body after discharge. Common devices include outfall booms and skimmer boats." (*Guidance for Nine Minimum Controls*)

Currently, HWU captures the "first flush" in the CSS to ensure S&Fs do not reach receiving streams. Furthermore, quarterly visual inspections of outfall points indicate that S&F materials are not a significant issue in receiving waters. Typically, HWU does not receive complaints about debris in receiving water bodies.

3. Methods to Prevent Extraneous Solids and Floatables from Entering the Combined Sewer System

"Source control programs that address the prevention or removal of street litter and the proper disposal of personal hygiene materials can contribute greatly to the control of floatables." (*Guidance for Nine Minimum Controls*)

HWU has been active at preventing S&Fs from entering the CSS by implementing relatively simple measures including catch basin cleaning, street sweeping, implementing a leaf collection program, and increasing the number of public garbage cans in the combined sewer area. HWU has also constructed the Third Street Basin, which has proven to be effective at controlling solids. A brief description of each of these control measures are presented below.

a. Catch Basin Cleaning

Catch basins act to remove debris (S&Fs) from the storm sewer system before the pollutants can be washed into the receiving streams. Sediment, litter, and general debris will settle in catch basins until rainfall washes it into receiving waters. HWU has initiated a routine catch basin cleaning program in an effort to reduce the amount of debris entering the sewer system from catch basins. A two-man, full-time crew uses a vactor truck owned by HWU to clean catch basins on a routine basis. Every catch basin and inlet is cleaned at least once per year, and many are cleaned on a more frequent schedule.

b. Street Sweeping

Street sweeping reduces street litter and pollutant wash-off from the pavement. Street sweeping helps reduce the amount of S&Fs found in overflows because of the collection of debris and sediment that would otherwise be flushed into the storm sewer inlets. The City utilizes a full-time crew to perform street sweeping on a daily basis. Although not documented, it is likely that every street in the CSS is cleaned at least once per month.

c. Leaf Collection Program

HWU initiated a leaf collection program in 1999 to alleviate seasonal backup of the CSS. Leaves may not only cause blockages in the collection system, but also cause aesthetic problems on the receiving stream, and use oxygen as the material decomposes. The leaf collection program consists of distributing large plastic garbage bags to city residents and having them collected by the City Solid Waste Program in an effort to prevent leaves from entering the CSS. In addition to receiving plastic bags, city residents annually receive an information package that discusses the need to keep leaves out of stormwater intakes. In 2005, the leaf bag collection program was expanded to include all residents in the city, not just those living in the CSO area. Since the program was initiated, HWU continues to distribute the large plastic bags annually. The program has proven effective at reducing the amount of leaves entering the collection system during the fall season. To date, HWU has spent approximately $95,000 on the leaf collection program.

d. Public Garbage Cans

Proper disposal of trash prevents litter from entering storm sewer inlets and thereby prevents the trash and debris from being washed into the CSS and ultimately receiving streams. The City and HWU added additional garbage cans in the downtown area in 2000. The garbage cans were strategically placed in the combined sewer area to reduce the amount of litter entering the CSS.

e. ORSANCO River Sweep Program

Henderson participates in the ORSANCO River Sweep each June. While this program does not reduce S&Fs in the CSS, it does reduce S&Fs in the receiving waters.

As a result of these measures, HWU has not had any problems with S&F materials in the CSS.

2.08 NMC7: POLLUTION PREVENTION PROGRAMS TO REDUCE CONTAMINANTS IN CSOs

A. General

The development and implementation of pollution prevention programs is intended to keep contaminants from entering the CSS and thus receiving waters via CSOs. The most economical method of mitigating the effects of a CSO is to prevent pollution before it reaches the CSS. There are several methods to establish pollution prevention measures. This control focuses on eliminating pollution before it is created so that it does not have an opportunity to impact the CSS, and contribute to any CSO. Waste minimization reduces the amount of pollutants and flow that must be conveyed through the CSS and reduces overflow volumes and pollutant loadings to receiving waters. Programs to consider with this minimum control include street cleaning, public education programs, solid waste collection and recycling, product ban/substitution, control of product use, illegal dumping, bulk refuse disposal, hazardous waste collection, water conservation, and commercial/industrial pollution prevention activities.

B. Current Status of Control Measures

HWU has been active at implementing pollution prevention measures to reduce contaminants from entering the CSS including catch basin cleaning, street sweeping, implementation of a leaf collection program and increasing the number of public garbage cans. According to USEPA's *Guidance for Nine Minimum Controls*, "Pollution prevention measures such as street cleaning, public education programs, solid waste collection, and recycling can keep contaminants from entering the CSS."

1. Street Cleaning

"Street litter can be removed by mechanical or manual street cleaning or by street flushing during dry weather." (*Guidance for Nine Minimum Controls*)

Street sweeping reduces street litter and pollutant wash-off from the pavement. Street sweeping helps reduce the amount of pollutants found in overflows because of the collection of debris and sediment that would otherwise be flushed into the storm sewer inlets. The City of Henderson utilizes a full-time crew to perform street sweeping on a daily basis. Although not documented, it is likely that every street in the CSS is cleaned at least once per month.

Catch basins act to remove debris (S&Fs) from the storm sewer system before the pollutants can be washed into the receiving streams. Sediment, litter, and general debris will settle in catch basins until rainfall washes it into receiving waters. HWU has initiated a routine catch basin cleaning program in an effort to reduce the amount of debris entering the sewer system from catch basins. A two-man, full-time crew uses a vactor truck owned by HWU to clean catch basins on a routine basis. Every catch basin and inlet is cleaned at least once per year, and many are cleaned on a more frequent schedule.

2. Public Education Programs

"Education methods can include public service announcements, advertising, stenciling of street drain inlets, and distribution of information with water or sewer bills." (*Guidance for Nine Minimum Controls*)

HWU's annual leaf collection program serves as a Public Education and Outreach program consisting of distribution of large plastic garbage bags and information packages to city residents. The information packets include information regarding the importance of keeping leaves out of stormwater intakes as well as general information regarding stormwater quality.

HWU representatives have appeared several times on a live radio call-in show called "Speak Up." The local broadcasts highlight HWU's leaf collection program and other current issues, and reached an audience of approximately 5,000 listeners. The broadcasts feature representatives from HWU such as the Water and Sewer Commission Chairman, General Manager, Operations Superintendent, and Project Coordinator. The public education programs also included advertisements in Henderson's local newspaper, *The Gleaner*. Furthermore, information explaining the leaf collection program and an audio archive of "Speak Up" broadcasts has been published on HWU's Web Site at www.hkywater.org. HWU routinely broadcasts several different Public Service Announcements on local radio during football events and other high listener times. The 30-second audio clips are also available for listening via HWU's Web Site.

Formal presentations to the HWU Board and public meetings also serve as means for public education and outreach. Programs also include communication with groups such as the Rotary Club, Lions Club, downtown merchant organizations, and others as required by each specific situation/project.

Other methods of public education and outreach include door hangers, fliers, Web Site notifications, and signs throughout the neighborhood. Also, the public relations program includes booths at numerous local festivals and school programs, brochures that explain the purpose of the HWU, and tours of the WWTP for interested groups.

HWU has posted large CSO warning signs at each outfall that provide information regarding the outfall and a phone number to call with questions or concerns. HWU also participates in the annual Ohio River Sweep to remove any debris or litter collected along specific areas along the Ohio River. This activity is also utilized as a public education opportunity.

3. Solid Waste Collection and Recycling

"Trash receptacles along city streets should reduce the amount of litter on streets." (*Guidance for Nine Minimum Controls*)

Proper disposal of trash prevents litter from entering storm sewer inlets and thereby prevents the trash and debris from washing into the CSS and ultimately receiving streams. The City and HWU added additional garbage cans in the downtown area in 2000. The garbage cans were strategically placed in the combined sewer area to reduce the amount of litter entering the CSS.

HWU initiated a leaf collection program in 1999 to alleviate seasonal backup of the CSS. Leaves can not only cause blockages in the collection system, they also cause aesthetic problems on the receiving stream and use oxygen as the material decomposes. The leaf collection program consists of distributing large plastic garbage bags to city residents in an effort to prevent leaves from entering the CSS. In addition to receiving plastic bags, city residents annually receive an information package that discusses the need to keep leaves out of stormwater intakes. In 2005, the leaf bag collection program was expanded to include all residents in the city, not just those living in the CSO area. Since the program was initiated, HWU continues to distribute the large plastic bags on an annual basis. The program has proven effective at reducing the amount of leaves entering the collection system during the fall season. To date, HWU has spent approximately $95,000 on the leaf collection program.

2.09 NMC8: PUBLIC NOTIFICATION

A. General

The intent of this control is not only to inform the public when overflows occur, but also to provide the public with an understanding of the health and environmental consequences associated with CSOs. According to USEPA's *Guidance for Nine Minimum Controls*, "The intent of this minimum control is to inform the public of the location of CSO outfalls, the actual occurrences of CSOs, the possible health and environmental effects of CSOs, and the recreational or commercial activities curtailed as a result of CSOs. Public notification is of particular concern at beach and recreation areas directly or indirectly affected by CSOs. Potential risk is generally indicated by the exceedance of relevant water quality criteria." Public notification will provide improved public safety when overflows do occur and can also have the side benefit of creating support for CSO mitigation activities, once the public understands the potential benefits.

B. Current Status of Control Measures

USEPA provides a list of potential measures for notifying the public about CSO events. The list includes postings at affected use areas, selected public places, and at CSO outfalls. It also includes methods of notification to citizens such as notices in newspapers, announcements on radio and TV news programs, letters, and telephone hot lines. HWU continues to follow current public notification measures as required by the KPDES permit. HWU has also included public notification procedures that are followed in the SORP.

1. Posting at Combined Sewer Overflow Outfalls

"Posting at CSO outfalls is advisable where outfalls are visible and the affected shoreline areas are accessible to the public" (*Guidance for Nine Minimum Controls,* USEPA).

HWU has posted large, easy-to-read signs at each of the permitted CSO outfall locations. The signs list the CSO outfall number and a telephone number for the public to call if they have questions or concerns.

See Figure 2.09-1 for the information included on the CSO outfall sign.

WARNING
COMBINED SEWER OVERFLOW (CSO)
THE WATER FLOWING FROM THIS PIPE MAY BE POLLUTED DURING OR AFTER RAINSTORMS.
FOR MORE INFORMATION ABOUT CSOs AND THEIR EFFECT ON THE WATER QUALITY OF OUR STREAMS AND RIVERS, CALL HENDERSON WATER UTILITY (HWU) AT 826-2824.
CSO NO. ___
PLEASE CALL HWU AND REPORT IF WATER IS FLOWING DURING DRY WEATHER.

Figure 2.09-1 CSO Outfall Sign

Figure 2.09-2 shows the posting at one CSO outfall. HWU does not have postings in affected use areas or selected public places. These postings are intended for areas where prolonged restrictions to water use may occur.

Figure 2.09-2 Combined Sewer Overflow Outfall Sign at CSO No. 014

2. Other Public Notification Control Measures

Another way that HWU informs the public about CSOs is through its Web site, www.hkywater.org. General information about CSOs and their impact on receiving waters is included on the Web site.

HWU routinely held public meetings in 2006 through 2008 to discuss two major sewer separation projects. The projects included the Center/Julia Street project and the downtown separation project. During the meetings with the public, HWU discussed the current status of the projects as well as issues relating to CSOs. These public meetings were advertised in the local newspaper, *The Gleaner*, on the local radio station, and the Chamber of Commerce newsletter. Each meeting was followed up with a news story in the local newspaper.

2.10 NMC9: MONITORING TO CHARACTERIZE CSO IMPACTS AND THE EFFICACY OF CSO CONTROLS

A. General

This minimum control deals with establishing benchmarks and metrics to determine the impact and effectiveness of any CSO controls implemented by HWU. According to USEPA's *Guidance for Nine Minimum Controls*, "This minimum control is an initial characterization of the CSS to collect and document information on overflow occurrences and known water quality problems and incidents that reflect use impairments caused by CSOs. Changes in the occurrences of such incidents can provide a preliminary indication of the effectiveness of the minimum controls." This should provide demonstration that control measures taken are reducing the frequency, duration, and volume of CSOs, minimizing DWOs, and improving water quality in the receiving streams.

B. Current Status of Control Measures

Reduction in CSO activity attributable to implementation of the minimum controls is a good indicator of the effectiveness of the various programs. Historically, HWU conducted CSO flow monitoring in 1995 and 1996 to establish baseline conditions of the collection system. Wet weather sampling was conducted in Canoe Creek until 2000. The sampling was discontinued at that time because sufficient data was collected and construction of the Third Street Storage Basin collected the majority of combined sewage previously discharged to Canoe Creek. Recently, HWU installed eight flow monitors on Ohio River CSOs in 2006. Flow data is analyzed weekly to monitor the activity of each of these CSOs. Flow monitors were not installed on the three Canoe Creek CSOs because HWU expects these overflows to be greatly reduced at the completion of the Canoe Creek project that will redirect flow away from the CSS. In addition, SCADA equipment at every pumping station in the collection system allows HWU to monitor the performance of the pumping stations and estimate the duration and volume of any CSO at a pumping station.

1. General Characteristics of the Combined Sewer System

"The municipality should first obtain maps, tables, and other general information on the characteristics of the system." (*Guidance for Nine Minimum Controls*)

In accordance with the requirements of the Consent Judgment, HWU recently submitted a comprehensive series of maps of the entire collection system. The maps show all public sewer lines and the direction of flow and size of each line, manhole, pumping station, CSO outfall, and regulator structure. HWU maintains the collection system mapping in a GIS database. Each feature in the collection system including all sewer lines, manholes, and pumping stations has specific data stored in the GIS database.

2. Overflow Occurrences

"The municipality should record the number of CSO overflows at as many outfalls as feasible. The municipality should record the date and time of each overflow event through visual observation or by an appropriately placed flow or level sensor. In addition, the municipality should measure and record the total daily rainfall, using a suitably placed rain gauge." (*Guidance for Nine Minimum Controls*)

USEPA recommends several measures that can be applied to detect overflows including visual inspections, visual inspections with inspection aids, and automatic measurement. Several CSOs in HWU's collection system are not very accessible and present a safety issue for any type of visual observation during storm events. Therefore, visual inspection of the CSOs is limited. As a result, HWU has decided to use automatic measurements to collect information on the characteristics of CSOs.

HWU consistently monitors the flow in eight CSO discharge points along the Ohio River by using flow meters. HWU has installed Teledyne-ISCO 2150 Area Velocity Flow Modules at seven of these eight CSO discharge points. The modules use continuous wave Doppler technology to measure mean velocity. The Janalee Drive P.S. is monitored with a weir and ultrasonic level sensor. The flow data collected is used to generate information regarding the characteristics of CSOs. The flow data is used to document the start and end date of overflows, the duration of the CSO, and the estimated CSO volume. Flow data is collected and analyzed by HWU personnel from each of the flow modules on a weekly basis. The flow meters have collected data since September 2006 at the following outfalls:

a. KPDES No. 002 (Janalee Drive)
b. KPDES No. 003 (Ragan Street)
c. KPDES No. 004 (Jackson Street)
d. KPDES No. 005 (Towles Street)
e. KPDES No. 007 (Powell Street)
f. KPDES No. 008 (Washington Street)
g. KPDES No. 009 (First Street)
h. KPDES No. 010 (Second Street)

HWU measures overflow occurrences at the Second Street Pumping Station (KPDES No. 014). Ultrasonic level measurement is utilized to control the pumps and measure the liquid level within the wet well. Overflows are assumed and estimated whenever a high level alarm occurs concurrently with all pumps running. As described previously, in April 2008, HWU sealed the two flap gates on the attached structure next to the Second Street Pumping Station. As a result, there were no overflow events at that location in the four and a half months of the modification. Overflow that would have escaped from the system has successfully been contained in a new interceptor line, due to maximizing storage. Overflow occurrences at the Third Street Basin (KPDES No. 015) are determined based on pump runtime and not on direct flow measurement.

The results of these overflow measurements were submitted by HWU to USEPA Region 4 in February 2008 as part of the USEPA Administrative Order. The tables were updated to include any overflows through June 2008. This updated list of CSO occurrences will be submitted as part of the annual reporting requirements. Some of the information included in the tables is known to be inaccurate during times when the Ohio River level is higher than the outfalls. On many occasions, the CSO outfall points were submerged by flooding or high water. One of the outfall points has a controlled flap gate that remains closed when flooded. No discharge occurs even though the flow meters indicate there is an overflow occurrence.

In addition to proactively monitoring the CSO outfall points, HWU also monitors all the pumping stations in the collection system using SCADA. The SCADA equipment at the pumping stations allows HWU to closely monitor and inspect the performance of all pumping stations in the collection system.

3. Incidents Relating to Combined Sewer Overflow Impacts

“The municipality should develop a routine report to record and summarize information available from other sources on the water quality or use of waters affected by the CSOs.” (*Guidance for Nine Minimum Controls*)

Only the Ohio River and Canoe Creek are receiving streams for the HWU’s CSO discharge. HWU reviews information included in the 303(d) List of Surface Waters developed by KDOW. The latest report developed in 2008 includes the Ohio River and Canoe Creek in Henderson County on the 303(d) list. One of the pollutants listed is fecal coliform as a result of the CSOs.

SECTION 3

SENSITIVE AND PRIORITY AREAS

3.01 GENERAL INFORMATION

The City of Henderson, Kentucky, is located on the Kentucky shore of the Ohio River between river miles 801 and 806. Over 25 million people reside in the Ohio River Basin, approximately 8 percent of the United States population. An estimated 3.6 million people live in cities and towns adjacent to the Ohio River, from which most receive their drinking water. The river is also used for power generation and commercial navigation. A series of locks and dams, operated and maintained by the United States Army Corps of Engineers, regulate pool elevation on the Ohio River. Long-term average flows in the Ohio River, depending on location and time of year, range from 35,000 to 250,000 cubic feet per second (cfs).

Henderson has one of approximately 52 CSSs along the Ohio River. These CSSs plus nonpoint sources were designated by Ohio River Valley Water Sanitation Commission (ORSANCO) as a source of bacteria during heavy rains. Henderson is located approximately midway between the Newburgh Locks and Dam (mile point 776) and the John T. Myers Locks and Dam (mile point 846), commonly called the Myers Pool, since its elevations are regulated by the John T. Myers Locks and Dam.

The HWU's direct influence on the Ohio River is limited from approximately mile point 804 to mile point 806, or about 0.1 percent of the entire Ohio River basin. Figure 3.01-1 shows the CSO locations.

3.02 SENSITIVE AREAS

The National CSO Control Policy requires that special consideration be given to potentially sensitive waters that may be adversely impacted by CSO discharges. According to guidance provided by USEPA in the *LTCP-EZ* template, sensitive areas include the following:

A. Outstanding National Resource Waters.
B. National Marine Sanctuaries.
C. Waters with Threatened or Endangered Species and their Habitat.
D. Waters with Primary Contact Recreation.
E. Public Drinking Water Intakes or their Designated Protection Areas.
F. Shellfish Beds.

Twelve HWU CSO locations discharge to the Ohio River. Nine of the Ohio River CSOs are active and three are inactive. Four CSOs discharge to Canoe Creek. Three of the four Canoe Creek CSOs are active and one is inactive. Both reaches of the receiving waters have a designated use of Primary Contact Recreation, which is true for virtually all streams in Kentucky and for the entire Ohio River. 'Primary Contract Recreation' is the only potential characteristic of sensitive areas that might apply to Henderson. However, there are no concentrated recreation areas within the CSO discharge areas, such as bathing beaches.

HWU has already eliminated all CSO discharge locations upstream of Henderson's drinking water intake and boat ramps. The next closest drinking water intakes are Mt. Vernon, IN (on the opposite side of the river and 26.1 river miles downstream) and Morganfield, KY (on the same side of the river and located 39.3 river miles downstream). The CSO discharges are not located in a designated protection area.

There are two potential recreation areas located in or near Henderson. The first is Hayes Boat Ramp, located at the north (upstream) end of Atkinson Park. The second is the Downtown Boat Ramp, located between Second Street and Third Street. Both boat ramps are upstream of all CSO discharges and not normally used during inclement or severe weather.

3.03 PRIORITY AREAS

Since all CSO discharges are located within waters designated for Primary Contact Recreation, there are no areas deemed more sensitive than others. However, priority is given to addressing the CSOs that discharge to Canoe Creek due to its smaller dilution potential compared to the Ohio River. The majority of LTCP costs are aimed at mitigating CSOs to Canoe Creek, chiefly through the construction of the Canoe Creek Pumping Station and Interceptor. This project is already underway and is the centerpiece of HWU's LTCP.

Not only does the Canoe Creek project mitigate CSOs on Canoe Creek but it also improves conditions within the portion of the Combined Sewer System that overflows to the Ohio River.

CSO DISCHARGE LOCATIONS IN RELATION TO POTENTIAL SENSITIVE AREAS

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

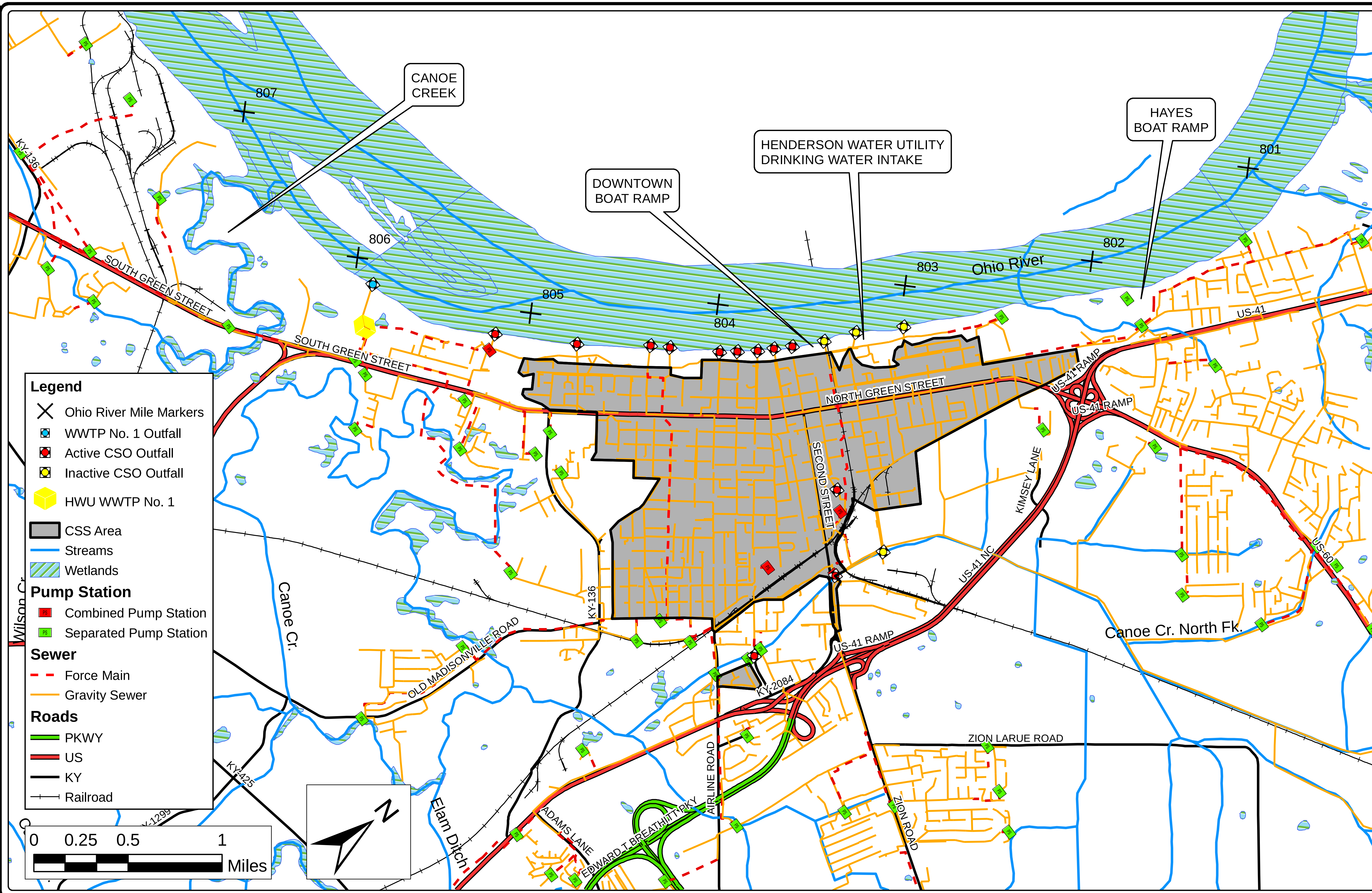

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FIGURE 3.01-1
5454.002

SECTION 4

SYSTEM CHARACTERIZATION

Line 8 through Line 11 and Schedule 3 of the *LTCP-EZ* requires site specific information concerning the CSS in Henderson, Kentucky.

The *LTCP-EZ* template states that an adequate control plan requires a thorough understanding of the CSS and lists the following items as the most important for small communities:

1. The extent of the CSS and the number of CSO outfalls.
2. The interconnectivity of the system.
3. The response of the CSS to rainfall.

The following is a discussion of the system characterization.

4.01 SYSTEM DESCRIPTION

HWU owns and operates a CSS that serves the entire city of Henderson, Kentucky and certain outlying areas. The population of Henderson County, Kentucky was 44,829 based on the 2000 United States Census. According to the Henderson Chamber of Commerce website (www.hendersonky.com), the Henderson County, Kentucky 2008 population is 45,940, and the Henderson City, Kentucky 2008 population is 27,768. The average annual growth in the county from 2000 to 2008 is approximately 0.3 percent per year.

HWU manages approximately 10,800 acres of sewered area. The majority of sewered area is located in the Henderson city limits. The sewered area is divided into the separate sanitary system (SSS) area and the CSS area. The CSS is located in the downtown Henderson area and makes up about 13 percent of the sewered area or approximately 1,440 acres. The SSS is located outside the CSS and makes up about 87 percent or the sewered area or approximately 9,360 acres. Figure 4.01-1 shows the Henderson collection system.

The CSS is divided into 15 sewersheds. These sewersheds were developed for the 1996 CSOP to subdivide the CSS area based on the primary CSO serving each area. Wastewater is conveyed by these sewersheds towards the Ohio River or Canoe Creek, a tributary to the Ohio River. The Downtown (Ohio River) Drainage Basin is 470 acres, or approximately 33 percent of the CSS, and the Canoe Creek Drainage Basin is approximately 970 acres, or approximately 67 percent of the CSS. Since 1996, HWU has been proactive at separating the CSS area. Figure 4.01-2 shows a dividing line between the CSS area that drains to the Ohio River Drainage Basin and the Canoe Creek Drainage Basin, and the combined sewer area in the CSS. Figure 4.01-3 shows the drainage areas of the sewershed subbasins.

Table 4.01-1 provides detailed information on each sewershed and CSO. The format of this information is similar to that of Schedule 4 in the *LTCP-EZ* template and provides information such as latitude and longitude of the CSO and acreage.

HENDERSON WATER UTILITY OVERALL SEWER SYSTEM

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

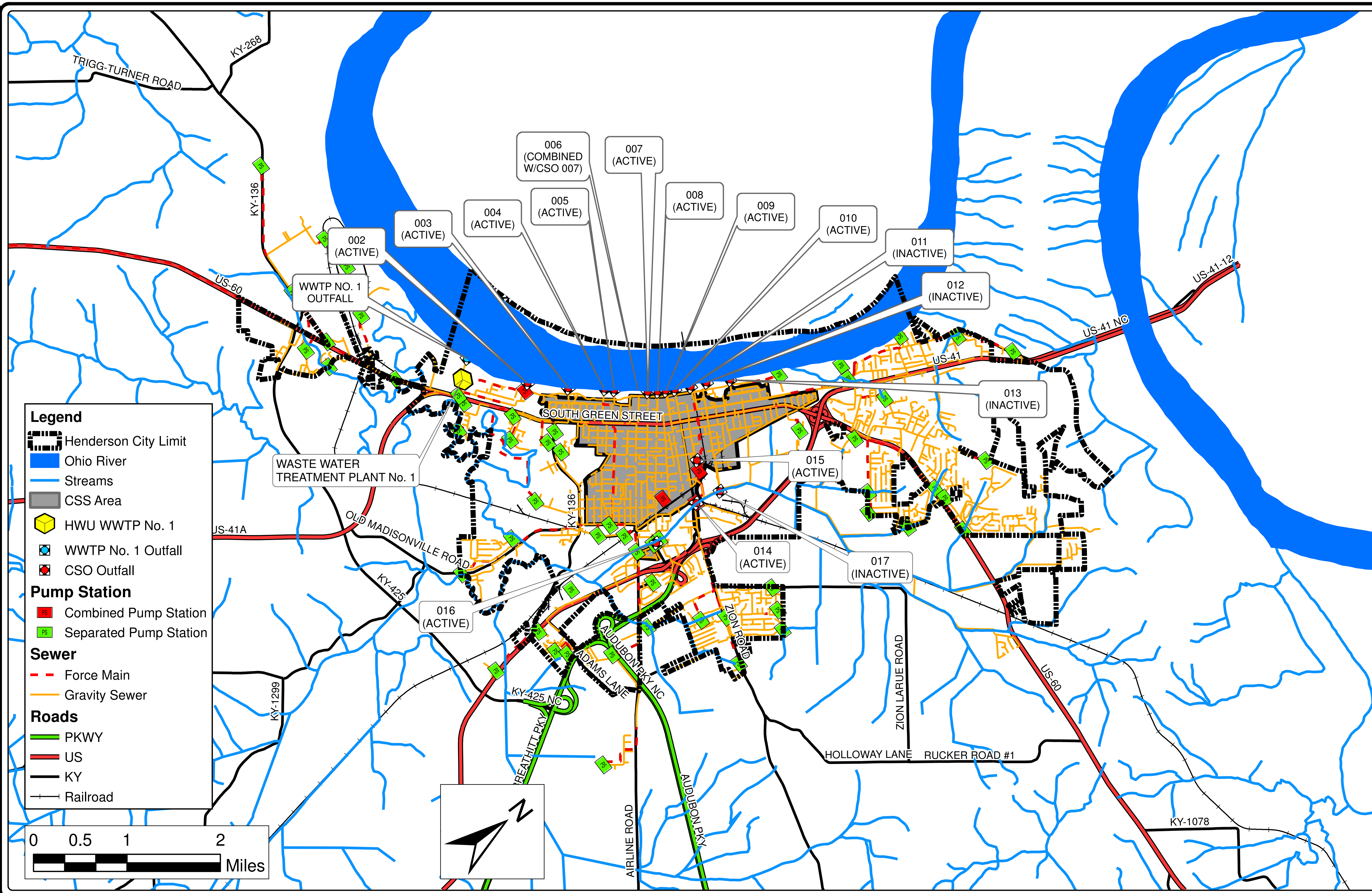

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FIGURE 4.01-1
5454.002

OHIO RIVER / CANOE CREEK COMBINED SEWER SYSTEM DIVIDING LINE

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

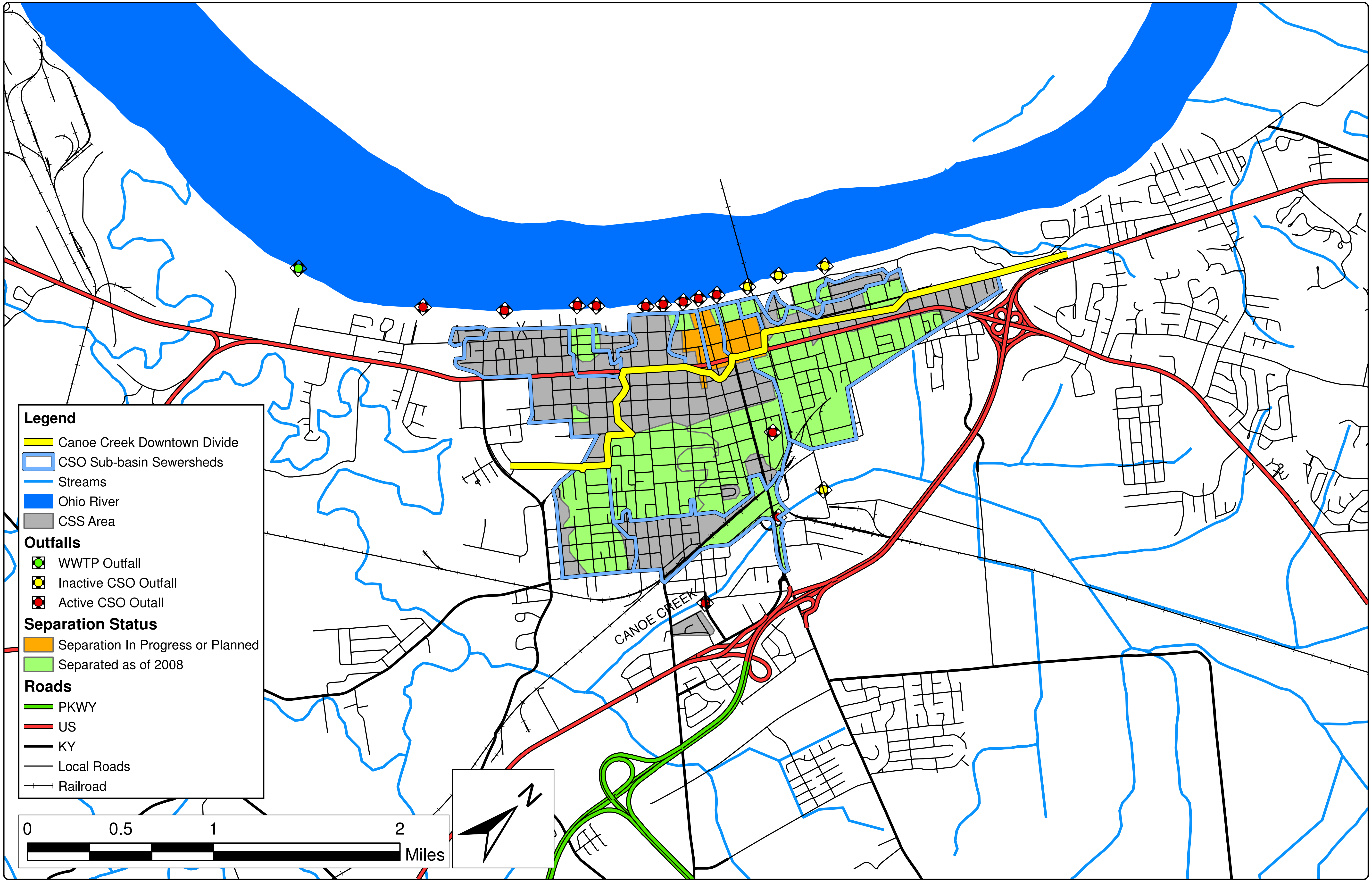

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FIGURE 4.01-2
5454.002

CSO SUBBASIN SEWERSHEDS

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

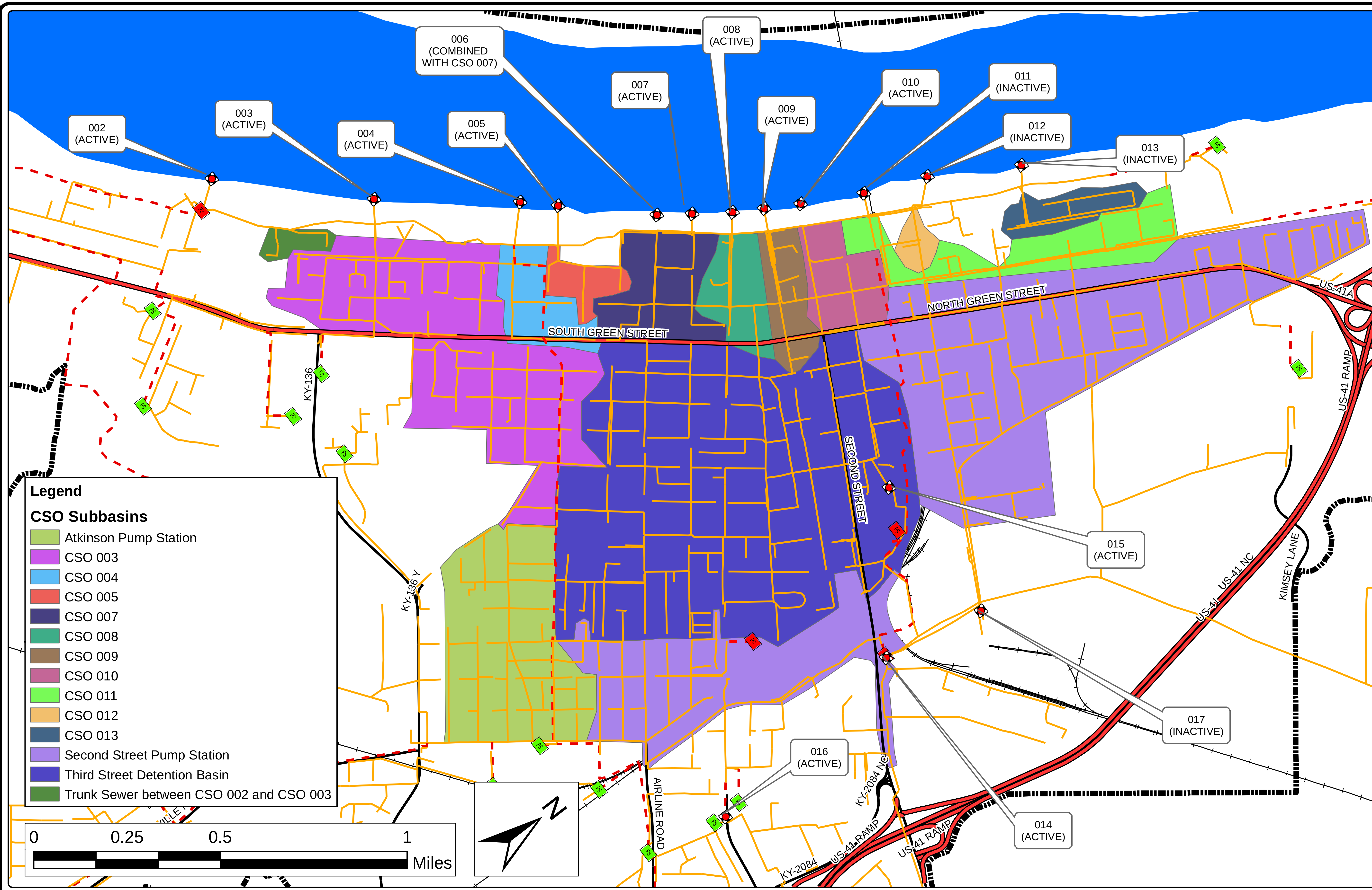

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FIGURE 4.01-3
5454.002

TABLE 4.01-1

SYSTEM CHARACTERIZATION

Status	Permit Number	CSO Name	Latitude	Longitude	Receiving Water	Ohio River Mile	Distance to Canoe Creek Mouth	Subsewershed Area in CSS* (acres)	Percent Combined in CSS	Subsewershed Area outside CSS (acres)	Principal Land Use	Type of CSO Regulator
N/A	KPDES 001	North WWTP Outfall	37° 49" 6.9666"	87° 37" 23.4834"	Ohio River	805.8	-	N/A	N/A	N/A	N/A	N/A
Active	KPDES 002	Janalee Drive Pumping Station	37° 49" 26.097"	87° 36" 44.2044"	Ohio River	805.3	-	8	100%	0	Residential–Single Family	Weir
Active	KPDES 003	Ragan Street	37° 49" 42.6822"	87° 36" 24.3792"	Ohio River	804.7	-	190	97%	215	Residential–Single Family	Drop Connection
Active	KPDES 004	Jackson Street	37° 49" 58.893"	87° 36" 8.7546"	Ohio River	804.4	-	31	50%	0	Residential–Single Family	Drop Connection
Active	KPDES 005	Towles Street	37° 49" 2.85"	87° 36" 4.2228"	Ohio River	804.3	-	15	79%	0	Residential–Single Family	Drop Connection
Active	KPDES 006	Clay Street	Control structure diverted to CSO 007 outfall.		Ohio River	804.0	-	included in CSO 007	-	included in CSO 007	-	Drop Connection
Active	KPDES 007	Powell Street	37° 49" 17.232"	87° 35" 49.0668"	Ohio River	803.9	-	49	96%	0	Business–Neighborhood	Drop Connection
Active	KPDES 008	Washington Street	37° 50" 21.9006"	87° 35" 45.0744"	Ohio River	803.8	-	30	81%	0	Business–Downtown	Drop Connection
Active	KPDES 009	First Street	37° 50" 25.8036"	87° 35" 42.3204"	Ohio River	803.7	-	48	7%	0	Business–Downtown	Drop Connection
Active	KPDES 010	Second Street	37° 50" 30.2886"	87° 35" 39.1662"	Ohio River	803.6	-	12	0%	0	Business–Downtown	Drop Connection
Inactive	KPDES 011	Fourth Street	37° 50" 38.2776"	87° 35" 34.0656"	Ohio River	-	-	58	52%	2,120	Residential–Single Family	Drop Connection
Inactive	KPDES 012	Fifth Street	37° 50" 46.8018"	87° 35" 29.8206"	Ohio River	-	-	8	70%	0	Residential–Single Family	Drop Connection
Inactive	KPDES 013	Eighth Street	37° 50" 58.3326"	87° 35" 56.1552"	Ohio River	-	-	21	79%	83	Residential–Single Family	Drop Connection
Active	KPDES 014	Second Street Pumping Station	37° 50" 2.2596"	87° 34" 25.7694"	Canoe Creek	-	9.6	422	34%	3,300	Residential–Single Family	Weir
Active	KPDES 015	Third Street Basin	37° 50" 16.6914"	87° 34" 49.6308"	Canoe Creek	-	9.9	427	32%	0	Residential–Single Family	Drop Connection and Weir
Active	KPDES 016	Cooper Park Pumping Station	37° 49" 31.002"	87° 34" 20.0022"	Canoe Creek	-	9.0	13	-	0	Residential–Single Family	Pumping Station Overflow
Inactive	KPDES 017	Fifth Street on Canoe Creek	37° 50" 16.8108"	87° 34" 22.5264"	Canoe Creek	-	-	-	-	-	Residential–Single Family	Eliminated by the time of LTCP field work.

*Area includes both separated and area to be separated as shown in Figure 4.01-2.

4.02 DOWNTOWN (OHIO RIVER) DRAINAGE BASIN

Wastewater in the Downtown Drainage Basin flows toward the Ohio River in a combined sewer system (CSS). A typical diversion structure within the downtown drainage basin consists of a large combined sewer pipe with a smaller drop pipe located in the bottom of a manhole. The drop pipe diverts dry weather separate sanitary sewer flows to a 36-inch interceptor line which runs parallel along the Ohio River.

During dry weather, sanitary sewer in the 36-inch interceptor flows to the Janalee Drive Pumping Station which then transfers the wastewater to the WWTP. The Janalee Drive Pumping Station is the largest pumping station in the CSS with a capacity of approximately 11.5 million gallons per day (mgd).

During wet weather, the diversion structures within each sewershed and at the Janalee Drive Pumping Station act as control devices or regulators. The control devices permit combined sewage flow volumes exceeding the capacity of the downstream conveyance system to be discharged to the Ohio River.

Figures 4.02-1 and 4.02-2 show a typical layout for diversion structures in the downtown drainage basin.

Originally, the Henderson CSS had a total of 12 permitted CSO points along the Ohio River. Since 1995, three CSO locations have been rendered inoperative and disconnected from the CSS. In 2009, nine CSO locations still have the potential to discharge to the Ohio River.

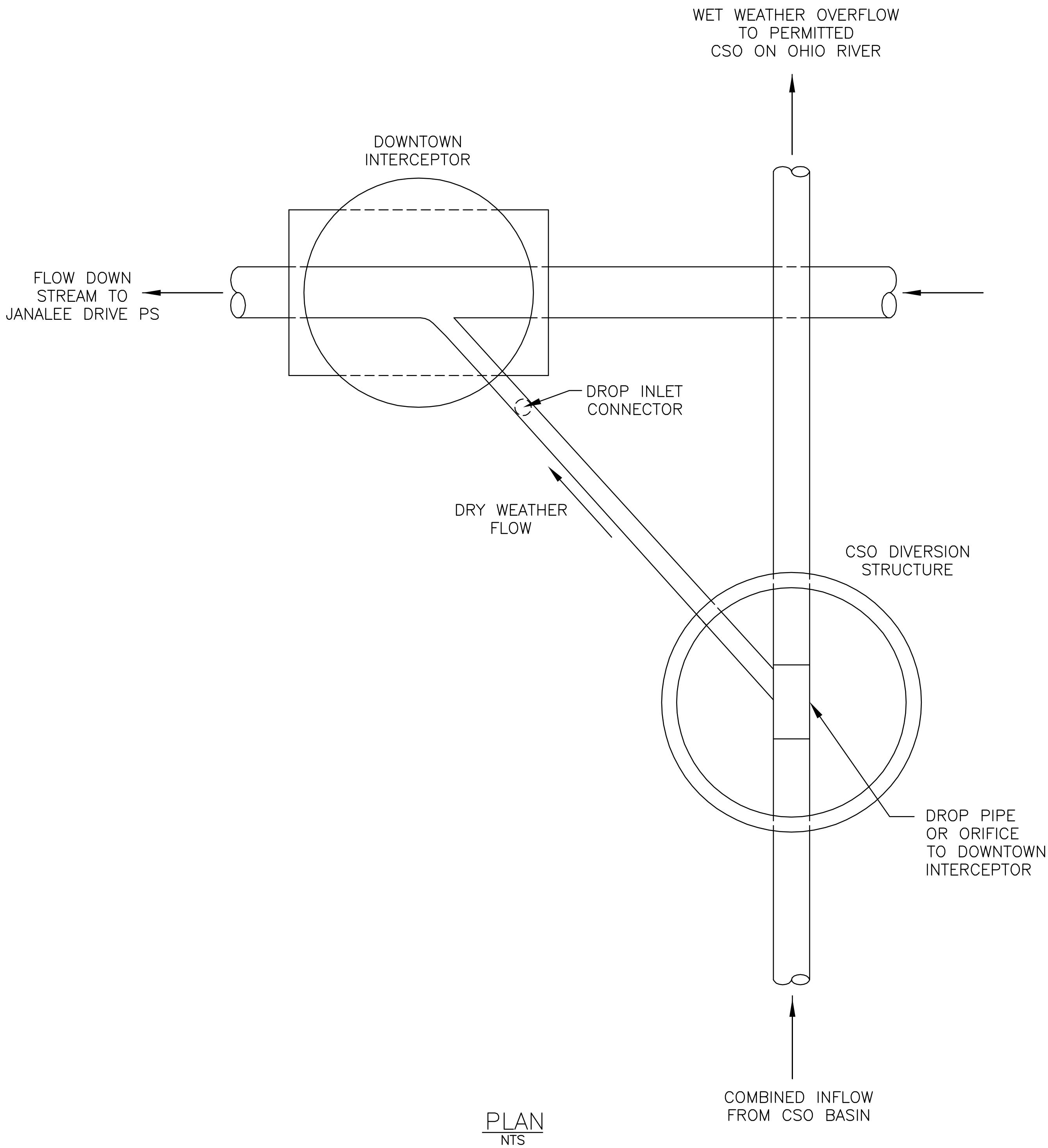
Most CSO structures in the downtown basin have a separate outfall pipe to the Ohio River, although two points share an overflow outfall pipe.

CSO #002 is located at the Janalee Drive Pumping Station, which is the most downstream CSO in the CSS. The overflow point consists of a 10-foot weir adjacent to the pumping station wet well. CSO #002 provides flow relief at the Janalee Drive Pumping Station to prevent flooding and failure of the pumping station as well as limiting the surcharge on the 36-inch Downtown Interceptor. A flapgate is installed downstream of the weir on the CSO #002 outfall pipe to prevent high water on the Ohio River from back flooding the outfall pipe.

A list of sizes and hydraulic capacities of the downtown control structures is provided in Section 6 of this report (see Table 6.04-1). The format of this information is similar to Schedule 4 in the *LTCP-EZ* template.

4.03 CANOE CREEK DRAINAGE BASIN

Wastewater in the Canoe Creek Basin flows toward Canoe Creek. During dry weather, wastewater is conveyed to two main pumping stations, the Second Street Pumping Station (capacity is approximately 5.4 mgd) and the Atkinson Street Pumping Station (capacity is approximately 2.9 mgd). These pumping stations transfer wastewater from the Canoe Creek Drainage Basin to the 36-inch interceptor in the Downtown Drainage Basin. During wet weather, the Canoe Creek collection system begins to surcharge at the Second Street Pumping Station. Eventually, if the storm is large enough, CSO 014 at the Second Street Pumping Station and CSO 015 at the Third Street Basin begin to discharge.



File: S:\LOU\5400--5499\5454\001\Acad\MANHOLE FIGURE1.dwg Time: Feb 23, 2009 - 10:23am

TYPICAL ACTIVE DOWNTOWN DRAINAGE BASIN
CSO DIVERSION STRUCTURE PLAN

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

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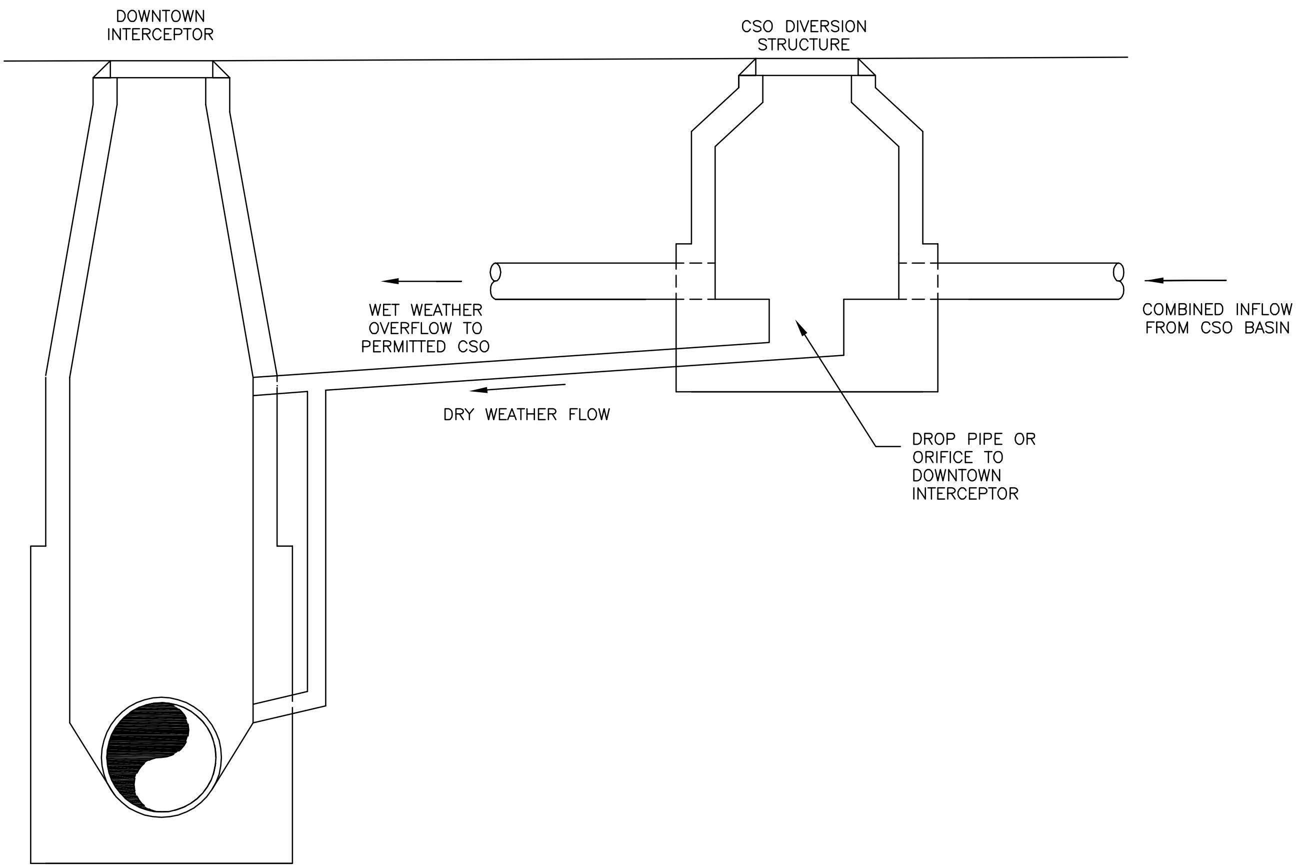
FIGURE 4.02-1

5454.002



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TYPICAL ACTIVE DOWNTOWN DRAINAGE BASIN
CSO DIVERSION STRUCTURE SECTION

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.02-2
5454.002

Originally, the Henderson CSS had a total of four CSOs discharging to Canoe Creek, CSO 014 through CSO 017. Three of the CSOs are still active. CSO 017 was disconnected as part of Phase I of the Canoe Creek Interceptor project.

CSO 014 is located at the Second Street Pumping Station. In the 1996 CSOP, CSO 014 consisted of an overflow pipe in the Second Street Pumping Station wet well wall connected to Canoe Creek. Since the 1996 CSOP, the Second Street Pumping Station was rebuilt and the CSO 014 outfall was modified. The CSO outfall pipe at Canoe Creek was enclosed with a metal coffer dam and two 24-inch flap gates were added. The metal coffer dam increases the combined sewage storage in the CSS, and the flap gates prevent Canoe Creek from flooding the Second Street Pumping Station (see Figure 2.03-1 in Section 2 of this report).

In 1998, HWU constructed the Third Street CSO/Stormwater Detention Basin. Approximately 420 acres of commercial and residential CSS area on the southeast side of US 41 are served by the basin. This basin was designed to provide 15 million gallon detention capacity for combined sewage discharging from the CSO 015 outfall. A 66-inch x 44-inch elliptical brick sewer carries combined sanitary sewage and stormwater to the CSO 015 control structure. The control structure utilizes a 36-inch drop pipe to convey flow around the basin to the Second Street Pumping Station. During wet weather conditions, when the 36-inch pipe (which transitions to 24-inch downstream) is at capacity and begins to surcharge, the flow is diverted over a weir in the CSO 015 control structure into an 8-foot x 4-foot box culvert leading to the Third Street Basin. Up to 15 million gallons of combined flow can be captured by the Third Street Basin.

The Third Street Basin contains two pumping stations. CSO Pumping Station No. 1 has two submersible pumps with a total capacity of 1,200 gpm and pumps to the Second Street Pumping Station force main. CSO Pumping Station No. 2 has three submersible pumps with a total capacity of 15,000 gpm and pumps to a drainage ditch tributary to Canoe Creek. CSO Pumping Station No. 2 operates only when the basin is full and there is potential for additional storms. This strategy is meant to minimize overflows and prevent damage to property. The Third Street Basin provides primary treatment for the removal of solids from the flow. Until Canoe Creek Interceptor Phase 2 is installed, Pumping Station No. 1’s operation is tied to the activity of the Second Street Pumping Station. Pumping Station No. 1 pumps from the basin if there is any liquid detected in the basin and continues to pump until the basin is empty. This station will only pump if the Second Street Pumping Station is not overflowing. Pumping Station No. 2 is monitored with an ultrasonic level transducer. Figure 4.03-1 shows a plan view of the Third Street Basin.

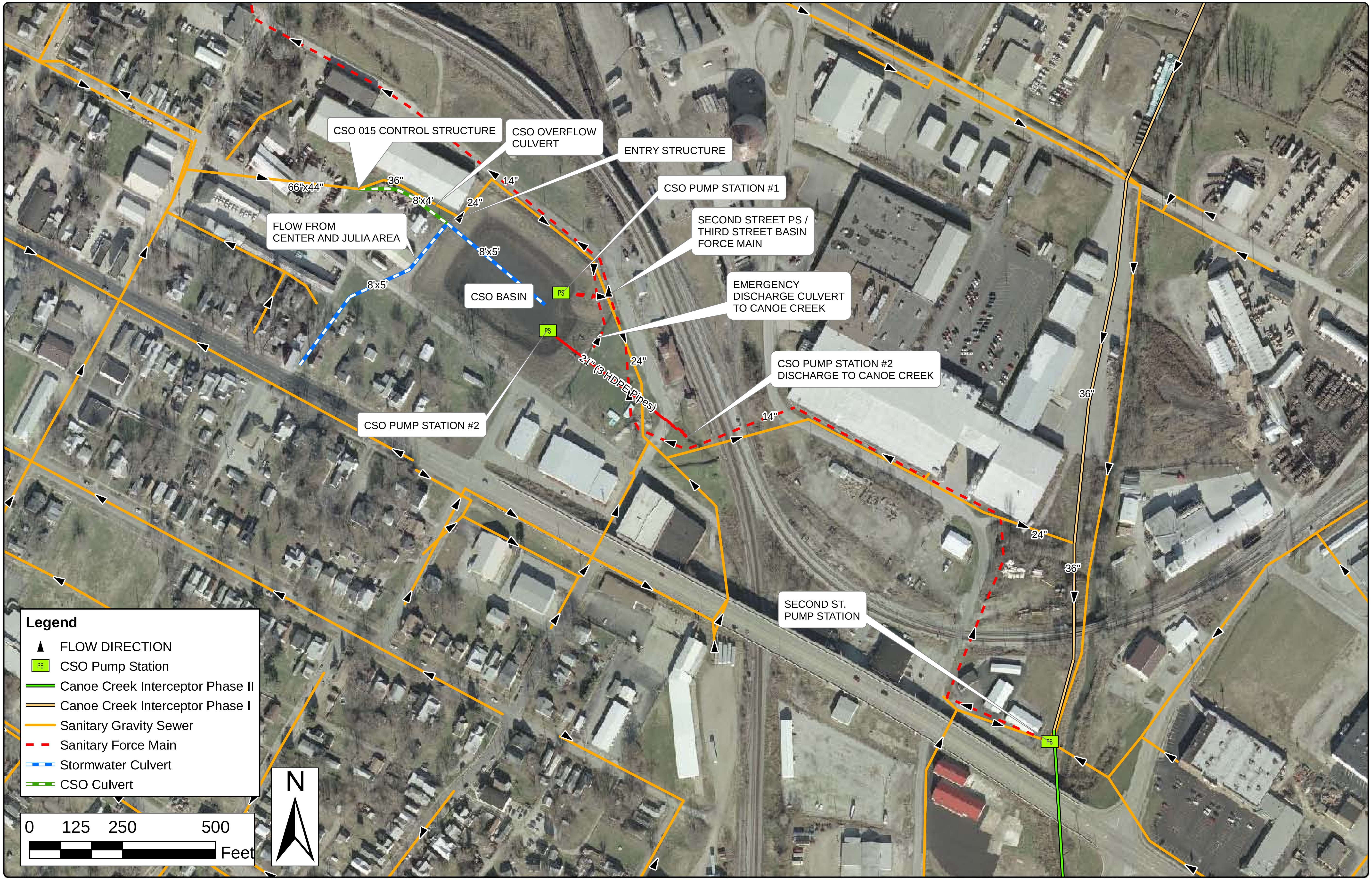
CSO 016 at the Cooper Park Pumping Station is located outside the main CSS. Stormwater in a small, isolated, residential subdivision is collected and conveyed to the Cooper Park Pumping Station. When the Cooper Park Pumping Station capacity is exceeded, then the wet well level rises to an 8-inch CSO overflow pipe on the wet well wall.

4.04 CSS RESPONSE TO RAINFALL

Eleven out of 12 CSOs are now continuously monitored via SCADA equipment. In 2006 and 2007, monitoring devices were installed on all but one active CSO. The Cooper Park Pumping Station CSO (CSO 016) is the only CSO not actively monitored, but HWU is in the process of installing a monitoring

THIRD STREET CSO BASIN
DRY WEATHER FLOW CONDITIONS

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY



STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.03-1
5454.002

device. This station will be eliminated with the Canoe Creek Pumping Station and Interceptor (Phase 2) project.

Recently, HWU installed an ultrasonic level sensor at the CSO 002 control structure in the Janalee Drive Pumping Station to accurately measure the water level above the outfall weir.

The combined sewage discharge at CSO 014 (Second Street Pumping Station) is determined based on the water level in the Second Street Pumping Station wetwell.

The combined sewage discharge from CSO 015 (Third Street Basin) is estimated based on the run time and pumping capacities of CSO Pumping Station No. 2.

Table 4.04-1 and Table 4.04-2 summarize observed CSO events as submitted to the USEPA on February 22, 2008. The submitted document contained observed CSOs during the five year period from 2003 to 2007. However, the CSO monitoring was not continuous during this time.

TABLE 4.04-1

REPORTED CSO OCCURRENCES (DOWNTOWN BASIN)[(1)]

Permit Number	CSO Name	Status	Current Monitoring Device	Number of Observed CSOs[(2)]	Number of Observed CSOs in 2007[(3)]	Number of Observed CSOs in the first half of 2008[(4)]
KPDES 002	Janalee Drive Pumping Station	Active	Ultrasonic level sensor above outfall weir	114	24	18
KPDES 003	Ragan Street	Active	Teledyne-ISCO area-velocity flow module	62	32	17
KPDES 004	Jackson Street	Active	Teledyne-ISCO area-velocity flow module	36	19	7
KPDES 005	Towles Street	Active	Teledyne-ISCO area-velocity flow module	45	16	21
KPDES 006	Clay Street	Active	Combined with CSO 007	-	-	-
KPDES 007	Powell Street	Active	Teledyne-ISCO area-velocity flow module	53	24	16
KPDES 008	Washington Street	Active	Teledyne-ISCO area-velocity flow module	47	23	14
KPDES 009	First Street	Active	Teledyne-ISCO area-velocity flow module	59	26	20
KPDES 010	Second Street	Active	Teledyne-ISCO area-velocity flow module	Disconnected[(5)]	Disconnected[(5)]	Disconnected[(5)]
KPDES 011	Fourth Street	Inactive	-	-	-	
KPDES 012	Fifth Street	Inactive	-	-	-	
KPDES 013	Eighth Street	Inactive	-	-	-	
				Total CSOs observed	**164**	**113**

[(1)] Based on letter from Henderson Water Utility dated February 22, 2008 to USEPA, "Submittal Requirements from EPA Administrative Order dated December 21, 2007" and update compiled through June 30, 2008.
[(2)] Based on available data from letter dated February 22, 2008. CSO monitoring was not continuous for reported data.
[(3)] There were 106 rain days in 2007.
[(4)] Observed CSO data from January 1, 2008 to June 30, 2008; there were 64 rain events from January 1, 2008 to June 30, 2008.
[(5)] Field investigations revealed that CSO 010 (Second Street) has been disconnected.

TABLE 4.04-2

REPORTED CSO OCCURRENCES (CANOE CREEK BASIN)[(1)]

CSO Permit Number	CSO Name	Status	Current Monitoring Device	Number of Observed CSOs[(2)]	Number of Observed CSOs in 2007[(3)]	Number of Observed CSOs in the first half of 2008[(4)]
014	Second Street Pumping Station	Active	Estimate based on high level alarm	210	N/A[(5)]	20
015	Third Street Basin	Active	Estimate based on pump run time	25	3	20
016	Cooper Park Pumping Station	Active	Data Not Available	Data Not Available	Data Not Available	Data Not Available
017	Fifth Street on Canoe Creek	Inactive	-	-	-	-
				Total CSOs Observed	N/A	40

(1) Based on letter from Henderson Water Utility dated February 22, 2008 to USEPA, "Submittal Requirements from EPA Administrative Order dated December 21, 2007" and update compiled through June 30, 2008.
(2) Based on available data from letter dated February 22, 2008. CSO monitoring was not continuous for reported data.
(3) There were 106 rain days in 2007.
(4) Observed CSO data from January 1, 2008 to June 30, 2008; there were 64 rain events from January 1, 2008 to June 30, 2008. Due to sealing the flap gates, there have been no overflows at this station since April 2008.
(5) No data was available for 2007.

4.05 WASTEWATER TREATMENT

The Henderson CSS conveys flows to WWTP No. 1, operated by HWU, along the Ohio River at the downriver end of the city. Treatment currently includes preliminary screening and grit removal, biological secondary treatment, and chemical disinfection. A plant process flow schematic is included in Figure 4.05-1. A site layout of the WWTP is included in Appendix G.

The headworks system currently includes influent flow measurement, coarse screening, grit removal, and fine screening. The influent flume appears to be one limitation and may be inaccurate at peak flows because of approach channel constraints. The coarse screens, which are intended to remove large debris including leaves from the CSS, are not capable of handling the loads they receive, and adversely affect the performance of the fine screens downstream.

The headworks wastewater is routed around the primary sedimentation basins to the extended aeration basins at the recirculation pumping station (sometimes referred to as the mixed liquor wetwell). There are four pumps installed at this location, two with a capacity of 10 mgd each and two with a capacity of 7.5 mgd each. A limitation in the electrical system only allows for three of the four pumps to operate. The fourth pump can be run in the event one of the other pumps is not operating. At this location, screened wastewater is pumped to the basin flow splitter box. Return activated sludge (RAS) is also pumped, through a separate force main, to the basin flow splitter box.

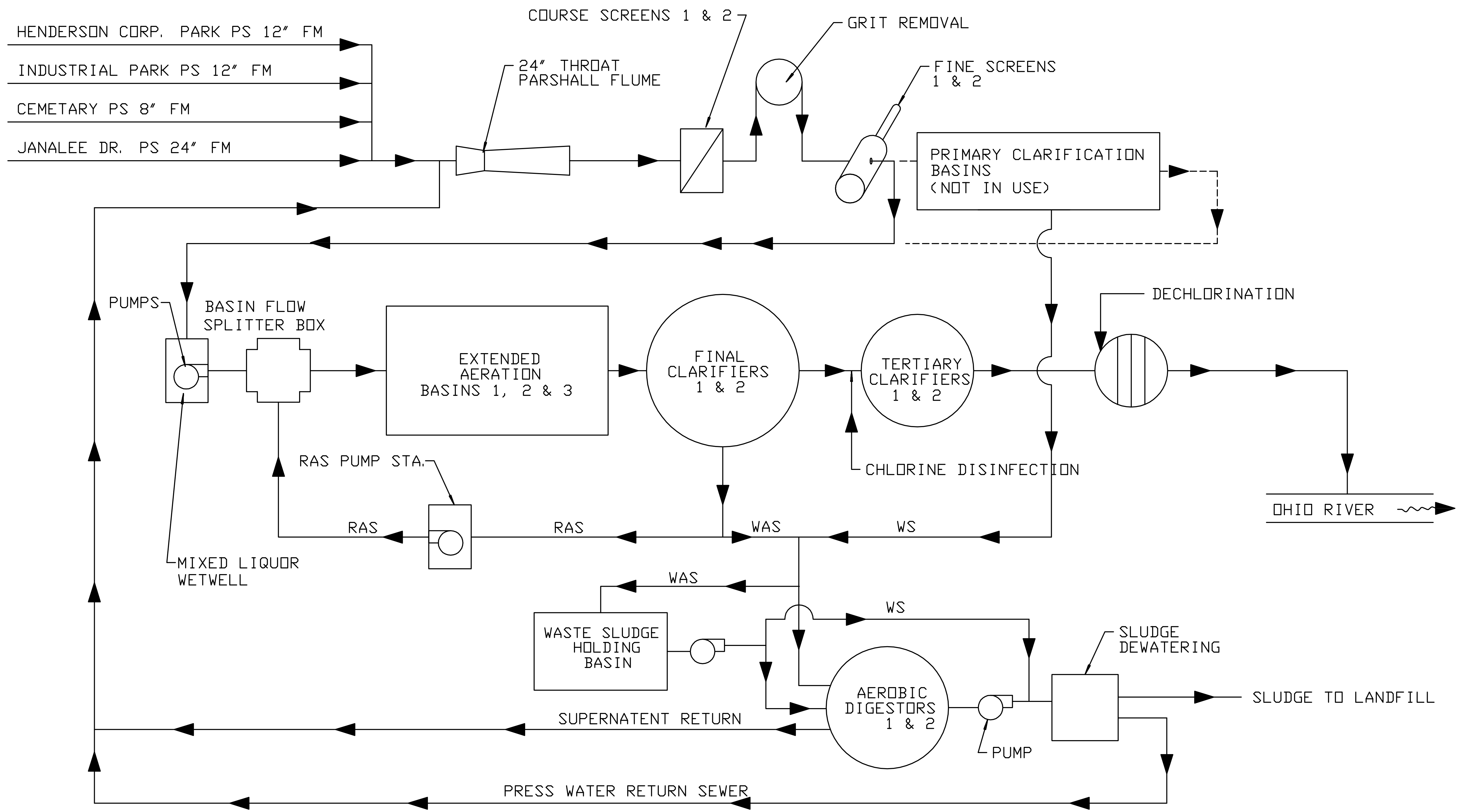
From the basin flow splitter box, influent wastewater and RAS are sent to each of the three extended aeration basins. A Biolac® type aeration system is used in each of the basins. Following aeration, the mixed liquor is sent to the two 141-foot diameter final clarifiers. RAS from the clarifiers is pumped back to the basin flow splitter box. RAS pumping capacity appears to be adequate. It is possible the clarifiers could handle peak flows up to 29 mgd, based on surface overflow rates.

Secondary effluent from the clarifiers flows to the tertiary clarifiers, which have been converted to chlorine contact tanks, where chlorine gas is used for disinfection. These tanks have a volume of approximately 680,000 gallons that would allow for flows up to 31 mgd with a 15 minute hydraulic detention time.

After the chlorine contact tanks, a final circular tank is used for dechlorination. Final effluent flows over a serpentine weir at the downstream end of the dechlorination tank into the plant outfall pipe, which discharges into the Ohio River.

Waste solids are decanted and sent to storage before dewatering on a belt filter press. Drying beds are available as a backup in the event that mechanical dewatering is not available. Expanded treatment of peak flows at the WWTP would not be expected to have a substantial impact on overall solids production at the treatment plant.

Some drawings and photos of the WWTP show abandoned biotowers south of the preliminary sedimentation basins. These biotowers have been demolished.



WASTEWATER TREATMENT PLANT NO. 1
PROCESS FLOW SCHEMATIC
COMBINED SEWER OVERFLOW
LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 4.05-1

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SECTION 5

PUBLIC PARTICIPATION

5.01 GENERAL

Line 11 and Schedule 3 of the *LTCP-EZ* requires information of the utility's efforts toward public participation.

Public participation is a critical element of a LTCP. Citizens of a community must be involved with the decisions made concerning the future of their community because they directly benefit from the improved water quality and they are the ones who will cover the costs to reach that goal. A successful LTCP includes constructive input from a representative group of people so that actions outlined in the LTCP are acceptable and beneficial to those affected by it and to those asked to pay for it.

Henderson is committed to informing HWU customers and users of CSO impacted water bodies about CSO controls. *LTCP-EZ* template states that public participation is typically accomplished through one or more activities. These are described below.

A. <u>CSO Awareness</u>

1. Placement of information and warning signs at CSO outfalls.
2. Media advisories for CSO events.

B. <u>Public Education</u>

1. Media coverage.
2. Newsletters/Information booklet.
3. Educational inserts to water and sewer bills.
4. Direct mailers.
5. CSO project Web sites.

C. <u>Public Involvement</u>

1. Public meetings.
2. Funding task force.
3. Local river committee.
4. Community leader involvement.
5. General public telephone survey.
6. Focus groups.

Table 5.01-1 is a list of past public participation.

TABLE 5.01-1

PAST PUBLIC PARTICIPATION

Date	Title	Purpose
1989 to Present	ORSANCO River Sweep	Public Involvement: Organized annual event to cleanup the riverbank of the Ohio River and its tributaries including many Ohio River communities along 1,962 miles of Ohio River shoreline.
February 1996	Combined Sewer Operational Plan Report	Public Education: Satisfied the requirements of the National Combined Sewer Overflow Control Policy and informed citizens of Henderson's CSS.
Spring 1998	Combined Sewer Overflow Signs placed on outfalls on Ohio River	CSO Awareness: Marks the location of CSO outfalls.
1999 to Present	Annual Drinking Water Quality Report	Public Education: Inform HWU customers of the drinking water quality and provide information about water quality issues including stormwater runoff.
1999 to Present	Leaf Collection Program	Public Education and Public Involvement: HWU distributes information and large plastic garbage bags to residents to collect leaves and to alleviate seasonal backup of the combined sanitary sewer system.
Spring 2001	Combined Sewer Overflow Signs placed on outfalls on Canoe Creek	CSO Awareness: Marks the location of CSO outfalls.
September 2002 to Present	Henderson Water Utility website	CSO Awareness and Public Education: Provides a source of information for all things related to HWU operations including the LTCP.
November 2003	Stormwater Phase II–Erosion Prevention and Sediment Control Workshop	Public Education and Public Involvement: Educate contractors, developers, public works employees, etc. about erosion control methods and maintenance.
April 2004	Stormwater Technical Manual	Public Education and Public Involvement: Provides a written guidance document for implementing erosion control measures for contractors.
April 2004	Sanitary Sewer Technical Manual	Public Education and Public Involvement: Provides a written guidance document for requirements and specifications for designers and builders.
February 2005 to April 2005	Stormwater Runoff Lessons–to five Henderson schools	Public Education and Public Involvement: Educate students about why stormwater runoff is a problem.
2005 to Present	Tri-Fest (annual three-day festival in April) (Ongoing)	Public Education and Public Involvement: Maintained educational booth about HWU operations, stormwater runoff, and CSOs.
Fall 2005–present	Public Service Announcements	Ongoing series of radio spot announcements for CSO awareness.
October 2005	System Investment Plan & Revenue Needs	CSO Awareness, Public Education, and Public Involvement: Televised presentation to Henderson City Commission on the Investment Plan to meet LTCP requirements.
October 2004	Speak Up (WSON Radio Call-In Program)	Public Education and Public Involvement: Educate the community about CSO and Stormwater issues.
October 2005	Speak Up (WSON Radio Call-In Program)	Public Education and Public Involvement: Educate the community about CSO and Stormwater issues.
November 2004	Stormwater Phase II–Erosion Prevention and Sediment Control Workshop	Public Education and Public Involvement: Educate contractors, developers, public works employees, etc. about erosion control methods and maintenance.
January 2006	Canoe Creek Study In Henderson City/County	Public Education and Public Involvement: Presentation of the study conducted on Canoe Creek that identified problems with Canoe Creek, the ongoing program to correct problems on Canoe Creek, the economic impact of correcting these problems, and what citizens can do to maintain Canoe Creek.
March 2006, June 2006	CSO/SSO Compliance Inspection Report	Public Education: Presentation to KDOW in response to a KDOW inspection in August 2005 of the combined sewer system facilities.
March 2006 to April 2008	Center and Julia Separation Project	Series of Public Education and Public Involvement: Regular Public Meetings held at Norris Chapel Baptist Church to discuss the progress of the project.
April 2006 to Present	Downtown Separation Project	Public Education and Public Involvement: Series of Public Meetings held at Downtown Business Association meeting to discuss the progress of the project.
2005 to Present	Stormwater Runoff Lesson (Television Broadcast)	Public Education: Regular broadcasts of presentation that educates students and residents about why stormwater runoff is a problem.
2005 to Present	Stormwater Runoff Lesson (DVD)	Public Education: Presentation that is available for educators/teachers for educating students about why stormwater runoff is a problem.
January 2007	Stormwater Phase II–Erosion Prevention and Sediment Control Workshop	Public Education and Public Involvement: Educate contractors, developers, public works employees, etc. about erosion control methods and maintenance.

5.02 PRESENTATION

The Henderson City Commission and Water and Sewer Commission received regular monthly updates concerning progress on the development of the LTCP through General Manager reports. The City Commission and Water and Sewer Commission members were provided with individual copies of the final draft LTCP prior to their meetings, wich were open to the public. A presentation was given at a City Commission public meeting, with the meeting agenda published in advance. In addition, the final draft LTCP was made available for public viewing at area libraries and at the HWU offices. An additional separate informational meeting for the public regarding the final draft LTCP was advertised in the local newspaper to encourage attendance. The purpose of the informational meeting was to allow the public to review the draft LTCP and encourage input. The Henderson Water and Sewer Commission also discussed the final draft LTCP at a monthly meeting open to the public, with the agenda published in advance.

As the LTCP is implemented, HWU will continue to inform the public of the ongoing progress of the LTCP construction projects and solicit more comments from HWU customers and users of the impacted water bodies. HWU is planning to conduct another informational meeting to introduce the LTCP to the community after its approval by KDOW.

SECTION 6

CSO VOLUME AND EVALUATION OF CONTROLS

The CSO control policy provides for several presumptive design guides for CSO controls to meet water-quality based goals of the Clean Water Act. HWU will meet the CSO Control Policy by eliminating or capturing for treatment a minimum of 85 percent by volume of flow collected in the CSS during precipitation events on a system wide annual average basis. The LTCP, therefore, must focus on the potential cost impact of constructing system improvements based on modeling results that would reduce flows and/or provide adequate conveyance and treatment capacity to achieve that goal.

6.01 EVALUATION OF CONTROLS

In lieu of completing Schedule 4 of the *LTCP-EZ* template to evaluate the level of control needed to achieve 85 percent capture, a separate analysis of the CSS was performed to determine the percent capture based on HWU's plan for the CSS. The analysis involved developing spreadsheet models for the Downtown Interceptor and the Canoe Creek Interceptor to take into account the proposed separation projects and the Canoe Creek Interceptor. Three separate spreadsheet models were created representing the operation of the CSS at different points in time. The three time periods selected were 1995, 2008, and 2018. The 1995 model represents the CSS before any improvements or separation projects were completed. The average year vs. 2008 actual model represents the current CSS. The 2018 model represents how the CSS will operate based on HWU's planned improvements and the completion of the Canoe Creek Interceptor. The spreadsheet models were developed using SCADA data, global positioning system (GPS) data, drawings, field investigations, and verifications. The models are designed to evaluate the percent capture of the CSS before and after the planned projects in the downtown and Canoe Creek areas are complete.

HWU has been proactively reducing CSO volume since the development of the CSOP in 1996. Even as a small community, HWU has committed a substantial amount of time and effort to reduce CSOs and develop a plan to meet the 85 percent capture of wet weather flows. Future improvement and separation projects, such as the Canoe Creek Interceptor, are currently being designed and budgeted for. Modeling results of their current plan of action achieves 85 percent capture of wet weather flows. It was not appropriate to evaluate other alternatives that would have deviated from the diversion and separation approach to CSO control implemented by HWU over 10 years ago.

6.02 RATIONAL METHOD

Schedule 4 of the template follows the rational method, which was used for both models. The rational method is as follows:

$Q_p = kCIA$, where:

- Q_p = Peak discharge, cubic feet per second (cfs)
- k = Conversion factor, as needed
- C = Runoff coefficient, dimensionless
- I = Rainfall intensity, in/hr
- A = Catchment area, acres

The rational method provides a peak discharge analysis for a selected storm event based on the storm intensity, catchment area, and an empirical runoff coefficient, or C factor. The rainfall intensity varies based on the frequency and duration of the selected storm event. The runoff coefficient varies based on the abstractive and diffusive properties of the catchment. The rational method assumes all rainfall enters the CSS and combines with the industrial, commercial, and domestic wastewater flow to generate combined wastewater.

The rational method is a peak discharge analysis, therefore it will always over predict the actual amount of runoff from a catchment and under predict the CSO reduction based on system improvements, if the C factor is selected appropriately. Factors such as stormwater time of concentration, catchment storage, and any other dynamic considerations are not accounted for using the rational method and would reduce the amount of peak flow in a catchment.

6.03 DOWNTOWN INTERCEPTOR MODEL

The Downtown Interceptor flows southwest parallel to the Ohio River through downtown Henderson, Kentucky. The Downtown Interceptor discharges at the Janalee Drive Pumping Station where flow is then pumped to the North WWTP. Refer to Table 4.01-1 in Section 4 of this report for a list of CSO outfalls to the Ohio River. Figure 4.01-2 in Section 4 of this report shows the Downtown Interceptor CSOs and their contributing areas, which are all areas west of the Ohio River Canoe Creek boundary. CSO basin sewersheds and watersheds were delineated based on sewer connectivity and topographical GIS information supplied by HWU. Runoff coefficients for delineated sewershed and watershed areas were determined using structure and road edge GIS data provided by HWU and GIS data from the National Land Cover Database 2001 (NLCD01).

The model uses the rational method to determine a peak storm flow for each CSO subbasin based on selected storm event intensity and the hydraulic capacities within the system to calculate the peak flow rates in the Downtown Interceptor, CSO drop connections, and other important CSO pipes. Dry weather flow contributions for each CSO subbasin are weighed based on the area of the subbasin. The peak dry weather flow was divided by the total service area to determine a peak flow per area. This factor was multiplied by the area of each subbasin and/or contributing separated areas to determine the peak dry weather flow. The peak dry weather flow was obtained from hourly WWTP influent data in April 2008 and is approximately 11.5 mgd.

Drawings of combined sewers upstream of CSO control structures are not available for the combined sewer area. All model calculations assume that all combined wet weather flow reaches the control structure. The model then compares the wet weather combined flow to the hydraulic capacity of the drop connection in the CSO control structure. Once the flow exceeds the capacity of the drop connection, the remaining flow is assumed to overflow to the Ohio River. Overflow pipes from the control structures are always larger than the drop connection and have a steep slope to the outfall on the Ohio River. Overflow pipes are therefore assumed to have infinite capacity for modeling purposes and can convey all flow in excess of the hydraulic capacity of the drop connection. This flow balance calculation occurs at each CSO control structure along the Downtown Interceptor. Figures 6.03-1 and 6.03-2 show a schematic of the 1995 and 2018 Downtown Interceptor model configurations, respectively.

1995 DOWNTOWN INTERCEPTOR MODEL SCHEMATIC

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN

HENDERSON WATER UTILITY

HENDERSON, KENTUCKY

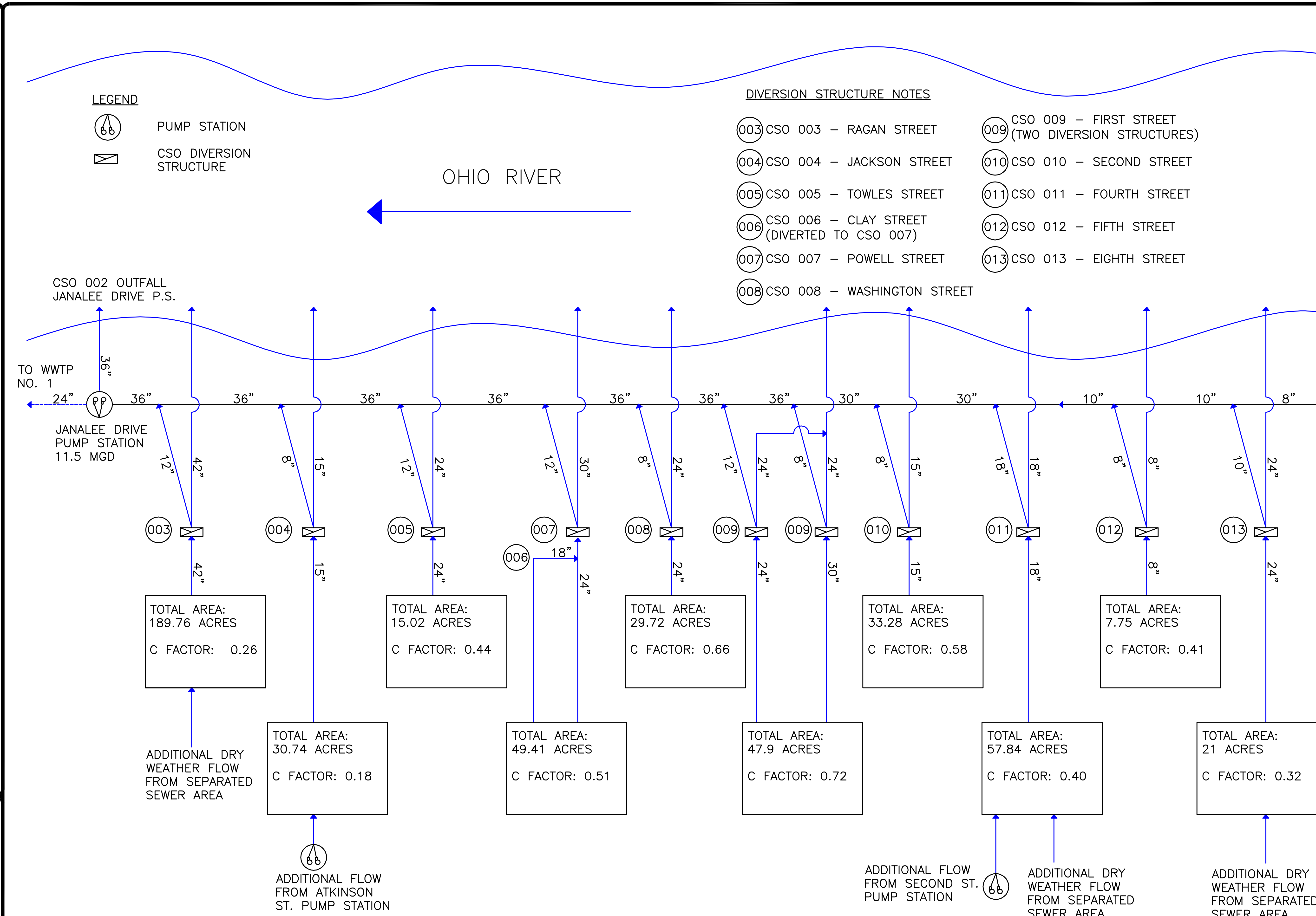

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FIGURE 6.03-1

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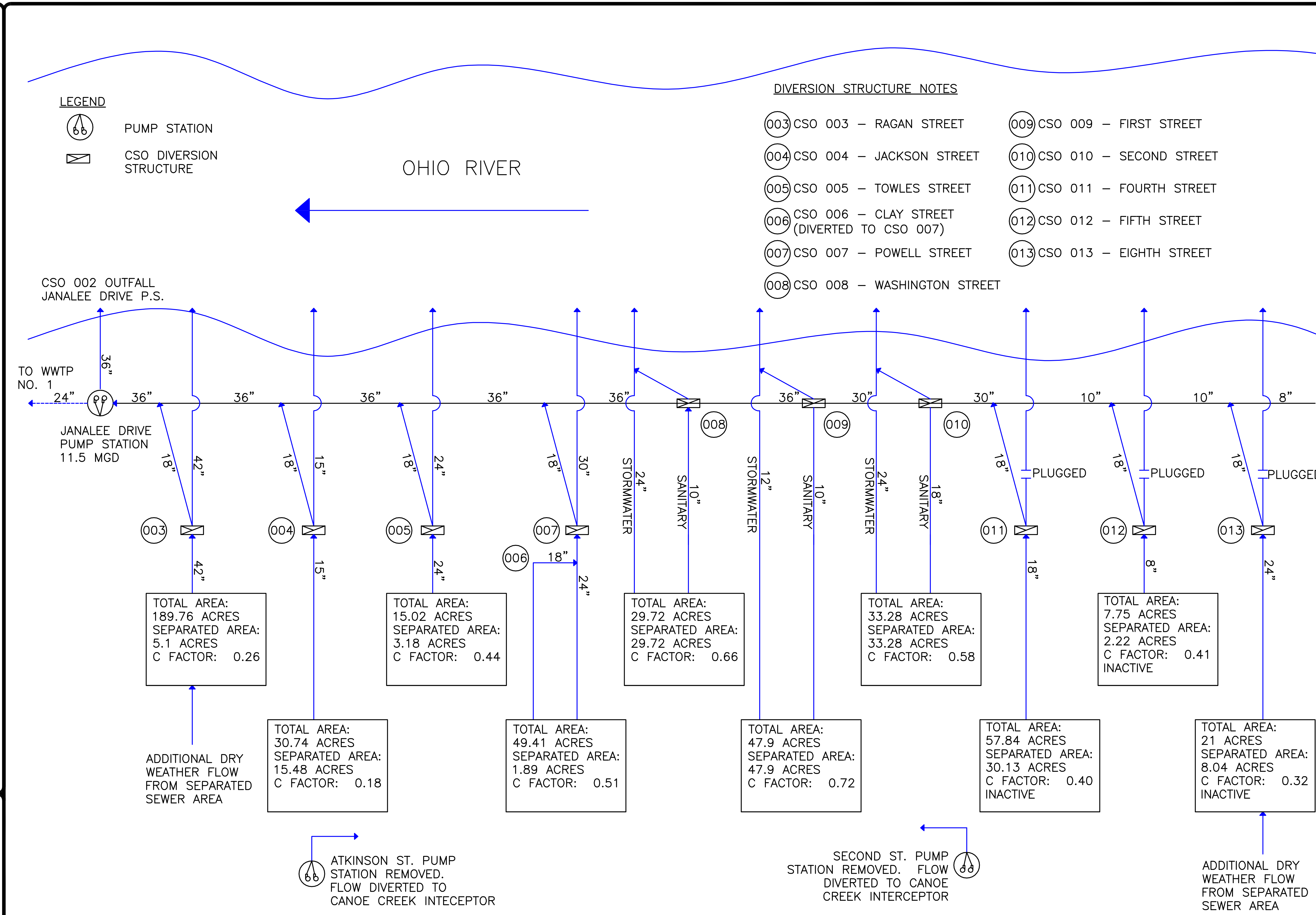
2018 DOWNTOWN INTERCEPTOR MODEL SCHEMATIC

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN

HENDERSON WATER UTILITY

HENDERSON, KENTUCKY



STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 6.03-2

JOB NO. 5454.002

File: S:\LOU\5400--5499\5454\001\Acad\New Figure Title Orientation\2018 DOWNTOWN INTERCEPTOR MODEL SCHEMATIC-NEW.dwg Time: Mar 17, 2009 – 3:33pm

Flow from the drop connections accumulates in the Downtown Interceptor from each CSO subbasin and is conveyed to the Janalee Drive Pumping Station. The Janalee Drive Pumping Station is a three-pump pumping station with a peak capacity of approximately 11.5 mgd, as verified by draw-down testing. All combined flow conveyed to the Janalee Drive Pumping Station in excess of 11.5 mgd is assumed to be overflow for modeling purposes except when accounting for storage provided by the Downtown Interceptor. Based on the 1954 plans and GIS information, the storage capacity of the interceptor is approximately 0.5 million gallons (mil gal).

The Second Street Pumping Station, Atkinson Street Pumping Station, and separated areas flowing into the CSS were taken into account by adding their flow contributions to their respective CSO subbasins. The Atkinson Street and Second Street Pumping Stations are assumed to pump at all times at peak capacity during the storm events. The peak pumping capacities of the Second Street Pumping Station and the Atkinson Street Pumping Station are 5.4 mgd and 2.9 mgd, respectively.

The hydraulic capacities used for modeling the Downtown Interceptor and the CSO control structures were based on the 1954 Sewer System Improvements drawings provided by HWU. The drawings show the profile, location, and details of the Downtown Interceptor and the CSO control structures discharging to the Ohio River. The drawings were field verified for accuracy at all CSO control structures and several points along the Downtown Interceptor. Manhole entries were made at three locations (the CSO 005 control structure, the CSO 007 control structure, and the interceptor connecting to the CSO 007 control structure) where field measurements varied from the 1954 drawings. Table 6.03-1 lists the current hydraulic capacities used in the model for the Downtown Interceptor model. Appendix H shows the design capacities and subbasin attributes used for the Downtown Interceptor model.

6.04 CANOE CREEK INTERCEPTOR MODEL

The Canoe Creek Interceptor is located near Canoe Creek along the eastern and southern side of Henderson. The Canoe Creek interceptor will convey flow from a significant portion of the Henderson service area to the NWWTP. Refer to Table 4.01-1 in Section 4 of this report for a list of CSO outfalls in the Canoe Creek area. Refer to Figure 4.01-1 in Section 4 and Table 1.04-1 in Section 1 to review the Canoe Creek Interceptor Phase I and II CSOs, and their contributing areas, which are all areas east of the Ohio River/Canoe Creek boundary. CSO basin sewersheds and watersheds were delineated based on sewer connectivity and topographical GIS information supplied by HWU. Runoff coefficients for delineated sewershed and watershed areas were determined using structure and road edge GIS data provided by HWU and GIS data from the NLCD01.

Similar to the Downtown Interceptor model, the Canoe Creek Interceptor model is a steady state peak flow model that uses the rational method to determine peak storm flows based on selected storm events. Dry weather flows are calculated based on the size of the contribution area using the same method as the Downtown Interceptor model. The model uses a flow balance to determine the overall overflow rate by subtracting the pumping capacity of the Second Street Pumping Station from the total combined flow of the contributing areas.

TABLE 6.03-1

2008 DOWNTOWN INTERCEPTOR HYDRAULIC CAPACITIES

CSO Basin	Control Pipe (Drop Connection)					Upstream Interceptor					Downstream Interceptor				
	Diameter (in)	Mannings n	Slope	Material	$Q_{H.Control}$ (mgd)	Diameter (in)	Mannings n	Slope	Material	$Q_{H.Int.Up}$ (mgd)	Diameter (in)	Mannings n	Slope	Material	$Q_{H.Int.Down}$ (mgd)
CSO 002	-	-	-	-	11.5	36	0.013	0.14%	RCP	16.2	-	-	-	-	11.5
CSO 003	12	0.016	0.40%	VCP	1.2	36	0.013	0.10%	RCP	13.7	36	0.013	0.14%	RCP	16.2
CSO 004	8	0.016	3.00%	VCP	1.1	36	0.013	0.10%	RCP	13.7	36	0.013	0.10%	RCP	13.7
CSO 005	12	0.016	3.00%	VCP	3.2	36	0.013	0.10%	RCP	13.7	36	0.013	0.10%	RCP	13.7
CSO 007	12	0.016	0.68%	VCP	1.5	36	0.013	0.10%	RCP	13.7	36	0.013	0.10%	RCP	13.7
CSO 008	8	0.016	0.80%	VCP	0.6	36	0.013	0.10%	RCP	13.7	36	0.013	0.10%	RCP	13.7
CSO 009 CS1	12	0.016	0.40%	VCP	1.2	30	0.013	0.17%	RCP	11.0	36	0.013	0.10%	RCP	13.7
CSO 009 CS2	8	0.016	6.76%	VCP	1.7	30	0.013	0.17%	RCP	11.0	36	0.013	0.10%	RCP	11.0
CSO 010	18	0.016	2.00%	VCP	7.8	30	0.013	0.17%	RCP	11.0	30	0.013	0.17%	RCP	11.0
CSO 011	18	0.016	4.60%	VCP	11.9	10	0.016	0.60%	VCP	0.9	30	0.013	0.17%	RCP	11.0
CSO 012	8	0.016	3.00%	VCP	1.1	10	0.016	0.60%	VCP	0.9	10	0.016	0.60%	VCP	0.9
CSO 013	10	0.016	2.85%	VCP	1.9	8	0.016	5.00%	VCP	1.4	10	0.016	0.60%	VCP	0.9

$Q_{H.Control}$ = Hydraulic capacity of the drop connection from the CSO control structure leading to the Downtown Interceptor.
$Q_{H.Int.Up}$ = Hydraulic capacity of the Downtown Interceptor directly upstream of its connection to the CSO control structure.
$Q_{H.Int.Down}$ = Hydraulic capacity of the Downtown Interceptor directly downstream of its connection to the CSO control structure.
Note that CSO 009 consists of two control structures: CS1 and CS2

The Second Street Pumping Station is assumed to pump at peak capacity at all times during the storm events. Appendix I shows the subbasin attributes used for the Canoe Creek Interceptor model. Figures 6.04-1 and 6.04-2 show schematics of the Canoe Creek basin for 1995 and 2018, respectively.

With the construction of the Canoe Creek Pumping Station and Interceptor (Phase 2), the Third Street CSO Basin is operated to maximize the entire 15 million gallons of storage available. Overflows from the basin typically come through the emergency overflow discharge. CSO Pumping Station No. 2 (15,000 gpm) is operated manually and only when multiple rain events are expected in a short period of time. This allows HWU to discharge a small amount from the basin and create more storage for the next event, thus minimizing the overall volume being released and protecting nearby property from damage. As soon as flow into the basin stops, CSO Pumping Station No. 1 (1,200 gpm) will begin pumping the stored combined sewage back to the Canoe Creek Phase 2 Pumping Station.

6.05 MODEL CALIBRATION

A. Downtown Interceptor Calibration

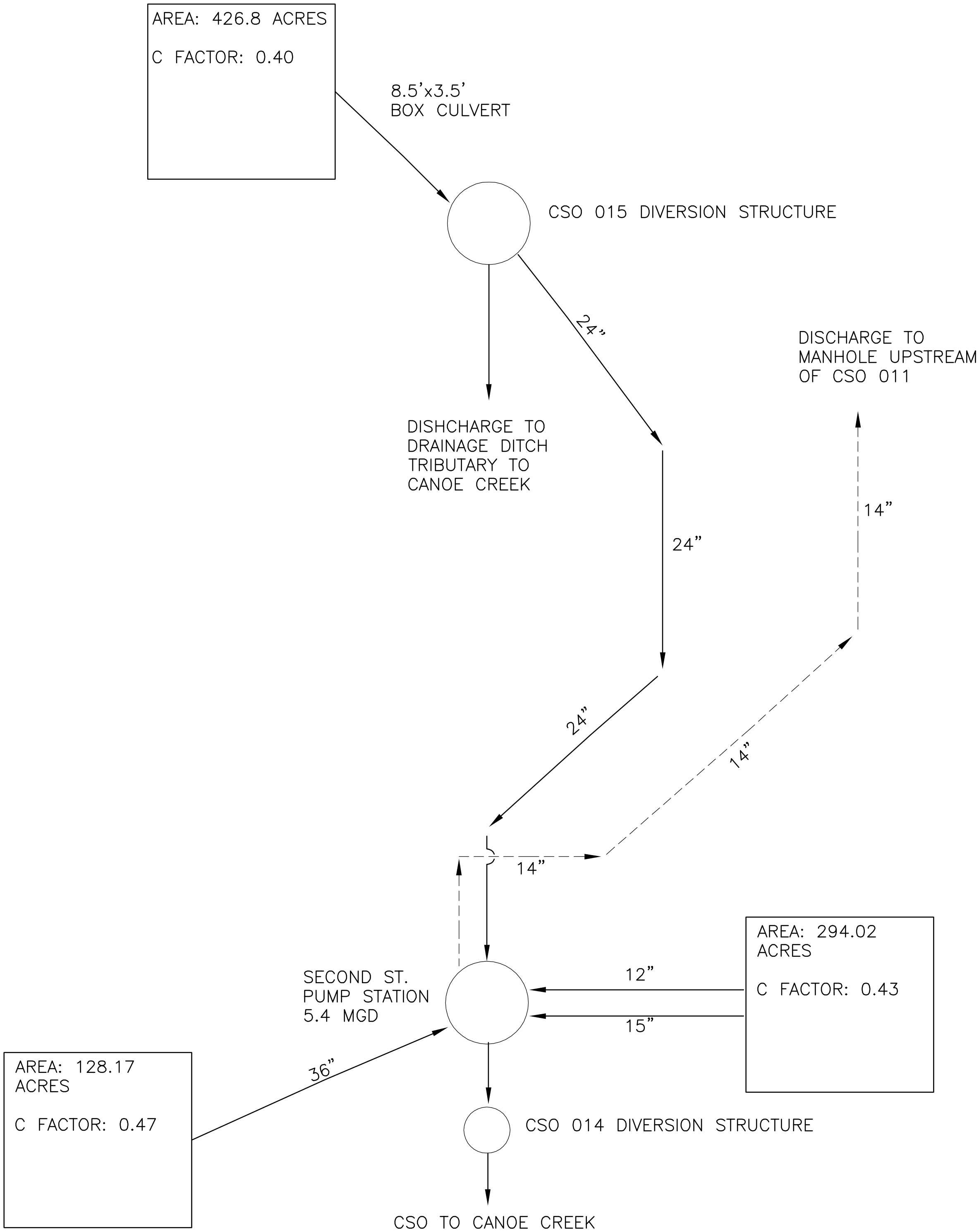
A Downtown Interceptor 2008 model was created representing the current conditions in Henderson. The 2008 model was created to calibrate the runoff coefficients for the CSO subbasins based on rainfall data collected at the Third Street CSO Basin rain gauge and flow data collected at the Downtown Interceptor CSO control structures.

In 2006, HWU installed seven Teledyne-ISCO 1250 Area Velocity Flow Modules (ISCO meter) for the following CSOs:

1. CSO 003–Ragan Street
2. CSO 004–Jackson Street
3. CSO 005–Towles Street
4. CSO 007–Powell Street
5. CSO 008–Washington Street
6. CSO 009–First Street
7. CSO 010–Second Street

At the time the Teledyne-ISCO modules were installed, HWU maintained four rain gauges: the State Police Post, North WWTP, Third Street CSO Basin, and on US 60. The Third Street CSO Basin rain gauge data was selected because it was the only rain gauge located within the CSS. Data from the ISCO meters and the Third Street CSO Basin rain gauge were used to create a correlation between peak CSO discharge and rainfall intensity. (Subsequently, an additional rain gauge has been installed on the Ohio River raw water intake near Fifth Street.)

Seventeen storm events were selected based on a range of rainfall intensity, duration, and peak CSO discharge rate to create the correlation using a linear best fit line. These correlations are shown in Appendix J. The downtown model was calibrated based on the first surge of rainfall during a rain event so that the model could be calibrated based on dry antecedent moisture conditions for all CSO basins. As soil moisture increases in the CSO basins, runoff conditions can



YEAR 1995 CANOE CREEK BASIN SCHEMATIC

COMBINED SEWER OVERFLOW
LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 6.04-1

5454.002

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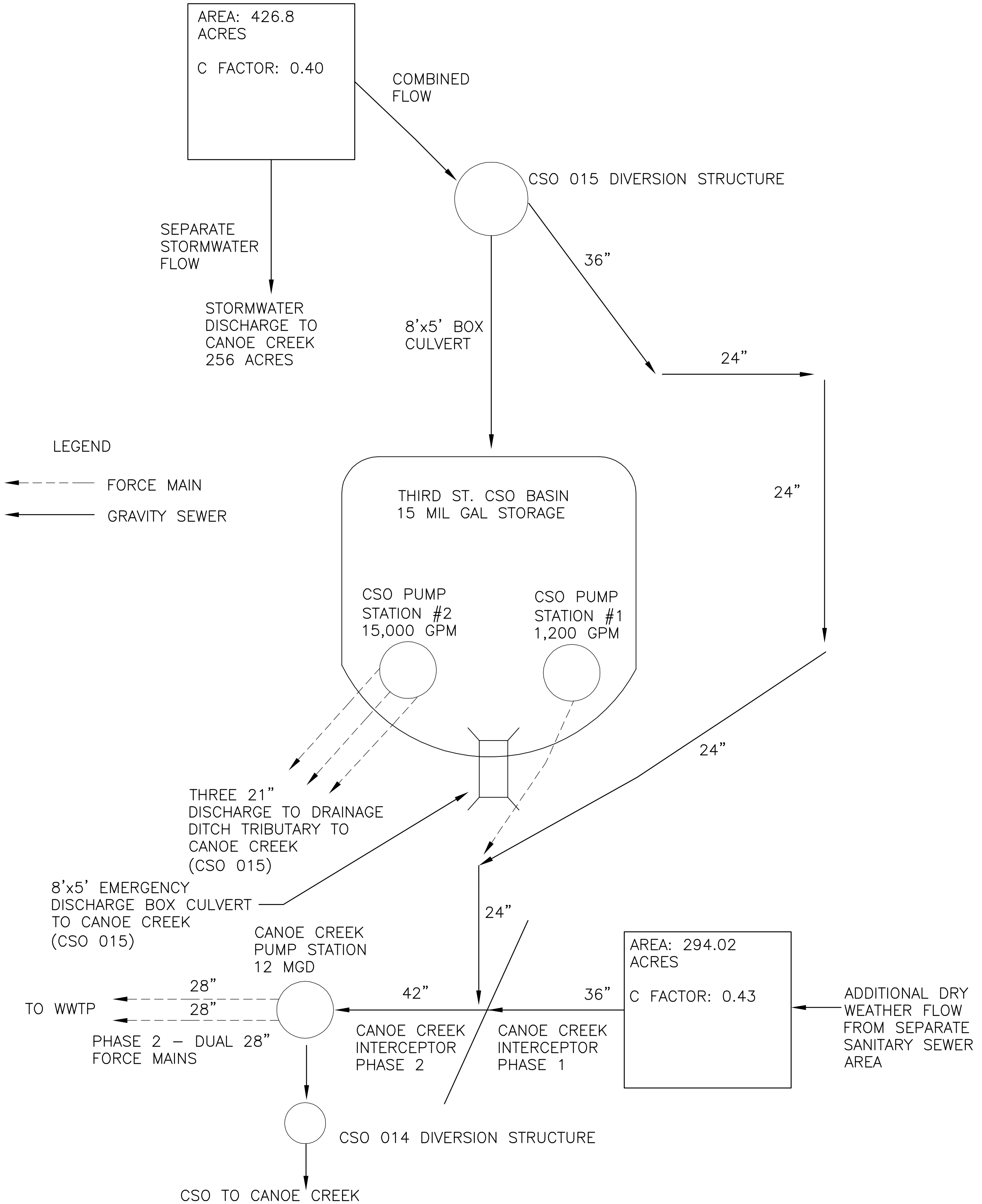

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YEAR 2018 CANOE CREEK BASIN SCHEMATIC

COMBINED SEWER OVERFLOW
LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 6.04-2

5454.002

vary within each basin and may not vary consistently across the individual CSO basins. Therefore, dry antecedent moisture conditions were used to calibrate the model. Rainfall totals in Appendix J only take into the account the first surge of rainfall, which is denoted by the vertical line shown on the rainfall event graphs in Appendix J. Based on the data collected by the ISCO meters; only runoff coefficients for CSO subbasins 003, 004, 007, 008, and 009 could be calibrated.

Data collected at CSO 002, 005, and 010 could not be used for calibration purposes. CSO subbasins with unreliable or no CSO flow data relied on the calculated runoff coefficient based on land use.

When the trend lines were created, they were used to determine the peak overflow rate of each CSO control structure for a 3-month 1-hour storm. The spreadsheet model was then run and iterated by varying the runoff coefficient using the 3-month 1-hour storm event until a runoff coefficient was found that calculated the predicted peak flow from the trend lines. This calibrated runoff coefficient was later used in determining the estimated annual average overflow volume and overall CSO volume reduction.

B. Canoe Creek Interceptor Calibration

There are no CSO flow meters at the Third Street CSO Basin or the Second Street Pumping Station to correlate rainfall or levels in the CSO Basin or Second Street Pumping Station to overflow rates or volumes. CSO events are captured by HWU based on pump high level alarms from the Second Street Pumping Station and the Third Street CSO Basin Pumping Station. Attempts were made to calibrate the runoff coefficients of areas contributing to the Canoe Creek Interceptor for the 2008 model by the levels in the Second Street Pumping Station. Levels in the Second Street Pumping Station could be used to correlate rainfall to overflow volumes if the level in the pumping station matched the level in the CSO outfall structure. Hydraulic capacities were calculated for the Canoe Creek Interceptor and gravity sewers leading from the Third Street Basin to the Second Street Pumping Station based on record drawings, GIS provided by HWU, and field investigations to determine the hydraulic relationship between the Third Street Basin CSO control structure and the Second Street Pumping Station CSO control structure. After performing a hydraulic capacity analysis, it was determined that the headloss in the pipe leading from the Second Street Pumping Station to the CSO outfall structure was great enough to cause the levels in the pumping station and the CSO outfall structure to differ. There is no recorded level data for the Second Street Pumping Station CSO outfall structure, therefore, no correlation could be made and runoff coefficients could not be calculated. Runoff coefficients based on land use were used for the Canoe Creek Interceptor model.

6.06 CSO VOLUME AND PERCENT CAPTURE METHODOLOGY

Rain gauge data was obtained from the National Climatic Data Center for the Evansville Airport rain gauge in Evansville, Indiana, which is approximately 15 miles north of Henderson. Rain data was collected from 1948 to 2008 and shows the total inches of rainfall in hour increments. This is also the average rainfall intensity for that hour. The rational method was used for the spreadsheet model analysis; therefore, the resulting flow from each basin is dependent on the intensity of the storm event being simulated. Rainfall intensities up to three inches per hour in 0.01 increments were included in the model for each time period to calculate a potential overflow volume and volume conveyed to the WWTP by pumping stations. Example models were simulated and the results of this process are shown in Appendix K. Rainfall is assumed to fall uniformly across the CSS. These results were then associated for each hour of collected rainfall data from 1948 to 2008.

The percent capture results shown in Appendix K do not incorporate the storage of the system because the rational method itself does not account for storage. Storage was accounted for after the rational method calculations were made based on the operation of the system. Potential overflow volume based on the rainfall intensity is compared to the pumping station capacities in the basin (Janalee Drive Pumping Station in the downtown area and the Second Street/Canoe Creek Pumping Station in the Canoe Creek area). If the combined flow from a rain event exceeds the pumping capacity, the flow is then placed in storage. As flow accumulates and exceeds the available storage capacities, overflows occur.

The 2018 models assume the completion of all planned separation projects. HWU also plans to increase the size of the drop connections in the CSO control structures leading to the downtown interceptor. The 2018 downtown model assumes that all drop connections below 18-inches in diameter are replaced with 18-inch diameter pipes.

During hours where rain does not occur or the flow caused by the rain is less than the capacity of the pumping stations, the volume of combined sewage stored is pumped back into CSS to eventually be treated at the WWTP. For the Downtown Interceptor storage, Janalee Drive Pumping Station empties the interceptor after rain occurs. The storage in the interceptor is 0.5 mil gal and Janalee Drive Pumping Station has a capacity of 11.5 mgd, or 0.48 mil gal/hr. Therefore, the interceptor is emptied in about a single hour when no rain occurs. The Third Street CSO basin uses a 1,200 gpm, or 0.07 mil gal/hr pumping station to empty the 15 mil gal of storage provided by the basin. Hence, it takes approximately nine days to empty the basin if it is completely full. Rain events occurring on consecutive days or hours after another event will often have less available storage in the basin due to combined sewage not yet pumped out. This process of accounting for system storage was also used for the 1995 model, the 2008 model, and 2018 model.

By incorporating the large amount of available rain data and knowledge of the system, storage can be accounted for while using the rational method. Detailed surcharging and antecedent moisture conditions cannot be incorporated using this method. Figure 6.06-1 shows a graphical example of the 2018 model during a rain event in April 1996 to show the model's operation.

The majority of the rain fell within a 24-hour period. The event had a maximum intensity of 0.86 in/hr and a total rainfall depth of about 7.25 inches, which is approximately a 100-year frequency 24-hour duration event. All frequencies and durations of storm events referenced in this section are based on the *Rainfall Frequency Atlas of the Midwest*. The total system volume shows the volume of combined sewage in the CSS. The flow conveyed and treated shows the combined sewage pumped to the WWTP. During the periods of heavy rain, Janalee Drive Pumping Station and the proposed Canoe Creek Pumping Station were operating at capacity, which is represented by the flat lining during the second half of the day on April 28, 1996. Once the pumping stations are operating at capacity, potential overflow in the system then goes to system storage, which is represented by the increase in flow stored. When the storage capacity for the system is reached, flow created by the storm then causes a CSO. This is represented by the flow stored graph flat lining, indicating that the storm has filled all available storage and is now causing a CSO. The small amount of storage provided by the interceptor and the Janalee Drive Pumping Station capacity indicates the Downtown Interceptor storage fills and empties very quickly. The storage provided by the Third Street CSO basin in the Canoe Creek area, however, is much larger and takes longer to reach capacity, but it drains slowly. Although the basin takes up to nine days to drain in the 2018 model, the 15 mil gal of storage used in the 2018 model only allowed three overflow events over the 60 year analysis period. The example rain event shown in Figure 6.06-1 shows one of those three events.

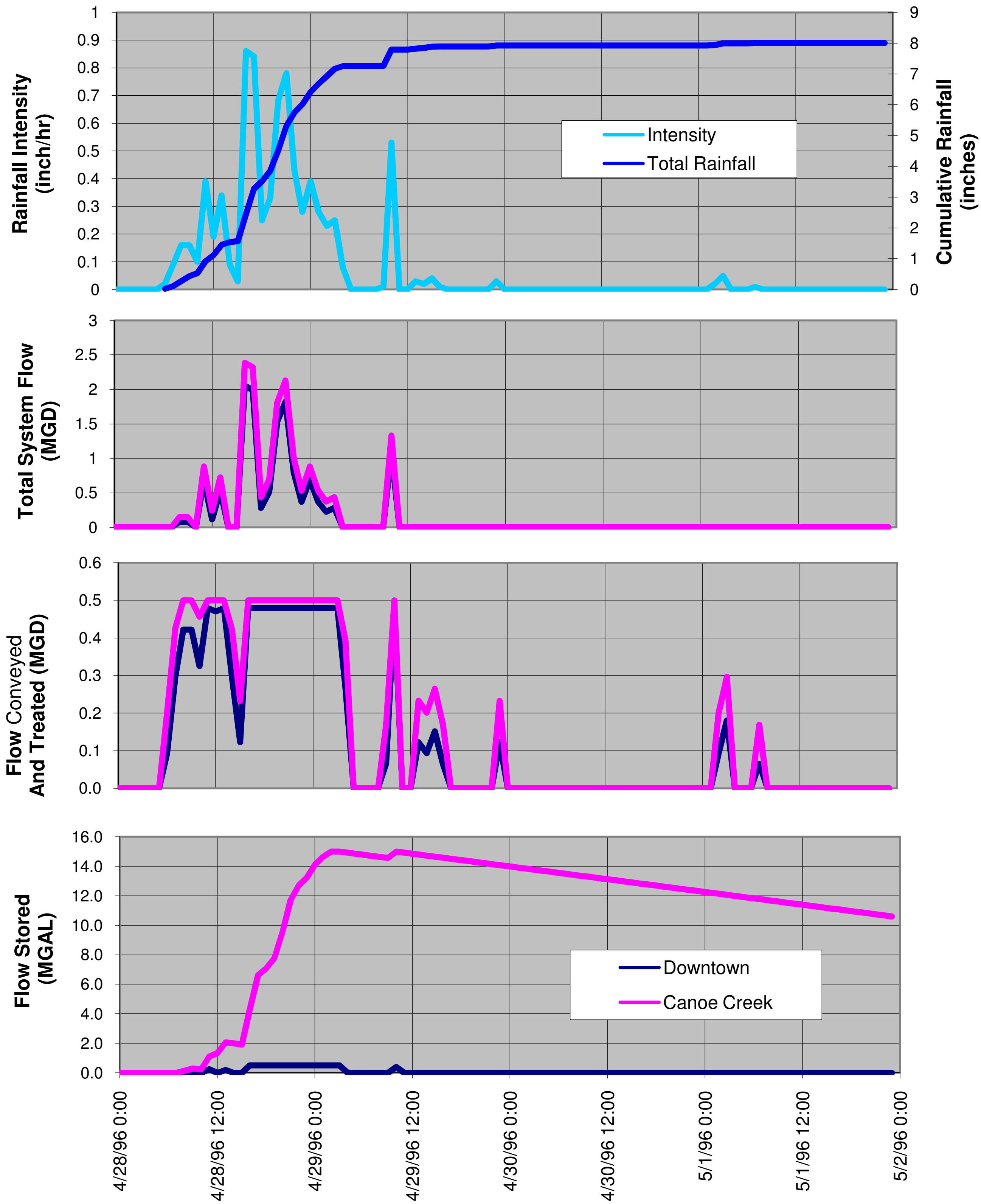
A typical year was not developed for the model presented in Figure 6.06-1. The total overflow volume, volume treated/captured, and total system volumes calculated by the spreadsheet model for the 60 years of hourly rainfall data were summed and annualized to determine the average volumes per year for each spreadsheet model. Table 6.06-1 shows a summary of the hourly rainfall events that occurred during the 60 years of available rainfall data. Figure 6.06-2 shows the total annual rainfall from 1949 to 2007. The rain data used for the model is the most complete set of data available. Rain data represents a wide range of storm events including many short 3-month to 1-year recurrence interval storms, and large storms including a 25-year recurrence interval 1-hour event, a 50-year recurrence interval 24-hour event as mentioned above, and more.

6.07 OVERFLOW ANALYSIS RESULTS

Table 6.07-1 shows the results of the spreadsheet models.

The Downtown Interceptor captured approximately 68 percent of wet weather flows in 1995. Through improvements made by HWU, it is estimated to capture 73 percent of wet weather flows today. After implementation of the LTCP, it will capture 80 percent of wet weather flows in 2018. Through various separation projects in the downtown area, HWU has decreased the amount of stormwater allowed into the Downtown Interceptor, allowing the existing infrastructure to capture a much higher percentage of the combined flow.

The Canoe Creek interceptor model has had a substantial increase in projected percent capture from an estimated 25 percent in 1995 to nearly 100 percent in 2018 after LTCP implementation. The low percent capture in the 1995 model is because of undersized infrastructure and no available storage in the Canoe Creek area. The Third Street CSO basin was constructed in 1998 allowing HWU to store a large amount of combined sewage throughout the course of a rain event until it could be treated after the rain subsided. Based on preliminary design, the Canoe Creek Interceptor Pumping Station will be 12 mgd, which is more than twice the capacity of the current Second Street Pumping Station capacity of 5.4 mgd. The upgrades to the WWTP will allow HWU to convey and treat the additional flow from the Canoe Creek basin, increasing percent capture even further.

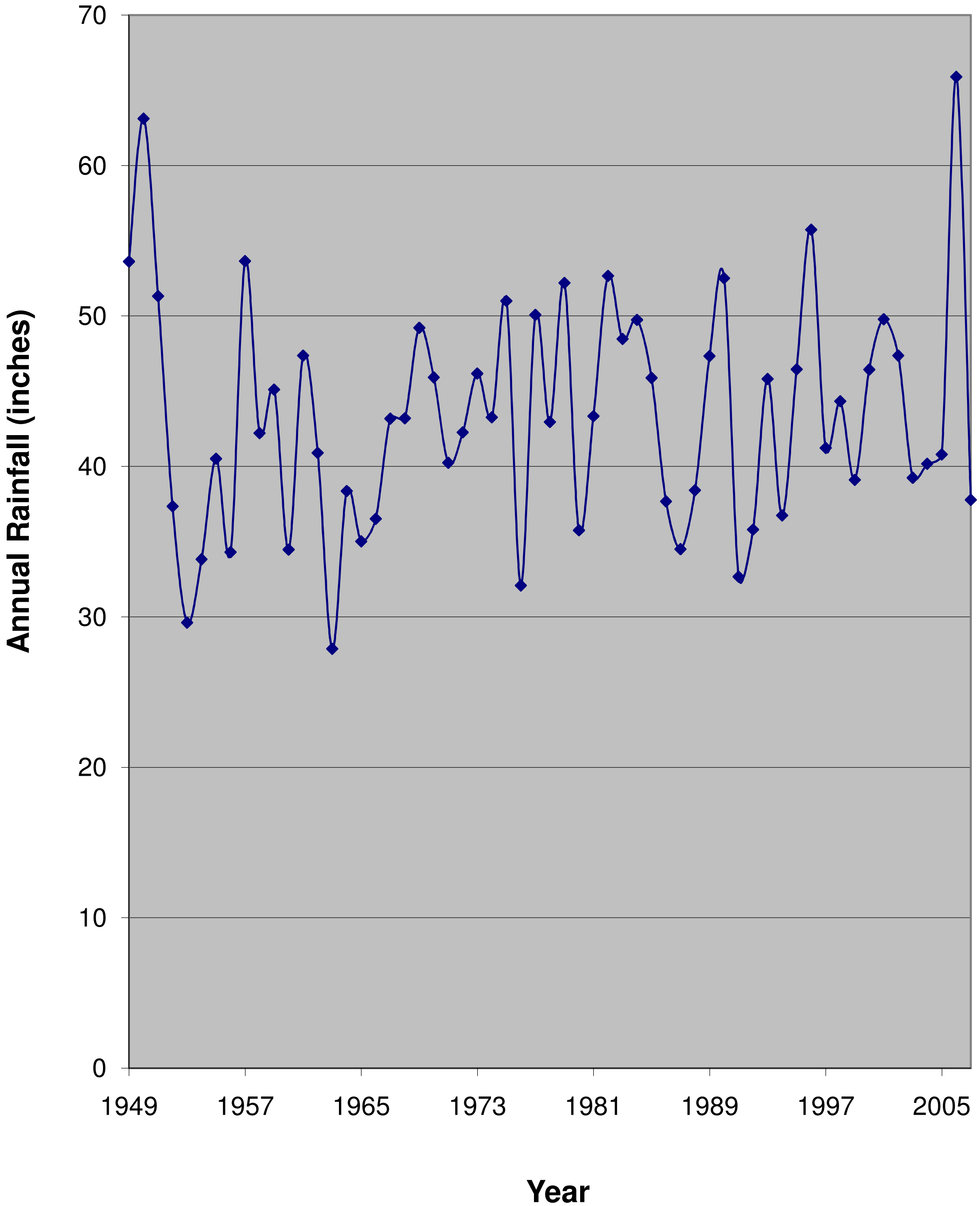


SPREADSHEET MODEL EXAMPLE RAIN EVENT

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KY

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 6.06-1
5454.002



*Data is based on the National Climatic Center, Evansville, Indiana airport rain gauge.

AVERAGE ANNUAL RAINFALL FROM 1949 TO 2007

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

STRAND ASSOCIATES, INC.® ENGINEERS

FIGURE 6.06-2
5454.002

TABLE 6.06-1

HOURLY RAINFALL DATA ANALYSIS (1948 to 2008)*

Intensity (in/hr)	Number of Discrete 1-hr Rainfall Events
0.05	20,941
0.1	5,544
0.15	2,578
0.2	1,411
0.25	858
0.3	556
0.35	347
0.4	257
0.45	170
0.5	135
0.55	120
0.6	87
0.65	66
0.7	68
0.75	52
0.8	43
0.85	30
0.9	26
0.95	15
1	16
1.05	8
1.1	14
1.15	5
1.2	4
1.25	6
1.3	5
1.35	3
1.4	3
1.45	7
1.5	1
1.55	1
1.6	0
1.65	1
1.7	1
1.75	0
1.8	0
1.85	1
1.9	2
1.95	1
1.96	1
2.62	1
2.99	1

*Evansville Airport Rainfall Data obtained from National Climatic Data Center.

TABLE 6.07-1

SPREADSHEET MODEL RESULTS

Model	60 Year Data Totals[1]				Annual Average			
	Volume Captured/Treated[2] (mil gal)	Overflow Volume[3] (mil gal)	Total System Volume[4] (mil gal)	Percent Capture[5]	Volume Captured/ Treated[2] (mil gal)	Overflow Volume[3] (mil gal)	Total System Volume[4] (mil gal)	Percent Capture[5]
1995 SPREADSHEET MODEL								
The 1995 spreadsheet model represents the HWU CSS as it was in 1995 before any separation or improvements were made.								
Combined System	26,451	28,935	55,387	48%	440.9	482.3	923.1	48%
2008 SPREADSHEET MODEL								
The 2008 spreadsheet model represents the HWU CSS, to the best of our knowledge, as it is today. This includes the construction of the Third Street CSO basin and various separation projects throughout the CSS.								
Combined System	28,691	7,321	36,012	80%	478.2	122.0	600.2	80%
2018 SPREADSHEET MODEL								
2018 Spreadsheet Model represents the HWU CSS as it will be in 2018 assuming their current improvement and separation projects are completed on schedule. This includes the completion of the Canoe Creek interceptor,additional separation in the downtown area, and increased control pipe sizes in the downtown area.								
Combined System	20,010	1,719	21,729	92%	333.5	28.7	362.1	92%

[1]Rain data for modeling purposes was obtained from the National Climatic Data Center at the Evansville Airport rain gauge in Evansville, IN. Data consists of hourly rainfall totals from July 1948 to June 2008.
[2]Volume of combined sewage stored and/or conveyed to the WWTP during wet weather events.
[3]Volume of combined sewage discharged by permitted CSOs in the CSS.
[4]Sum of the volume captured/treated and overflow volume.
[5]Percent of combined sewage during wet weather events captured and treated. Percent capture equals the volume captured/treated divided by the total system volume.

The 2008 Canoe Creek model assumes that potential overflow from a wet weather event first fills the basin before it overflows, which is not always the case. The Third Street CSO basin and the Second Street CSO control structure are both low hydraulic relief points in the Canoe Creek area, which can cause overflows at the Second Street Pumping Station before the Third Street CSO basin is full. Operational changes by HWU in the near future will address this and only allow overflows after the basin has filled.

Percent capture results for the 2008 Canoe Creek model are likely being over predicted. However, with the introduction of the Canoe Creek Pumping Station and interceptor by 2018 and by raising the manholes upstream of the new Canoe Creek Pumping Station several feet, the Third Street CSO basin will become the lowest hydraulic relief point in the Canoe Creek basin, allowing combined sewage to first fill the basin before it overflows at any other location.

As a result, the 2018 Canoe Creek model will more accurately predict the amount of available storage and overflow volume than the 2008 Canoe Creek model.

6.08 CONCLUSION

Since the development of their Combined Sewer Operating Plan (CSOP) in 1996, HWU has adopted a proactive approach to CSO issues within their community. HWU has been actively implementing a CSO control strategy consistent with the intent of the 1994 CSO Control Policy. HWU has been designing and constructing sewer separation projects and other improvements to reduce CSO volumes and occurrences. Even as a small community with limited resources, HWU has already committed $17.3 million to reduce CSO within their CSS.

HWU's LTCP continues the strategy that has been implemented for more than ten years which includes:

1. Installing separate sanitary sewers in the older downtown area to reduce the amount of stormwater entering the CSS.

2. Rerouting sanitary flows that currently flow through the Downtown Interceptor away from the downtown area to increase available capacity within the CSS.

3. Make improvements to the WWTP to accommodate the higher flow rates being captured and transported to the WWTP.

The next phase of a new sanitary sewer interceptor and pumping station is currently being designed and planned for construction to divert flows away from the downtown CSS and convey almost twice the estimated combined flow directly to the WWTP.

HWU has also initiated the planning and design of upgrades to the WWTP to accept and treat the increased flow from this interceptor. All of these improvements benefit the CSS.

The currently proposed plan demonstrates a substantial amount of reduction is CSO volume and a large increase in percent of capture. Upon completion of this plan, approximately 56 percent of the CSS will be completely separated which includes all of the downtown areas with the highest percentage of impervious area.

Modeling results verify that separation efforts and planned projects by HWU will result in capturing at least 85 percent of the combined sewer flow as required by the *Presumptive Approach.* Although all models have some degree of inaccuracy, every component of our model has been conservatively assembled to create a very conservative simulation of the results that will be achieved by implementing HWU's LTCP. HWU is committed to achieving compliance with the CSO Control Policy by meeting or exceeding the 85 percent capture threshold.

SECTION 7

AFFORDABILITY

Affordability is a key concept within the National CSO Control Policy. USEPA guidance for the policy includes methods that help identify locally appropriate implementation schedules that allow phasing of projects over an extended time frame to avoid excessive customer sewer use charges. In small communities like Henderson, the financial impact of CSO control can be very acute because of a limited population base to share costs, fewer job-creating industries, and generally less opportunities for higher income careers. Henderson is also susceptible to significant per capita impacts from the loss of jobs in the local industries due to its relatively small population.

7.01 RESIDENTIAL INDICATORS

USEPA guidance generally indicates that, as a function of the median household income (MHI), residential annual costs for sewer service have the following financial impact on residential customers:

Low	Less than 1 percent MHI
Mid-range	1 percent to 2 percent MHI
High	Greater than 2 percent MHI

Kentucky communities are generally economically stressed as compared with national averages. For example, according to the latest Census Bureau information, MHI for the Commonwealth of Kentucky is nearly 20 percent below the national average and Kentucky unemployment is almost 30 percent more than the national average. The regulated community has felt that sewer rates of 1.5 percent or more of MHI would represent a hardship when considering MHI, unemployment rates, poverty rates, and other factors.

This section will review current budget requirements for HWU programs and the projected costs associated with additional CSO control to interpret the financial impact these programs will have on the local community.

A. <u>Current Costs and Revenue</u>

1. Operating Expenses

According to HWU’s 2008 audited financial statement, operating costs were $4,858,000 for the North System which includes the CSS.

2. Existing Annual Debt Service

HWU’s current debt service for the North System is $887,500 annually.

B. Projected CSO Controls Costs

1. Projected Annual Operations and Maintenance Expenses

The construction of several new miles of large diameter gravity lines and force main, a large pumping station, and improvements to the wastewater treatment plant will require additional resources to operate and maintain.

The additional costs associated with these efforts are shown in Table 7.01-1.

Item	Project Annual Cost
Electricity	$12,000
Maintenance (manpower and materials)	$50,000
TOTAL	$62,000

Table 7.01-1 Additional O&M Expenses as a Result of LTCP Projects

2. Projected Debt Costs

HWU has already begun its aggressive implementation of CSO control and incurred approximately $17,300,000 in costs associated with executing the program to date. The impact of this debt is accounted for in the existing annual debt service. To finance the remaining work, HWU's technical and financial advisors estimate that an additional $33,000,000 will be required. This equates to an annual debt service of $2,640,000 as shown in Table 7.01-2.

Project	Cost Opinion
Canoe Creek Pumping Station and Interceptor (Phase 2)	$8,500,000
Canoe Creek Pumping Station and Interceptor (Phase 3)	$2,000,000
Canoe Creek Pumping Station and Interceptor (Phase 4)	$1,500,000
Center and Julia Separation Project, Phase III	$2,600,000
Downtown Area Separation Project	$10,100,000
WWTP Improvements, (Headworks)	$8,200,000
Ershig Stormwater Line (Ragan and Green Streets)	$100,000
Subtotal	$33,000,000
Annualization Factor (assumes 5% interest over 20 years)	0.08
Projected Annual Debt Costs (project costs x annualization factor)	$2,640,000

Table 7.01-2 Projected Annual Debt Costs

3. Total Projected Costs for Wastewater Treatment and CSO Control

Summing the values of HWU's current costs, projected costs and debt service yields a total cost of $8,447,500 as shown in Table 7.01-3.

Item	Projected Annual Cost
Current Annual WWTP and CSO Costs	$5,745,500
Projected Annual WWTP and CSO Control Debt Costs	$2,640,000
Projected Additional Annual WWTP O&M Expenses Associated with LTCP Projects	$62,000
TOTAL	$8,447,500

Table 7.01-3 Total Projected Costs for Wastewater Treatment and CSO Control

C. Cost per Household (Residential Portion of Wastewater Treatment Plant Flow)

Most of HWU's highest volume customers are industrial customers with existing, long-term contracts that set rates based on the cost of service. Rates are adjusted annually based on contractually defined cost of service to provide wastewater services to them.

Determining the residential portion of CSO control costs using the percentage of flow to the WWTP is inappropriate because of the unique factors affecting HWU's rates. This approach would work in communities where the revenue from residents is approximately equal to their portion of flow; however, a more accurate assessment would be made using the portion of additional revenue Henderson residents are responsible for. Table 7.01-4 calculates the residential share of costs for wastewater treatment and CSO control, as well as the annual cost per household.

Total Annual Projected Costs for Wastewater Treatment and CSO Control	$8,447,500
Portion of Total Costs Financed by Residents	65%
Residential Share of Total Costs	$5,490,875
Number of Households in Service Areas	9,000
Annual Costs per Household ($5,516,875/9,000)	$610

Table 7.01-4 Projected Annual Costs per Household for Wastewater Treatment and CSO Control

D. Median Household Income

The most recently available median household income figure is from a 1999 US Census Bureau report that lists the City of Henderson's median household income as $30,427. According to *LTCP-EZ* guidance, adjusting that figure to 2008 dollars using an average consumer price index (CPI) increase of 3.14 percent over 1999 to 2008, results in a median household income of $40,164. See Table 7.01-5. For comparison, the 2008 median household income for the entire United States is $51,740. This means the average household in Henderson makes approximately 25 percent less than the average household in the United States.

City of Henderson Median Household Income (1999)	$30,427
Adjustment Factor (1+3.14%)^(2008-1999)	1.32
Adjusted Median Household Income (in 2008 dollars)	$40,164

Table 7.01-5 Median Household Income

E. Residential Indicator

As shown in Table 7.01-6, dividing the cost per household calculated in Table 7.01-4 by the adjusted MHI (determined in Table 7.01-5) and then multiplying by 100 yields a Residential Indicator (defined as the annual cost of wastewater treatment and CSO control as a percentage of adjusted MHI) of 1.52.

Annual Costs of Wastewater Treatment and CSO per Household	$610
Adjusted Median Household Income (in 2008 dollars)	$40,164
Cost of Wastewater Treatment and CSO Control as a Percentage of Median Household Income ($6/$40,164)	1.52

Table 7.01-6 Residential Indicator Factor

7.02 FINANCIAL CAPABILITY INDICATORS

An "affordability matrix" concept was developed in USEPA guidance to assist in determining appropriate phased implementation timing for a complete CSO control program by assessing a community's borrowing or financing resources. A very high stress score would, for example, justify extending the total implementation timeline to a period of 15 to 20 years. A low stress score would mean that a relatively short implementation schedule for the entire CSO control program would be favored.

A. Bond Rating

Bond ratings summarize a community's credit capacity. In May 2008, Moody's Investors Services gave the City of Henderson an AAA rating on their bonds which corresponds to a 'Strong' Bond Rating Benchmark indicating Henderson has good credit to issue bonds with respect to bonding capabilities.

B. Overall Net Debt as a Percentage of Full Market Property Value

Net debt is an indicator of the overall debt burden on residents in a community calculated by comparing the existing debt a community is carrying to the full market value of real property. The City of Henderson is currently carrying a direct debt of $6,600,000 and a debt of overlapping entities of $19,726,806, which brings the overall net debt to $26,326,806. The full market property value is $1,599,707,000 which results in the overall net debt being 1.65 percent of the full market property value as shown in Table 7.02-1. This means that Henderson's overall indebtedness is relatively low and equates to a 'Strong' Net Debt Benchmark.

Direct Debt (General Obligation Bonds Excluding Double-Barreled Bonds)	$6,600,000
Debt of Overlapping Entities	$19,726,806
Overall Net Debt	$26,326,806
Full Market Property Value (MPV)	$1,599,707,000
Overall Net Debt as a Percent of Full MPV	1.65%

Table 7.02-1 Overall Net Debt as a Percentage of Full Market Property Value

C. Unemployment Rate

The unemployment rate is one method to assess the general economic well-being of a community. Communities with high unemployment will have more difficulty financing CSO controls. According to the State Office of Employment and Training, the unemployment rate for Henderson County, Kentucky was 6.2 percent in October 2008. Unemployment data for the City of Henderson is not available. The national unemployment rate at the same time was 6.7 percent, according to the Bureau of Labor Statistics. The local unemployment rates are less than the national rate; therefore, the Unemployment Rate Benchmark is 'Mid-Range' meaning that Henderson is reasonably well employed compared to other communities. It should be noted that the local economy is significantly dependent on the automotive industry and the current economic climate for this industry is not promising. It is anticipated that substantial lay offs could be forthcoming should the automotive industry continue to struggle.

D. Local Median Household Income as Compared to National Median Household Income

A community's median household income is another benchmark to judge overall economic well-being. A community with a high median household income is assumed to be better able to afford additional CSO control costs. As noted earlier, the median household income in 2008 dollars for the City of Henderson is $40,164 while the national median household income is $51,740 (also in 2008 dollars). A local median household income less than 75 percent of the national median household income is the threshold between a 'Mid-Range' and 'Weak' Median household income benchmark. The median household income for the City of Henderson is 77.6 percent of the national median household income which qualifies for a benchmark of 'Mid-Range' but is extremely close to being 'Weak'.

E. Financial Management

As noted above, the full market value of real property in the City of Henderson is $1,599,707,000. Property tax revenues were $5,282,485 or 0.33 percent of the full market value of real property. This relates to a 'Strong' rating on the City's Financial Management Benchmark because the City does not rely heavily on property taxes to fund City functions as compared to other cities.

Property Tax and Collection Rate

The property tax revenue collection rate is an indicator of the efficiency of the tax collection system and the acceptability of tax levels to residents. The effective property tax rate of the full market value of real property within the City limits is 0.353 percent. In 2008, $5,644,932 in property taxes were levied resulting in a property tax revenue collection rate of 93.6 percent as shown in Table 7.02-2. This qualifies as 'Weak' for the Collection Rate Benchmark which indicates that Henderson residents are less likely to be receptive to new taxes or fees for services.

Full Market Value of Real Property	$1,599,707,000
Effective Property Tax Rate	0.353%
Property Taxes Levied	$5,644,932
Property Taxes Collected	$5,282,485
Property Tax Collection Rate	93.6%

Table 7.02-2 Property Tax Collection Rate

However, trends in the city's socioeconomic conditions relating to household income, employment, population growth, and sewer rates show increasing percentages of low income households, decreasing employment opportunities, diminishing population growths, and elevating sewer rates. Furthermore, tax revenue considerations are important in determining the overall financial capability of the city.

The property tax burden does help indicate the funding capacity; however, it provides inadequate information regarding the true tax burden within the City limits area because the city's main source of revenue is through taxes other than property tax.

F. Matrix Scores

The scores from each of the Financial Capability Benchmarks as summarized in Table 7.02-3. According to USEPA guidance, 'Strong' benchmark ratings were assigned a score of 3, 'Mid-Range' a score of 2, and 'Weak' a score of 1. The scores are summed and divided by the number of benchmarks (six) to develop an overall score of 2.33. Overall scores that are between 1.5 and 2.5 qualify as 'Mid-Range' which signals that Henderson has an average ability to finance additional CSO controls.

TABLE 7.02-3

LOCAL FINANCIAL CAPABILITY ASSESSMENT[1]

Benchmark	Rating	Score	Comments
Bond Rating	Strong	3	AAA Rating by Moody's
Overall Net Debt	Strong	3	Net Debt is 1.65% of full MPV
Unemployment Rate	Mid-Range	2	Local Employment is Heavily Dependent on the Automotive Industry which is in Financial Distress
Median Household Income	Mid-Range	2	Henderson's MHI is 77.6% of the National MHI Putting it Near the 75% Level That Would Classify it as 'Weak'
Property Tax	Strong	3	Revenue Diversification by Henderson Avoids Dependency on Property Tax
Property Tax Collection Rate	Weak	1	93.6% Collection Rate is Below the 94% Level Necessary to Qualify as 'Mid-Range'
Sum of Scores		14	
Average Score		2.33	Classifies Henderson's financial capability as mid range.

(1) The Local Financial Capability Assessment evaluates several indicators to determine the ability of Henderson to finance CSO control costs. It is used in conjunction with the Residential Indicator (expressed as a percentage of median household income) to conclude the overall impact of implementing this LTCP. As defined by EPA guidance, complying with CSO Control Policy will result in a 'Medium-Burden' to the residents of Henderson.

7.03 OVERALL FINANCIAL BURDEN TO COMMUNITY FOR CSO CONTROL

USEPA guidance provides a matrix to help determine the overall financial burden to a community for implementing CSO control. This matrix takes into account all considerations discussed above to present a summation of the impact to the community. Table 7.03-1 demonstrates that implementing Henderson's CSO control plan will result in a 'Medium Burden' to the community. This validates Henderson's assertion that its plan is appropriate as presented. Additional measures will only add financial strain on the community with little to no additional improvements to water quality.

CSO control is just one of many pressing needs in the Henderson community. Beyond the need to better fund schools, parks, roads, and public safety improvements, significant portions of the Henderson drinking water and wastewater system are over 120 years old. Proactively replacing these lines throughout the system is critical to the economic well being of Henderson, as the lost revenue and damages to the community could be disastrous if several failed in succession.

Permittee Capability (Socioeconomic, Debt, and Financial Indicators)	Residential (Cost per Household as %MHI)		
	Low	Mid Range	High
Weak	Medium Burden	High Burden	High Burden
Mid-Range	Low Burden	Medium Burden	High Burden
Strong	Low Burden	Low Burden	Medium Burden

Table 7.03-1 Overall Financial Burden to Henderson for CSO Control Implementation

Henderson is also complying with the unfunded federal mandate to manage municipal stormwater quality in addition to their existing responsibilities for managing effective drainage in the community as well as operating the water and sewer systems under additional regulatory requirements.. These and other factors make finding additional funds available for CSO control difficult.

It is important to note this summary is a generalization of Henderson's financial capability to support the expense of CSO control. Henderson's benchmarks for MHI are on the cusp of being rated as 'Weak'. Furthermore, 10 percent or more of the city's population rely directly on the automotive industry for employment. Consequently, Henderson is particularly vulnerable to shifts in that industry. While Henderson is currently capable to financially execute its plans, those plans may need to be adjusted in response to changing economic conditions.

SECTION 8

RECOMMENDED CSO CONTROL PLAN

Since the development of their Combined Sewer Operating Plan (CSOP) in 1996, HWU has adopted a proactive approach to CSO issues within their community. HWU has been actively implementing a CSO control strategy consistent with the intent of the 1994 CSO Control Policy. HWU has been designing and constructing sewer separation projects and other improvements to reduce CSO volumes and occurrences. Even as a small community with limited resources, HWU has already committed $17.3 million to reduce CSO within their CSS.

HWU has been working towards mitigating the effects of CSOs since the mid-1990s and over time developed an approach to CSO control that relies on two time-tested approaches: separation and conveyance for treatment. HWU's pro-active and aggressive approach to CSO control is evident in the many accomplishments it has made prior to preparing this LTPC:

- Investing over $17 million in CSO control and mitigation efforts,
- Eliminating 4 CSOs, including all CSOs upstream of Henderson's public drinking water intake,
- Separating 48% of the CSS,
- Constructing a 15 million gallon detention basin with primary treatment,
- Hosting numerous public events to inform and involve the community in the CSO control process,
- Meeting all of the Nine Minimum Controls requirements, and
- Completing ahead of schedule the Center and Julia Phase II Separation Project which was a commitment made in the Early Action Plan as set forth in the Consent Judgment.

This LTCP builds on HWU's long-standing commitment to conforming to the CSO control policy by presenting a plan that exceeds the requirements set out in Policy guidance:

- Eliminating or capturing for treatment **92%** of the volume of the combined sewage collected in the system during rain-events on an average annual basis,
- Separating a total of 56% of the CSS,
- Disconnecting 77% of the contributing flow through the CSS through separation and rerouting of flows,
- Making an additional seven CSOs inactive,
- Expanding treatment capacity at the WWTP, and
- Constructing a multi-phase, interceptor, pump station and force main to transport wet weather flows away from the CSS and to the WWTP.

This section summarizes the projects and outcomes anticipated by the implementation of the LTCP. It concludes that HWU will meet or exceed the minimum requirements of the *Presumptive* approach as defined in CSO Control Policy Guidance.

8.01 SEPARATION PROJECTS

Separating combined sewers has been a foundation of HWU's approach to CSO control. Since 1996, when the CSO Control Policy was developed and implemented, HWU has been implementing the projects defined in the CSOP as a long-term program to separate 56 percent of the CSS area, as shown in Table 8.01-1.

Year	Acres Separated	Cumulative Acres Separated	Cumulative Percentage of CSS Separated	Status
Before 1998	64	64	4%	Complete
1998	31	95	6%	Complete
1999	32	127	9%	Complete
2000	101	228	16%	Complete
2001	50	278	19%	Complete
2002	75	353	24%	Complete
2003	150	503	34%	Complete
2004	41	544	37%	Complete
2005	58	602	41%	Complete
2006-2008	114	716	48%	Complete
2009	112	828	56%	Under Design

Table 8.01-1 Combined Sewer Separation Projects

Additional separation projects include:

A. **Center & Julia Stormwater Phase III**: This project is designed to complete the Center & Julia Phase II Stormwater Separation Project. It will reroute the separated stormwater flow from the Third Street CSO Storage Basin and take it directly to Canoe Creek. This will reduce the volume of separated stormwater entering the basin and reserve more capacity for the combined flow. This project is now in construction and will be completed in the first quarter of 2012.

B. **Downtown Sewer Separation Project:** This project will separate sanitary sewer and stormwater from 16 blocks of the main downtown area. This project will also eliminate all combined flow to CSOs 008, 009, and 010. This project will begin in late 2009 and will be completed no later than the first quarter of 2013.

C. **Ershig Stormwater Line (Ragan and Green Streets):** This project will consist of installing a 60" stormwater pipe and ditch work to reroute stormwater away from the CSS at Green Street. This water now flows into intakes on a 42" combined sewer line that goes to the Ragan Street CSO outfall.

Figure 8.01-1 shows the areas within the CSS that have been separated or are slated to be separated.

COMBINED SEWER SEPARATION AREAS AND STATUS AS OF FEBRUARY 2009

COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

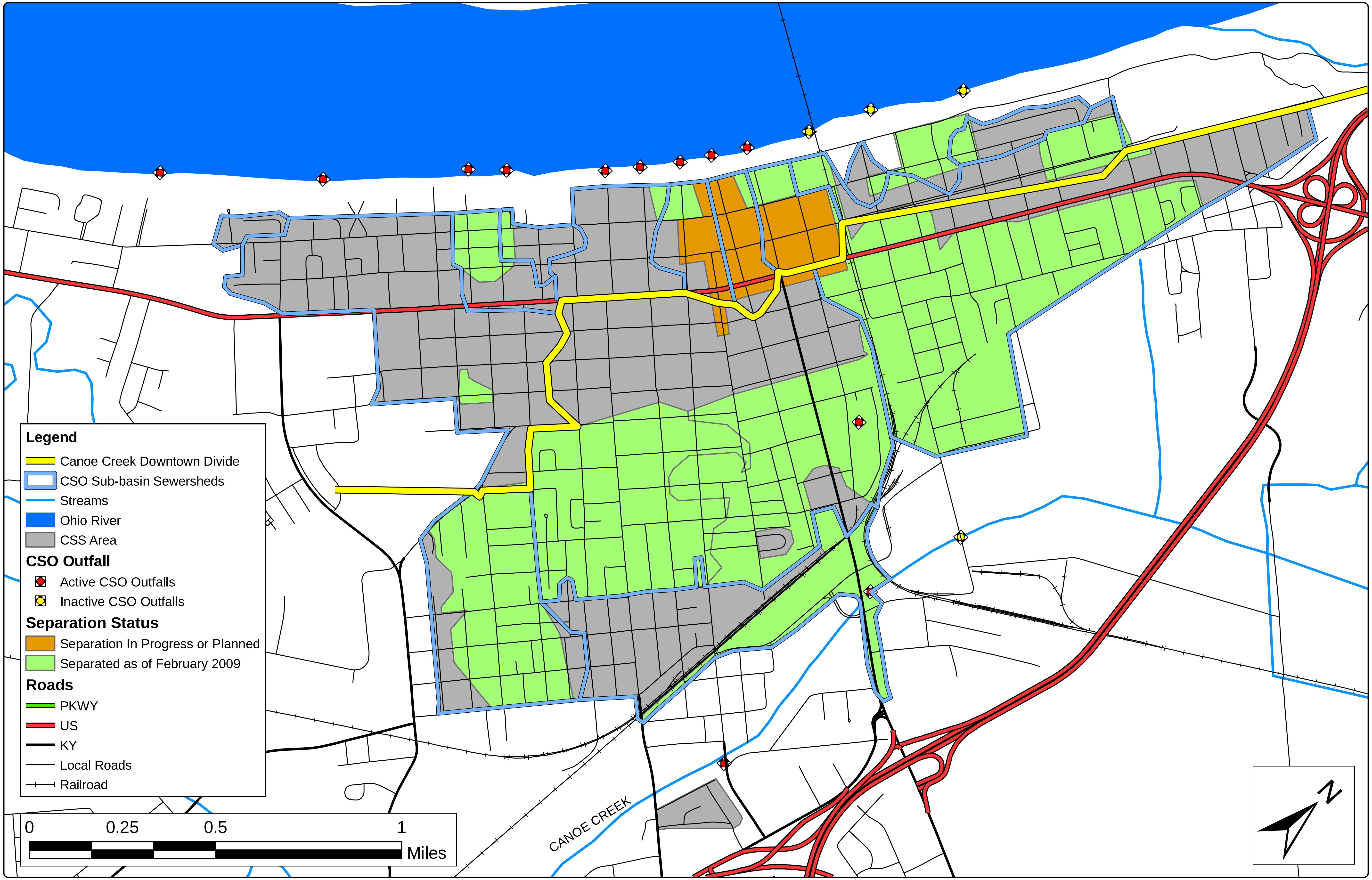


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FIGURE 8.01-1
5454.002

8.02 CONVEYANCE TO TREATMENT PROJECTS

HWU's goal in their conveyance to treatment strategy is to provide relief to the Downtown Interceptor by:

A. Redirecting combined sewage flow from the existing CSS away from the Downtown Interceptor.

B. Rerouting flow from separated areas outside of the CSS around the CSS so that they no longer have to flow through the Downtown Interceptor to reach the WWTP.

The central component of this strategy is the Canoe Creek Interceptor. The Canoe Creek Interceptor is composed of the following four phases:

A. Phase 1 is already constructed and conveys flow from the northern area of Henderson with separate sewers around the eastern edge of the CSS via 18-inch, 24-inch, 30-inch, and 36-inch gravity sewer lines.

B. Phase 2 is currently under design and is expected to begin construction in mid to late 2010. Phase 2 will connect to Phase 1 through a 42-inch gravity sewer line from Second Street Pumping Station to Clay Street and will include a new pumping station that will pump wastewater through two force mains directly to the WWTP. The Second Street, Clay Street, Burdette Alley, and Cooper Park Pump Stations will be eliminated with this phase of the project. The preliminary sizes of the pumping station and two force mains are 12 mgd and 28 inches, respectively. These sizes are preliminary and may change as design proceeds further. Phase 2 will collect flow from the CSS redirected away from the Downtown Interceptor as well as from other separate sewered areas.

C. Phase 3 will eliminate the Atkinson Street Pumping Station, Wright Street Pumping Station, and Period Table Pumping Station, and reroute the Atkinson Park Force Main to the Canoe Creek Phase 1 Interceptor line.

D. Phase 4 will upgrade the Henderson Corporate Park Pumping Station with a new force main tied into the Canoe Creek Phase 2 Force Main. This phase also includes the rehabilitation of the Russell Drive Pumping Station and route its force main to the Henderson Corporate Park Pumping Station.

With the additional flow being collected and transported to the WWTP, HWU understands that improvements to the treatment capacity must be made as well. HWU plans to replace their existing headworks which is the largest bottleneck in the treatment system. In addition, HWU plans to develop underutilized facilities at their plant to augment the treatment capacity if necessary.

Figure 8.02-1 shows all proposed system improvements for CSO control.

8.03 VERIFICATION OF THE EFFECTIVENESS OF CSO CONTROL

The capture for treatment of no less than 85 percent (by volume) of the combined sewage collected in the CSS during precipitation events on a systemwide annual average basis is the threshold necessary in the *Presumptive Approach*, according to CSO LTCP guidance. The HWU control plan exceeds this criteria. As discussed in Section 6, **the estimated annual average percentage of captured flow under this LTCP is 92 percent**. This estimate is based on spreadsheet calculations utilizing the rational method to determine surface runoff into the CSS. The spreadsheets were purposely set up to be inherently conservative in their prediction of capture by not including time of concentration factors or significant amounts of inline storage.

The approach presented in Section 6 also provides for a more comprehensive examination of the effectiveness of CSO control by going beyond a typical year analysis that can ignore the potential for large (20-year, 50-year, etc.) rain events by simulating the improvements using 60 years of historical hour-by-hour rainfall data annualized to provide a true historical average annual wet weather flow capture rate.

By using actual hourly rainfall data collected over the past six decades, HWU is able to test the effectiveness of their control plan under a larger variety of rain events.

To verify that HWU's plan meets the standards of the National CSO Control Policy, HWU is committed to continue its flow monitoring program as part of their LTCP implementation. This program will monitor the flow of every overflow as well as key points within the system and at the WWTP to track the total flow entering and leaving its system during rain events. With this information, HWU can evaluate the effectiveness of their CSO controls.

Through yearly reports to KDOW, HWU will communicate their progress toward CSO mitigation. HWU has set a goal for compliance before the year 2018, so it is crucial that HWU adjust their CSO control program based on its review of the success of their strategy, if appropriate, after full implementation. Due to variations in annual rainfall patterns, HWU prefers to evaluate results for several consecutive years.

8.04 IMPLEMENTATION SCHEDULE

HWU developed its plan to allow for CSO control to be implemented in an appropriate time frame. Table 8.04-1 shows the implementation schedule that will be complete before the year 2018. This schedule should allow sufficient time for verification of the LTCP's effectiveness.

PROPOSED SYSTEM IMPROVEMENTS FOR CSO CONTROLS
COMBINED SEWER OVERFLOW LONG TERM CONTROL PLAN
HENDERSON WATER UTILITY
HENDERSON, KENTUCKY

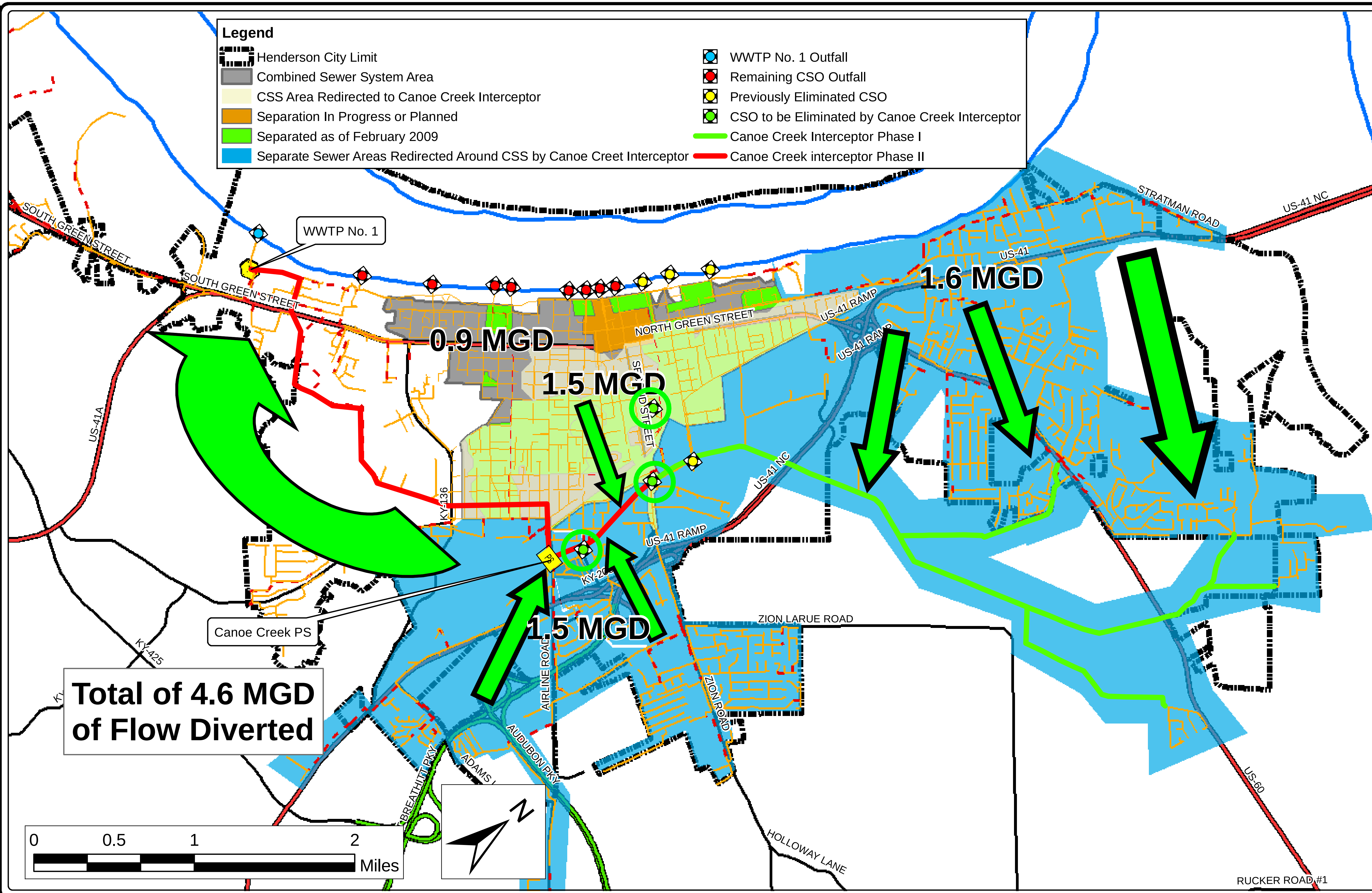

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FIGURE 8.02-1
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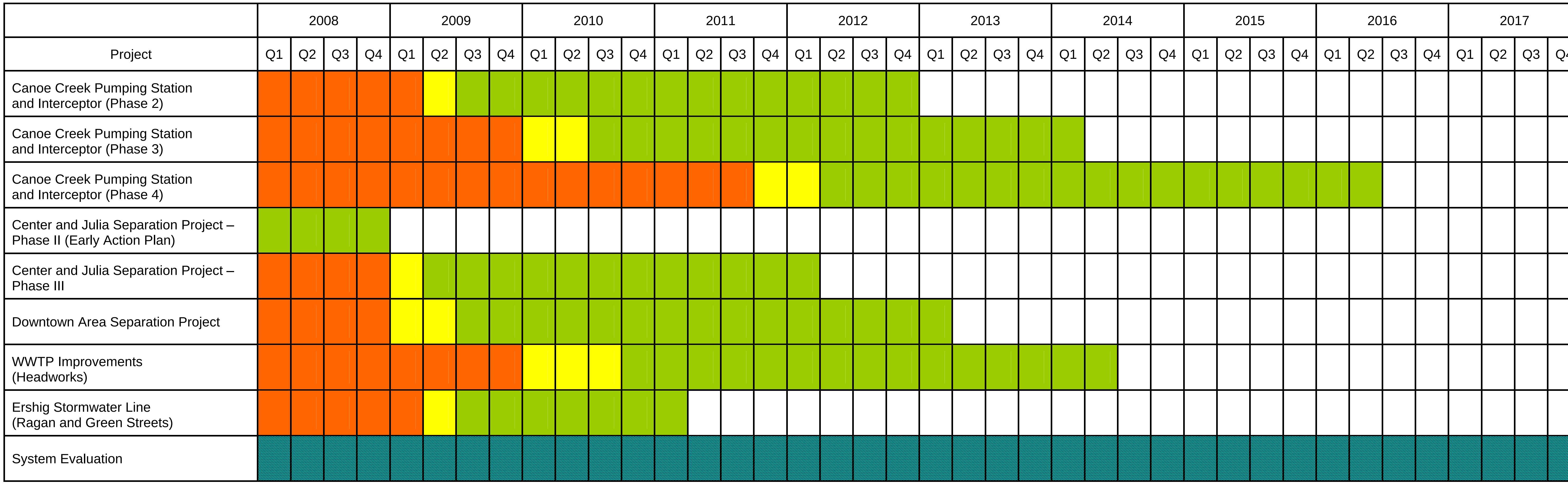
TABLE 8.04-1

CSO CONTROL PROJECTS IMPLEMENTATION SCHEDULE*



*Schedule includes planning, design, permitting, bidding, and construction. Planning is complete on all projects and design has been initiated on most projects.