SELECTION AND IMPLEMENTATION OF ALTERNATIVES REPORT

Camden County Municipal Utilities Authority
City of Camden
Gloucester City

NJPDES Permit Nos.

NJ0026182

NJ0108812

NJ0108847

September 2020

CDM Smith
cdmsmith.com

Intermunicipal Agreements

Andy Kricun

Resolution of

THE CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY

Authorizing an Intermunicipal Agreement With the Cities of Camden and Gloucester for Preparation of a NJDEP-Required Combined Sewer Overflow System Management Plan

#R-13:7-103

Whereas, the New Jersey Department of Environmental Protection has promulgated new regulations for combined sewer overflow systems that require the CCMUA, Camden City and Gloucester City to develop a new Combined Sewer Overflow System Management Plan for the overall system that comprises the CCMUA's wastewater treatment plant, Camden City's combined sewer overflow system and Gloucester City's combined sewer overflow system; and

Whereas, the interconnectedness of these three systems dictates that one plan addresses all three systems; and

Whereas, accordingly, the CCMUA, Camden City and Gloucester City have negotiated an intermunicipal agreement which calls for the CCMUA to prepare the NJDEP-required plan for the three systems, while reaffirming the Cities' ongoing responsibility to own, operate and maintain their own systems.

Now, Therefore Be It Resolved by the CCMUA Board of Commissioners that it authorizes execution of an intermunicipal agreement with the Cities of Camden and Gloucester for preparation of a NJDEP-required Combined Sewer Overflow System Management Plan

ADOPTED: July 15, 2013

Kim Michelini

Kim Michelini, Authority Secretary

I hereby certify that the foregoing is a true copy of the Resolution adopted by the members of the Camden County Municipal Utilities Authority at a meeting held on July 15, 2013.

Kim Michelini

Intermunicipal Agreement Among Camden County Municipal Utilities Authority, Camden City and Gloucester City For Completion of NJDEP-Required Planning For Combined Sewer Systems

Whereas, the New Jersey Department of Environmental Protection has promulgated new requirements for combined sewer overflow systems which include the requirement that owners of combined sewer systems must develop new planning documents to demonstrate best management practices and minimization of combined sewer overflows; and

Whereas, accordingly the Camden County MUA, Camden City and Gloucester City agree as follows:

1) The Camden County MUA will complete the planning requirements for the Cities of Camden and Gloucester at its own cost. Camden City and Gloucester City will provide as much of the required background information as possible in order to assist the CCMUA in completing the required planning documents.

2) Although the CCMUA is undertaking this planning study on behalf of Camden City and Gloucester City at its own cost, all parties agree that this does not, in any way, alleviate Camden City and Gloucester City's ongoing responsibilities to own, operate and maintain their combined sewer systems, or to undertake any improvements that may be required as a result of the aforementioned planning study or any other NJDEP requirements.

IN WITNESS WHEREOF, the parties hereto have made and executed this Agreement and affixed their corporate seals as of the day and year first above written.

CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY
OWNER

BY: _____ 8/19/13
Michael G Brennan, Chairman — Date

ATTEST:

CAMDEN CITY

BY: _____ 7/29/13
Name/Title: Mayor — Date

ATTEST:

GLOUCESTER CITY

BY: _____
Name/Title: — Date

THE CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY

ATTEST:

RESOLUTION OF THE CITY OF GLOUCESTER CITY

#R 159-2013

RESOLUTION AUTHORIZING INTERLOCAL AGREEMENT BETWEEN CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY, CAMDEN CITY AND GLOUCESTER CITY FOR COMPLETION OF NJDEP-REQUIRED PLANNING FOR COMBINED SEWER SYSTEMS

WHEREAS, the New Jersey Department of Environmental Protection has promulgated new requirements for combined sewer overflow systems which include the requirement that owners of combined sewer systems must develop new planning documents to demonstrate best management practices and minimization of combined sewer overflow; and

WHEREAS, accordingly the Camden County MUA, Camden City and Gloucester City agree as follows:

1) The Camden County MUA will complete the planning requirements for the Cities of Camden and Gloucester at its own cost. Camden City and Gloucester City will provide as much of the required background information as possible in order to assist the CCMUA in completing the required planning documents.
2) Although the CCMUA is undertaking this planning study on behalf of Camden City and Gloucester City at its own cost, all parties agree that this does not, in any way, alleviate Camden City and Gloucester City's ongoing responsibilities to own, operate and maintain their combined sewer systems, or to undertake any improvements that may be required as a result of the aforementioned planning study or any other NJDEP requirements.
3) Gloucester City will review, approve all plans and deliverables prior to any submittal.

William P. James, Mayor

Passed by the Mayor and Common Council of Gloucester City this 27th day of June, 2013.

It is hereby certified that the foregoing is a true and correct copy of a resolution duly adopted by the City of Gloucester City, in the County of Camden, at a meeting held on 6-27-13

Kathleen M. Jentsch, RMC

Kathleen M. Jentsch, City Clerk

RESOLUTION MC-13: 388
On Motion Of: Dana M. Burly
APPRCVED: June 11th, 201

R-64

MAR:dh
05-11-13

RESOLUTION AUTHORIZING A SHARED SERVICES AGREEMENT BETWEEN THE CITY OF CAMDEN, THE CITY OF GLOUCESTER AND THE CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY FOR THE PLANNING OF THE NEW PERMIT REQUIREMENTS FOR THE COMBINED SEWAGE OVERFLOW SYSTEM

WHEREAS, the New Jerse/ Department of Environmental Protection has pomulgated new requirements for combined sewer overflow systems wtich include the requirement that owners of combined sewer systens must develop new planning documents to demonstrate best management practices and minimization of combined sewer overflows; and

WHEREAS, accordingly the Camden County MUA, Camden City and Gloucester Cty agree as follows:

SECTION 1. The Camden County MUA will complete the planning requirements for the Cities of Camden and Gloucester at its own cost. Camden City and Gloucester Cty will provide as much of the required background information as possible in order to assist the CCMUA in completing the equired planning documents.

SECTION 2. Although the CCMUA is undertaking this planning study on behalf of Camden City and Gloucester City at its own cost, all parties agree that this does not, in any way, alleviate Camden City and Gloucester City's ongoing responsibilities to own, operate and maintain their combined sewer systems, or to undertake any improvements that may be required as a result of the aforementioned planning study or any other NJDEP requirements.

NOW THEREFORE, BE IT RESOLVED by the City Council of the City of Camden that a Shared Services Agreement is hereby authorized between the City of Camden and the City of Gloucester and the Camden County Municipal Utilities Authority for the Planning of the new permit requirements for the Combined Sewage Overflow System.

BE IT FURTHER RESOLVED, that pursuant to N.J.S.A. 52:27BB-23, a true copy of this Resolution shall be forwarded to the State Commissioner of Community Affairs, who shall have ten (10) days from the receipt thereof to veto this Resolution. All notices of veto shall be filed in the Office of the Municipal Clerk.

Date of Introduction June 11, 2013

The above has been reviewed
and approved as to form.

MARC A. RIONDINO
City Attorney

FRANCISCO MORAN
President, City Council

ATTEST:
LUIS PASTORIZA
Municipal Clerk

I, **LUIS PASTORIZA, MUNICIPAL CLERK OF THE CITY OF CAMDEN**, DO HEREBY CERTIFY, that the foregoing is a true copy of a resolution entitled "**Resolution authorizing a shared services agreement between the City of Camden, The City of Gloucester and the Camden County Municipal Utilities Authority for the planning of the new permit requirements for the combined sewage overflow system**" **ADOPTED** by the Council of the City of Camden, New Jersey the **11th** day of **June 2013** as taken from and compared with the original now on file in my office.

IN TESTIMONY WHEREOF, I have thereunto set my hand and affixed seal of the City of Camden, at this **31st** day of **July, 2013.**

Luis Pastoriza, Municipal Clerk

N.J.A.C. 7:14A-4.9 Certifications

Camden County Municipal Utilities Authority
NJPDES Permit NJ0026182 Submittal
N.J.A.C 7:14A-4.9 Certification Form

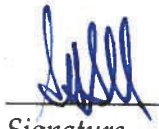
Pursuant to the requirements under NJPDES Permit NJ0026182, the Camden County Municipal Utilities Authority, Camden County New Jersey is submitting the following document(s):

Selection and Implementation of Alternatives Report
(Title of Document)

As required under Part IV - Combined Sewer Management Paragraph D.1(c) (Submittals), the Authority is providing the following certification:

> "I certify under penalty of law that this document and all attachments were prepared either: (a) under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted; or (b) as part of a cooperative effort by members of a hydraulically connected system, as is required under the NJPDES Permit, to provide the information requested. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the 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 purposely, knowingly, recklessly, or negligently submitting false information".

Name: Scott Schreiber, Title: Executive Director
Camden County Municipal Utilities Authority



Signature

9/22/2020

Date

Resolution of

THE CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY

Authorizing the Executive Director to Submit the CCMUA component of the CCMUA, Camden City and Gloucester City Long Term Control Plan

R-20:8-126

Whereas, the CCMUA, Camden City and Gloucester City were issued NJPDES permits in or around June of 2015 that had certain combined sewer overflow ("CSO") provisions; and

Whereas, the 2015 permit specifically called for the creation of a long-term control plan to comply with the EPA combined sewer overflow control policy; and

Whereas, the permit specifically required hydraulically connected CSO entities, like the CCMUA, Camden City and Gloucester City, to work in unison in the creation of the long-term control plan Long Term Control Plan; and

Whereas, the CCMUA, Camden City and Gloucester City entered into a shared services agreement in which the CCMUA would lead and fund the planning effort; and

Whereas, the CCMUA contracted with CDM Smith to consult on long term control plan the Long-Term Control Plan; and

Whereas, the CCMUA, Camden City and Gloucester City have previously submitted a System Characterization Report and a Development and Evaluation of Alternatives Report In support of long-term control plan the Long-Term Control Plan; and

Whereas, the CCMUA, Camden City and Gloucester City have jointly identified the alternatives that provide the best environmental, social and financial benefits, including a flood mitigation plan, that will control combined sewage overflows; and

Whereas, the foundation of the plan depends on the regular cleaning and maintenance of the Camden City and Gloucester City sewer systems, with a recognition that the and failure to properly operate and maintain those systems will create conditions for continued combined sewer overflow and flooding; and

Whereas, the CCMUA has been designing and implementing many of the alternatives identified in the plan, including the cleaning and dredging of 9 Camden City CSO outfalls, the rehabilitation of the Cooper Street 72 combined sewer pipe, upgrades to the Camden City Arch Street Pump Station; the separation of the County and Camden City interceptor, the replacement and upgrades to CCMUA raw sewage pumps at the headworks of the wastewater treatment plant and the expansion of the plant to 185 million gallons per day; and

Whereas, implementation, and the timing thereof, of other components of the plan will be negotiated with the NJDEP after the Long-Term Control Plan is submitted submission on October 1, 2020; and

Whereas, the result of those negotiations will be new 5 year NJPDES permits for the CCMUA, Camden City and Gloucester that will require further CSO controls that will require each of the entities to incur ongoing costs and expenses; come at considerable expense to the entities.

Now, Therefore, Be it Resolved by the CCMUA, in recognition of the importance of controlling combined sewage flooding and overflows and to comply with the 2015 NJPDES permit, hereby authorizes the Executive Director to submit the CCMUA component of the CCMUA, Camden City and Gloucester City long term control plan Long-Term Control Plan to all applicable Federal and/or State agencies.

TABLED: August 17, 2020
ADOPTED: September 21, 2020

Kim Michelini

Kim Michelini, Secretary

I certify that the above is a true copy of the resolution adopted by the members of the Camden County Municipal Utilities Authority at a meeting held on September 21, 2020.

Kim Michelini

THE CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY

Camden County Municipal Utilities Authority
NJPDES Permit NJ0026182 Submittal
N.J.A.C 7:14A-4.9 Certification Form

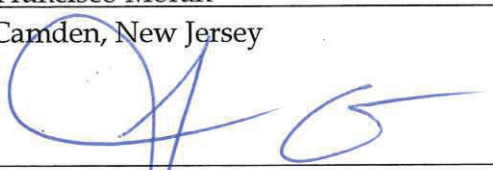
Pursuant to the requirements under NJPDES Permit NJ0108812, the City of Camden, New Jersey is submitting the following document(s):

Selection and Implementation of Alternatives Report
(Title of Document)

As required under Part IV - Combined Sewer Management Paragraph D.1(c) (Submittals), the Authority is providing the following certification:

> "I certify under penalty of law that this document and all attachments were prepared either: (a) under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted; or (b) as part of a cooperative effort by members of a hydraulically connected system, as is required under the NJPDES Permit, to provide the information requested. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the 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 purposely, knowingly, recklessly, or negligently submitting false information".

Name: Francisco Moran, Title: Mayor
City of Camden, New Jersey



Signature

9/22/20

Date:

RESOLUTION OF THE CITY OF GLOUCESTER CITY
County of Camden, State of New Jersey
#R 174 -2020

RESOLUTION AUTHORIZING THE MAYOR OF THE CITY OF GLOUCESTER CITY TO EXECUTE A NJPDES PERMIT #NJ0026182 SUBMITTAL "CERTIFICATION FORM", IN ACCORDANCE WITH THE PROVISIONS, N.J.A.C. 7:14A-4.9 FOR THE BENEFIT OF THE CAMDEN COUNTY MUNICIPAL UTILITIES AUTHORITY

WHEREAS, in accordance with the requirements under NJPDES Permit NJ0108847, the City of Gloucester City ("City"), in the County of Camden, State of New Jersey has been requested to execute a Certification Form relating to the Camden County Municipal Utilities Authority ("CCMUA"), City of Camden and City's Selection & Implementation of Alternatives Report ("SIAR") prepared by DCM Smith and relating to the City's Combined Sewer Overflow System ("CSO"); and

WHEREAS, the City wholeheartedly supports the development of the SIAR, developed on behalf of the Parties which is the third of the three NJPDES required documents which comprise the Authority's and the Cities' CSO Long Term Control Plan; and

WHEREAS, the City finds that the proposed long term control strategy for the CSO is straightforward and addresses certain needs including Optimizing the Current System, Monitoring and Evaluating before Building More Controls, Lead with Green Technologies, Addressing Street Flooding, planning for the implementation of the Cooper River Water Quality Optimization Program (Camden City only), as well as exploring the imposition of Additional Structural Controls as Necessary; and

WHEREAS, Mayor and Common Council believe that this project is in the best interest of the citizens of the City of Gloucester City.

NOW, THEREFORE, BE IT RESOLVED by the Mayor and Common Council of the City of Gloucester, County of Camden and State of New Jersey as follows:

1. The provisions of the **WHEREAS** clauses set forth above are incorporated herein by reference and made a part hereof.
2. The Mayor and City Clerk of the City of Gloucester City are hereby authorized to execute the Certification Form attached hereto and made a part hereof as well as take any and all actions necessary to effectuate the purposes authorized herein.

3. The City Clerk is hereby directed to transmit three (3) original signed copies of the Certification Form and Resolution upon adoption and promptly return same to the CCMUA for submittal to the New Jersey Department of Environmental Protection

Daniel T. Spencer, Mayor
City of Gloucester City

CERTIFICATION

I hereby certify this is a true and exact copy of a resolution adopted by the Mayor and Common Council of the City of Gloucester this September 24, 2020.

Vanessa L. Parent, Registered City Clerk

Camden County Municipal Utilities Authority
NJPDES Permit NJ0026182 Submittal
N.J.A.C 7:14A-4.9 Certification Form

Pursuant to the requirements under NJPDES Permit NJ0108847, Gloucester City, New Jersey is submitting the following document(s):

Selection and Implementation of Alternatives Report

As required under Part IV - Combined Sewer Management Paragraph D.1(c) (Submittals), the Authority is providing the following certification:

> "I certify under penalty of law that this document and all attachments were prepared either: (a) under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted; or (b) as part of a cooperative effort by members of a hydraulically connected system, as is required under the NJPDES Permit, to provide the information requested. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the 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 purposely, knowingly, recklessly, or negligently submitting false information".

Name: Daniel T. Spencer, Jr., Title: Mayor
Gloucester City, New Jersey

Signature

9-24-2020
Date

Glossary of Anacronyms and Technical Terms Used
CCMUA / City of Camden / Gloucester Selection & Implementation of Alternatives Report

	Term	Explanation
1	C-32	The CSO outfall located on the back channel of the Delaware River for which CCMUA is the permittee.
2	CSO Policy	USEPA document issued in April of 1994 that set the national framework for the permitting and management of combined sewer systems and the planning and implementation of long term controls of combined sewer system discharges. (59 FR 18688).
3	DEAR	Development & Evaluation of Alternatives Report – The second of three documents required by NJDEP that together comprise a Long Term Control Plan. The DEAR evaluates options and strategies for the control of combined sewer overflows. The CCMUA / Camden / Gloucester DEAR was submitted to NJDEP in July of 2019.
3	GSI	Green Stormwater Infrastructure: The use of built stormwater control features that utilize plants and other components to reduce stormwater flows into the combined sewer system though natural processes.
4	High Rate Treatment	A type of wastewater treatment facility intended to treat combined sewage quickly and intermittently in lieu of the combined sewage being discharged untreated during storms.
5	Hydrologic / Hydraulic Model	Computer models that simulate the performance of a sewer system during various weather and other conditions. The models are informed by sewer flow monitoring data and other physical and hydrologic data such as sewer type, land use, soil type, etc.
6	I/I Reduction	Reduction in inflow and infiltration. Inflow is surface storm water that enters a separate sewer system rather than a storm sewer or drain. Infiltration is groundwater that leaks into sanitary or combined sewer pipes through cracks or other defects.
7	Long Term Control Plan	A long term plan detailing the technical approaches, target levels of control, costs, timeframe and institutional responsibilities for the control of combined sewer overflows. The components of a LTCP are set forth in the CSO Policy.
8	LTCP	Long Term Control Plan
9	MGD	Million Gallons per Day
10	MGY	Million Gallons per Year
11	NMC	Nine Minimum Control(s): Nine requirements set forth in USEPA's Combined Sewer Overflow Control Policy intended to optimize the performance of existing combined sewer systems.

Term		Explanation
12	Off-Line Storage	A type of wastewater treatment facility intended to capture and hold combined sewage quickly and intermittently in lieu of the combined sewage being discharged untreated during storms. The captured combined sewage is then bled back into the combined sewer system for full treatment at the main wastewater treatment plant after a storm.
13	OPY	Overflows per year: The number of times a given CSO outfall structure discharges during the typical year.
14	Overflow Frequency	The number of times a combined sewer overflow structure (e.g. C-32) discharges combined sewage during a typical year.
15	Percent Capture	The percentage of total combined sewage (sewage + stormwater) captured in the combined sewer system during wet weather during a typical year.
16	Real Time Control	The use of system monitors and control mechanisms to adjust the flow into interceptor sewers and the WPCF #1 from different areas in "real time" during the course of a storm.
17	Satellite	A CSO control facility serving a sub-system or portion of a sub-system that captures for storage and/or treatment combined sewage that would otherwise be discharged through CSO structures.
18	SCR	System Characterization Report: The first of the three documents comprising a LTCP in New Jersey. Documents the physical characteristics and performance of combined sewer systems at the start of the CSO control planning process.
19	SIAR	Selection & Implementation of Alternatives Report: The third and final part of the NJDEP required documents which combined constitute the CSO Long Term Control Plan
20	Sub-System	A portion of the combined sewer system that is logically defined based on geography and hydraulic characteristics. The portion of Gloucester City that discharges overflows through CSO structures G-1 through G-6 is one example.
21	Surface Flooding	Street Flooding
22	Typical Year	An historical year determined to be representative of typical weather and other conditions driving the behavior of a sewer system.
23	WPCF # 1	Delaware Water Pollution Control Facility # 1: CCMUA's wastewater treatment plant

Note: There may be official definitions for some of these terms in New Jersey or federal regulations or guidance.

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Executive Summary

Executive Summary

E.1 Introduction

This document constitutes Camden County Municipal Utilities Authority's (CCMUA) *Selection and Implementation Report* (SIAR) developed on behalf of CCMUA, the City of Camden and Gloucester City (the Cities). The SIAR is the third of the three NJPDES required documents which comprise the Authority's and the Cities' CSO Long Term Control Plan (LTCP).

The 2018 System Characterization Report documented the physical nature and baseline performance of the combined sewer system. The 2019 Development and Evaluation of Alternatives (DEAR) evaluated approaches to controlling combined sewer overflows. This SIAR documents the selection of a long term strategy, schedule and institutional framework for implementation of CSO controls. This SIAR maintains the CSO control target of capturing for treatment 85% of the combined sewage generated during precipitation events occurring over the Typical Year. A Typical Year is an empirically determined historical year that is representative of typical weather and other conditions driving the behavior of a sewer system. The combined sewer system addressed by this report is shown on Figure E-1 on the following page.

Due to the unique and challenging circumstances facing Camden and Gloucester, it was apparent to CCMUA, the City of Camden and Gloucester City from the outset that the communities and the environment will be best served by leveraging a coordinated and collaborative approach combining regulatory compliance, sustainable redevelopment and environmental justice. Towards these ends, the program outlined in this SIAR focuses on near term community benefits through:

- Sustainable community redevelopment using green stormwater infrastructure (GSI);
- Reduce street and basement flooding of combined sewage during storms; and
- The optimization of and reinvestment in existing community assets such as the restoration of the Camden sewer system through comprehensive cleaning.

E.2 Long Term Control Strategy

The proposed long term control strategy is straightforward:

- ***Optimizing the Current System*** – which is well underway. CCMUA is completing the capacity expansion of its Delaware Water Pollution Control Facility #1 (WPCF) from 150 million gallons per day (MGD) to 185 MGD. This project will also enable the ultimate expansion of wet weather treatment capacity to 220 MGD as may be determined necessary in the future. Meanwhile, City of Camden is restoring the hydraulic capacity of its combined collection sewer system and is making related capital improvements such as the upgrading of capacity of Camden's Arch Street pump station.

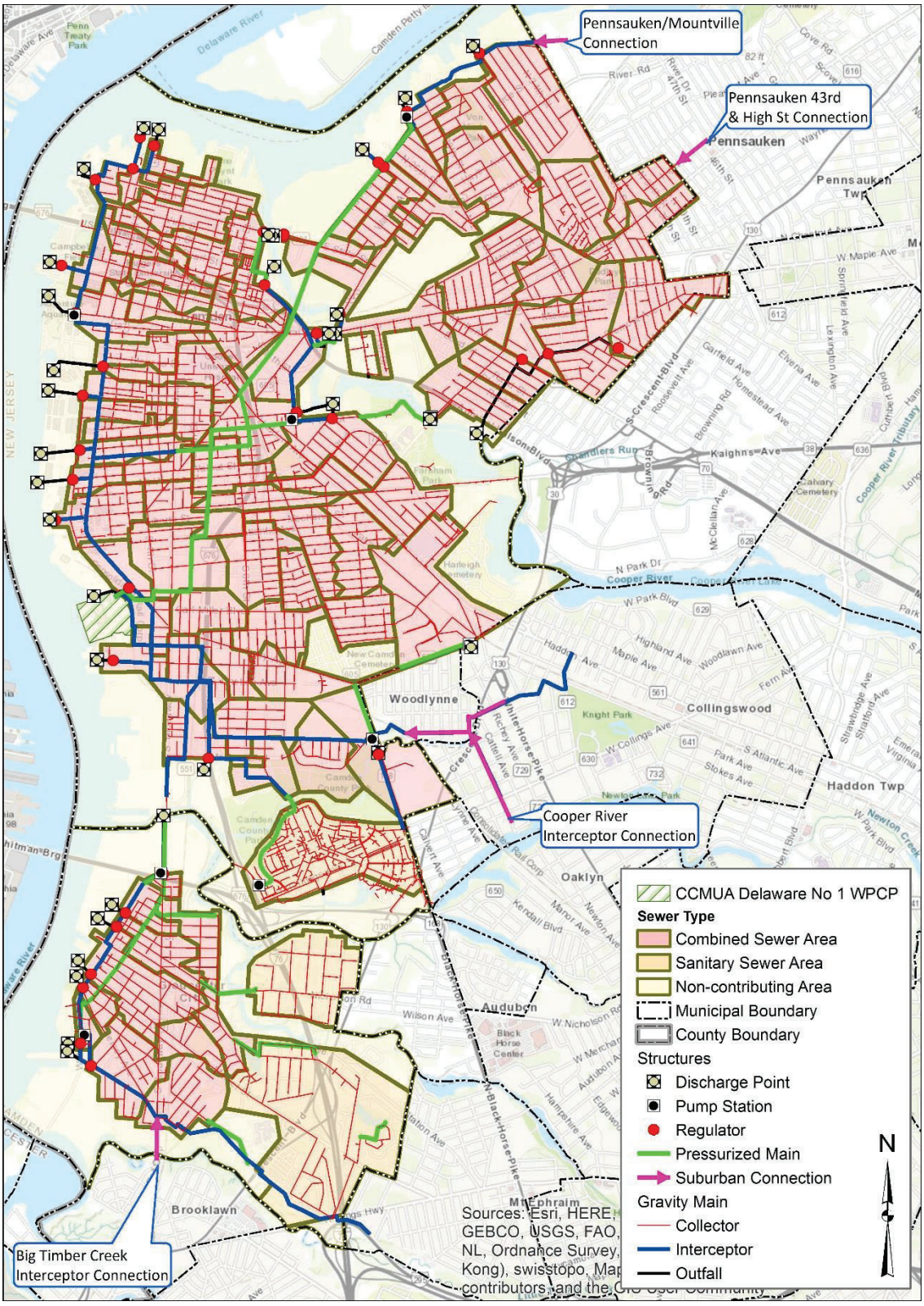


Figure E-1
Camden and Gloucester Sewer Systems Base Map

- ***Monitor and Evaluate before Building More Controls*** - This SIAR is based on the best available information. A comprehensive and iterative process of measuring and evaluating the efficacy of the current projects, GSI and street flooding mitigation will inform future decisions about the need for, size of and technical approaches to building structural (grey) control facilities.
- ***Lead with Green*** – Camden's acclaimed green stormwater infrastructure (GSI) and neighborhood redevelopment efforts will be formalized and expanded with an aggressive goal of a ten percent reduction in the directly connected impervious areas (DCIA) contributing stormwater runoff to the combined sewer system. (Details are in Section 3.)
- ***Address Street Flooding*** – A key control program element is a comprehensive Street Flooding Mitigation Program to serve as the basis for short and long term operational and capital improvements. (Details are in Section 4.)
- ***Cooper River Water Quality Optimization Program*** – While the Cooper River is a vital environmental, recreational and economic redevelopment asset eliminating CSOs from the Cooper River is not financially feasible and would not result in water quality compliance. To optimize what is achievable, the development of a **Cooper River Water Quality Optimization Strategy** is proposed. (Details are in Section 5)
- ***Additional Structural Controls as Necessary*** – structural controls will raise the level of CSO capture system-wide to no less than 85% of wet weather flows during the Typical Year. The sizing and scheduling of these facilities will be determined based upon the results of the green source reduction, street flooding remediation and Cooper River optimization efforts described above. (Details are in Section 5)

E.3 Additional Controls Likely Will be Necessary

With the completion of the WPCF expansion, the restoration of the hydraulic capacity of the Camden sewer system, and the ramping up of green and flood mitigation efforts, the performance of the combined sewer system will be significantly improved as shown on Table E-1.

Table E-1 – Benefits of the CSO Control Elements Before Satellite Control Facilities

System Performance Metric	Baseline Condition	With System Optimized	Optimized + 10% Reduction in DCIA
WPCF Capacity (Millions of Gallons per Day)	150	185	185
Overflow Volume (Millions of Gallons per Year)	823	582	487
% Wet Weather Capture	69%	78%	81%
Range of Overflow Event Frequencies (min – max (median))	11-70 (47)	8 -71 (45)	6 - 67 (43)
Modeled Street Flooding (Millions of Gallons per Year)	80	33	24

Key benefits of optimizing the current system include:

- A reduction in annual overflow volumes of 243 million gallons per year;
- An increase in the system-wide rate of wet weather capture and treatment from 69% to 78%; and
- Modeled street flooding volume reduced by roughly 60%.

Despite these significant gains, optimizing the current system and the best case implementation of green infrastructure still leaves the system-wide wet weather capture rate at less than 85%. Therefore, over the long term additional controls will be required.

E.4 Getting to 85% System-Wide Capture

E.4.1 Satellite Control Facility Capacity Requirements

For purposes of developing control strategies, the 30 active outfalls within the combined sewer system have been divided into hydraulically isolated and sub-systems as shown on Figure E-2 (following page). While all of the sub-systems are ultimately connected to CCMUA's WPCF, providing the conveyance capacities necessary to convey the required wet weather flows to the treatment plant from the Gloucester City, Cooper River, Delaware River Back Channel and Newton Creek sub-systems would be cost prohibitive. Moreover, site limitations at WPCF preclude expanding the wet weather treatment capacity to what would be needed if these flows could be conveyed cost-effectively (details in Section 2). Therefore, additional controls will be needed for certain CSO discharges to the Cooper River in Camden and to the Delaware River in Gloucester City.

The capacities of additional controls needed to achieve 85% system-wide in all five sub-systems are shown on Table E-2. Either remote (satellite) storage tanks or remote (satellite) treatment facilities would be required. Table E-2 includes capacity requirements with and without the accomplishment of the targeted green source reduction. Decisions about the size, configuration and type of satellite facilities must be deferred until a long term determination as to the efficacy of green source reduction can be made, ascertained.

Table E-2 – Required Satellite Control Capacities

Sub-System	Serving Sewersheds	With a 10% DCIA Reduction		Without a 10% DCIA Reduction	
		Tanks (Million Gallons)	Treatment (Million Gallons / Day)	Tanks (Million Gallons)	Treatment (Million Gallons / Day)
Delaware River – Gloucester	G-1 and G-4 / G-5	1.1	6.4	1.9	11.2
Cooper River	C-22 / C-22A	1.3	20.0	2.6	21
	C-27 / Thorndyke	3.0	20.4	3.5	38.5
	C-17	NA	NA	0.4	4.8

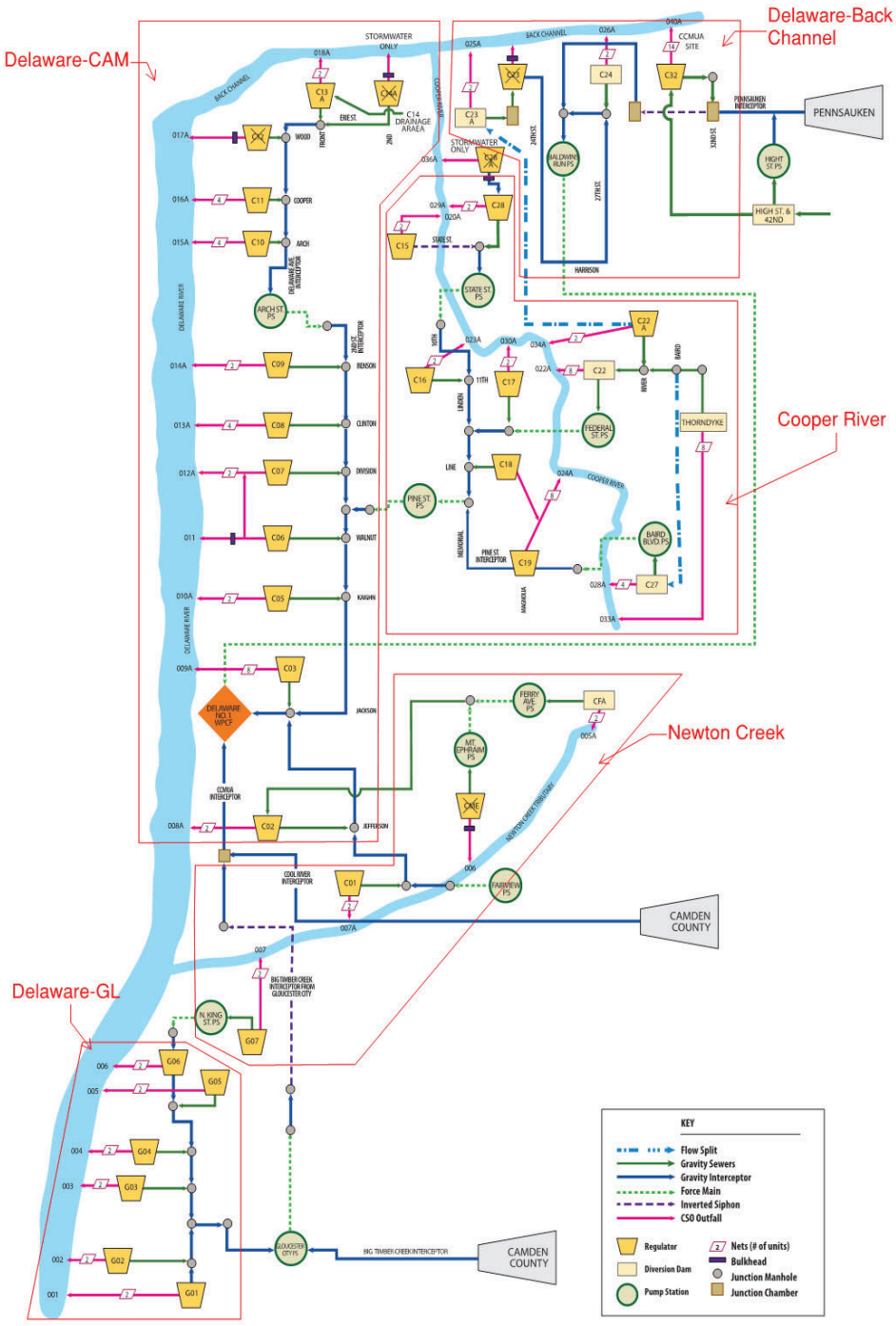


Figure E-2 – Combined Sewer System – Five Subsystems

Satellite facilities are not the ideal solution for CSO control since they pose significant siting, financial and operating burdens on the municipalities which they serve.

E.4.2 Overview of Satellite Control Technologies

Satellite Treatment

USEPA's CSO Policy requires that CSO treatment facilities provide the equivalent of primary clarification analogous to that provided at the WPCF and the disinfection of the treated effluent. The term Enhanced High-Rate Clarification (EHRC) is generally used to describe a physical-chemical process in which coagulants and polymers are added to wastewater to enhance the waste removal process and to reduce the treatment tank detention time, thereby reducing the required physical size of the facility. An example of the two technologies are shown on Figure E-3.

Satellite Storage

Off-line tank storage can be used to capture all or part of CSO discharge. When system capacity becomes available, flows are then released for conveyance to the treatment plant. When flow volumes exceed the storage capacity, flow will be discharged to CSO outfalls. A typical storage tank arrangement includes a regulator, bar screens, pumping facility and piping to and from the collection system. Design details such as flow distribution, tank flushing, and facility activation also are affected by the overall goals for and hydraulics of the specific site.

Storage tanks are generally fed by gravity and the stored flow is typically pumped back to the interceptor after the storm. This gravity-in / pump-out arrangement minimizes pumping costs (both capital and operating). However, if the existing combined sewers are deep, then the storage tank must be deep and construction becomes more expensive. An example of a typical storage tank under construction is shown on Figure E-4.

Figure E-3 – Example 25 MGD Enhance High Rate Clarification Treatment Facility

Figure E-4 – Examples of Satellite Storage Facility

E.4.3 Preliminary Site Considerations

The preliminary site requirements for the potential satellite treatment or storage facilities described above are shown on Table E-3. Approximate site vicinity and current land use maps for these potential satellite facilities are shown on Figures E-5 through E-8.

Table E-3 Potential Satellite Facilities Vicinity Information

Subsystem		Vicinity of Regulators	Approximate Area Required (acres)	Vicinity Notes
1	Delaware River – Gloucester	G1 or the CCMUA Gloucester City Pump Station	~1.5	A facility would be located either in the vicinity of the G-1 regulator or near the Gloucester City Pump Station. A new pipe would convey wet weather flows from regulators G-4 and G-5 and, as needed G-1 to this facility. Current brownfield site.
2	Cooper River	C22 – C22A	~1.5	Brownfield (status unknown) private bus yard, Federal Street pump station.
		C27 - Thorndyke	~1.5	Grassed area of Gateway Park
		C17	~1.5	Only required if green control targets can't be met in the Cooper River sub-system.

Gloucester City – Satellite Facility for Wet Weather Flows from G4/G5 and G-1 Regulators

Additional controls are needed for Gloucester City's volumetrically largest CSOs, namely regulator structures G-4 and G-5. From a technical perspective, the most effective approach would be a satellite facility capturing overflows from G-4 and G-5 in or in the vicinity of Proprietors Park as outlined in the 2019 DEAR report. While hydraulically efficient, this location is not acceptable to Gloucester City. As an alternative, wet weather flows from G-4 and G-5 that would otherwise overflow into the Delaware River could be conveyed by a new pipe to a downstream facility. This facility could be located either in the vicinity of regulator structure G-1 or a bit further upstream in the vicinity of CCMUA's Gloucester City pump station (shown on Figure E-5).

The facility would receive wet weather flows from G-4, G-5 and G-1 and would be sized to achieve the 85% wet weather capture target for Gloucester City. During future facilities planning work that will be required to implement the LTCP, the cost-effectiveness of different options will be evaluated including the number of facilities, the preferred locations, the size and how flow is conveyed from G4/G5 to the facility.

Figure E-5 – Vicinity of potential locations for a Gloucester Satellite CSO Facility and Adjacent Land Use

Cooper River – Camden C-22 /22A and C-27 / Thorndyke Regulators

These four regulators discharge to the Cooper River. C-22 and C-22A are adjacent to the Federal Street pump station and the Federal Street bridge over the Cooper River as shown on Figure E-6.

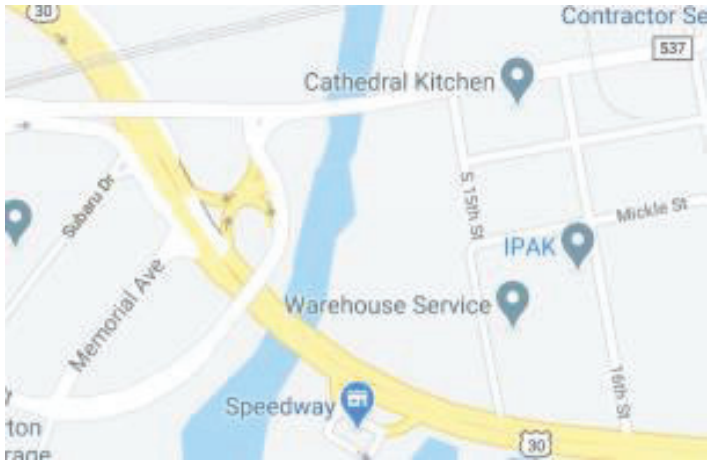
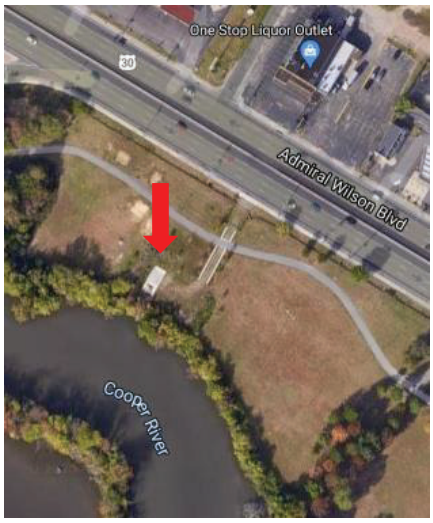


Figure E-6 – Vicinity of the Camden C-22 / C22-A Outfalls

The outfalls for C-27 and Thorndyke are the upstream most in the Camden combined sewage system. The potential location for a satellite facility, adjacent to the existing Thorndyke Street netting facility is shown on Figure E-8.



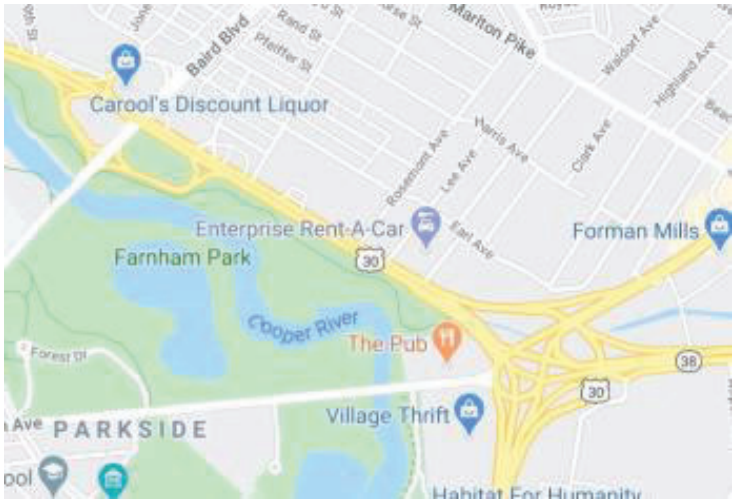


Figure E- 7 – Vicinity of the Camden C-27 and Thorndyke St. Outfalls

Cooper River – Camden C-17 Regulator

If the long term goal of reducing runoff from directly connected impervious in the Cooper River sub-system is not met, an additional satellite treatment facility for the C-17 sewershed will be needed to meet the 85% control objective. The C-17 regulator structure is across the Cooper River and slightly upstream from the C-22 regulator. Should additional controls for C-17 prove to be necessary in the long term; the cost-effectiveness of upsizing and consolidating either the C-22 or the C-17 satellite facilities and conveying the wet weather flows across the river for treatment or storage could be evaluated.

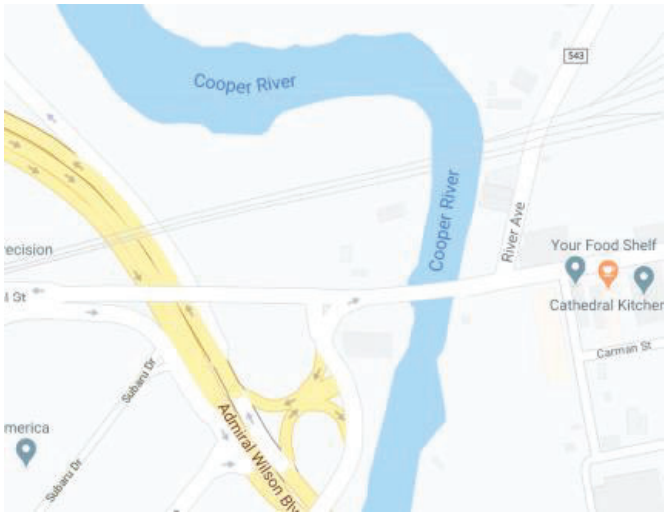


Figure E- 8 – Vicinity of the Camden C-17

E.5 Preliminary System-Wide Cost Estimates

The respective cost estimates for Camden, Gloucester and CCMUA are aggregated and summarized on Table E-4. Aggregated capital costs, including construction contingencies total $208.9 million for the EHRC option and $254.4 million for the storage option, a difference of about 22%. Combined annual incremental O&M costs are estimated to be $2.1 million for treatment and $1.4 million for storage.

Table E-4 – System-Wide Roll Up of Cost Estimates

Permittee	Estimated CSO Control Costs*	
	Treatment	Storage
City of Camden		
Capital Costs		
Before Contingencies	$73,654,000	$93,597,000
With Contingencies	$101,888,000	$129,621,000
Annual O&M	$1,183,000	$753,000
Present Worth		
Present Worth of O&M	$18,016,000	$11,467,000
Total Present Worth (w/o Contingencies)	$91,670,000	$105,064,000
Gloucester City		
Capital Costs		
Before Contingencies	$19,667,000	$32,405,000
With Contingencies	$27,135,000	$44,849,000
Annual O&M	$427,000	$151,000
Present Worth		
Present Worth of O&M	$6,504,000	$2,300,000
Total Present Worth (w/o Contingencies)	$26,171,000	$34,706,000
CCMUA		
Capital Costs [excludes Incured 185 MGD plant costs]		
Before Contingencies	$57,605,600	57,605,600
With Contingencies	$79,892,900	79,892,900
Annual O&M	$500,000	500,000
Present Worth		
Present Worth of O&M	$7,613,600	7,613,600
Total Present Worth (w/o Contingencies)	$57,605,500	57,605,500
Rollup: Camden + Gloucester + CCMUA		
Capital Costs		
Before Contingencies	$150,926,600	$183,607,600
With Contingencies	$208,915,900	$254,362,900
Annual O&M	$2,110,000	$1,404,000
Present Worth		
Present Worth of O&M	$32,133,600	$21,380,600
Total Present Worth (w/o Contingencies)	$175,446,500	$197,375,500

* Excludes future costs for system renewal and replacement necessary to maintain design capacities.

** Excludes pipe costs for conveying wet weather flows from Gloucester G-4 / G-5 to a satellite facility near G-1 or the Gloucester City pump station.

It should be noted that the estimated costs for controls in the Camden combined sewer system shown above in Table E-4 do not include the costs of eliminating overflows from the lower Cooper River described in Section E.7. Section E.7 concerns the reclassification of lower Cooper River to a C-1 (exceptional ecological significance) designation usage, thereby potentially triggering a requirement for the complete elimination of combined sewer overflows. As demonstrated in Section E-7 and detailed in Section 5.4.2 ***the elimination of all overflows is financially not achievable and is not included in the proposed long term control program defined in this SIAR.***

E.6 Cost / Performance Considerations

The Cities of Camden and Gloucester and CCMUA have determined to use the Presumption Approach as the regulatory basis for their CSO control strategies and have established the control of 85% of wet weather flows generated during the Typical Year as the CSO control performance target. NJDEP requires that permittees utilizing the Presumption Approach to analyze various levels of CSO controls to determine where the increment of pollution reduction achieved in the receiving waters diminish compared to the increased costs. Such and evaluation often is referred to as a "knee of the curve" analysis.

For this analysis, CCMUA and the Cities initially evaluated the relationship between the frequencies of overflows during a Typical Year and the volumes of combined sewage discharged from the overflows. The use of an overflow-event based performance target, e.g. 4 to 6 overflows per year requires that controls be in place at every outfall that exceeds the target frequency under baseline conditions. Therefore, decisions as to where to allocate scarce resources may not be driven by the optimization of overflow reductions.

The modeling done for this cost-performance analysis indicates that achieving 85% capture system-wide will reduce CSO volumes by roughly 485 million gallons per Typical Year. This level of CSO reduction approximates (and slightly betters) that which would be accomplished with control levels resulting in about ten overflows per year at roughly one half of the capital cost. A cost-control level curve showing the CSO removal volumes at CSO frequency controls ranging from twenty overflows per year down to zero is presented in Figure E-9.

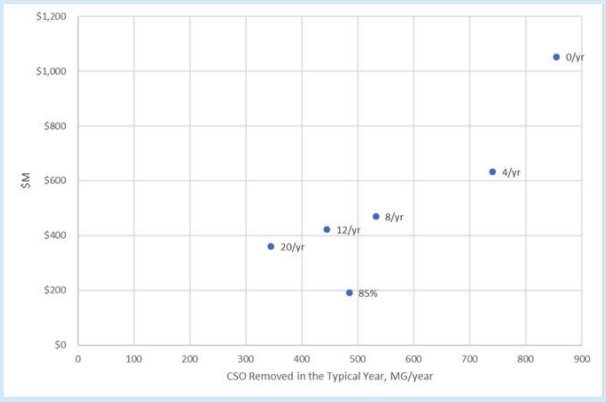


Figure E-9 – Cost / Performance Relationship of Overflow Frequency Based and 85% System-Wide Capture Control Strategies – Typical Year Overflow Reduction Volumes

E.7 Cooper River Designated Use Reclassification

On April 6, 2020 NJDEP finalized a change the use designation of the segment of the Cooper River from the U.S. Route 30 crossing to the confluence with the Delaware River from FW-2NT (fresh-water non-trout) to Category 1 as having exceptional ecological significance due to the presence of the Eastern Pondmussel within this segment of the river.

The USEPA CSO Control Policy suggests that overflows to such areas be eliminated or relocated wherever physically possible and financially achievable. Six Camden CSO outfalls discharge into the Cooper River downstream of U.S. Route 30. These are shown on Figure E-11.

A conveyance and treatment alternative that would eliminate untreated overflows to the Cooper River was evaluated. To eliminate the CSO discharges to a sensitive area, the wet weather conveyance interceptor and high rate treatment facility would be sized to capture 100% of wet weather not entering the existing Camden combined sewer system during the typical year.

In lieu of the satellite treatment or storage facilities needed for 85% capture in the Cooper River, wet weather flows not entering the existing Camden interceptor would be conveyed via a new wet weather relief conveyance interceptor pipe terminating at a new EHRC treatment facility. The treated effluent would be discharged to the Delaware near the confluence with the Cooper River.

Figure E-10 – Eastern Pondmussel *(Ligumia Nasuta)* – photo source: Conserve Wildlife Foundation of N.J.

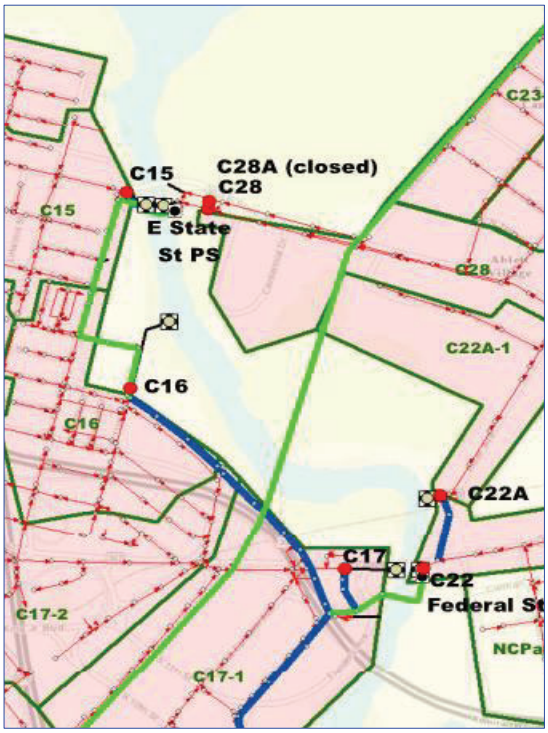


Figure E-11: Six impacted outfalls: C15, 16, 17, C22, C22A, and C28.

Cost Implications

The estimated capital costs to eliminate CSO discharges to the Cooper River are $272.1 million. The control elements comprising this amount are shown on Table E-5. For perspective, this capital cost estimate may be compared to the estimated capital cost of achieving 85% Typical Year wet weather capture in Camden which range from $102 million and $130 million depending upon control technologies selected. As summarized below and

detailed in Section 6, these 85% capture controls will not be affordable to Camden barring significant outside funding assistance. The elimination of discharges to the Cooper River is demonstratively not be financially achievable by the City of Camden and is not part of the selected control plan proposed in this SIAR.

Table E-5 – Summary of Estimated Capital Costs to Eliminate Untreated Overflows to the Cooper River

	Control Element	Description		Estimtated Capital Cost (million $)
		Quantity	Units	
1	Upgrade of C-27 / Thorndyke EHRC to 0 OPY	237.1	MGD	$91.9
2	Consolidation Sewer C-19 to State St. PS	9,450	linear feet	$83.6
3	EHRC Facility at State St. Pump Station	326.0	MGD	$105.8
4	Effluent Line from the EHRC facility to the confluence of the Cooper River and the Delaware Back Channel	2,400	linear feet	$21.8
	Subtotal			$303.1
5	Less Satellite Facilities Sized for 85% Capture			
	@ C-22 / C-22A Satellite Facility	20.0	MGD	($15.4)
	@ C-27 / Thorndyke	20.1	MGD	($15.6)
	Grand Total			$272.1

E.8 Affordability and Financial Capability

E.8.1 Overview

Independent affordability and financial capability assessments were performed for Camden, Gloucester and CCMUA to identify the upper limits of what could constitute affordable future capital expenditures, including CSO controls. Lack of affordability does not excuse a permittee from complying with regulatory requirements but provides the basis for negotiating a workable implementation schedule for the LTCP.

The Financial Capability assessment is a two phased process. The residential indicator (RI) is the percentage of a permittee's service area median household income (MHI) expended on wastewater (including stormwater) management. The upper limit of affordability for wastewater services within the Cities and CCMUA will be the point where total wastewater management costs for the typical residential user exceed 2.0% of their respective Median Household Incomes (MHI) based on the EPA metrics shown on Table E-6.

Table E-6 – EPA Residential Indicator

Residential Indicator	Cost per Household
Low Burden	Less than 1.0 percent of MHI
Mid-Range Burden	1.0-2.0 percent of MHI
High Burden	Greater than 2.0 percent of MHI

The financial capability indicator is an assessment of the permittee's debt burden, socioeconomic conditions, and financial operations. These two measures are subsequently

entered into a *financial capability matrix*, suggested by EPA, to determine the level of financial burden placed on residential customers and the permittee by the existing and projected future expenditures to operate, maintain, and enhance the wastewater management system.

E.8.2 Current Costs and Residential Indictors

The estimated typical annual cost for wastewater services for a typical single family residential wastewater user account in 2019 for Camden was $448 annually. The cost per residential account in Gloucester was $724 and $526 in the CCMUA service area as shown on Table E-7.

Table E - 7 – Calculated Costs per Typical Residential Wastewater User in 2019

Metric	Permittee		
	Camden	Gloucester	CCMUA
Wastewater Costs per Typical Residential User Account			
Municipal			
Service Charge	$71.2[a]	$372	$174[c]
Collection System	$158[b]		
Subtotal Municipal	$229		
CCMUA	$219	$352	$352
Total	448	$724	$526
Median Household Income	$26,105[d]	$51,152[d]	$69,283[c]
Current Residential Indicator	1.7%	1.4%	0.76%

a Camden service charge of $17.80 per quarter x 4

b Camden collection system charge of $2.20 per 100 cubic feet of water consumption and an estimated monthly water consumption of 6.02 CCF.

c Average for the 37 CCMUA municipalities weighted by the number of Census households. Municipal costs were calculated based on total costs per household as presented in "Assessing the Affordability of Water and Sewer Utility Costs in New Jersey" by Daniel J. Van Abs (Rutgers University) and Tim Evans (NJ Future) published 2018.

d Source: US Census - American Community Survey (2013 - 2017)

E.8.3 Affordability Impacts of CSO Control Alternatives

The capital costs and resulting residential indicators to achieve 85% Typical Year wet weather capture are shown on Tabled E-8.

Table E-8 – Affordability Impacts of the 85% Control Program Capital Costs

Item	Permittee		
	Camden	Gloucester	CCMUA
Estimated Total Capital Costs of 85% Capture Long Term Program by Permittee (in current dollars)			
Least Cost	$101.9	$27.1	$79.8
Most Cost	$129.6	$44.8	

Item	Permittee		
	Camden	Gloucester	CCMUA
Projected Residential Indicator After Full Implementation in 2042[a]			
	With Inflation		
Least Cost	4.8%	4.0%	0.80%
Most Cost	5.0%	4.7%	
	Without Inflation		
Least Cost	2.5%	3.0%	0.75%
Most Cost	2.6%	3.7%	

[a] 2042 is used for example only. It is based on the approval of the SIAR in 2021 and implementation of the long term control program through 2041. These dates may not be appropriate for Camden and Gloucester.

Key observations about the data in these table include:

- Owing to its number of outfalls on three receiving streams, the projected least capital cost controls for Camden's CSOs are at $102 million are roughly four times those estimated for Gloucester and 30% more than CCMUA.
- Camden's least cost controls would push the Camden residential indicator to at least 2.5% even if inflation is excluded.
- Gloucester's controls would likewise result in Gloucester's residential indicator being at least 3.0% with or without inflation.

As shown on Table E-8, there is a huge gap between the estimated costs of the selected long term control program and the economic and financial resources of the residents and municipal governments of Camden and Gloucester.

E.8.4 Potential Responses to the Affordability Conundrum

A variety of scheduling and financing options to improve on the affordability of the 85% capture program for Camden and Gloucester have been evaluated.

Scheduling Variations

The base case affordability / financial capability assessment assumes a 22 year implementation schedule based on the durations for facilities planning, design and construction shown in Table E-9.

Table E-9 – Base Case Implementation Schedule for Affordability Analysis

Start Date	2021
Facilities Planning	1
Design & Permitting	3
Construction	17
Total Years to Implement LTCP (inclusive)	21

The assumed start date is based on the submittal and approval of the SIAR in 2020 and coincides with the effective date of the next NJPDES permit. The impacts of extending the

implementation schedule on the residential indicators depend on whether or not inflation is considered as shown in Table E-10.

Table E-10 – Impacts of Implementation Scheduling on the Residential Indicators

Implementation Duration in Years	Camden Residential Indicator		Gloucester Residential Indicator	
	With Inflation	Without Inflation	With Inflation	Without Inflation
22	4.8%	2.5%	4.0%	3.0%
32	5.9%	2.2%	4.2%	2.2%
42	7.1%	2.1%	4.1%	2.1%

If as is assumed in the base-case affordability model that costs will continue to outpace income growth, affordability decreases as the implementation period is extended. If inflation is not included in the analysis, extending the implementation period does improve affordability, however even with an implementation period extending more than forty years, the residential indicators for both Camden and Gloucester are projected to remain well over the 2.0% high burden threshold.

Annual Pay-as-You-Go Funding

The amounts that each city could spend on an annual basis without causing their respective residential indicators to exceed 2.0% have also been calculated and are shown on Table E-11.

Table E-11 – Maximum Annual Expenditures Without Trigger a 2.0% Residential Indicator

Implementation Duration in Years	Camden		Gloucester Residential Indicator	
	With Inflation	Without Inflation	With Inflation	Without Inflation
22	None	~$1.0 million	$80,000	$530,000
32	None		None	
42	None		None	

External Funding

As documented above, the least capital cost 85% control options would result in residential indicators of well over the 2.0% high burden threshold with or without factoring in inflation. A meaningful CSO control program is not feasible for Camden or for Gloucester without external funding that would effectively reduce the capital expenditures by the two cities. Shown on Table E-12 are the impacts of various levels of external capital funding and/or capital cost reduction on the residential indicators.

Table E-12 – External Funding and/or Capital Cost Reduction Impacts on Residential Indicators

Municipal Cost Reduction	Camden		Gloucester	
	With Inflation	Without Inflation	With Inflation	Without Inflation
0%	4.8%	2.5%	4.0%	3.0%
25%	4.4%	2.3%	3.6%	2.5%
50%	4.1%	2.1%	3.2%	2.2%

Municipal Cost Reduction	Camden		Gloucester	
	With Inflation	Without Inflation	With Inflation	Without Inflation
75%	3.7%	2.0%	2.8%	1.8%
100%	3.5%	1.9%	2.4%	1.6%

The combinations of implementation schedule and external funding or cost reductions that would result in a projected residential indicator of 2.0% or less are highlighted in green. No combinations of schedule and funding work if inflation is included.

E.9 Selected Long Term Control Program

E.9.1 Framework

Through the expansion of CCMUA's WPCF # 1 to 185 MGD, the restoration of the hydraulic capacity of Camden collection system, flow reduction through green infrastructure and street flooding mitigation the capture level is projected to reach 81% capture of combined sewage generated during wet weather. This falls short of the 85% capture target that CCMUA, Camden and Gloucester selected as the basis for LTCP compliance under the terms of their respective NJPDES permits.

Long term, additional controls will be necessary for the Cooper River, Delaware River back channel, and the Delaware River Gloucester City sub-systems to achieve 85% system-wide capture. The technical options for doing this have been refined. For purposes of long term control planning these options focus on storage through tanks or treatment and disinfection at remote (satellite) facilities. This SIAR is not making a recommendation between storage and treatment. It is assumed that the ultimate choice is best left to future municipal decision makers based on then current conditions.

Whatever the ultimate decision, **due to the extremely limited affordability and financial capabilities of the Cities of Camden and Gloucester, as demonstrated above and detailed in Section 6 of this report, these controls will require significant external funding and will likely need to be implemented over an extended period of time as resources permit.**

E.9.2 Control Program Elements

The selected long term control program consists of five program elements that will have phased and overlapping implementation schedules (detailed in Section 8). These five elements are:

1. ***Completion of Current Projects*** **-** Timely completion of ongoing control projects including the capacity expansion of CCMUA's Delaware Water Pollution Control Facility # 1 to 185 MGD, the restoration of the hydraulic capacity of Camden's combined collection sewer system through a comprehensive sewer cleaning and rehabilitation program and related capital improvements such as the upgrading of Camden's Arch Street pump station capacity.
2. ***Iterative Efficacy Evaluation*** - The evaluation of the efficacy of these current improvements through comprehensive flow monitoring which will inform the

refinement and recalibration of the existing hydrologic / hydraulic model to then current conditions. This will establish a new baseline of overflow statistics informed by the wet weather operating history with these capacity improvements in place. Similar evaluations may occur after the implementation of the formalized green stormwater infrastructure and the street flooding mitigation program elements.

3. ***Formalized Green Stormwater Infrastructure Program*** – Accelerating green stormwater infrastructure through a coordinated, formalized and expanded GSI Implementation Program with the goal of achieving a ten percent reduction in the directly connected impervious areas contributing stormwater runoff to the combined sewer system.

4. ***Street Flooding Mitigation Program*** – The development and rapid implementation of a comprehensive Street Flooding Mitigation Program will be developed within the City of Camden to provide an empirical understanding of the frequency, location and extent of street flooding remaining after the Camden sewer system is cleaned. This will serve as the basis for short and long term operational and capital improvements.

5. ***Cooper River Water Quality Optimization Program*** – The Cooper River is an important environmental, recreational and economic asset for the City of Camden's economic redevelopment. Eliminating Camden's CSOs from the Cooper River is not financially feasible and would not result in water quality compliance. CCMUA and the City of Camden are committing to the work with the other Cooper River municipalities, stakeholders and NJDEP to develop a **Cooper River Water Quality Optimization Strategy** during the first NJPDES permit cycle after this SIAR is approved.

6. ***Additional Structural Controls*** – Within the limitations imposed by affordability constraints, structural controls in each of the five sub-systems that will raise the level of CSO capture in each sub-system and system-wide to no less than 85% of wet weather flows during the Typical Year. These additional controls include satellite control facilities and the potential build out of the WPCF #1 capacity to 220 MGD. **Due to the extremely limited affordability and financial capabilities of the Cities of Camden and Gloucester, as demonstrated in Section 6, these controls will require significant external funding and will likely need to be implemented over an extended period of time as resources permit.**

E.10 Implementation Scheduling and Adaptive Management

The implementation scheduling strategy proposed in this SIAR has been is informed by the following:

- CCMUA and the Cities will focus initially on projects that will provide significant near-term overflow and street flooding benefits such as the expansion of the WPCF # 1 and the restoration of the hydraulic capacity of the Camden collection system;
- The projected costs to fully implement the CSO control strategy are far greater than the financial resources currently available to the Cities of Camden and Gloucester ; and
- The complete implementation of the CSO control strategy presented in this SIAR will span decades; and will be implemented in the midst of changes and uncertainties.

Therefore, ongoing performance monitoring and adaptive management will be required to adjust the control program to match conditions.

Developing a workable funding strategy will require a partnership between the two Cities, CCMUA, NJDEP and likely other state and regional agencies. The NJPDES permits requires the submittal of a ***Construction and Financing Schedul***e as an early long term control program deliverable to NJDEP. Due to the financial constraints facing Camden and Gloucester the scope of this document will need to be broadened into a comprehensive program financing and funding strategy that addresses from a financial perspective ***what is doable and when?***

The implementation schedule will synchronize projects, milestones and activities to coincide with the five year NJPDES permit cycles. The proposed implementation schedule synchronized with NJPDES permit cycles is provided in Table E-13.

Table E-13 – Implementation Schedule (Based on five-year NJPDES permit cycles)

Time Frame	Activities
2020	• Continued cleaning of Camden CSO outfalls • Completion of Camden regulator mechanism rehabilitation • Completion of Arch Street PS capacity expansion • NJPDES renewal discussions with NJDEP. The NJPDES permit will include the implementation schedule for the implementation of the long term CSO control plan as defined in the SIAR
2021 – 2025: First Five Year NJPDES Permit Cycle	• Completion of initial Camden collection system and outfall cleaning ***- Program Element 1 (system optimization)*** • Completion of the expansion of CCMUA's WPCF # 1 to 185 MGD ***- Program Element 1*** • Ongoing collection system maintenance, inspection & cleaning • Submission of a Construction and Financing Schedule as required by paragraph G-8(a) of the NJPDES permits • Development and Implementation of GSI Program Plan - target reduction of 2% (30 acres) - ***Program Element 3 (green first)*** • Development and implementation of Camden Street Flooding Mitigation Program – ***Program Element 4*** • Develop the Cooper River Regional Water Quality Optimization Strategy – ***Program Element 5*** • (2025) Permit Cycle 1 Progress Evaluation: – Evaluate the impacts of the expansion of the WPCF # 1 to 185 MGD over a range of wet weather including the potential to increase wet weather flows from CCMUA's Gloucester City pump station, thereby potentially reducing overflows in Gloucester City. – GSI implementation status (acres of DCIA reduction) – Street flooding mitigation status to ascertain the efficacy of cleaning the Camden pipes and outfalls and of the expansion of the WPCF # 1 wet weather treatment capacity to 185 MGD – Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit. ***Program Element 2 (iterative evaluation)***
2026 – 2030: Second Five Year NJPDES	• Continued Implementation of GSI Program and the Street Flooding Mitigation Program - ***(Program Elements 3 and 4)*** – (2030) Revise GSI Program based as needed based on lessons learned during previous five years – Target reduction of DCIA by 2.0% (30 acres)

Permit Cycle	– (2030) Revised Street Flooding Mitigation Program as needed based on lessons learned during previous five year cycle • Reduction of wet weather flow from Pennsauken into the Camden combined sewer system in sewershed C-32 – ***Program Element 6.*** • Efficacy Evaluation - ***Program Element 2***. • Feasibility study for further expansion of WPCF # 1 up to 220 MGD as necessary – ***Program Element 6.*** • Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit - ***Program Element 2***.
2031 – 2035: Third Five-Year NJPDES Permit Cycle	• Continued implementation of GSI and Flood Mitigation Program – ***Program Elements 3 & 4*** • Update Long Term Control Plan – ***Program Element 2.*** – Adjust the target for GSI based on prior performance experience. – Refine the need for additional controls for long term achievement of 85% system-wide capture based on the results of the update system performance characterization. – Other evolving environmental, regulatory and community conditions • Design and construction of the expansion of WPCF # 1 up to 220 MGD if needed – ***Program Element 6*** • Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit - ***Program Element 2***.
Subsequent five-year NPDES permit cycles	• Continued implementation of the GSI Program (target 2% DCIA removal – 30 acres) each five-year cycle • Continued implementation of the Camden Street Flooding Mitigation Program • Implementation of additional controls that were identified as being needed to reach the 85% capture goal. • Compliance Monitoring Program upon completion of the additional controls • Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit.

The implementation schedule outlined in Table E-14 above includes an evaluation at the completion of each five year NJPDES permit cycle. Based on these evaluations, CCMUA and the Cities will revise the LTCP as necessary with NJDEP's coordination and approval. This process exemplifies the concept of adaptive management.

Adaptive Management, as defined by the EPA, is "the process by which new information about the health of a watershed is incorporated into the watershed management plan."[12-1] In the context of the SIAR adaptive management assumes that while the CSO control goals will remain constant, the tactical approaches to achieving the goals must be adjustable.

A key component of adaptive management will be the inclusion of an affordability and financial capability trigger in the Construction and Financing Schedule. The projects and activities to be included in each five-year permit cycle would be selected and scheduled such that the residential indicator in either City and in the CCMUA service area not exceed the

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E-1 Watershed Analysis and Management Guide for Tribes (2000) EPA Watershed Analysis and Management Project. Step 5 page 1.

2.0% of median household income triggering the USEPA high burden definition. Should economic or other conditions occur such that the residential indicators exceed 2.0% during a permit cycle or lead to reasonable expectations that the 2.0% value be exceeded in subsequent permit cycles the projects and activities in subsequent permit cycles will be modified in cooperation with NJDEP.

CCMUA and the Cities will also be subject to a variety of other future conditions beyond their controls which may materially affect the benefits, feasibility and scheduling of the CSO controls described in this SIAR, thereby triggering a need to revise the LTCP. Examples of such triggering conditions include:

- External changes requiring modifications to the fundamental planning bases used in the development of the LTCP or in subsequent design due to changing demographics, municipal collection system conditions, climate change and other external changes, etc.;
- Emergent regulatory requirements specific to the receiving streams (e.g. TMDLs) or in general (e.g. the promulgation of a National SSO Policy);
- Emergent economic and other developments and trends that could materially affect the affordability and CCMUA's and the Cities' abilities to finance the CSO controls;
- Changes to water quality standards and guidance that could affect the types and levels of wet weather controls necessary to meet the program objectives;
- Innovative and alternative technologies that could enhance water quality and/or reduce costs thereby enabling expanded control efforts.
- The unavailability of supplies, materials, contractors or labor necessary to implement the LTCP as scheduled in the LTCP due to conditions beyond CCMUA's and the Cities control such as a natural disaster or other emergency; and
- Local, state or federal legal impediments to the timely or orderly implementation of the LTCP e.g. lengthy litigation over land acquisition or inability to obtain required permits.

CCMUA and the Cities will inform NJDEP upon becoming aware of circumstances such as those listed above as to:

- An analysis of the issues and implications posed by the condition;
- An analysis of the impacts on the implementation of the LTCP or the efficacy of the controls; and
- A proposed plan of action to address the adverse conditions that will preserve CCMUA's and the Cities' compliance with their NJPDES permits and the requirements of the CSO Control Policy.

1

Section 1
SIAR Introduction

1.1 Regulatory Context and Report Objectives

This document constitutes Camden County Municipal Utilities Authority's (CCMUA) ***Selection and Implementation of Alternatives Report*** (SIAR) developed by CCMUA on behalf of CCMUA, the City of Camden and Gloucester City (the Cities) for the required "Evaluation of Alternatives" under Part IV Section G.4 of CCMUA's New Jersey Pollutant Discharge Elimination System (NJPEDS) permit action (Permit number NJ0026182). The scope of this includes the Cities of Camden (Permit NJ0108812) and Gloucester (Permit NJ0108847).

The SIAR constitutes the third and final NJPDES deliverable addressing the control of wet weather overflows from their collective combined sewer systems. The *System Characterization Report* (2018) documented the physical characteristics and baseline performance of the combined sewer system. The 2019 *Development and Evaluation of Alternatives Report* (DEAR) documented the evaluation of combined sewer overflow (CSO) control alternatives that meet the water quality-based requirements of the Clean Water Act. The SIAR builds upon the DEAR and presents CCMUA's and the Cities selected control strategy and preliminary implementation schedule. These three reports collectively comprise a complete Long Term Control Plan (LTCP) as required in the NJPDES permits.

Due to the unique and challenging circumstances facing Camden and Gloucester, it was apparent to CCMUA, the City of Camden and Gloucester City from the outset that the communities and the environment will be best served by leveraging a coordinated and collaborative approach combining regulatory compliance, sustainable redevelopment and environmental justice. Towards these ends, the program outlined in this SIAR focuses on near term community benefits through:

- Sustainable community redevelopment using green stormwater infrastructure (GSI);
- Reduce street and basement flooding of combined sewage during storms; and
- The optimization of and reinvestment in existing community assets such as the restoration of the Camden sewer system through comprehensive cleaning.

1.2 Overview of the Combined Sewer System

The Combined Sewer System that this SIAR addresses consists of the respective collection systems owned and operated by the Cities of Camden and Gloucester and the portion of the CCMUA's regional conveyance interceptor system that is located within the Cities of Camden and Gloucester. The Camden and Gloucester sewer systems are shown on Figure 1-1.

There are 34 sewersheds within the Camden and Gloucester combined sewer collection systems. These include twenty-seven within the City of Camden and seven in Gloucester City. Each of these sewersheds drain to a regulator structure controlling the amount of wet weather flow that enters into the CCMUA interceptors from the Camden and Gloucester trunk sewers. As of 2018, there are a total of 30 active CSO outfalls located within the two cities, with several outfalls serving more than one regulator structure. Overflows from CSO

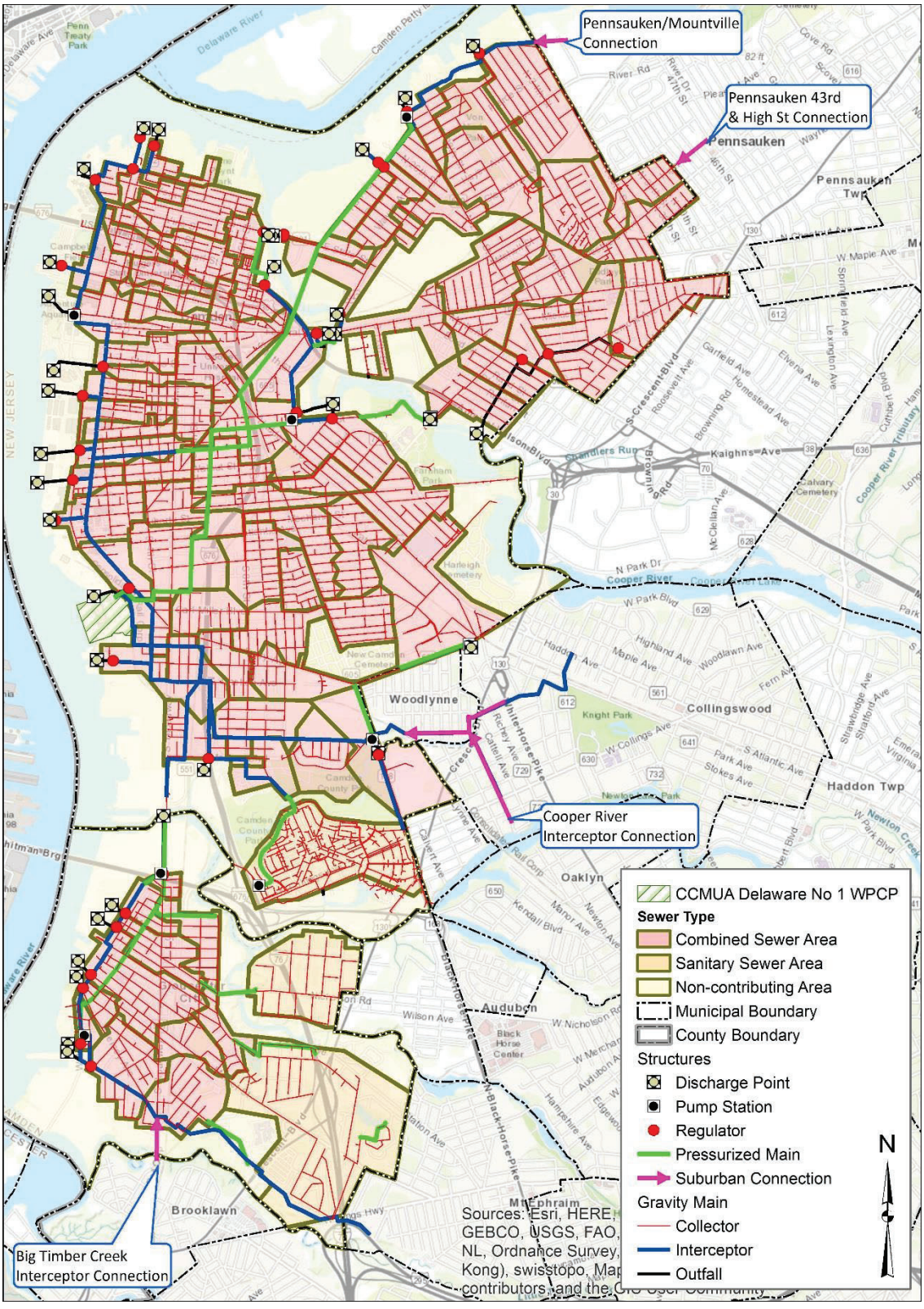


Figure 1-1
Camden and Gloucester Sewer Systems Base Map

outfalls discharge into three receiving streams: the Delaware and Cooper Rivers and Newton Creek. Each active outfall has an overflow netting facility controlling the discharge of solids and floatables. Dry weather flows and captured wet weather flows are treated at CCMUA's Delaware No.1 Water Pollution Control Facility (WPCF). The general characteristics of the combined sewer system are summarized on Table 1-1.

Table 1-1 – Collection System Overview

Jurisdiction	# Sewer-sheds	Collection System Pipe in Miles[1-1]	Appurtenances				Contributing Area (square miles)
			Active Regulators	Active Outfalls	Pump Stations	Overflow Netting Facilities	
Camden	27[1-2]	173	24	22	8	22	6.6
Gloucester	7	39	7	7	7	7	1.6
CCMUA			1	1	2	1	
Totals	34	212	32	30	17	30	8.2

Improvements currently underway by CCMUA and the City of Camden will result in the expansion of CCMUA's Delaware No. 1 WPCF wet weather treatment capacity from 150 (wet weather) to 185 MGD and the restoration of the hydraulic capacities of the Camden sewer system, including stormwater inlets and CSO outfalls to current design capacities through comprehensive cleaning. The restoration of the hydraulic capacities is critical to Camden's efforts to reduce street flooding which can occur during wet weather.

The results of these ongoing improvements are summarized on Table 1-2 below. The projected reduction in CSO volume, increased capture rates and reduction in surface flooding resulting from these early implementation steps may be noted.

Table 1-2 – System Wide Performance Characteristics Used for Control Alternatives Development

System Wide Performance Metrics		Baseline Condition	Upon Completion of Current Improvements*
		Camden Hydraulic Capacity not Restored	*Camden Hydraulic Capacity Restored*
WPCF # 1 Capacity		150 MGD	185 MGD
1	% Capture	66%	76%
2	Overflow Volume (million gallons)	900	618
3	Range of Overflow Frequencies (events)	10-69	10-69
4	Modeled Surface Flooding (million gallons)	94	44

*WPCF # 1 capacity at 185 MGD + Camden collection system hydraulic capacity restoration

1-1 Source: Table 2-2 from the Sewer System Inventory and Assessment / Facilities Inventory and Assessment Analysis Final Report prepared by CH2MHill, November 1999-69

1-2 Includes Camden sewersheds flowing to the C-32 regulator for which CCMUA is the permittee.

1.3 Previous Studies

This report builds upon the information provided in the previous studies required under the Cities' and the CCMUA's respective NJPDES permits as well as other studies and documents prepared for the Cities and for CCMUA. These are listed in Table 1-3.

Table 1-3 – Previous Studies

	Title	NJDEP Approval Date
1	System Characterization Report (SCR)	Jan. 2019
2	Baseline Compliance Monitoring Report	Feb. 2019
3	Baseline Consideration of Sensitive Areas	Jan. 2019
4	Development & Evaluation of Alternatives Report (DEAR)	Nov. 2019

1.4 Overview of Control Alternatives in the DEAR

This Selection and Implementation of Alternatives Report (SIAR) builds upon and incorporates the findings of this DEAR that:

- The control performance target will be system-wide 85% capture of wet weather combined sewer flow during the typical year;
- All control strategies assume that the hydraulic capacity of the Camden collection system will be restored through the ongoing cleaning of the pipes and the CSO outfalls and that regularly scheduled cleaning will occur to maintain the restored hydraulic capacity;
- All control alternatives will incorporate a target controlling runoff from no less than 10% of the directly connected impervious area within the combined sewer system through green stormwater infrastructure;
- CCMUA's WPCF No. 1 wet weather treatment capacity can be expanded further from the soon to be completed 185 MGD capacity of up to 220 MGD;
- Achieving a 10% reduction in directly connected impervious areas along with the expansion of wet weather treatment capacity up to 185 MGD is projected to bring the system-wide capture rate to 81%. Further expansion to 220 MGD would bring the capture rate to 82%; both just short of the 85% target. Moreover, the capture rates in three out of the five sub-systems (Delaware River - Gloucester City, Cooper River and Delaware River-Back Channel) will be well below the 85% capture target without additional controls. The five sub-systems are shown schematically on Figure 1-2.
- Therefore, satellite facilities to raise wet weather capture rates to no less than 85% using storage tanks or enhanced high rate clarification treatment facilities were evaluated.

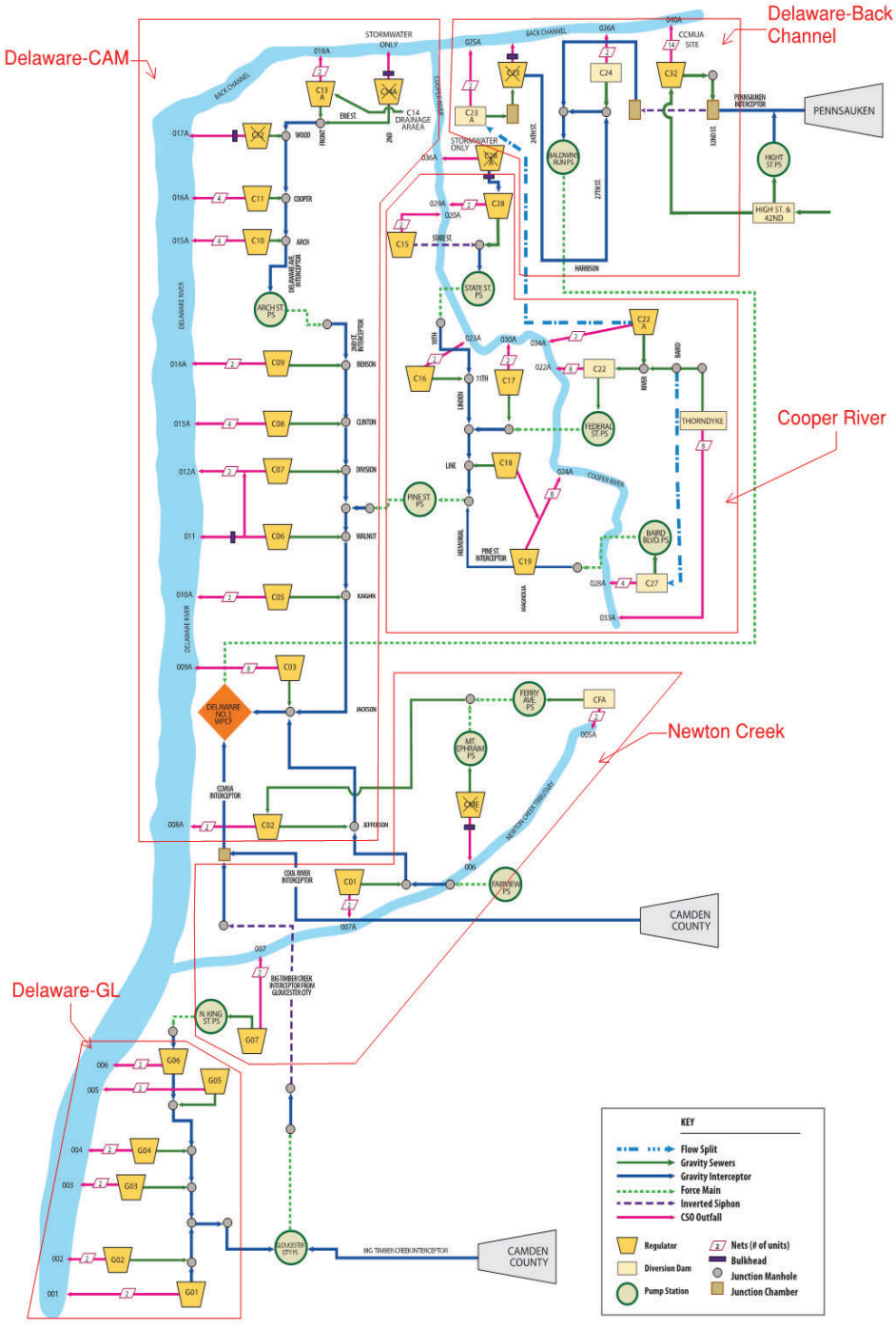


Figure 1-2 – Combined Sewer System – Five Subsystems

1.5 Organization of Report

Table 1-4 provides the locations of the elements referenced under the NJPDES permit within this SIAR. This SIAR combined with the SCR and the DEAR together comprise a complete long term control plan (LTCP) the requirements for which are set forth in Part IV Section G of the NJPDES permits. To verify that all of the Section G requirements have been addressed in the LTCP, references to all relevant Section G requirements are provided.

Table 1- 4 – Location of NJPDES Referenced Elements of the LTCP

Permit Section	Permit Requirement	Section Location
Part IV G.1.A	"The permittee, as per D.3.a and G.10, shall submit an updated characterization study that will result in a comprehensive characterization of the CSS developed through records review, monitoring, modeling and other means as appropriate to establish the existing baseline conditions, evaluate the efficacy of the CSO technology based controls, and determine the baseline conditions upon which the LTCP will be based. The permittee shall work in coordination with the combined sewer communities for appropriate Characterization, Monitoring and Modeling of the Sewer System."	Entire SCR
Part IV G.1.b	"The characterization shall include a thorough review of the entire collection system that conveys flows to the treatment works including areas of sewage overflows, including to basements, streets and other public and private areas, to adequately address the response of the CSS to various precipitation events"	SCR Section 2
Part IV G.1.b	"The characterization shall identify the number, location, frequency and characteristics of CSOs"	SCR Section 7
Part IV G.1.b	"The characterization shall identify water quality impacts that result from CSOs"	SCR Section 4
Part IV G.1.d.i	Rainfall Records Analysis	SCR Section 6
Part IV G.1.d.iii	CSO Monitoring	SCR Section 5
Part IV G.1.d.iv	System Hydrologic & Hydraulic Modeling	SCR Sections 3 & 5

Permit Section	Permit Requirement	Section Location
Part IV G.1.d.ii	Combined Sewer System Characterization	SCR - all
G.4.b	• Ensure CSO controls will meet water quality requirements of the CWA; • Protect existing and designated uses; • Prioritize sensitive areas	SIAR Section 7.0
G.4.c	The permittee shall select either the Demonstration or Presumption Approach for each group of hydraulically connected CSOs and identify each CSO group and its individual discharge location.	DEAR 3.0
G.4.d	The Evaluation of Alternatives Report shall include a list of control alternative(s) evaluated for each CSO.	DEAR 5.3
G.4.e	The permittee shall evaluate a range of CSO control alternatives: i. Green infrastructure ii. Increased storage capacity iii. STP expansion, CSO related bypassing and/or storage iv. I/I reduction v. Sewer separation vi. Treatment of the CSO discharge vii. CSO related bypass	DEAR 4.4
G.4.f	The Presumption Approach – documentation of conformance with one of the three criteria.	DEAR 5.4
G.4.g	The Demonstration Approach – Documentation of conformance with all of the four criteria.	Not Applicable
G.5.a	Cost-Performance Considerations – Conduct "Knee of the Curve" analysis for a range of overflow event control levels.	SIAR 5.0

1.6 Stakeholder Involvement in the SIAR Development

1.6.1 Introduction

The City of Camden and Camden County Municipal Utilities Authority (CCMUA) actively and consistently work together to engage, inform and educate the public on the following key issues:

1. Combined Sewage Flooding;
2. Combined Sewage Overflows; and
3. The development of a long term control plan.

Actively engaging with the community predates the start of the Long Term Control Plan (LTCP) process. The Camden SMART (Stormwater Management and Resource Training) Initiative, a voluntary collaboration among the City of Camden, CCMUA, Cooper's Ferry Partnership, Rutgers Cooperative Extension Water Resources Program, New Jersey Tree

Foundation and the NJ Department of Environmental Protection, was formed in 2011 to protect human health, improve conditions for economic development, improve water quality and enhance the quality of life for the residents of Camden City through the use of green and grey infrastructure. The Camden SMART Initiative also has a robust public outreach component.

The creation of the Camden SMART Initiative began an era of public outreach and education on the combined sewage flooding and overflow issue that continues to grow and thrive. The goals of the Camden City and CCMUA public outreach and education program are as follows:

1. ***Inform*** – bring awareness to the public health threat of combined sewage flooding, water quality issues associated with combined sewage overflows, and the LTCP process.
2. ***Educate*** – delivering basic knowledge on why combined sewage flooding and overflows occur and the steps entities like Camden City and the CCMUA can take to correct these problems.

Camden City and the CCMUA meet the goals of informing and educating in the following ways:

1. Passive, General Public Outreach – websites, flyers, posters;
2. Targeted, General Public Outreach – providing flyers, posters, pamphlets and other educational materials at public events like environmental fairs and through bill inserts;
3. Educational/Workforce Programs – The PowerCorps and Green Ambassador Programs
4. Demonstration Projects – Implementation of Green Infrastructure sites throughout Camden City;
5. Mitigation Projects – The Camden City Rain Barrel Installation Program and water conservation kits; and
6. Forums and Summits – events which gather together stakeholders and interested parties to discuss combined sewage flooding and overflow issues.

The need for engagement, outreach and education varies greatly across the service areas of Camden City and CCMUA and is dictated by the type of sewer system which services the geographic location of a customer's home or business.

Nearly all the residents and business owners of Camden City make up the affected public due to the public health concerns associated with combined sewage flooding. It is important to not only inform the Camden City public that combine sewage flooding exists (so they can avoid if possible) but to educate them on ways (green infrastructure, rain barrels, water conservation) to minimize inputs to the system to minimize the volume during flooding events.

Except for Gloucester City, the rest of the CCMUA customers are from 35 suburban municipalities that have separated sewer systems. The CCMUA has concentrated its LTCP public outreach efforts on informing the public of the combined sewage system issues in Camden and Gloucester Cities. The CCMUA has also worked with local officials from the suburban municipalities to educate them on infiltration and inflow (I&I) issues.

The desired outcome of the Camden City and CCMUA public outreach and education effort is to bring attention to the public health hazard of combined sewage flooding and the detrimental effects of combined sewage overflows on the quality of the receiving water body until the responsible entities can eliminate combined flooding in its entirety and effectively control overflows.

1.6.2 Completed Outreach Activities

A description of outreach activities that have been completed prior to and during the development of this SIAR is provided below. The materials referenced are provided in the Appendix to this document and are labeled as appendix item A-1, etc.

1) Camden SMART and Green Infrastructure Sites

Camden SMART (Stormwater Management And Resource Training) Initiative was founded in 2011 by a coalition of six entities - Cooper's Ferry Partnership (CFP), the City of Camden (City), Camden County Municipal Utilities Authority (CCMUA), Rutgers Cooperative Extension Water Resources Program (RCE), New Jersey Tree Foundation (NJTF), and the NJ Department of Environmental Protection (NJDEP)- the Camden SMART Initiative is a community-driven movement to protect human health, improve conditions for economic development, improve water quality, and enhance the quality of life for Camden City, its residents, and the Delaware River watershed through the broad use of green and grey infrastructure techniques for stormwater management.

Because of Camden's aging and overtaxed combined sewer system, a one-inch rainstorm can leave major roads impassable, turn parking lots into stagnant lakes, and send sewage into parks, homes, and waterways. Not only is this a nuisance, it is a public health crisis that degrades the quality of life of Camden's residents and negatively impacts the City's economic viability and environmental quality. The objective of the Camden SMART is to develop a comprehensive network of green infrastructure programs and projects to solve the combined sewer problem in the City of Camden.

The "Camden SMART Green Infrastructure Sites" (A-1) lists the projects which manage stormwater in Camden City. These sites have signs developed by Rutgers Water Resources Staff that explain the stormwater features to the public. The sites provide a visual reminder of the need to manage storm water in this combined sewer overflow community. The selection and design of these sites involve engaging the community throughout the process. Meetings and site visits are conducted throughout the process. Site 63 is currently in the design phase with The Trust for Public Land whose process involves extensive public outreach. Construction will begin this year on Sites 62, 64, 65 and 66.

2) PowerCorps Camden

PowerCorps Camden is an AmeriCorps direct service program focused on improving Green Infrastructure in the City of Camden. In partnership with Camden County Municipal Utilities Authority (CCMUA) and the City of Camden under the National Governor and Mayor's Initiative, Center for Family Services launched the program in December 2015, with the goals

to improve outcomes for opportunity youth and improve green infrastructure in Camden City.

Over the last five years, PowerCorps Camden has aimed to increase economic opportunity through job training and readiness for up to 60 youth each year. Since inception, 171 Camden City residents have served and over 730 acres of land have been treated by PowerCorps members in Camden. Through projects focused on Camden's green infrastructure network, PowerCorps members play a key role in maintaining green infrastructure installations including rain gardens, city and county parks, vacant lots, and stormwater inlets that comprise Camden City's network. The members are all familiar with the issues of combined sewer systems and help to maintain the sites listed in the appendix "Camden SMART Green Infrastructure Sites". Through knowledge and skills training, some which is provided by Camden SMART and Camden Collaborative Initiative partners, PowerCorps Camden develops and nurtures young adults into environmental stewards and strong candidates for the workforce. In addition, at the beginning of each cohort, our Camden SMART partners from Rutgers University provide a day of education to teach each member about the combined sewer issues that Camden faces and the benefits of green infrastructure.

The service projects PowerCorps Camden members take part in are often in collaboration with CCMUA, the Camden SMART partners and many of the Camden Collaborative Initiative partners. In addition to general green infrastructure maintenance, members take part in environmental trainings, group service learning trips and in varied innovative projects, including repurposing concrete/rubble from construction sites to create barriers that protect existing rain gardens within the city. These collaborations allow for members to expand their environmental knowledge while also having a real and lasting impact on the City.

3) Green Infrastructure Maintenance Activities

Periodically, environmental stewardship events are held in the city so that all stakeholders including local citizens, local workers, non-profits, and governmental entities can be educated about, and actively participate in, the green infrastructure projects addressing combined sewer flooding and overflows. Since May of 2015, over 600 people have actively participated in such events.

On 5/04/2018 and 5/11/2018 the CCMUA and the Center for Family Services organized an event for 20 Subaru staff that work in Camden City. The staff maintained and planted at five Camden SMART rain gardens. On both days the combined sewer flooding issues were discussed. Rutgers staff and Rutgers Environmental Stewards, New Jersey Tree Foundation, Camden PowerCorps, Coopers Ferry Partnership, New Jersey Conservation Foundation and CCMUA staff all helped at the rain gardens.

On 4/16/2018 the New Jersey Tree Foundation and Coopers Ferry Partnership organized 50 people who planted 20 trees at Gateway Park. Urban Promise students, Camden PowerCorps, Coopers Ferry Partnership, New Jersey Conservation Foundation, Delaware Riverkeeper and CCMUA staff all helped with the planting which was attend by Camden's Mayor Frank Moran.

On 4/11/2018 the Authority staff organized a renovation of the Camden SMART rain garden at the Urban Promise School, 3700 Rudderow Street. The students in the school's environmental program worked with the Camden PowerCorps and installed a new rubble border to protect the rain garden. The CSO flooding issues in the City were discussed with the group. Rutgers Environmental Stewards assisted with the project which involved 35 people.

On 10/12/2017 Camden Public School, Brimm Medical Arts hosted "Imagine a Day Without Water" (A-2). Camden SMART presented to 90 students and faculty. The presentation is attached. It included; Combined sewer system & Green infrastructure, Camden SMART, Camden Reports, Impact of development on local water sources, Water pledge and rain barrel painting, Rain garden re-fresh.

On 9/20/2017, our Authority hosted Camden City's Aramark Building Communities Day. 45 Aramark employees worked at three sites to maintain Camden SMART rain gardens and associated green infrastructure. Rutgers, New Jersey Tree Foundation, New Jersey Conservation Foundation, Coopers Ferry Partnership and CCMUA staff all helped by instructing the volunteers and describing the CSO issues these features work to mitigate.

On 9/17/2017 Jeremiah Bergstrom, LLA, ASLA, Senior Research Project Manager, Rutgers Cooperative Extension Water Resources Program, Rutgers, The State University of New Jersey conducted a site visit for 30 Rutgers Environment Stewards.

On 8/20/17 Camden SMART staff worked with 30 New Jersey American Water employees to maintain the 29th Street Rain Gardens. The gardens were weeded, cleaned up and new plants were added.

On 6/07/2017 Camden SMART held the Camden Environmental Summit and 250 people attended this day-long event held at Rowan University. Panel discussions were held on the following topics: Voices of Camden's Aspiring Green Leaders, Don't Waste Our Open Space, Resilient and Healthy Futures for New Jersey's Environmental Justice Communities, Building Healthy Environments for Food Access and were followed by a CCMUA Facilities Tour. The CCMUA Executive Director, Andrew Kricun, lead 50 people on a tour of the Regional Sewer Treatment plant. The summit was organized by the members of Camden SMART.

On 4/28/2017 the New Jersey Tree Foundation held an Arbor Day celebration. At the Camden Day Nursery volunteers planted street 10 trees. The Arbor Day event was attended by Rutgers University, New Jersey Tree Foundation, New Jersey Department of Environmental Protection, Camden City, Coopers Ferry Partnership and CCMUA staff.

On 9/15/2015, 16 volunteers from Stantec along with the New Jersey Tree Foundation, Rutgers Water Resources, Coopers Ferry Partners, Camden County Soil Conservation District and CCMUA staff planted the Union field rain garden.

On 5/13/2015, 21 Home Depot volunteers along with the New Jersey Tree Foundation, Rutgers Water Resources, Coopers Ferry Partners and CCMUA staff maintained the

Waterfront South Rain Gardens. The gardens were weeded, mulch and plants were added to the rain gardens.

4) Camden Rain Barrel Installation Program

This program, modeled after a successful Philadelphia Water Department Program, began in late June 2017. Community Rain Barrel Meetings are set up throughout Camden City. City residents who attend a one-hour meeting are then eligible to have a free rain barrel installed at their home. The one-hour meeting describes how the rain barrel functions and the problem with combined sewer systems. This educational program is presented by the Pennsylvania Horticulture Society. PHS staff make the arrangements with a contractor to install the rain barrels at the homes in Camden City. Camden SMART Partners are responsible for the promotion of the program and make the arrangements for the meetings. Flyers are printed and distributed by the Camden PowerCorps and by the host organization. The "List of CSO Supplemental Information Distributed" (A-3) has the date and number of flyers distributed for each rain barrel meeting. 16 rain barrel meetings have been held in most of the city's neighborhoods. Online or phone registration is accepted for the meeting. 190 people have attended the meetings and 110 rain barrels have be installed since the program began.

In conjunction with the Camden PowerCorps, an informational video promoting rain barrel use and their purpose in a community with a combined sewer system. The video was posted online and an additional 30 city residents participated in the installation program. The link to the video can be found in the "List of CSO Supplemental Information Distributed".

5) Customer Mailings

CCMUA has 160,000 customers that are charged every three months for sewer service. Our customers are the properties in Camden County that are connected to the sewer system. The "List of CSO Supplemental Information Distributed" has the date and number of educational flyers distributed to our customers by mail.

6) Brochures at Public Events

The CCMUA has several brochures available in the lobby of our administration building designed to inform our rate payers of various stormwater-related issues that affect the county. The Appendix includes a sample of each of these brochures: 7 SMART Steps (A-4a) to reduce neighborhood flooding and improve stormwater management; How to Prevent Stormwater Pollution (A-4b); Camden SMART Initiative; Camden County Conserves - Saving Water, Saving Money (A-4c); Toilets Are Not Trashcans(A-4d). These valuable sources of information are also given out at the various summits, festivals, school and community events, county fairs and public education events that the Authority participates in. At each of these events, a representative of the CCMUA staffs a table to engage with the public, answering questions and providing information about the Authority and its initiatives. These information table events attract and educate hundreds of families each year and include:

- The Camden Environmental Summit – 6/14/17
- Camden Jam: Arts and Music Festival – 9/9/17
- Camden River Days – 9/23/17

- The VietLead Harvest Moon Festival – 10/7/17
- National Community Development Week: Cramer Hill – 4/3/18
- National Community Development Week: Fairview – 4/5/18
- St. Anthony's of Padua School Art Show – 4/19/18
- The Camden Environmental Summit – 6/6/18
- The Camden Environmental Summit – 11/21/19

In addition to Camden City, brochures and information on the broader wastewater system of the County is made available at various annual county events such as:

- Collingswood May Fair
- Mt. Ephraim Night Out
- Blackwood Pumpkin Festival
- Camden County Fair
- Collingwood Green Festival
- International Day
- Gloucester Township Day

7) Media Outreach

The LTCP team has conducted extensive outreach through conventional media and the CCMUA web site. Media coverage of the team's actions in reducing combined sewer overflows and activities in promoting public awareness of CSO problems and solutions has been extensive and is listed in "Media Mentions"(A-5). Each press mention was posted on the CCMUA web site. The reported news fell into one or more of the following categories:

- Water conservation efforts, including green infrastructure and rain barrel programs
- Impact of combined sewer overflows on environmental justice communities
- Reduction of combined sewer overflows as a best management practice for wastewater utilities
- Benefits of public investment in infrastructure
- Public and organizational recognition of CCMUA/Camden SMART/Camden Collaborative Initiative efforts
- Contribution of green space and parks to stormwater management
- Impact of climate change on water infrastructure planning
- Wastewater treatment as a resource (e.g. for energy generation and process cooling)
- Publicization of innovative financing for infrastructure and other techniques to support stormwater reduction

8) CCMUA Website Information

The CCMUA Web site (http://www.ccmua.org) provides a central resource for relevant information available to the general public, including:

- Home page
    - Brief description of Camden County's regional sewer system and the impact of being connected to combined municipal sewer systems
- News Archive page

    - Links to each of the news items described above and listed in the Appendix
- Green Initiatives page
    - Link to Camden SMART web site (http://www.CamdenSMART.com)
    - Rain Gardens and other green infrastructure projects
    - Climate change information
    - Water Conservation
    - Energy Self-Sufficiency
    - Environmental Management System
    - Camden Collaborative Initiative
    - Living shorelines
- Education page offers informational material on
    - Opportunities for tours
    - Wastewater treatment plants processes
    - Keeping harmful materials out of the system
    - Wastewater industry best practices
    - Strengthening water and wastewater infrastructure
    - Pollution in waterways
    - Other material prepared by partners, distributed as inserts with CCMUA's quarterly bills, including:
        - River and watershed information
        - Stormwater and steps to reduce flooding
        - Water conservation
- Contact information for Authority officials and staff

9) Green Ambassadors Summer Internship Program

In 2014 the Green Ambassadors Summer Internship Program began with 10 Camden City high school students. The purpose of the program is to create a group of local young people who can serve as ambassadors of the environment to the people of Camden. The interns participate in hands-on work experience and classroom-style environmental education that introduces them to environmental issues, solutions, and careers. By participating in this program students work to transform the city into a greener, cleaner, safer community while experiencing meaningful employment and environmental education.

The program maintains a special focus on the environmental issues that impact Camden specifically, chief among which is the problems of combined sewer flooding and overflows. Each summer the interns tour our facility and green infrastructure sites and are educated about the causes and effects of the combined sewer issues in the city. To date, 80 youth have completed the program and have gone back to their neighborhoods to spread the word about Camden's environmental issues, as well as the steps being taken to address them. A description of the Green Ambassadors program can be found in the appendix (A-6).

1.6.3 CSO Supplemental Team

Camden City and the CCMUA used the *Forming and Utilizing Your Supplemental CSO Team* guidance document (A-7) and worked with the NJDEP via email correspondence (A-8) in creating the CSO Supplemental Team (CSOST). The result of those efforts is a CSO Supplemental Team made up of more than 20 individuals representing more than 15 entities

and was considered to be representative of the area and its needs (see Appendix A-9 for a complete listing of invitees). Camden City and the CCMUA understand that that there is a likelihood there are other interested parties whom they are not aware of but that should be part of the CSOST. To compensate for this likelihood, all CSOST invitees were asked, and have been continued to be encouraged, to identify and invite people and/or entities they feel should be involved in the LTCP process.

All individuals that were identified as potential CSOST members were sent a letter via email on or around April 7, 2018 (see sample in Appendix A-10) which explained the LTCP, the public participation component of the LTCP and asked them if would join the CSOST. It also conveyed the stated purpose of the CSOST as follows: Through the CSO Supplemental Team, the City and the CCMUA will gain a public perspective on CSOs, local water quality issues and sewer system problems including flooding.

The first convening of the CSOST took place on May 25, 2017. The goal of the meeting was to bring together the team and give an overview of combined sewer systems and the LTCP. The PowerPoint used in that meeting is provided (A-11).

The second convening of the CSOST took place on December 13, 2017. The goal of the meeting was to gain feedback from the team regarding Sensitive Areas in the combined sewer system area, especially primary contact recreation waters. Representatives from the CCMUA, the City of Camden, and the DEP met with community members and local organizations to discuss and determine which sections of the waters affected by CSO overflows require special consideration because of the possibility of direct or indirect contact through recreational activities. A list of the attendees and the organizations they represented can be found in appendix A-12.

A presentation was given by the Executive Director of the CCMUA to explain the combined sewer issue as a whole, the goals of the Long Term Control Plan, and the importance of identifying Sensitive Areas. Slides from the presentation (appendix A-13). Subsequent discussions with the attending members of the CSO Supplemental Team revealed which areas of the Cooper River, Newton Creek and Delaware River back channels are frequently canoed upon. A map of these locations can be found in appendix A-14. The magnitude of the recreational activities was estimated through the Urban Promise Ministries' Urban Trekkers Program representatives; In a given year, over 500 participants canoed these waters through the Urban Trekkers program.

The third Supplemental Team Meeting was held on July 17th, 2018 to examine the findings of the System Characterization Report. The then-current condition of the combined sewer systems of Camden and Gloucester City was discussed as the basis for future green and grey strategies for reducing the volume of overflows into the waterways of the community.

The fourth Supplemental Team meeting took place on June 18th, 2019, the invitee list can be found in appendix A-15. The various partners, stakeholders and community leaders discussed the elements of the DEAR including the CSO control goals for each receiving water segment the types of control alternatives identified as potential solutions to meet the LTCP requirements.

The fifth Supplemental Team meeting was held on January 16th, 2020, the sign in sheet for the meeting can be found in appendix A-16. This meeting focused on the effects of increasing the

treatment plant capacity would have on the CSO control goals, and projected effects of 10% DCIA disconnection. The effects on specific sewershed subsystems were discussed, focusing on the probable need for new capital projects at C32 and the C27/Thorndyke Outfalls. The group discussed the various options at eat location that would be required, and how each would impact the community in which they were placed. The presentation given to the group at this meeting can be found in appendix A-17.

1.6.4 Additional Municipal Coordination

During the development and finalization of the this SIAR, CCMUA held the following coordination meetings (virtual after January) with the City of Camden and Gloucester City:

- Meeting with Camden and Gloucester engineers, attorneys and public works officials (January 29, 2020)
- Distributed draft SIAR to the City of Camden and Gloucester City
- Discussion of draft SIAR with Cities' administrative and technical officials (June 1 and June 8)
- Presentation of the SIAR to the Mayors and executive teams of the Cities (Week of August 9th)
- Presentation of the SIAR to the Cities' Councils (Weeks of August 30th and September 7th).

2

Section 2

Maximizing Flows to WPCF # 1

2.1 CCMUA's Water Pollution Control Facility # 1

CCMUA treats approximately 53 million gallons of sewage per day at its wastewater treatment plant, which is referred to as the Delaware No. 1 Water Pollution Control Facility (WPCF), or simply "the plant." The plant was expanded in the 1980s to a secondary treatment facility with a capacity of 150 MGD. The WPCF operates under NJPDES Permit No. NJ 0026182, with primary year-round permit limits shown below in Table 2-1. The average influent CBOD and TSS concentrations are approximately 187 and 208 mg/L respectively, which is representative of a medium strength wastewater.

Table 2-1 – Delaware WPCF #1 Effluent Limits

Parameter	Monthly Average	Weekly Average
Flow Through Treatment Plant	Monitor & Report	
Total Suspended Solids	30 mg/l	45 mg/l
	85% removal	
Carbonaceous Biochemical Oxygen Demand	25 mg/l	40 mg/l
	85% removal	
Ammonia	35 mg/l	
Fecal Coliform	200 geometric mean #/100 mL	400 geometric mean #/100 mL

The four (4) existing raw sewage pumps together can provide a firm capacity (largest pump out of service) of 150 mgd, which is the maximum wet weather capacity at the plant. The treatment plant processes train[3-1] include preliminary treatment, primary sedimentation, aeration, final sedimentation, and disinfection. The process train flow is diagramed on Figure 2-1.

In 2017 CCMUA completed a study of alternatives for the upgrading of its WPCF #1. The study recommended a two phase program for the treatment plant. Under phase 1 the plant would be expanded to provide 185 MGD in full secondary treatment capacity. This expansion is underway and is scheduled for completion in 2020. The study also determined that it is feasible to further increase wet weather treatment capacity up to 220 MGD using CSO related bypassing. The potential increase in wet weather treatment capacity up to 220 MGD would provide the equivalent of primary treatment and effluent disinfection prior to discharge into the Delaware River in accordance with CCMUA's NJPDES permit. A preliminary process train schematic is shown in Figure 2-1.

[3-1] Excerpted from: Wet Weather Upgrades at the Delaware No. 1 WPCF – Concept Study of Alternatives Draft May 2017 prepared by Greeley & Hansen for CCMUA.

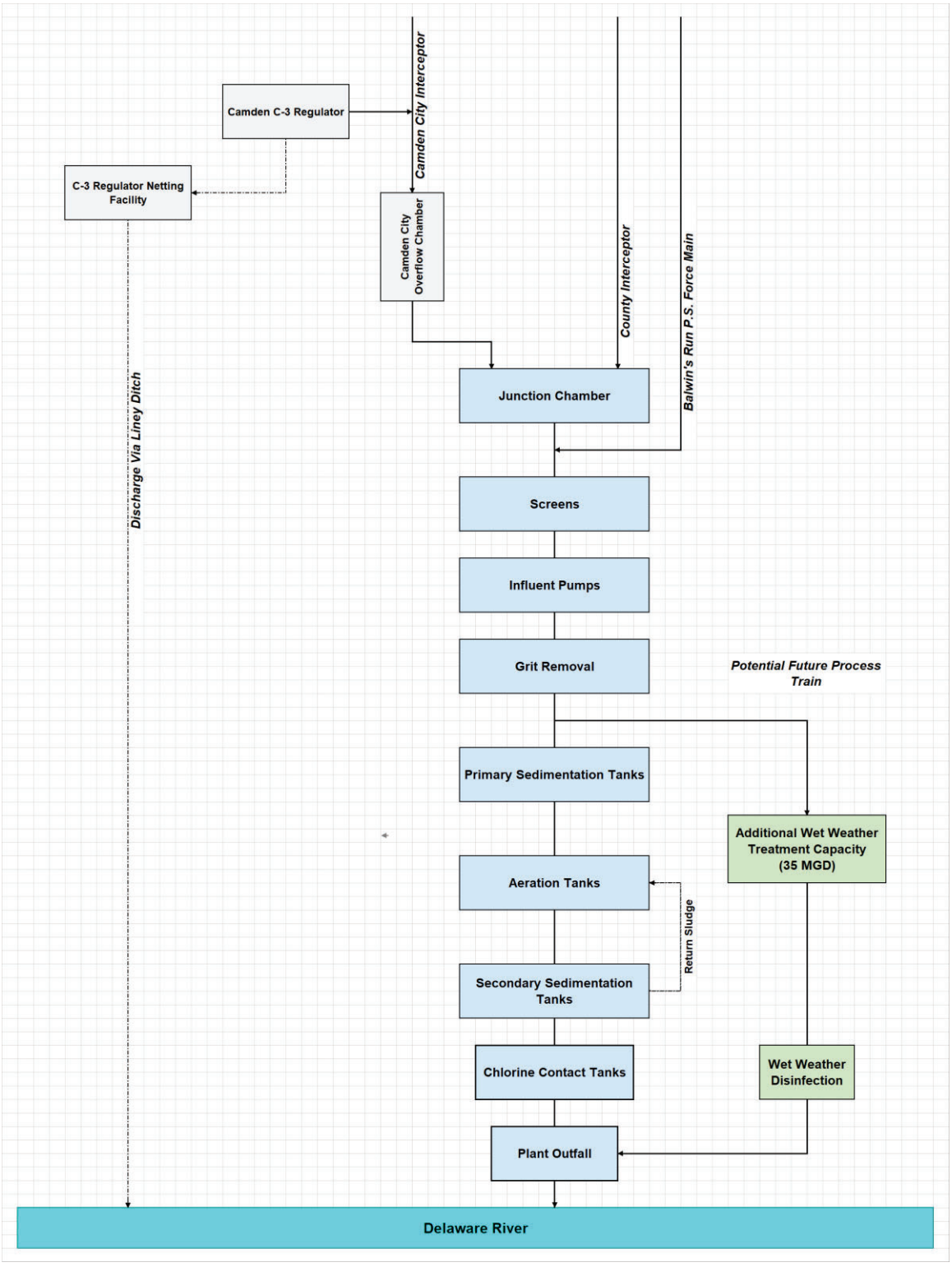


Figure 2-1 – Delaware No. 1 WPCF Treatment Process Flow Diagram

2.2 Regulatory Context

The regulatory basis for CCMUA's potential expansion of wet weather treatment capacity through a CSO related bypass of the secondary treatment process train is based the 1994 CSO Control Policy:

> "In some communities, POTW treatment plants may have primary treatment capacity in excess of their secondary treatment capacity. One effective strategy to abate pollution resulting from CSOs is to maximize the delivery of flows during wet weather to the POTW treatment plant for treatment. Delivering these flows can have two significant benefits: first, increasing flows during wet weather to the POTW treatment plant may enable the permittee to eliminate or minimize overflows to sensitive areas; second this would maximize the use of available POTW facilities for wet weather flows and would ensure that combined sewer flows receive at least primary treatment prior to discharge."[2-2]

The utilization of primary treatment capacities at treatment plants that exceed secondary treatment capacities is one of the options that combined sewer system permittees are required to evaluate under their respective NJPDES permits.[3-3] CCMUA's NJPDES permit was modified in July of 2019 to reflect the expansion of full secondary treatment capacity to 185 MGD. In it, NJDEP notes an expectation that CCMUA will consider CSO related bypassing options at WPCF # 1 in the SAIR.[3-4] The expansion of wet weather treatment capacity to up to 220 MGD using a CSO related bypass is one potential component of the CSO control strategy.

2.3 Wet Weather Capacity Expansion Beyond 220 MGD

It has been determined that additional controls beyond the expansion of WPCF # 1 of up to 220 MGD plus flow reduction through the use of green stormwater infrastructure will not achieve the system-wide control target of 85% wet weather capture during the typical year. To increase the targeted capture rate to 85%, additional controls will be needed for the Gloucester City CSO discharges on the Delaware River, the City of Camden discharges to the Cooper River and to the City of Camden and CCMUA discharges to the backchannel of the Delaware River.

CCMUA has determined that a wet weather treatment facility at or in the vicinity of WPCF #1 is not feasible due to site constraints. Land is not available at WPCF # 1 as evidenced by the already tight configuration of facilities at WPCF # 1 shown on Figure 2-2 on the following page. Moreover, the acquisition of additional land in the vicinity of WPCF # 1 is not realistic. The plant is bounded by the Delaware River, an active railroad, a recently completed brownfield to public park, expanding shipping and cargo businesses and a residential neighborhood. Therefore, it is not feasible to provide wet weather treatment beyond 220 MGD at or in the vicinity of WPCF #1.

2-2 59 FR 18693

2-3 Part IV-G.4-e(vii)

2-4 "Overview of Wet Weather Upgrades of Delaware WPCF # 1" included in the July 18, 2019 Final Surface Water Minor Modification Permit Action for Delaware WPCF #1 NJPDES number NJ0026182.

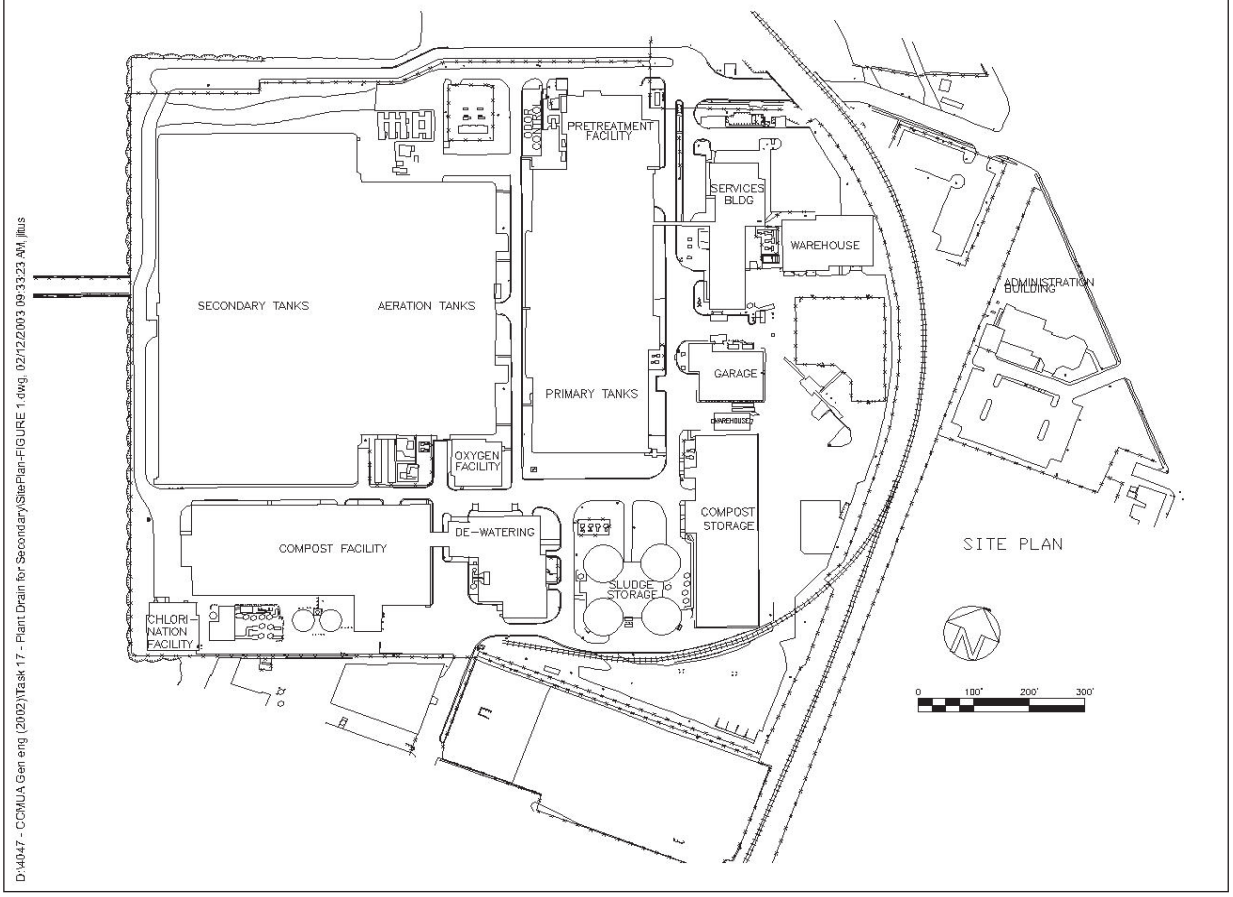


Figure 2-2 – Plan View of CCMUA Delaware Water Pollution Control Facility #1

Source Wet Weather Operating Manual for CCMUA Delaware No. 1 WPCF 2003 WRc/D&B, LLC.

Section 3
Formalized Green Stormwater Infrastructure Program

3.1 GSI Implementation Target

Green stormwater infrastructure is a foundational component of CCCMUA's and the Cities' control strategy due to the many environmental, community, aesthetic, economic and community health benefits intrinsic in green stormwater infrastructure (GSI).

CCMUA and the Cities of Camden and Gloucester are targeting a 10% reduction in impervious areas that are directly connected to the combined sewer system (DCIA) through the installation of GSI. Directly connected impervious areas such as paved streets, parking lots, building roofs, etc. from which stormwater runoff flows into the combined sewer system though a catch basin or other appurtenance.

The 10% target equates to approximately 145 controlled acres as shown in Table 10-1.

Table 3-1 – Calculation of Target Control of Runoff from DCIA

Combined Sewer Area	Acreage
Total	4,499
Directly Connected Impervious Area	1,446
Less 10% Reduction in DCIA	-145
Remaining Uncontrolled DCIA	1,302

The 10% directly connected impervious area reduction target reflects the upper limit of feasible GSI implementation during a twenty to forty-year implementation timeframe typical of CSO control programs. Over a longer timeframe, redevelopment and the renewal and replacement of the currently uncontrolled impervious areas represented by current buildings, roads, etc. will occur and the impervious area would be expected to decline as building and zoning codes and practices integrate GSI.

3.2 Wet Weather Control Benefits of GSI

Reducing stormwater runoff to the combined sewer system from directly connected impervious areas in Camden and Gloucester will have significant CSO control and street flooding reduction benefits. A ten percent decrease in stormwater runoff from impervious areas throughout the combined sewer area would result in a system-wide wet weather capture rate during the Typical Year of 81% coupled with the expansion of WPCF # 1 to 185 MGD and the restoration of the hydraulic capacity of the Camden collection system. This compares to 76% for the Control Alternatives Baseline conditions. Volumetrically, removing 10% (145 acres) of the system-wide DCIA would reduce the flow to the combined sewer system by approximately 90 million gallons during Typical Year precipitation.

3.3 GSI Implementation Strategy

By its nature, the ability to implement and the responsibility for the implementation of green stormwater infrastructure is diffuse. The directly connected impervious areas to be addressed using GSI are owned and controlled by all levels of government and private entities ranging from interstate highways and commercial redevelopment to church parking lots. CCMUA and the Cities have limited control over the location, timing and scale of green stormwater projects on private properties or on properties owned by county, state or federal agencies.

Given these institutional constraints, CCMUA and the Cities are proposing the establishment of a framework for the implementation of GSI that would formalize, expand upon and support the current efforts of groups such as the Camden SMART initiative. The intent is to maximize the implementation of GSI whenever feasible in coordination with:

- Development and redevelopment projects;
- Transportation and related public works (e.g. road work);
- Renewal and replacement projects (collection system or other work requiring street openings); and
- Opportunities for neighborhood enhancements (e.g. new or improved neighborhood parks or playgrounds).

CCMUA and the Cities will work with the current neighborhood and economic development groups, neighborhood groups, civic and economic leaders and county and state officials to develop the technical and institutional framework for implementing an aggressive and sustainable GSI program that will be an integral part of the implementation of the LTCP and other public and private projects and programs. The initial deliverable of these efforts will be a GSI Implementation Framework document that will include:

A) Specify technical criteria for identifying potential areas for DCIA reduction:

B) Determination of the potential for DCIA reduction:

   1) Identify technical feasibility criteria, e.g.

      (a) Contributing area runoff characteristics

      (b) Accessible work sites

      (c) Etc.

C) Methodology for identifying and supporting project stakeholders

D) Institutional Opportunities and Impediments

   1) Municipal code issues & opportunities (e.g. GSI requirements for redevelopment over a threshold size);

   2) Existing institutional support structures & organizations; and

   3) County, state and federal regulatory issues or opportunities.

E) Institutional and financial responsibilities for the ongoing maintenance of green stormwater management facilities

F) Funding mechanisms
   1) Current
      (a) State and federal programs
      (b) Private sources
   2) Potential
      (a) Stormwater fees
      (b) Other

G) Iterative planning, implementation, evaluation processes;
   1) Coordinate with municipal
      (a) planning and redevelopment plans
      (b) Public Works capital improvement program cycles
   2) Coordinate with NJDOT

The framework would be targeted for completion during 2021, with work to commence upon NJDEP approval of this SIAR. The framework will include specific performance targets for GSI implementation, e.g. 30 acres per five year NJPDES permit cycles. An evaluation of GSI implementation and flow reduction efficacy will occur at the end of each permit cycle to inform decisions as to the need for program modifications and to set priorities during the subsequent five year permit cycle.

A preliminary outline of the framework is provided on the following pages.

3.4 Draft GSI Implementation Program Framework

I) Framework Details:

A) Inventory of Potential DCIA Runoff Capture Locations – categorized by:

1) Consolidated Geographic Information System (GIS) data base of areas meeting the technical definition of DCIAs.

(a) Using municipal / county block & lot parcel mapping

(b) Evaluation / estimation of DCIA area by parcels to an appropriate level of detail necessary for an informed planning level understanding of the DCIA.

2) Land Use

(a) Current

(i) Actual

(ii) Zoned

(b) Future Land Use

(i) Announced redevelopment;

(ii) Land use & redevelopment plans.

3) Land Ownership & Control

(a) Public Land and Rights of Way (ROW)

(i) Municipal

- Streets, roads, mass transit;
- Parks, etc.;
- Building & facilities;
- Parking lots

(ii) Schools & universities

(iii) State & Federal

- Buildings, facilities & structures;
- Roads, bridges, mass transit, etc.

(b) Private lands

(i) Private businesses by zoned usage

(ii) Non-profits – e.g.

- Churches
- Hospitals, clinics;
- Etc.

4) Categorization of the above data by sewershed.

B) Technical Evaluation Criteria – How will target projects be identified and evaluated in terms of:

1) Spatial Scale

(a) By parcel

(b) Sewershed

(c) Neighborhood

(d) Etc.

2) DCIA Runoff Capture Potential

(a) Contributing area

(b) Site availability & conditions

(i) Accessibility

(ii) Conflicts & obstructions (e.g. utility lines)

(iii) Captured flow discharge opportunities

(c) Site appropriate controls

(i) Neighborhood fit

(ii) Cost

(iii) O&M effort and responsibilities

C) Institutional Evaluation – impediments and opportunities relating to GSI under the current legal and institutional framework – e.g.:[1]

1) Zoning – in terms of siting GSI facilities

2) Municipal & County codes – e.g. plumbing, building, stormwater management.

(a) Encourage GSI

(b) Discourage GSI

(c) Mandate GSI upon redevelopment or repairs?

3) Road design standards

4) Tax codes

5) Liabilities

D) Implementation Roles and Responsibilities [who's doing what]

1) Actors

[1] All of these have been dealt with in Philadelphia and elsewhere but a local assessment is warranted and may have been undertaken already by / for Camden.

(a) Municipalities

(i) Current and potential roles & responsibilities

(ii) Level of interest

(iii) Resource needs (staffing, technical expertise, etc.)

(b) County / CCMUA

(c) State

(d) Current property owners

(e) Non-Profit / Civic Organizations and Stakeholders

2) Activities:

(a) Project sponsors / champions

(i) Identifying potential projects

(ii) Identifying project owners

(iii) Rallying support

(b) Financial support

(c) Technical / legal reviews & permitting

(d) Technical support

(i) Design standards

(ii) O&M BMPs

(iii) "Hands on" technical support

E) Requirements and Incentives

1) Should GSI be mandatory and under what circumstances? e.g.:

(a) Redevelopment supported by public funding

(i) Direct funding

(ii) Indirect funding (government improvement of off-site infrastructure)

(b) Upon redevelopment or significant alternation?

(c) How to balance the desire for GSI with need for re-investment and the implicit unequal negotiating positions therein?

2) Responsibilities for ongoing maintenance of GSI facilities

(a) Institutional responsibilities

(b) Financial responsibilities

3) Funding incentives and resources:

(a) Current state or federal programs

(b) Tax incentives?

(c) Stormwater Utility / Fee

(i) As revenue source

(ii) As incentive – through fee avoidance by reducing impervious area.

F) Estimating the likely public / private mix of GSI

1) Based on other cities' experiences

2) Over various timeframes

III) Action Plan for Cycle 1 (NPDES permit cycle 2021 – 2025)

A) Stakeholder involvement and engagement

1) Stakeholder identification

2) Strategy for developing stakeholder support, buy-in and ownership?

B) (Strategy for) Identifying Project Priorities

1) CSO control potential

2) Feasibility / resources

3) Community interest

4) Etc.

C) Project Identification and Operation

1) Identifying and Committing Project Owners & Operators

(a) Ownership qualifications & responsibilities

(b) Operator qualifications & responsibilities

2) Implementation Support Structures

(a) Planning & design technical supports

(b) Construction delivery and management supports

(c) O&M supports – including potentials for DBE, training programs, etc.

3) Project Operation & Maintenance

(a) Standards of operation & maintenance

(b) Performance monitoring

D) Schedule and Performance Metrics

1) Target implementation schedule

2) Program evaluation metrics:

(a) DCIA acres removed per unit of time

(b) Estimated flow reduction

(c) Anecdotal information – e.g. flooding events.

Section 4
Mitigation of Street Flooding

4.1 Problem Overview

City of Camden

Street flooding during wet weather remains a major public health and environmental concern within the City of Camden. The results of the model that was developed to characterize the combined sewer system indicate that 90 million gallons of street flooding per year is the result of capacity limitations within the combined sewer system.[4-1] This figure is premised on the full capacity of the Camden collection sewer system having been restored and maintained through regular cleaning and required repairs. The contributions of stormwater that can't get into the combined sewer system due to current blockages or capacity limitations have not been calculated as part of this study and are not included in this figure. It should be noted that the relative roles of structural capacity limitations within the sewer system and of non-structural causes such as blockages is not well understood. Therefore, as outlined in this section of the SIAR, a comprehensive program to understand and address the causes of street flooding is proposed.

There are twenty sewersheds that have been associated with the reported street flooding hot spots identified in Camden's 2016 Flood Mitigation Plan. The number of locations where flooding has been reported Table 4-1 and locations are shown on Figure 4-1.

Table 4-1 – Camden Sewersheds Associated with Street Flooding

Sewershed / Regulator Name	# of Reported Flooding Locations	Sewershed / Regulator Name	# of Reported Flooding Locations
C1	5	C16	1
C3	21	C17	0
C5	5	C22	8
C6	5	C22A	1
C7	4	C23	0
C8	2	C24	1
C9	1	C27	4
C10	2	C28	1
C11	5	CFA	2
C13 / 13A	0	C32	12

[4-1] It should be noted that the hydraulic model is primarily intended to assess the performance of the regulator structures, interceptor sewers and WPCF capacity in relationship to flow rate and volume of combined sewage arriving at the regulator structures. The geographic extent of the model is limited in terms of the upstream collection sewers that send the combined sewage to the regulator structures and cannot simulate the performance of these un-modeled pipes. Therefore, the street flooding volumes shown must be viewed as indicative but imprecise.

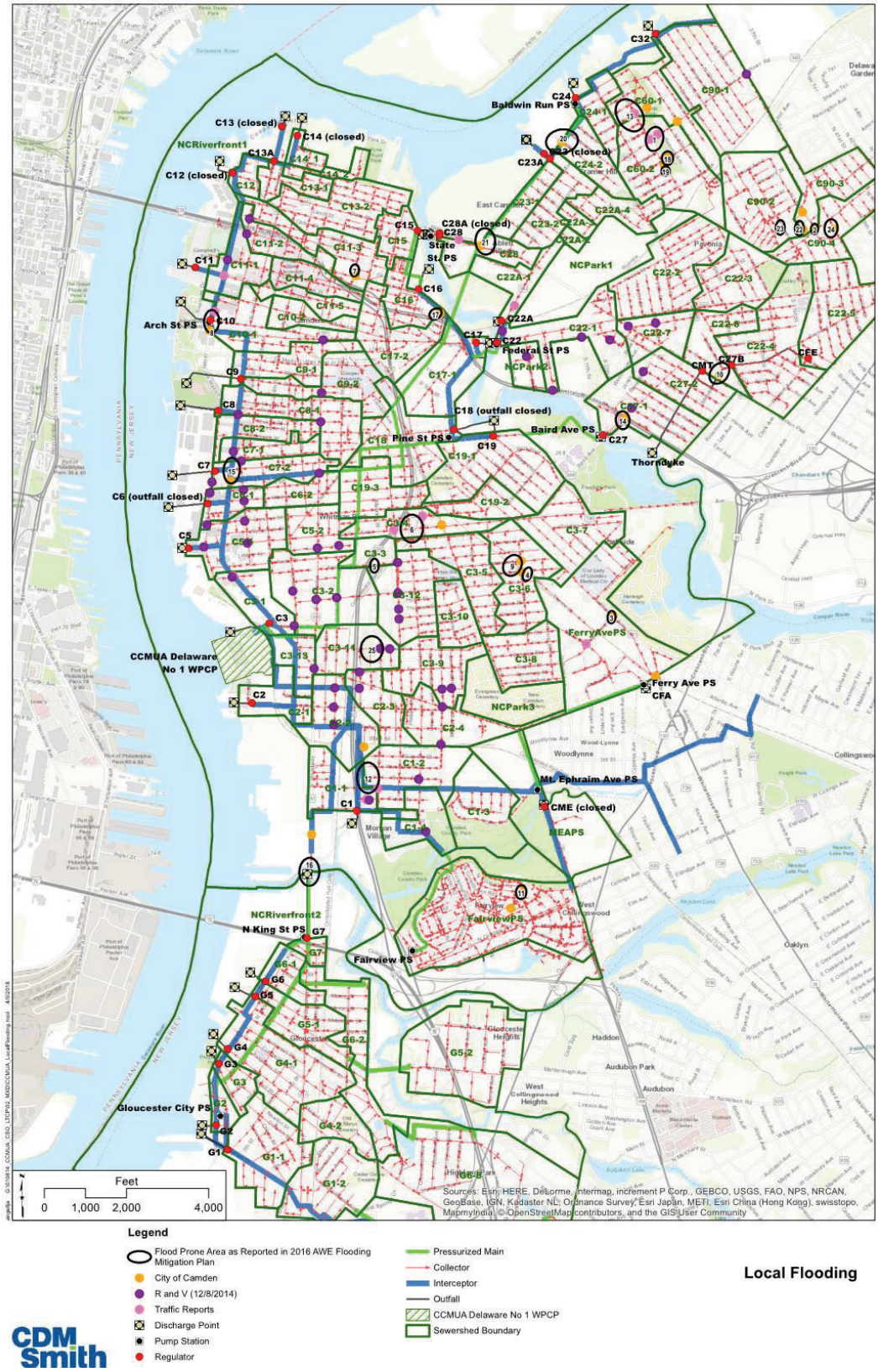


Figure 4-1 – Locations Associated with Street Flooding

Gloucester City

Street flooding can occur in Gloucester City during storm events occurring between two hours before and after high tides. Flooding has occurred near the King Street pumping station which is the low point of the combined system and along Water Street.

Gloucester City has a flood pump installed at the King St. pump station and another portable pump available to pump excess combined sewage when tidal conditions preclude normal drainage by gravity. In addition, Gloucester City and CCMUA coordinate the operation of CCMUA's Gloucester City pump station during high tide storm events to minimize flooding conditions.

Street flooding can have a number of causes, including:

- Stormwater not being able to enter the combined sewer system due to clogged catch basins;
- The hydraulic capacity of collection sewers being reduced by accumulated sediment;
- Clogged CSO outfalls;
- The hydraulic gradient of sewer segments being below that of the receiving stream during high tide; and
- Inherent capacity limitations of existing sewer segments.

The current understanding as to the proximate causes of street flooding at the known flooding locations is limited. Flooding event information such as flooding events dates, events per reported location, flooding duration, approximate sizes and depths of street floods and antecedent weather conditions are not currently available.

4.2 Street Flooding Reduction Benefits of CSO Controls

The CSO controls outlined in this SIAR will reduce the volumes of combined sewer overflow that is discharged through collection sewer backups significantly. Increasing the treatment capacity at CCMUA's WPCF # 1 from 150 MGD to 185 MGD is projected to reduce the simulated volume of Typical Year street flooding by around 58% from 90 million gallons per year to 33 update million gallons. This modest reduction in street flooding volume is due to capacity limitations within the Camden sewer system. Expanding the plant up to 220 MGD wet weather capacity will enable a significant increase in the capture rate from the large Camden C-3 regulator structure but would not significantly reduce street flooding further upstream in the Camden system.

Given the informational constraints as to the nature and causes of street flooding it is difficult to ascertain the street flooding reduction benefits of the satellite wet weather storage or treatment facilities needed to achieve 85% capture in the Cooper River, Gloucester and (if needed) Delaware Backchannel sub-systems. Regardless, these facilities will be sized to achieve 85% capture of wet weather flows generated in their respective sub-systems.

The analyses performed using the hydraulic model indicate that with the WPCF # 1 capacity upgrade to at 185 MGD, capacity limitations within the regulator structures and the interceptor sewers downstream of the regulator structures will not be a significant cause of street flooding. Wet weather flow arriving at the regulator structure that cannot enter the

interceptor should be fully discharged through the combined sewer overflow pipe, (assuming that the outfall pipes are maintained and open). Future analysis may reveal the need for the pumping of wet weather flows during high tides at certain locations. If necessary for CSO control purposes, satellite facilities would capture wet weather flows that would otherwise be discharged through the outfall pipes necessary to meet their performance standard (e.g. 85% capture).

A better understanding as to the causes of street flooding within the sewersheds that contribute to the potential satellite facilities is needed. If it were to be determined that street flooding in a sewershed is caused by hydraulic limitations in the collection system, then consideration of increasing the capacity and the implications of the resulting additional flow to the regulator structure and into the satellite facility could then be considered. Street flooding will be better understood and quantifiable after the collection system cleaning program is completed and prior to the design and construction of any satellite facilities.

4.3 Street Flooding Mitigation Program

It is proposed that a Comprehensive Street Flooding Mitigation Program be developed by each city and CCMUA as an early long term CSO control plan implementation action by the City of Camden with the support of CCMUA. The objective is to establish a framework for a comprehensive program to mitigate street flooding.

Key program elements could include:

- Establish flood location mitigation priorities and the criteria for prioritization;
- Development of System Performance Goals
- Documenting the implementation of the 2016 Wastewater System Flood Mitigation Plan;
- Identification and involvement of stakeholders and the identification of an institutional structure for the development and implementation of the mitigation program;
- Coordination with or working within existing green stormwater and sustainable redevelopment groups and programs;
- Establishing a GIS based street flooding event data base. This would involve establishing a flood event spotting and reporting system to track the occurrence, duration, approximate size and depth, preceding weather conditions and tides and integrating these data into a geo-referencing data base;
- Evaluate the principal causes of street flooding by location including but not limited to system hydraulic limitations situational hydraulic limitations (e.g. pipe or catch basin clogs, not enough inlets), changes in run-off characteristics, etc.;
- Targeted flow monitoring and the extension of the H&H model by Camden in flood prone segments of the Camden collection system within reasonable proximity to a regulator structure. This would could be implemented after the restoration of the hydraulic capacities through cleaning and the observation as to the impacts of this restoration on the occurrences of street flooding;

- Identify design standards and best practices for flooding mitigation for use on public and private redevelopment projects;
- Evaluate and develop a suite of mitigation alternatives;
- Identification and involvement of stakeholders and the identification of an institutional structure for the development and implementation of the mitigation program; and
- The identification and establishment of program funding sources.

5

Section 5
Additional Structural Controls

5.1 Additional Control Requirements

The system wide control target of 85% capture cannot be met through the wet weather treatment capacity increase and source reduction alone, therefore sub-system level controls using satellite control facilities was evaluated. The anticipated levels of CSO controls with the expansion of CCMUA's WPCF # 1 to 185 MGD plus a system-wide 10% reduction in DCIA are shown in Table 5-1.

Table 5-1 – Typical Year Capture Impacts of Controlling Runoff from DCIA by 10%

System / Sub-System	WPCF # 1 @ 185 MGD, Camden Hydraulic Capacity Restored	Add 10% Control of Runoff in DCIA
System-Wide	78%	81%
Sub-System		
Delaware R. – Camden	89%	91%
Delaware R. – Gloucester	69%	74%
Delaware R. - Back Channel	69%	72%
Cooper River	70%	75%
Newton Creek	85%	87%

Additional CSO controls will be evaluated for three of the five sub-systems to achieve the control objective of 85%system-wide wet weather capture during the Typical Year. It should be noted that the controls evaluated to achieve 85% system-wide wet weather capture will be sized to also achieve 85% capture in each individual sub-systems.

The 85% capture target for the Delaware River – Camden subsystem will be achieved through the expansion of the wet weather treatment capacity at WPCF # 1 to 185 MGD along with modification to the C-3 regulator structure and its operating rules. The expansion of the WPCF#1 will also help the Newton Creek subsystem in achieving 85% capture.

Due to their hydraulic isolation (varies pump stations) from the WPCF #1, the Delaware River – Gloucester City, the Delaware River Back Channel and the Cooper River sub-systems would not achieve increased capture with the potential expansion of the plant treatment capacity. The hydraulic limitations in the existing Camden and Gloucester interceptor sewers preclude the conveyance of additional wet weather flows to WPCF #1. Moreover, the additional conveyance option is mooted by the infeasibility of expanding the wet weather capacity at the WPCF beyond 220 MGD (see Chapter 5.3.2 of the DEAR report).

Ultimately, there are only four broad options for controlling combined sewer overflows:

1. Source reduction – through the removal or reduction of stormwater through green stormwater infrastructure or sewer separation;
2. Conveyance of wet weather flows to a central treatment facility;
3. Satellite storage of wet weather flows until they can be bled back into the combined sewer system for centralized treatment; or
4. Satellite treatment at or near the CSO outfall to provide at least the equivalent of primary treatment and disinfection.

CCMUA proposes to achieve 85% capture in the Delaware River backchannel subsystem through the reduction of wet weather flows from Pennsauken Township and increasing the wet weather flow rates through the Baldwins Run pump station.

Satellite storage or treatment will be required to achieve 85% capture in the Cooper River and Gloucester City sub-systems. The required capacities for these facilities are shown on Table 5-2. Capacity requirements are bracketed based on the achievement of 0% and 10% reductions in DCIA. A ten percent reduction in DCIA is the target established by CCMUA and the Cities as noted in Section 3 of this report. Zero percent reduction reflects the baseline current conditions and is used as a worst-case scenario. After the green stormwater program outlined in Section 3 has been underway for a while, the achievability of the 10% DCIA reduction goal can be re-evaluated.

Table 5-2 – Required Satellite Control Capacities

Sub-System	Locations	With 10% DCIA Reduction		Without 10% DCIA Reduction	
		Storage Volume in Million Gal.	Treatment Capacity in MGD	Storage Volume in Million Gal.	Treatment Capacity in MGD
Delaware River – Gloucester	G-4 / G-5	0.6	4.1	1.2	6.8
	G-1	0.5	2.3	0.7	4.4
Cooper River	C-22 / C-22A	1.3	20	2.6	21
	C-27 / Thorndyke	3	20.4	3.5	38.5
	C17	NA	NA	0.4	4.8

5.2 Overview of Alternative Control Technologies Evaluated

5.2.1 Satellite Treatment

Treatment Process Overview

Enhanced high-rate clarification (EHRC) has been used as the satellite treatment process for planning purposes. The term EHRC is generally used to describe a physical-chemical process in which coagulant and polymer are added to wastewater to remove solids from the stream.

The intent of EHRC treatment is to remove solids from and to disinfect the captured combined sewage. This provides effluent with total suspended solids concentrations that are similar or less than the effluent from the primary clarifiers at the wastewater plant. The removed solids then need to be conveyed to the main treatment plant for treatment.

The coagulant aggregates the suspended solids in the flow into a floc. The resulting floc particles adsorb onto either very fine sand added to the wastewater, or recirculated solids with the aid of a polymer. The fine sand and recirculated solids act as ballast and increases the settling rate of the adsorbed floc, removing the solids from the flow stream. The process is also known as "ballasted flocculation." EHRC systems can be operated intermittently during storm events.

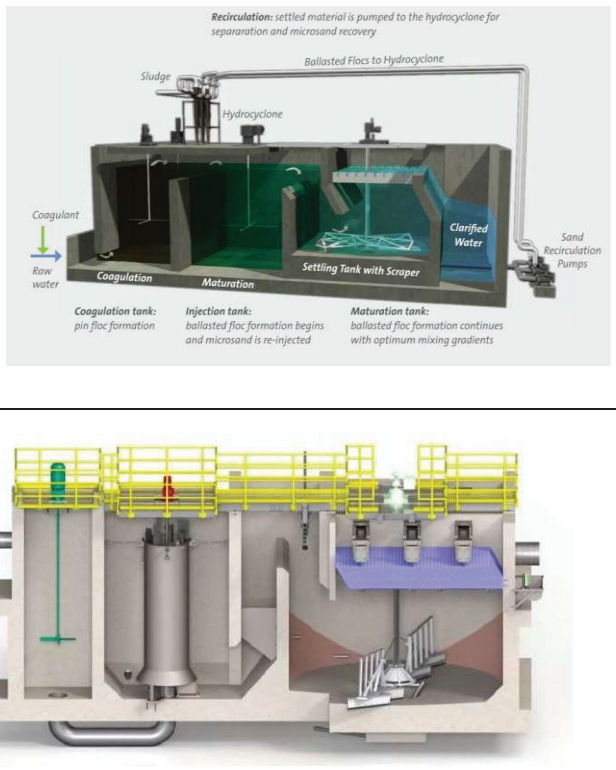


Figure 5-1 – Enhanced High Rate Clarification: Top – ACTIFLO unit, bottom – DensaDeg unit

A typical ballasted flocculation system consists of addition of ferric chloride, polymer, and "microsand" (sand approximately 100-microns in diameter) to wastewater. The wastewater and additives are rapidly mixed (flash mixing), then slowly stirred in a maturation tank before settling in a clarifier. The sludge from the settling process is passed through a hydrocyclone, where the microsand is removed from the sludge and recycled.

Several suppliers provide enhanced high-rate clarification systems as proprietary products, including: Kruger's Actiflo® process, which uses microsand as ballast, and Degremont Technologies' DensaDeg® process, which uses recirculated solids as ballast. Cross-sectional diagrams of the two technologies are shown on Figure 5-1

Whichever process is selected, BOD and TSS removal rates associated with high-rate clarification have been shown to be roughly double those of traditional clarification. BOD removal is between 65- and 80-percent and TSS removal is between 70- and 95-percent, according to the USEPA's August 2004 "Report to Congress on the Impacts and Control of CSOs and SSOs". These reductions clearly meet (and even exceed) those of conventional primary treatment processes, and thus satisfy the requirement to provide the "equivalent of primary clarification" per the EPA CSO Policy. Other benefits of this process include:

- Footprint area requirements are only one-tenth of traditional clarification area requirements (5 to 15-percent of the space required for conventional primary treatment);
- Can handle high hydraulic loading rates and treat rapidly varying flows; and
- Able to achieve secondary treatment effluent standards for TSS and approach these standards for BOD.

EHRC also has some disadvantages, including:

- Higher capital costs than less complex processes such as simple settling or screening technologies;
- Higher operating costs relative to conventional clarification due to chemical and floc media requirements;
- 15 – 30 minute start-up time before significant removal occurs;

Solids removed through the satellite treatment process range in concentration from around 0.1% to 1.0% with an average of around 0.3% and are typically discharged to the interceptor sewer for transport and treatment at the wastewater treatment plant. While high in solids concentration (1,000 mg/l to 10,000 mg/l the volume generated relative to total interceptor sewer flows are typical low enough to not pose operating problems. The feasibility of this being acceptable in Camden or Gloucester would need to be confirmed during a later detailed facilities planning phase of LTCP implementation.

Disinfection

As documented in the System Characterization Report, pathogens pose the primary water quality impact of the CSOs into the Delaware and Cooper Rivers and Newton Creek. Therefore, disinfection of effluent from satellite treatment facilities is assumed. Three disinfection technologies were considered:

- Sodium Hypochlorite;
- Ultraviolet (UV); and
- Peracetic Acid

Detailed descriptions and evaluations of these disinfection technologies were included in Appendix A of the approved Development and Evaluation of Alternatives Report. For purposes of this long term control planning document, disinfection using sodium hypochlorite is assumed. Regulations have required most wastewater treatment plants and CSO facilities to add a dechlorination process that uses sodium bisulfite to remove chlorine before it enters the receiving water. On average, dechlorination will add about $0.30 per gallon of treatment capacity to the cost of chlorination.

5.2.2 Satellite Storage

Off-line surface storage can be used to capture all or part of CSO discharge. When system capacity becomes available, flows are then released for conveyance to the treatment plant. When flow volumes exceed the storage capacity, flow will be discharged to CSO outfalls. Two different approaches can be used to handle these discharges: either (1) flow can be diverted around the storage tank when full, or (2) flow can pass through the tank and overflow at the downstream end of the tank, at which point the storage tank effectively becomes a high-rate settling tank. In either case, the size of a surface storage tank depends upon the capture goals set for each site.

A typical storage tank arrangement includes a regulator, bar screens, pumping facility and piping to and from the collection system. Design details such as flow distribution, tank flushing, and facility activation also are affected by the overall goals for and hydraulics of the specific site. Examples of storage tanks are shown on Figure 5-2.

Figure 5-2 – Examples of Satellite Storage Facilities. Left: below grade facility under construction. Right: retention treatment basin in Inkster Michigan.

Storage tanks are generally fed by gravity and the stored flow is typically pumped back to the interceptor after the storm. This gravity-in / pump-out arrangement minimizes pumping costs (both capital and operating). However, if the existing combined sewers are deep, then the storage tank must be deep and construction becomes more expensive.

5.3 Control Alternatives

5.3.1 Summary Assessment of Control Option

Satellite facilities can pose significant siting, financial and operating burdens on the municipalities in which they are located which must be considered in the alternatives selection process. A qualitative summary of the two approaches' pros and cons is provided on Table 5-3.

Table 5-3 – Qualitative Comparison of EHRC and Storage

	Enhanced High Rate Clarification (Ballasted Flocculation)	Storage Tanks
Pro	• High levels of treatment and treated effluent quality (meets / exceeds primary treatment). • Proven technology. • Process equipment relatively compact. • Not affected by precursor storm events.	• Relative operating simplicity. • Proven technology • Only discharges to receiving streams during storm events exceeding storage capacities • Captured flow is sent back to the wastewater treatment plant for full treatment
Con	• Operating complexity. • Requires post event cleaning and maintenance. • Requires on-site hypochlorite and other chemical storage • Likely point-source performance standards. • Capital and O&M costs	• Utilizes interceptor and treatment plant capacities during post storm drain downs. • Overflows when storage capacities are exceeded. • Required post event cleaning more difficult than for ballasted flocculation.

5.3.2 Treatment and Storage Cost Estimation

Generic planning level capital, operation and maintenance (O&M) and life-cycle costs for Enhanced High Rate Clarification and for storage facilities have been developed utilizing process equipment manufacturer data as presented in the January 2018 PVSC Updated Technical Guidance Manual (TGM) that was included as Appendix A in the approved CCMUA / Camden / Gloucester Development and Evaluation of Alternatives Report.[5-1]

5.3.3 Permittee Specific Cost Estimates

Detailed capital and O&M cost estimates have been developed for the Cities of Camden and Gloucester and for the CCMUA. These estimates are premised upon 1) the inclusion of green stormwater infrastructure sufficient to reduce the directly connected impervious areas of Camden and Gloucester by 10%, and 2) that each permittee will be responsible for the future capital and operating costs of CSO controls located within their respective collection systems.

City of Camden

The estimated capital costs (in 2020 dollars) and O&M costs for satellite treatment and for satellite storage at Camden regulators C-22 & C-22A (Cooper River) and C-27 & Thorndyke (Cooper River) are shown on Tables 5-4 and 5-5.

Table 5-4 – Camden CSO 85% Typical Year Wet Weather Capture Control Cost Estimates*

Sub-System	Treatment		Storage	
	Capacity in MGD	Cost	Capacity in MG	Cost
Cooper River				
C-22 / C-22A				
Construction Cost		$8,316,000		$10,447,000
Land Acquisition & Remediation		$605,000		$605,000
28% Non-Construction	20 MGD	$2,328,000	1.2 MG	$2,925,000
Total Capital		$11,249,000		$13,977,000
50% of Construction for Contingency		$4,158,000		$5,223,500
Total With Contingency		$15,407,000		$19,200,500
C-27 / Thorndyke				
Construction Cost		$8,316,000		$21,765,000
Land Acquisition & Remediation		$770,000		$770,000
28% Non-Construction	20 MGD	$2,328,000	1.2 MG	$6,094,000
Total Capital		$11,414,000		$28,629,000
50% of Construction for Contingency		$4,158,000		$10,882,500
Total With Contingency		$15,572,000		$39,511,500
Total Cooper River				
Construction Cost		$16,632,000		$32,213,000
Land Acquisition & Remediation		$1,375,000		$1,375,000
28% Non-Construction		$4,657,000		$9,020,000
Total Capital		$22,664,000		$42,608,000
50% of Construction for Contingency		$8,316,000		$16,106,500
Total With Contingency		$30,980,000		$58,714,500

5-1 Tables 2-18 through 2-22 for ballasted flocculation facilities and Tables 2-29 through 2-31 for disinfection.

Sub-System	Treatment		Storage	
	Capacity in MGD	Cost	Capacity in MG	Cost
10% DCIA Reduction via GSI				
Construction Cost		$39,836,000		$39,836,000
28% Non-Construction		$11,154,000		$11,154,000
Total Capital		$50,990,000		$50,990,000
50% of Construction for Contingency		$19,918,000		$19,918,000
Total With Contingency		$70,908,000		$70,908,000
Total Camden Capital Costs				
Construction Cost		$56,468,000		$72,048,000
		$1,375,000		$1,375,000
28% Non-Construction		$15,811,000		$20,174,000
Total Capital		$73,654,000		$93,597,000
50% of Construction for Contingency		$28,234,000		$36,024,000
Total With Contingency		$101,888,000		$129,621,000
* Excludes future costs for system renewal and replacement necessary to maintain design capacities.				

Table 5-5 - City of Camden CSO Controls Estimated Annual O&M and Life Cycle Costs

Present Worth & Annual Cost Calculations	Treatment & Green	Storage & Green
Annual O&M Cost Estimates		
Non-GSI	$854,000	$424,000
GSI Costs	$329,000	$329,000
Total Annual	$1,183,000	$753,000
Present Worth		
Present Worth of O&M	$18,016,000	$11,467,000
Plus Capital Costs (without contingency)	$73,654,000	$93,597,000
Total Present Worth	$91,670,000	$105,064,000
Estimated Annual Costs		
Debt Service Payments	$6,188,000	$7,864,000
Annual O&M	$1,183,000	$753,000
	$7,371,000	$8,617,000

As detailed above, the capital cost estimates for Camden range between $102 million for the enhanced high rate clarification treatment option and $130 million for storage tanks. While the estimated capital cost difference of roughly $28 or a difference of 27% It should be noted that the construction cost estimates are Class 5 (Conceptual Screening) as defined by the Association for the Advancement of Cost Engineering and therefore have an expected accuracy range of -50% through +100%.

The control facilities would add between $7.4 to $8.6 to the annual wastewater management costs of the City of Camden. While the capital costs for tanks is higher, the O&M costs are projected to be lower; with a 20 year present worth O&M cost savings of around $6.6 million. The projected annual costs also include debt service payments of $6.2 to $7.9 million, based on the use of the New Jersey Clean Water State Revolving Fund financing program. Total life cycle costs for the two options are $91.7 million for the EHRC option and $105.1 million for storage. The present worth calculations include a twenty year operating period and a discount rate for the O&M of 2.75%. Note that the capital costs used in the lifecycle cost calculation do not include the 50%

construction contingency and are therefore lower than the total capital costs shown in Table 5-6 which do include construction contingencies.

It should be noted that the estimated costs for controls in the Camden combined sewer system shown above in do not include the costs of eliminating overflows from the lower Cooper River described in Section 5.4.2 concerning the reclassification of lower Cooper River to a C-1 (exceptional ecological significance) designation usage, thereby potentially triggering a requirement for the complete elimination of combined sewer overflows. As demonstrated in Section 5.4.2 the elimination of all overflows is financially not achievable and is not included in the proposed long term control program defined in this SIAR.

Gloucester City Cost Estimates

The estimated capital costs (in 2019 dollars) and O&M costs for satellite treatment and for satellite storage serving Gloucester are shown on Table 5-6. The estimated capital costs for a treatment based approach to achieving 85% wet weather capture in Gloucester is approximately $27 million. Estimated capital costs for storage are $45 million.

Incremental annual costs for Gloucester would range between around $2.0 million for the treatment option and $3.0 million for the storage options as shown on Table 5-7. These figures include financing of the capital costs through the N.J. Clean Water SRF as was the case for Camden.

Table 5-6 – Gloucester CSO Control Cost Estimates

Sub-System	Treatment		Storage	
	Capacity	Cost	Capacity	Cost
Gloucester City - Delaware River				
Satellite Treatment or Storage				
Construction Cost		$10,943,000		$20,895,000
Land Acquisition & Remediation		$550,000		$550,000
28% Non-Construction	6.4 MGD	$3,064,000	1.1 MG	$5,850,000
Total Capital		$14,557,000		$27,295,000
50% of Construction for Contingency		$5,471,000		$10,447,000
Total With Contingency		$20,028,000		$37,742,000
10% DCIA Reduction via GSI				
Construction Cost		$3,993,000		$3,993,000
28% Non-Construction		$1,118,000		$1,118,000
Total Capital		$5,111,000		$5,111,000
50% of Construction for Contingency		$1,996,500		$1,996,500
Total With Contingency		$7,107,500		$7,107,500
Total Gloucester Capital Costs				
Construction Cost		$14,935,000		$24,887,000
Land Acquisition & Remediation		$550,000		$550,000
28% Non-Construction		$4,182,000		$6,968,000
Total Capital		$19,667,000		$32,405,000
50% of Construction for Contingency		$7,468,000		$12,444,000
Total With Contingency		$27,135,000		$44,849,000

* Excludes future costs for system renewal and replacement necessary to maintain design capacities.

Table 5-7 – Gloucester CSO Control Estimated Annual & Life Cycle Costs

Present Worth & Annual Cost Calculations	Treatment & Green	Storage & Green
Annual O&M Cost Estimates		
Non-GSI		
	$394,000	$118,000
GSI Costs	$33,000	$33,000
Total Annual	$427,000	$151,000
Present Worth		
Present Worth of O&M	$6,504,000	$2,300,000
Plus Capital Costs (without contingency)	$19,667,000	$32,406,000
Total Present Worth	$26,171,000	$34,706,000
Estimated Annual Costs		
Debt Service Payments	$1,322,000	$2,178,000
Annual O&M	$427,000	$151,000
Total Annual Costs	$1,749,000	$2,329,000

CCMUA Cost Estimates

The estimated capital costs for CSO controls for CCMUA total approximately $80 million as detailed on Table 5-8. This figure includes $36.6 million for the expansion of the wet weather capacity at WPCF # 1 from 185 MGD to 220 MGD and $44.3 to reduce overflows from CCMUA's C-32 regulator sufficiently to achieve 85% capture of wet weather flows during the Typical Year.

Table 5-8 – CCMUA CSO Control Capital Cost Estimates

Sub-System	Cost
Delaware Back Channel	
C-32	
Construction Cost	
Regulator Modifications	$156,300
Flow Restriction Modification	$39,100
Source Reduction	$19,379,300
Baldwins Run PS Modification	$5,000,000
Subtotal Construction	$24,574,700
Land Acquisition & Remediation	$550,000
28% Non-Construction	$6,880,900
Total Capital	$32,005,600
50% of Construction for Contingency	$12,287,300
Total With Contingency	$44,292,900

Sub-System	Cost
Expansion of WPCF # 1 to 220 MGD	
Construction Cost	$20,000,000
28% Non-Construction	$5,600,000
50% of Construction for Contingency	$10,000,000
Total With Contingency	$35,600,000
Total CCMUA Capital Costs	
Construction Cost	$44,574,700
Land Acquisition & Remediation	$550,000
Non-Construction @ 36%	$12,480,900
Total Capital	$57,605,600
Add Contingency @ 50% of Construction	$22,287,300
Total With Contingency	$79,892,900
* Excludes future general capital improvements and renewals & replacement.	

Projected incremental O&M costs for CCMUA as well as the estimated total lifecycle costs for the CCMUA improvements are shown on Table 5-9.

Table 5-9 – CCMUA CSO Control Incremental O&M and Life Cycle Cost Estimates

Present Worth & Annual Cost Calculations	
Estimated Incremental Annual O&M Costs	$500,000
Present Worth	
Present Worth of O&M	$7,613,600
Plus Capital Costs (without contingency)	$57,605,500
Total Present Worth	$65,219,100
Estimated Annual Costs	
Debt Service Payments	$3,872,000
Annual O&M	$500,000
Total	$4,372,000

System-Wide Cost Estimate Roll-Up

The respective cost estimates for Camden, Gloucester and CCMUA are aggregated and summarized on Table 5-10. Aggregated capital costs, including construction contingencies total $209 million for the EHRC option and $254 million for the storage option, a difference of about 31%. Combined annual incremental O&M costs are estimated to be $2.4 million for treatment and $1.4 million for storage.

Table 5-10 – System-Wide Roll Up of Cost Estimates

Permittee	Estimated CSO Control Costs*	
	Treatment	Storage
City of Camden		
Capital Costs		
Before Contingencies	$73,654,000	$93,597,000
With Contingencies	$101,888,000	$129,621,000
Annual O&M	$1,183,000	$753,000
Present Worth		
Present Worth of O&M	$18,016,000	$11,467,000
Total Present Worth (w/o Contingencies)	$91,670,000	$105,064,000
Gloucester City		
Capital Costs		
Before Contingencies	$19,667,000	$32,405,000
With Contingencies	$27,135,000	$44,849,000
Annual O&M	$427,000	$151,000
Present Worth		
Present Worth of O&M	$6,504,000	$2,300,000
Total Present Worth (w/o Contingencies)	$26,171,000	$34,706,000
CCMUA		
Capital Costs [excludes Incured 185 MGD plant costs]		
Before Contingencies	$57,605,600	57,605,600
With Contingencies	$79,892,900	79,892,900
Annual O&M	$500,000	500,000
Present Worth		
Present Worth of O&M	$7,613,600	7,613,600
Total Present Worth (w/o Contingencies)	$57,605,500	57,605,500
Rollup: Camden + Gloucester + CCMUA		
Capital Costs		
Before Contingencies	$150,926,600	$183,607,600
With Contingencies	$208,915,900	$254,362,900
Annual O&M	$2,110,000	$1,404,000
Present Worth		
Present Worth of O&M	$32,133,600	$21,380,600
Total Present Worth (w/o Contingencies)	$175,446,500	$197,375,500

* Excludes future costs for system renewal and replacement necessary to maintain design capacities.

5.4 Cost / Performance Considerations

5.4.1 Cost / Performance Evaluation

The Cities of Camden and Gloucester and CCMUA have determined that the Presumption Approach[5-2] should be used as the basis for their CSO control strategies and have established the control of 85% of wet weather flow volume generated during the Typical Year as the CSO control performance target.

Paragraph G-5(a) of the respective NJPDES permits require that permittees utilizing the Presumption Approach to analyze various levels of CSO controls to determine where the increment of pollution reduction achieved in the receiving waters diminish compared to the increased costs. Such an evaluation often is referred to as a "knee of the curve" analysis.

For this analysis, CCMUA and the Cities initially evaluated the relationship between the frequencies of overflows from the 30 active outfalls during a Typical Year and the volumes of combined sewage discharged from the overflows. As is typical for combined sewer systems with diverse sewershed sizes and land use characteristics, there is little correlation between overflow frequencies and annual overflow volumes from individual out falls. This is shown graphically for the Camden / Gloucester / CCMUA combined sewer system on Figure 5-3.

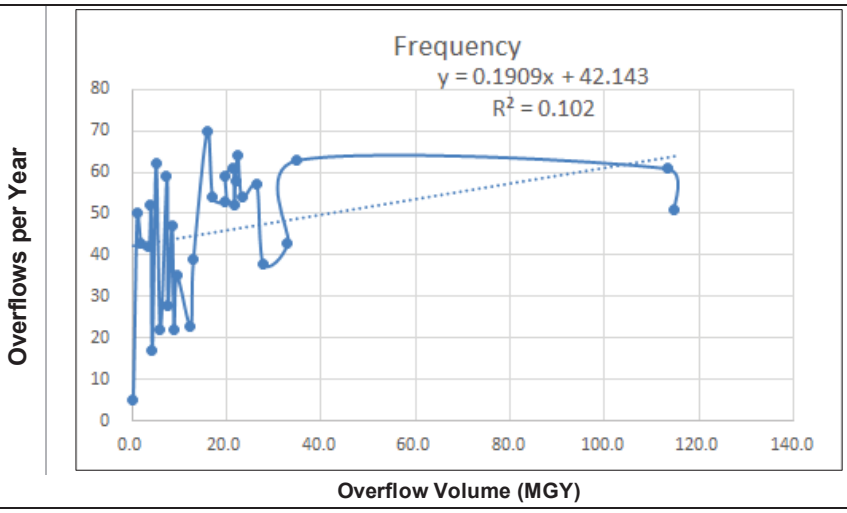


Figure 5-3 – Correlation Between Overflow Frequencies and Annual Discharge Volumes

The variability in overflow volumes between outfalls and the weak relationship between frequency and volume supports the selection of the 85% system-wide capture performance standard. The use of an overflow-event based performance target, if strictly applied across the 30-outfall system, e.g. 4 to 6 overflows per year, could require that controls be in place at every outfall that exceeds the target frequency under baseline conditions. Therefore, decisions as to where to allocate scarce resources would not be driven by the optimization of overflow reduction benefits, as compared to a more flexible volume-based target applied at the system or sub-system level.

The modeling performed for this cost-performance analysis indicates that achieving 85% capture system-wide will reduce annual CSO volumes by roughly 485 million gallons. This level of CSO

5-2 Under the USEPA CSO Control Policy (59 FR 18692) a CSO control program that eliminates or captures for treatment no less than 85% of the volume of combined sewage that is collected in the combined sewer system during precipitation events during a Typical Year would be presumed to provide an adequate level of control.

reduction approximates (and slightly betters) that which would be accomplished with control levels between eight and twelve overflows per year.

As shown on Table 5-10, the estimated capital costs for system-wide 85% control is around $200 million (excluding construction contingencies). This figure is based on the averaging of the system-wide costs using satellite treatment and those using satellite storage and is net of the 50% construction contingency. The $200 million estimated compares with the approximately $450 million in estimated capital costs for reducing overflows to eight times per Typical Year. A cost-control level curve showing the CSO removal volumes at CSO frequency controls ranging from twenty overflows per year down to zero is presented in Figure 5-4. Included on this graph are the costs and overflow removal volume under an 85% capture strategy. A corollary cost curve showing the Typical Year remaining annual CSO volumes is shown in Figure 5-5.

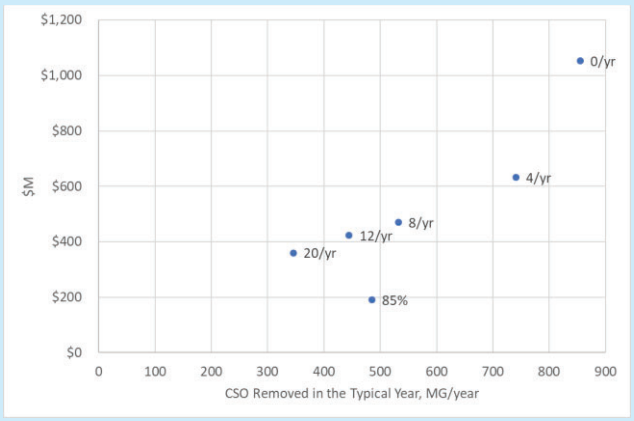


Figure 5-4 – Cost / Performance Relationship of Overflow Frequency Based and 85% System-Wide Capture Control Strategies – Typical Year Overflow Reduction Volumes

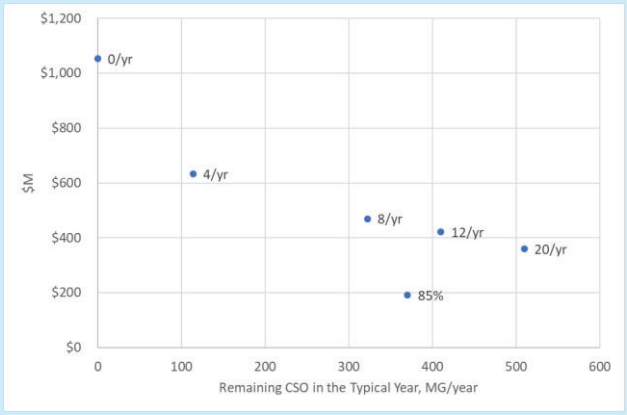


Figure 5-5 – Cost / Performance Relationship of Overflow Frequency Based and 85% System-Wide Capture Control Strategies – Typical Year Remaining Overflow Volumes

5.4.2 Potential Impacts of Cooper River Designated Use Reclassification

On April 6, 2020 NJDEP finalized a change in the use designation of the segment of the Cooper River from the U.S. Route 30 crossing to the confluence with the Delaware River from FW-2NT (fresh-water non-trout) to Category 1. Category 1 waters are those listed in N.J.A.C 7:9B1-15(c) as having exceptional ecological significance, exceptional recreational significance, exceptional water supply significance or exceptional fisheries resources.

Figure 5-6 – Eastern Pondmussel *(Ligumia Nasuta)* – photo source: Conserve Wildlife Foundation of N.J.

NJDEP proposed this designated use change as a result of confirming the presence of the Eastern Pondmussel within this segment of the river. As documented in the 2018 System Characterization Report, NJDEP had previously identified this stream segment as suitable habitat to support this New Jersey state threatened species. The presence of a state or federal threatened species is one of the six triggers for a receiving stream to be considered a sensitive area under the USEPA CSO Control Policy.

Six Camden CSO outfalls discharge into the Cooper River downstream of U.S. Route 30. These are shown on Figure 5-7. To achieve 85% capture in the entire Cooper River sub-system controls are not required for each outfall. Controls for regulators C-22, C22A, C-27 and the Thorndyke Street outfalls are proposed to reach 85% wet weather capture during the Typical Year.

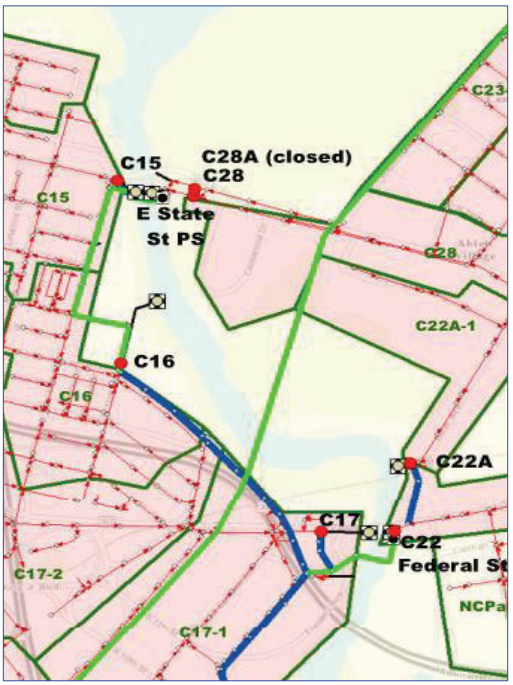


Figure 5-7: Six impacted outfalls: C15, 16, 17, C22, C22A, and C28.

The CSO Policy states that overflows to sensitive areas should be eliminated or relocated wherever physically possible and financially achievable. A conveyance and treatment alternative that would eliminate untreated overflows to the Cooper River was evaluated. To effectively eliminate the CSO discharges to this area, the wet weather conveyance interceptor and high rate treatment facility could be sized to capture 100% of wet weather flow not entering the existing interceptor during the Typical Year. This alternative would involve the following elements.

Lower Cooper River (downstream of the U.S. Route 30 bridge)

In lieu of a satellite treatment or storage facility for C-22 and 22A, wet weather flows not entering the existing Camden interceptor sewer at C-22 would be conveyed across the river to discharge to a new wet weather relief conveyance pipe at a connection point in the vicinity of the C-17 regulator. This new pipe would originate at the C-19 regulator and flow north-westerly in the general vicinity of the left bank of the Cooper River. It would connect with the C-17, C16, and C15 regulator structures to capture flows that would otherwise overflow. Upstream of the State Street bridge the line would again cross the Cooper River and terminate at a new EHRC treatment facility. The facility would also receive flow from the C-28 regulator through a new connecting pipe. The treated effluent would be discharged to the Delaware near the confluence with the Cooper River. A conceptual routing of this new conveyance line is shown on Figure 5-8.

Upper Cooper River (upstream of the U.S. Route 30 bridge)

As noted above, wet weather flows from the C18/C19 outfall would be captured and conveyed for treatment. The 20.4 MGD EHRC facility that is proposed to treat wet weather flows currently discharging from regulator C-27 and Thorndyke outfall under the 85% capture strategy would be sized at 237 MGD to eliminate CSO discharge (i.e. 100% capture) during the Typical Year.

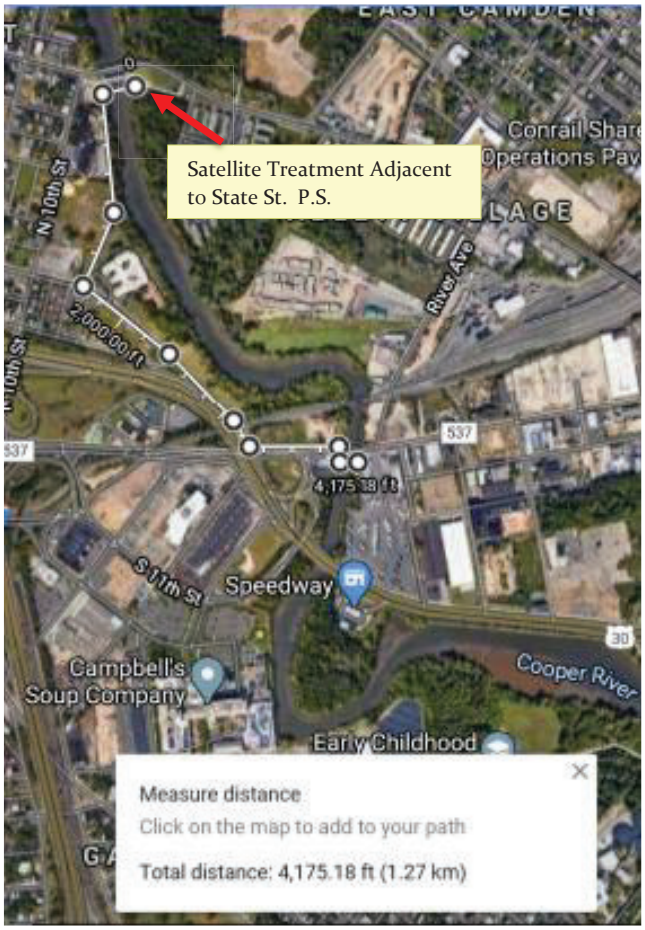


Figure 5-8: Conceptual Routing of Wet Weather Conveyance Interceptor to a High Rate Clarification Facility in the Vicinity of the State Street Pump Station

Environmental Implications

Evaluation of a wet weather conveyance interceptor and enhanced high rate clarification facility in the C-1 designated area of the Cooper River must consider the net environmental benefit of eliminating the untreated discharge of CSOs against the potential harm done to the C-1 riparian area as a result of construction. As noted in New Jersey's Surface Water Quality Standards:

> "Category One Waters shall be protected from any measurable changes (including calculable or predicted changes) to the existing water quality. Water quality characteristics that are generally worse than the water quality criteria, except as due to natural conditions, shall be improved to maintain or provide for the designated uses where this can be accomplished without adverse impacts on organisms, communities or ecosystems of concern".[7-3]

The feasibility of controlling the CSOs that discharge to the lower Cooper River without adverse impacts to the Eastern Pondmussel or their habitat would need to be further evaluated if this alternative were to be considered further.

Water Quality Implications of Eliminating the Cooper River CSOs

As documented in the approved CCMUA / City of Camden / Gloucester City Baseline Compliance Monitoring Report, the primary pollutant category responsible for the violation of water quality standards for primary contact recreation in the Cooper River is pathogens. The elimination of combined sewer overflows would reduce pathogen discharges to the Cooper River during wet weather, thereby improving water quality. Wet weather CSO discharge sampling conducted during the Sewerage Infrastructure Improvement Act study conducted in the late 1990s

[7-3] N.J.A.C. 7:9B-1.5(d)2iii

the fecal coliform concentrations measured as colonies per 100 ml ranged from 229,100 to 5,137,300. These values compare to the then current New Jersey water quality pathogen standards for Fresh Water – 2 receiving streams of 200 colonies / 100 ml (geometric mean) and not more than 400 colonies / ml in 10% of samples.[5-4]

However, the removal of the combined sewer overflows into the Cooper River likely would not result in the Cooper River meeting the pathogen standards. If the CSO elimination took the form of sewer separation including the use of green infrastructure to the maximum feasible extent, the load of pathogens and other pollutants discharged from the remaining urban stormwater would be significant. The 2018 update (Version 4.02) to the National Stormwater Quality Database[5-5] reported the following statistics based on 1,447 samples taken during 18 storm events:

- Mean fecal coliform concentrations of 55,200
- Median fecal coliform concentrations of 3,700
- Standard deviation of 282,900

The value of the standard deviation being five times higher than the mean value is indicative of the high variability of stormwater characteristics. In any event, these data suggest that the stormwater discharged from a separated sewer system would still have pathogen loadings likely to result in the receiving stream failing to meet water quality standards.

Pathogen loadings occurring upstream of the current CSOs also contribute to water quality standard violations in the Cooper River. As documented in the approved Baseline Water Quality Compliance Report, 11 of 13 dry day samples taken upstream and downstream of the CSOs on the Cooper River exceeded the current pathogen single sample standard of 235 CFU/100 ml of e-coli (escherichia coliform), i.e. the pathogen water quality standard is not being met during dry weather when no overflows are occurring. Similarly, 17 of 24 wet day samples from the Cooper River exceeded the pathogen limit both upstream and downstream of the CSOs.

Thirty-day geometric mean for at least five samples is generally required for bacteria in recreational water. Due to limited data, a seasonal geometric mean was calculated for the Cooper River from samples collected between late March and early November. The seasonal geometric mean for eight samples taken in 2009 at Cuthbert Boulevard upstream of the CSOs was 338 CFU / 100 ml. compared to the FW-2 standard of 126 CFU / 100 ml. Values of samples taken between 2004 and 2011 downstream of the CSOs near the mouth of the Cooper River ranged from 142 CFU/100 ml to 1,590 CFU/ml.

As will be documented below, the costs of eliminating the CSOs is not financially achievable and as outlined above, their elimination would likely not result in the Cooper River meeting water quality standards for pathogens. CCMUA and the City of Camden are committed however to furthering the improvement of the Cooper River and in supporting this important environmental, recreational and aesthetic asset for Camden's economic redevelopment. Towards this end, the development of a Cooper River Water Quality Optimization Strategy is proposed as an early action activity of the long term control plan in Section 7 of this SIAR.

5-4 N.J.A.C. 7:93-1.14(c)

5-5 The National Stormwater Quality Data Base (NSQD), Version 4.02, R. Pitt, A. Maestre, and J. Clary. University of Alabama February 17, 2018

Cost Implications

The estimated capital costs to eliminate CSO discharges to the Cooper River are $303 million. However, deducting the costs for treatment facilities at C-22 / C-22A and C-27 / Thorndyke that would be required for 85% capture, the net increase in capital costs would be $271 million. The control elements comprising this amount are shown on Table 5-11.

As will be demonstrated in Section 6 (Institutional and Financial Capability Assessment), implementing an 85% Typical Year wet weather capture would result in high financial burdens on the residents of Camden. The addition of $272 million would be demonstratively not financially achievable by the City of Camden and is not included in the controls recommended in this SIAR.

Table 5-11 – Summary of Estimated Capital Costs to Eliminate Untreated Overflows to the Cooper River

	Control Element	Description		Estimtated Capital Cost (million $)
		Quantity	Units	
1	Upgrade of C-27 / Thorndyke EHRC to 0 OPY	237.1	MGD	$91.9
2	Consolidation Sewer C-19 to State St. PS	9,450	linear feet	$83.6
3	EHRC Facility at State St. Pump Station	326.0	MGD	$105.8
4	Effluent Line from the EHRC facility to the confluence of the Cooper River and the Delaware Back Channel	2,400	linear feet	$21.8
	Subtotal			$303.1
5	Less Satellite Facilities Sized for 85% Capture			
	@ C-22 / C-22A Satellite Facility	20.0	MGD	($15.4)
	@ C-27 / Thorndyke	20.1	MGD	($15.6)
	Grand Total			$272.1

5.5 Site Considerations

The preliminary site requirements for the potential satellite treatment or storage facilities described above are shown on Table 5-12. Approximate site vicinity and current land use maps for these potential satellite facilities are shown on Figures 5-9 through 5-13.

Table 5-12 – Potential Satellite Facilities Vicinity Information

	Subsystem	Vicinity of Regulators	Approximate Area Required (acres)	Vicinity Notes
1	Delaware River – Gloucester	G1 or the CCMUA Gloucester City Pump Station	~1.5	A facility would be located either in the vicinity of the G-1 regulator or near the Gloucester City Pump Station. A new pipe would convey wet weather flows from regulators G-4 and G-5 as needed G-1 to this facility. Current brownfield site.

Subsystem		Vicinity of Regulators	Approximate Area Required (acres)	Vicinity Notes
2	Cooper River	C22 – C22A	~1.5	Brownfield (status unknown) private bus yard, Federal Street pump station.
		C27 - Thorndyke	~1.5	Grassed area of Gateway Park
		C17	~1.5	Only required if green control targets can't be met in In the Cooper River sub-system.

Gloucester City

The hydraulically optimal location for satellite CSO controls within Gloucester City is in the vicinity of Gloucester regulator structures G-4 and G-5 as shown on Figure 5-9. This however would require placement of a satellite facility within or adjacent to Gloucester's Proprietor's Park.

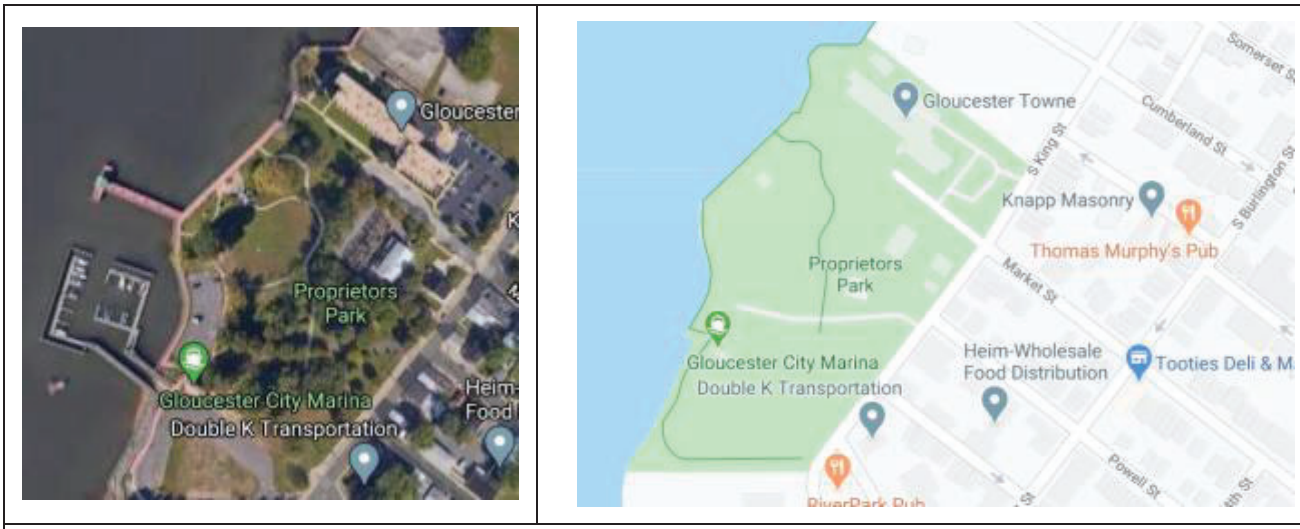


Figure 5-9 – Vicinity of Gloucester City regulators G-4 and G-5 and Adjacent Land Use

To avoid this, an alternative site has been identified in the vicinity of the CCMUA Gloucester City regional pump station and/or around regulator G-1 as shown on Figure 5-10. Consolidation pipes would be needed to convey flow from G-4 and G-5 into the off-site facility.

Figure 5-10 – Gloucester City CSO Control Facility Potential Alternative Site Vicinity

Cooper River – Camden C-22 /22A and C-27 / Thorndyke Regulators

These four regulators discharge to the Cooper River. C-22 and C-22A are adjacent to the Federal Street pump station and the Federal Street bridge over the Cooper River as shown on Figure 5-11.

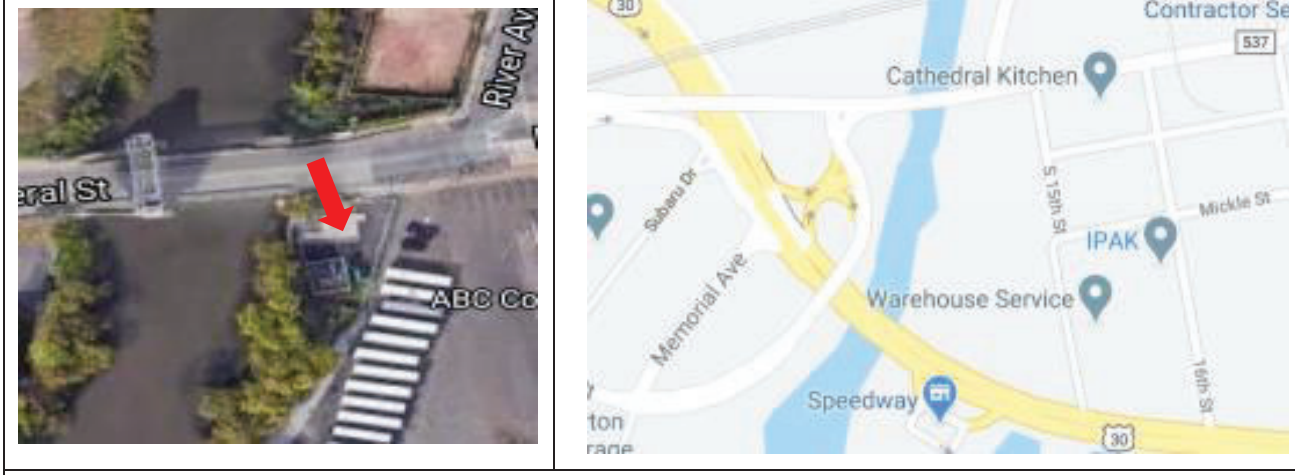
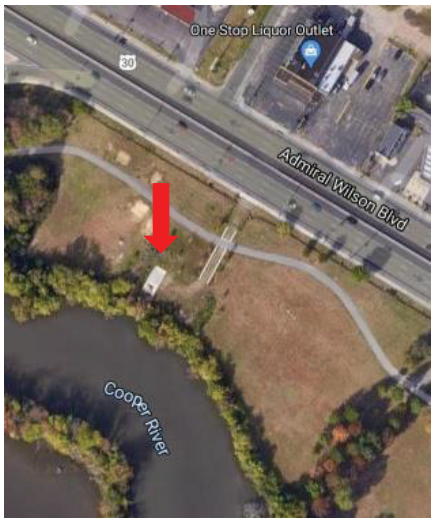


Figure 5-11 – Vicinity of the Camden C-22 / C22-A Outfalls

The outfalls for C-27 and Thorndyke are the most upstream in the Camden combined sewage system. The potential location for a satellite facility, adjacent to the existing Thorndyke Street netting facility is shown on Figure 5-12.



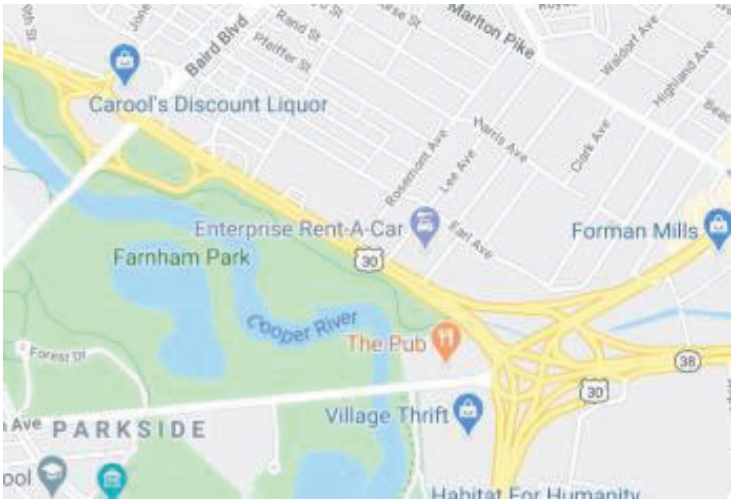


Figure 5-12 – Vicinity of the Camden C-27 and Thorndyke St. Outfalls

Cooper River – Camden C-17 Regulator

If the long term goal of reducing runoff from directly connected impervious in the Cooper River sub-system is not met, an additional satellite treatment facility for the C-17 sewershed will be needed to meet the 85% control objective. The C-17 regulator structure is across the Cooper River and slightly upstream from the C-22 regulator. Should additional controls for C-17 prove to be necessary in the long term; the cost-effectiveness of upsizing and consolidating either the C-22 or the C-17 satellite facilities and conveying the wet weather flows across the river for treatment or storage could be evaluated.

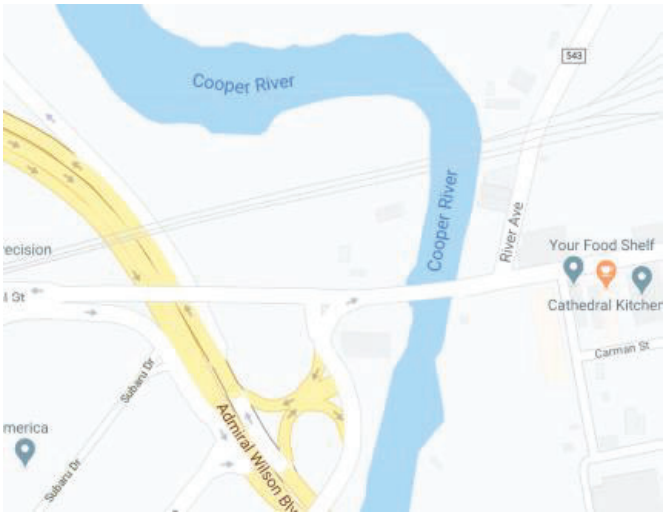


Figure 5-13 – Vicinity of the Camden C-17

5.6 Conclusions

The approved Development and Evaluation of Alternatives Report CCMUA and the Cities of Camden and Gloucester presented a suite of control strategies that would result in the system-wide capture and treatment of 85% of wet weather flows to the combined sewer system during a Typical Year. Through the expansion of CCMUA's WPCF # 1 to 185 MGD, the restoration of the hydraulic capacity of Camden collection system and flow reduction through 10% green infrastructure the capture level is projected to reach 81%and additional controls will be necessary in for the Cooper River, Delaware River back channel, and the Delaware River Gloucester City sub-systems.

The technical options for achieving the required additional controls that were outlined in the DEAR have been refined in this section and for purposes of long term control planning now focus on satellite storage through tanks or treatment through enhanced high rate clarification and disinfection. This SIAR is not making a recommendation between storage and treatment. Capacity requirements and cost estimates are provided and it is assumed that the ultimate choice between storage and treatment is best left to future municipal decision makers based on then current conditions.

6

Section 6.0 Financial & Institutional Capability Assessments

6.1 Affordability Assessments

6.1.1 Purpose and Methodology

This section of the SIAR presents a Financial Capability Analysis (FCA) relating to the development of the CSO Long Term Control Plan (LTCP) required under Paragraph G(8)(a) of the Combined Sewer Management section of a permittee's NJPDES discharge permit. The assessment is based upon the EPA document "Combined Sewer Overflows – Guidance for Financial Capability Assessment and Schedule development," (EPA Guidance Document) published February 1997[6-1], as supplemented by EPA's November 2014 memorandum entitled "Financial Capability Assessment Framework for Municipal Clean Water Act Requirements".[6-2]

This document supports the twofold purposes of the FCA as envisioned in the 1994 CSO Control Policy[6-3] (Policy). First, this FCA is intended to identify the upper limits of what could constitute an affordable future investment strategy as defined by the Policy and related guidance documents under an assumed LTCP implementation schedule; thereby informing the development of CSO, SSO, MS4, TMDL, and other necessary control alternatives. Second, the assessment will support the development of a workable implementation schedule for the LTCP.[6-4]

The Financial Capability assessment is a two phased process. The residential indicator (RI) is the percentage of a permittee's service area median household income (MHI) expended on wastewater (including stormwater) management. The upper limit of affordability for wastewater services within the Cities and CCMUA will be the point where total wastewater management costs for the typical residential user exceed 2.0% of their respective Median Household Incomes (MHI).

The financial capability indicator is an assessment of the permittee's debt burden, socioeconomic conditions, and financial operations. These two measures are subsequently entered into a *financial capability matrix*, suggested by EPA, to determine the level of financial burden placed on residential customers and the permittee by the existing and projected future

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6-1 EPA 832-B-97-004

6-2 November 24, 2014 memorandum from Ken Kopocis, Deputy Assistant Administrator, Office of Water (OW) and Cynthia Giles, Assistant Administrator, Office of Enforcement and Compliance (OECA) to Regional Administrators

6-3 Combined Sewer Overflow Policy Section II-C(8) 59 FR 18694

6-4 "Schedules for implementation of the long-term CSO control plan may be phased based on the relative importance of adverse impacts upon water quality standards and designated uses, and on a permittee's financial capability." (59 FR 18688)

expenditures to operate, maintain, and enhance the wastewater management system. The EPA matrix appears in Table 6-12 of this document.

The projected future expenditures driving the RI and imposing demands upon the financial capability of the Cities and CCMUA will include the implementation of CSO controls, stormwater controls, conveyance / collection system rehabilitation, and other operational, maintenance, and capital improvements to the municipal sewer systems. In effect, the future CSO control expenditures will be net of all other expenditures necessary to maintain the appropriate levels of service required to meet public needs, protect public health and the environment and to maintain regulatory compliance under the Clean Water Act, the New Jersey Water Pollution Control Act and the Safe Drinking Water Act.

These analyses are based on information provided by the Cities, CCMUA and external sources such as the on-line fiscal reports available through the New Jersey Department of Community Affairs.[6-5]

6.1.2 Estimated Current Wastewater Costs per Household [6-6]

The Residential Indicator is an approximation of "affordability" which EPA defines as a households' abilities to pay their total wastewater costs and is derived by dividing the total annual wastewater costs for the typical household within the permittees' service areas by the median household income within the service areas. The Residential Indicator is compared to EPA-defined criteria to determine whether total annual wastewater costs impose a low, mid-range, or high impact on residential users. Table 6.-1 shows U.S. EPA's Residential Indicator criteria, which define a "low" impact as a cost per household (CPH) less than 1.0% median household income (MHI), a "mid-range" impact between 1.0 and 2.0%, and "high" impact as greater than 2.0% of MHI.

Table 6 - 1 – EPA Residential Indicator

Residential Indicator	Cost per Household
Low Burden	Less than 1.0 percent of MHI
Mid-Range Burden	1.0-2.0 percent of MHI
High Burden	Greater than 2.0 percent of MHI

The estimated typical annual cost for wastewater services for a typical single family residential wastewater user account in 2019 for Camden was $581 annually. The cost per residential account in Gloucester was $724 and $520 in the CCMUA service area. The derivation of these estimates is shown on Table 6.-2.

For these analyses, the annual costs for a single family residential wastewater accounts are used as proxy for households. User charge rate information combined with an estimate of typical potable water consumption provides an empirically based uniform annual cost estimate.

6-5 https://www.nj.gov/dca/divisions/dlgs/resources/fiscal_rpts.shtml

6-6 Estimates are for 2019 based on latest published rate information from the permittees.

Table 6 - 2 – Calculated Costs per Typical Residential Wastewater Account in 2019

Metric	Permittee		
	Camden	Gloucester	CCMUA
Wastewater Costs per Typical Residential User Account			
Municipal			
Service Charge	$71.2[a]	$372	$174[c]
Collection System	$158[b]		
Subtotal Municipal	$229		
CCMUA	$219	$352	$352
Total	449	$724	$526
Median Household Income	$26,105[d]	$51,152[d]	$69,283[c]
Current Residential Indicator	1.7%	1.4%	0.76%

a Camden service charge of $17.80 per quarter x 4

b Camden collection system charge of $2.20 per 100 cubic feet of water consumption and an estimated monthly water consumption of 6.02 CCF.

c Average for the 37 CCMUA municipalities weighted by the number of Census households. Municipal costs were calculated based on total costs per household as presented in "Assessing the Affordability of Water and Sewer Utility Costs in New Jersey" by Daniel J. Van Abs (Rutgers University) and Tim Evans (NJ Future) published 2018.

e Source: US Census - American Community Survey (2013 - 2017)

The residential indicator in Camden was at 1.7% of median household income, reflecting the estimated $449 in annual costs and the median household income of $26,105. This places the current wastewater cost burden at the upper end of the mid-range category. While the estimated cost per typical residential user in Gloucester was somewhat higher at $724, Gloucester's median household income of $51,152 resulted in a residential indicator of 1.45%. This is in the middle of EPA's "medium burden" category.

Calculating the typical cost per residential user throughout the CCMUA service area is a bit less direct. CCMUA has thirty-seven customer municipalities ranging in population from 75,500 (Camden) to 4 (Pine Valley and Tavistock Boroughs), number of households ranging from 26,356 (Camden) to 2 each for Pine Valley and Tavistock, and median household incomes ranging from $200,000 (Pine Valley and Tavistock) down to $26,105 (Camden). Annual municipal collection system costs per residential user ranged from $400 (Chesilhurst Borough) down to zero. It should be noted that the municipalities with "zero" collection system user charges recover their system costs through their property tax bases. A detailed analysis of the collection sewer system related portion of the property tax levies in these municipalities is beyond the scope of this SIAR analysis.

In Camden, 37.4% of the population was living below the poverty line. The total Census households are broken out by income brackets on Table 6.-3 below, along with the respective current Residential Indicators by income bracket. The RI for each bracket was calculated from the mid-point income within the bracket. As may be noted, the current RI for more than 15,000 households exceed 2.0% and around twelve thousand households have wastewater costs exceeding 3.0%.

Table 6-3 – Analysis of the Current Residential Indicator for Camden

Income Bracket	Households		Bracket Average Income	Bracket RI at Typical Cost per Household
	Number	Cumulative		
Less than $10,000	5,380	5,380	$5,000	11.64%
$10,000 to $14,999	2,538	7,918	$12,500	4.66%
$15,000 to $24,999	4,329	12,247	$20,000	2.91%
$25,000 to $34,999	2,882	15,129	$30,000	1.94%
$35,000 to $49,999	3,368	18,497	$42,500	1.37%
$50,000 to $74,999	3,260	21,757	$62,500	0.93%
$75,000 to $99,999	1,633	23,390	$87,500	0.67%
$100,000 to $149,999	1,217	24,607	$125,000	0.47%
$150,000 to $199,999	380	24,987	$175,000	0.33%
$200,000 or more	208	25,195	$200,000	0.29%
Total	25,195			

In Gloucester, 11.2 percent of the population was living below the poverty line. The total Census households are broken out by income brackets on Table 6.-4 for Gloucester. In Gloucester, around 1,500 households had residential indicators exceeding 2.4% of household income.

Table 6 - 4 – Analysis of the Current Residential Indicator for Gloucester

Income Bracket	Households		Bracket Average Income	Bracket RI at Typical Cost per Household
	Number	Cumulative		
Less than $10,000	165	165	$5,000	14.48%
$10,000 to $14,999	281	446	$12,500	5.79%
$15,000 to $24,999	470	916	$20,000	3.62%
$25,000 to $34,999	554	1,470	$30,000	2.41%
$35,000 to $49,999	497	1,967	$42,500	1.70%
$50,000 to $74,999	815	2,782	$62,500	1.16%
$75,000 to $99,999	575	3,357	$87,500	0.83%
$100,000 to $149,999	500	3,857	$125,000	0.58%
$150,000 to $199,999	175	4,032	$175,000	0.41%
$200,000 or more	43	4,075	$200,000	0.36%
Total	4,075			

6.1.3 Affordability Impacts of CSO Control Alternatives

The estimated capital, incremental debt service and incremental operation and maintenance (O&M) costs of achieving the 85% control target were developed in Section 5 of this SIAR. CCMUA has developed dynamic financial planning and affordability models Camden, Gloucester and CCMUA. These have been used to project the annual costs per typical single family wastewater user upon full implementation of the CSO controls. The projected impacts are shown on Tables 6-5 through 6-7 for Camden Gloucester and CCMUA respectively.

Included in the tables are the residential indicators for 2042 based on an assumed 20 year implementation schedule. The use of a 20 year implementation schedule is intended only to provide a uniform initial basis for analysis; as will be seen from the model outputs a 20 year

implementation schedule would result in unacceptable affordability impacts. Also included is set of hypothetical residential indicators if the CSO controls could be implemented instantaneously this year. This exercise is intended to remove the impacts of inflation.

Table 6 - 5 – Affordability Impacts of the Evaluated CSO Controls: Camden

Metric	≥ 85% Capture	
	Low	High
Capital Costs (millions in 2019 $)		
85% Typical Year Wet Weather Capture Program	$101.9	$129.6
Incremental Costs to Control Cooper River to Zero Overflows per Year	$272.1	
Potential Total Capital Costs (85% Capture Program + Cooper River Zero OPY less 85% capture Cooper River satellite facilities	$374.0	401.7
Projected Residential Indicator in 2042 (Twenty-Year Implementation with inflation)		
For 85% Capture Program	4.8	5.0
Projected Residential Indicator If CSO Control Costs Were Implemented All at Once This Year (to remove inflation impacts)		
For 85% Capture Program	2.5	2.6
With Cooper River Zero Overflow per Year Controls	4.8	5.0
With Cooper River Zero Overflow per Year Controls ***(For documentation of financial infeasibility only – Elimination of Lower Cooper River overflows is not included in the proposed long term control program.)***	8.4	8.1

As noted in Section 5.3.3 and as demonstrated in Section 5.4.2 the elimination of all overflows to the lower Cooper River is financially not achievable and is not included in the proposed long term control program defined in this SIAR.

Table 6 - 6 – Affordability Impacts of the Evaluated CSO Controls: Gloucester City

Metric	≥ 85% Capture	
	Low	High
Capital Costs (millions in 2019 $)	$27.1	$44.8
Projected Residential Indicator in 2042 (Twenty-Year Implementation with inflation)	4.0%	4.7%
Projected Residential Indicator If CSO Control Costs Were Implemented All at Once This Year (to remove inflation impacts)	3.0%	3.7%

Table 6 - 7 – Affordability Impacts of the Evaluated CSO Controls: CCMUA

Metric	≥ 85% Capture
	Low
Capital Costs (millions in 2019 $)	$79.9
Projected Residential Indicator in 2042 (Twenty-Year Implementation with inflation)	0.80%
Projected Residential Indicator If CSO Control Costs Were Implemented All at Once This Year (to remove inflation impacts)	0.75%

Details about the nature and cost breakouts for the control strategies included in these tables are provided in Section 5.3.2 of this document.

Key observations about the data in these table include:

- Owing to its number of outfalls on three receiving streams, the projected least capital cost controls for Camden's CSOs are at $102 million are roughly four times those estimated for Gloucester and 27% more than CCMUA.
- Camden's least cost controls would push the Camden residential indicator to at least 2.5% even if inflation is excluded.
- Gloucester's controls would likewise result in Gloucester's residential indicator being at least 3.0% with or without inflation.

Due to its size, higher median household income and CSO control obligations being limited to the C-32 outfall and the potential further expansion of its WPCF # 1 , the projected RI for the CCMUA service area would appear to remain at the upper limit of what USEPA considers as a low impact. However, due to the income variations between the CCMUA customer municipalities, the use of a regionalized residential indicator is very misleading.

6.1.4 Methodology and Underlying Assumptions

Methodology

CCMUA has developed individual detailed dynamic financial models for each of Camden, Gloucester and CCMUA. These models project current system costs through any reasonable CSO control program implementation period (e.g. 20 through 40 years) based on assumed rates of inflation and any available information as to future system changes or planned capital improvements outside of the CSO controls covered in this SIAR.

Annual revenue requirements for the current municipal systems are calculated by each model based on the projected annual costs along with policy options such as debt service coverage targets, the percentages of capital improvements to be funded by debt or available funds (e.g. from renewal and replacement funds) and the use of retained earnings. The models "start"

with the adopted 2019 budgets and 2019 user rates. User rates are adjusted in the model annually based upon changes in revenue requirements. For example, if a hypothetical borough's total wastewater budget is $10 million in 2020 and typical residential costs are $300 annually and the projected budget in 2021 is $11 million, the model would project the cost per residential user to be $330.

Future annual capital costs for CSO controls along with any other new capital programs that have been identified are overlaid to the existing costs in the models. Based upon the financing policy assumptions used, incremental debt service is added one year after a financed capital expenditure. For model simplification purposes, the models "assume" that debt is issued annually during the course of the implementation phase of the capital program(s). Incremental operation and maintenance (O&M) costs are added as applicable in the years following the completion of capital expenditures.

The models can be run with inflation on or off. Running future scenarios without inflation provides a simpler view of the impacts of varying program scopes and schedules. This approach has the advantage of eliminating the need to estimate future rates of inflation and income growth. However, omitting inflation can understate the affordability impact of long-term programs since income growth has not kept pace with and is not projected to keep pace with water utility capital and O&M cost inflation. For example, for the period of 1999 through 2013, the national costs for typical household wastewater services increased at a rate of 4.8%.[6-7] The national Consumer Price Index increased at an annual rate of around 2.4%[6-8] for the period while the US median household income increased from around $42,000 to $52,250 at an annual rate of 1.6%.[6-9]

On the other hand, running the models with inflation turned on provides an arguably more realistic vision of the future albeit based on some conjecture as to future economic variables such as inflation and interest rates. Including assumptions about inflation rates based upon look-backs at historical rates for time periods approximating the CSO control implementation schedule can provide a reasonable approach to estimating future affordability.

Underlying Assumptions

Key assumptions used in the above analysis are summarized on Table 6 - 8. An annotated complete list of all data and assumptions used in the affordability model is provided as Appendix B to this memorandum.

Table 6- 8 – Affordability Model Key Inputs and Assumptions

Item	Value	Notes
Finance		
Bond Term		
Market Interest Rate	6.0%	NJEIT Financing – Smart Growth program offers 75% funding at 0% interest and 25% funding at market rates for 20 years for CSO control projects.
NJDEP	0.0%	
Blended Interest Rate	1.5%	
Target Coverage	125%	

6-7 NACWA 2013 Cost of Clean Water Index

6-8 US Bureau of Labor Statistics

6-9 US Census

Table 6- 8 – Affordability Model Key Inputs and Assumptions

Item	Value	Notes
O&M as % of Capital Cost	2.0%	
Economic		
LTCP O&M Inflation	3.9%	Based on national rates of wastewater system O&M costs in 2017 NACWA study.
LTCP Construction Inflation	3.7%	Based on 1984 – 2015 ENR Construction Cost Index for New York City (80%) and Philadelphia (20%).
Estimate Base Year		
MHI Data Year	2015	
Typical Household Monthly Consumption	4,500	Typical urban water consumption.

6.2 Financial Capability Assessment

The second part of the financial capability assessment is intended to evaluate the financial capabilities of the permittees to finance the required CSO controls. The process is similar to that used by the bond rating agencies and includes six items that fall into three general categories of debt, socioeconomic, and financial management indicators. The six items are:

1. Bond rating
2. Total net debt as a percentage of full market real estate value
3. Unemployment rate
4. Median household income
5. Property tax revenues as a percentage of full market property value
6. Property tax revenue collection rate

Items 2, 5 and 6 are applicable to municipalities that have taxing authority and that can fund capital expenditures directly by or backed up through property taxation. Municipal authorities such as CCMUA have no taxing authority and these three property tax related metrics are not applicable.

Each item is given a score of three, two, or one, corresponding to ratings of strong, mid-range, or weak, according to EPA-suggested standards. The overall financial capability indicator is then derived by taking a simple average of the ratings. This value is then entered into the financial capability matrix to be compared with the residential indicator for an overall capability assessment). Table 6-9 contains the six criteria and the ratings that categorize the permittee as strong, mid-range, or weak in each category. A discussion of each item follows.

Table 6 - 9 – Permittee Financial Capability Indicator Benchmarks

Indicator	Strong (3)	Mid-Range (2)	Weak (1)
Bond Rating	AAA-A (S&P) or Aaa-A (Moody's)	BBB (S&P) or Baa (Moody's)	BB-D (S&P) of Ba-C (Moody's)
Overall Net Debt as a Percent of Full Market Property Value	Below 2%	2% to 5%	Above 5%

Indicator	Strong (3)	Mid-Range (2)	Weak (1)
Unemployment Rate	More than 1% below the National Average	+/- 1% of the National Average	More than 1% above the National Average
Median Household Income	More than 25% above National MHI	+/- 25% above National MHI	More than 25% below National MHI
Property Tax as a Percent of Full Market Property Value	Below 2%	2% to 4%	Above 4%
Property Tax Collection Rate	Above 98%	94% to 98%	Below 94%

6.2.1 Bond Rating – Indicator 1

The bond ratings of the three permittees are as follows:

- City of Camden – Standard & Poor's BBB+ which is considered to be mid-range
- Gloucester City – Standard & Poor's AA- which is considered to be strong.
- CCMUA – Moody's Aa2 – which is considered to be strong.

6.2.2 Overall Direct Net Debt as a Percent of Full Market Value – Indicator 2

Debt Burden is measured by overall net debt as a percent of full market property value, which evaluates the ability of local government to issue additional debt. Overall Direct Net Debt is defined as current total liability to be repaid by property taxes divided by the municipality's full market property value. This indicator is relevant as a metric for municipalities issuing general obligation bonds which are substantially repaid through property tax revenues.

Overall direct net debt for Camden for 2019 was $47.1 million.[6-10] The percent of total net debt to the three-year average property valuation of $1.57 billion[10] was 3.03% places Camden in the midrange range on this measure.

Overall direct net debt for Gloucester for 2019 was $13.9 million.[6-11] The percent of total net debt to the three-year average property valuation of $543 million[10] was 2.75% places Camden in the midrange range on this measure.

This metric is not applicable to CCMUA.

6.2.3 Unemployment Rate – Indicator 3

The unemployment rate is used as an assessment of the economic well-being of residential users in the service area. The dataset for the municipal unemployment rates is taken from the US Census American Community Survey 2013-2017 estimates. The American Community Survey gathers data over a 5-year period.[6-12] The prevailing unemployment rate provided by the ACS for that timeframe more closely represents the actual strength of the economy in a municipality.

[6-10] Source: Camden's 2019 NJDCA User Friendly Budget Sheet USB-10

[6-11] Source: Gloucester's 2019 NJDCA User Friendly Budget Sheet USB-10

The unemployment rate for Camden at 14.0% compared to the national rate of 6.6% for the same time period, resulting in a weak rating. It may be noted that the "weak" rating is triggered in the EPA table when the local unemployment rate is one percent above the national average. Gloucester's unemployment rate was 6.7%, resulting in a mid-range score. The Camden County county-wide unemployment rate of 7.9% can be used as a proxy for CCMUA. This unemployment rate was slightly more than one percent above the national average of 6.6% for the same period, resulting in a weak score.

6.2.4 Median Household Income – Indicator 4

Median Household Income (MHI) divides the relevant incomes of a population into two parts so that half of the incomes are below the median and half of the incomes are above the median. Unlike average income, median income is not skewed by extremely high or extremely low incomes in the dataset. The median household incomes for Camden, Gloucester and the CCMUA service area are shown on Table 6-10.

Table 6-10 – Median Household Income

Permittee	Median Household Income[6-12]	United States	% Difference from US	Categorization
Camden	$26,105	$57,650	-55%	Weak
Gloucester	$51,152		-11%	Mid-Range
CCMUA	$69,283		+20%	Mid-Range

6.2.5 Tax Revenues as a % of Full Market Value – Indicator 5

The three year average property valuations in Camden was $1.7 billion.[6-13] A tax of $28.1 million is levied on the assessed valuation. Therefore, the property tax levy is approximately 1.6%. This value is considered strong in the USEPA metrics.

The three year average property valuations in Gloucester was $543 million.[6-14] A tax of $22 million is levied on the assessed valuation. Therefore, the property tax levy is approximately 4.0%. This value is considered weak in the USEPA metrics.

This metric is not applicable to CCMUA

6.2.6 Property Tax Collection Rate

The EPA criterion for a strong rating in this category is a collection rate of more than 98%. Camden's rate is calculated to be 88.4%, which places it in the weak range for real estate tax collections. Gloucester's collection rate is calculated to be 96.7% which is considered mid-range.

This metric is not applicable to CCMUA.

6-12 Source: US Census – National Community Survey estimates for 2013 - 2017

6-13 Source: 2019 User Friendly Budget – sheet USB 10

6-14 Source: 2019 User Friendly Budget – sheet USB 10

6.2.7 Financial Indicator Score

As shown on Table 6 -11, the overall score for the financial indicators is 2.0, yielding an EPA Qualitative Score of midrange. This calculation is based on the use of all six of the indicators that are applicable to Camden, Gloucester and CCMUA.

Table 6 - 11 – Permittee Financial Capability Indicator Benchmarks

Indicator	Camden		Gloucester		CCMUA	
	Rating	*Numeric Score*	*Rating*	*Numeric Score*	*Rating*	*Numeric Score*
Bond Rating	Mid-Range	2	Strong	3	Strong	3
Overall Net Debt as a Percent of Full Market Property Value	Mid-Range	2	Mid-Range	2	NA	
Unemployment Rate	Weak	1	Mid-Range	2	Weak	1
Median Household Income	Weak	1	Mid-Range	2	Mid-Range	2
Property Tax as a Percent of Full Market Property Value	Strong	3	Mid-Range	2	NA	
Property Tax Collection Rate	Weak	1	Mid-Range	2	NA	
	Total	10		13		
Overall Indicator Score: (numeric score / number of applicable indicators)		1.67		2.17		6.0
EPA Qualitative Score	Mid-Range		Mid-Range		Mid-Range	

6.3 Financial Capability Matrix

In this section the results of the step 1 affordability analysis which goes towards the residential ratepayers' ability to afford CSO controls within the context of other capital investment needs is integrated with the step 2 (Financial Capability) analysis which goes towards the permittee's ability to finance the implementation of the LTCP.

It was established previously that the least present worth cost CSO control options described in this SIAR would result in the following projected residential indicators in 2042 after a twenty-year implementation period:

- Camden – The residential indicator would be 5.4% of MHI for the least cost approach to controlling wet weather overflows from its Delaware River, Cooper River and Newton Creek overflow structures;
- Gloucester - The residential indicator would be 3.3% of MHI for the least cost approach to control its discharges to the Delaware River and Newton Creek; and
- CCMUA – The residential indicator would be 1.0% after implementing controls for its wet weather discharges to the back channel of the Delaware River from its C-32 outfall.

The overall financial capability ratings for Camden, Gloucester and CCMUA are all considered to be midrange under the EPA framework. The intersection of these two ratings on the EPA financial capability matrix places Camden and Gloucester in the category of high

financial burden and CCMUA would be in the mid-range, as shown on Tables 6-12 through 6-14 respectively.

Table 6-12 – The Financial Capability Matrix - (Shaded areas Indicate Camden's Ratings)

Permittee Financial Capability Indicators Score	Residential Indicator		
(Socioeconomic, Debt and Financial Indicators)	Low (Below 1.0%)	Mid-Range (Between 1.0 and 2.0%)	High (Above 2.0%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	**High Burden**
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

Table 6-13 – The Financial Capability Matrix - (Shaded areas Indicate Gloucester's Ratings)

Permittee Financial Capability Indicators Score	Residential Indicator		
(Socioeconomic, Debt and Financial Indicators)	Low (Below 1.0%)	Mid-Range (Between 1.0 and 2.0%)	High (Above 2.0%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	**High Burden**
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

Table 6-14 – The Financial Capability Matrix - (Shaded areas Indicate CCMUA's Ratings)

Permittee Financial Capability Indicators Score	Residential Indicator		
(Socioeconomic, Debt and Financial Indicators)	Low (Below 1.0%)	**Mid-Range (Between 1.0 and 2.0%)**	High (Above 2.0%)
Weak (Below 1.5)	Medium Burden	High Burden	High Burden
Mid-Range (Between 1.5 and 2.5)	Low Burden	Medium Burden	High Burden
Strong (Above 2.5)	Low Burden	Low Burden	Medium Burden

6.4 Additional Economic Factors

Measuring the household burden imposed by wastewater costs as a percentage of the median household income may underestimate the financial burden of the projected wastewater costs per household. As was noted in an analysis of the impacts of CSO controls in the Boston region:

> *"The greater are the costs of other necessities as a share of MHI, the greater will be the economic burden associated with sewer charges equal to a given percent of MHI."* [6-15]

Therefore, in addition to following EPA guidelines for completion of the financial capability assessment matric, a discussion of socioeconomic conditions in the City of Camden and Gloucester City is essential to the consideration of scheduling and compliance levels with CSO guidelines.

6.4.1 Cost of Living Index

City of Camden

The overall cost of living within the City of Camden has been calculated at 94% of the US national average.[6-16] Statewide, New Jersey's cost of living is 123% of the national average. The apparent lower cost of living in Camden is driven by the depressed housing market in the City which results in a housing index of 59% of the national average. Other components in the cost of living index are higher than their respective national averages:

- General goods and services – 105%
- Groceries – 117%
- Health care – 103%
- Transportation – 115%
- Utilities – 108%.

Camden's cost of living must be considered in the context of its median household income which is only 45% of the national MHI. Allowing for the 4% lower cost of living, the effective MHI in Camden would still only be about 48% of the national median, or conversely the effective cost of living in Camden is more than twice the national average.[6-17]

Gloucester City

The overall cost of living within Gloucester City has been calculated at 100% of the US national average.[6-15] Statewide, New Jersey's cost of living is 123% of the national average. The cost of living Gloucester being at the national average and 23% less than the New Jersey average is also driven by a housing index of 80% of the national average. As is the case for Camden, other components in the cost of living index are higher than their respective national averages:

- General goods and services – 105%
- Groceries – 117%
- Health care – 103%
- Transportation – 115%
- Utilities – 108%.

[6-15] Assessment of the Economic Impact of Additional Combined Sewer Overflow Controls in the Massachusetts Water Resource Authority Service Area (page 13) prepared by Robert N. Stavins, Genia Long, and Judson Jaffee. Analysis Group Incorporated, August 2004.

[6-16] Source: Areavibes.com

[6-17] Calculated as follows: cost of living (100%/94%) X Camden MHI @ 45% = 47.9%; or cost of living index of 100% / 47.9% = 2.08.

Gloucester's cost of living also must be considered in the context of its median household income which is 11% lower than the national MHI. This suggests an effective cost of living in Gloucester that is 12% higher than the national average.

6.4.2 Housing Costs

Based upon a 2017 study[6-18] by the National Low Income Housing Coalition, the fair market value of a two bedroom apartment in both Camden County and the Philadelphia / Camden/Wilmington MSA was $1,211 per month or $14, 532 annually. This works out to 58% of the Camden and 28% of the Gloucester median household incomes.

The same study defines affordable monthly apartment rents at around $662 per month. This figure represents 30% of the annual wages at the average hourly wages for renters (around $27,400). At $662 per month, annual rents equal about 32% of the Camden MHI and around 15% of the MHI in Gloucester.

6.4.3 Local Tax Burdens

City of Camden

The property tax burdens within Camden and Gloucester are substantial. The average residential tax for 2019 in Camden was $_____]. This includes Camden's taxes of $_____ along with Camden County and school district taxes.[6-19]

Gloucester City

The average residential tax for 2019 in Gloucester was $4,665 for a property with the average assessed valuation of 108,000. This includes Gloucester's taxes of $2,397 along with Camden County and school district taxes.[20] This compares with a national average local property tax levy of $3,500 for a similarly priced home.

6.4.4 Poverty Rate[6-21]

Per the US Census' 2013-2017 American Community Survey the poverty rates in Camden and Gloucester were 37.4 and 11.2 respectively. These compares to the national average poverty rate of 14.6%.

6.4.5 Income Growth Trends

The MHI growth rates between 2000 and 2015 were about 0.69% annually for Camden and 1.95% annually for Gloucester. This growth rate compares with the growth rates for New Jersey (2.20%) and for the U.S. (2.14%).

6-18 Out of Reach 2017 – The High Cost of Housing National Low Income Housing Coalition.

6-19 Source: 2017 NJDCA User Friendly Budget sheet UFB-1

6-20 Source: 2017 NJDCA User Friendly Budget sheet UFB-1

6-21 Source: US Census – National Community Survey 2013 - 2017

6.4.6 NJDCA Municipal Revitalization Index (MRI)

The Municipal Distress Index[6-22] measures the social, economic, physical and financial conditions of the 565 municipalities within New Jersey. The MRI is compiled by the NJ Department of Community Affairs and is used in the distribution of needs based funding. Six primary along with four secondary criteria are used:

Primary Criteria

- Children on TANF (Temporary Assistance for Needy Families) per 1,000 persons
- Unemployment Rate
- Poverty Rate
- High school diploma or higher
- Median Household Income
- Percent of households receiving SNAP (food stamps)

Secondary Criteria

- Ten year rate of change in population
- Non-seasonal housing vacancy rate
- Equalized three year effective property tax rate
- Equalized property valuation per capita

The 2017 state-wide MRI rankings for the thirty-seven municipalities within Camden County are shown on Table 6-15. The City of Camden has a ranking of 1 as the most distressed municipality. Gloucester City is ranked 51 state-wide, placing it in the top 10th percentile ranking. A synthesized ranking for all 37 CCMUA municipalities was calculated using the numbers of households per municipality as a weighting factor. The calculated MRI distress score is 40.6 which would give it a ranking of about 79th, or within the top 15th percentile.

Table 6-15 – Municipal Renewal Index for the CCMUA Customer Municipalities

Municipality		2017 Municipal Revitalization Index			Population	Households
		MRI Score	MRI Distress Score	MRI Rank		
1	**Camden City**	**-26.05**	**100.0**	**1**	**75,550**	**25,195**
2	Woodlynne Borough	-14.69	68.4	15	2,950	805
3	Lindenwold Borough	-8.96	52.4	32	17,418	7,096
4	Clemonton Borough	-7.70	49.0	42	4,933	1,898
5	Lawnside Borough	-7.21	47.6	46	2,917	1,148
6	Chesilhurst Borough	-6.64	46.0	49	1,647	584
7	**Gloucester City**	**-6.42**	**45.4**	**51**	**11,333**	**4,075**

[6-22] Measuring Distress in New Jersey: the 2017 Municipal Revitalization Index Office of Policy and Regulatory Affairs, New Jersey Department of Community Affairs.

Municipality		2017 Municipal Revitalization Index			Population	Households
		MRI Score	MRI Distress Score	MRI Rank		
8	Pine Hill Borough	-6.21	44.8	55	10,517	5,232
9	Brooklawn Borough	-6.14	44.6	57	2,006	713
10	Pennsauken Township	-5.11	41.7	71	35,863	12,163
11	Audubon Park Borough	-5.02	41.5	76	1,023	479
12	Bellmawr Borough	-4.54	40.2	83	11,583	4,357
13	Hi-Nella Borough	-4.54	40.1	84	861	366
14	Berlin Township	-4.22	39.3	94	5,453	2,058
15	Mount Ephraim Borough	-3.36	36.9	116	4,641	1,779
16	Magnolia Borough	-3.14	36.3	118	4,310	1,643
17	Somerdale Borough	-3.06	36.0	121	5,417	2,164
18	Runnemede Borough	-3.06	36.0	122	8,391	3,191
19	Merchantville Borough	-2.71	35.1	129	3,769	1,421
20	Waterford Township	-1.69	32.2	165	10,749	3,521
21	Barrington Borough	-1.47	31.6	172	6,811	2,770
22	Laurel Springs Borough	-1.34	31.2	177	1,917	707
23	Stratford Borough	-1.31	31.2	179	7,019	2,576
24	Winslow Township	-0.90	30.0	192	39,317	13,645
25	Oaklyn Borough	-0.88	30.0	193	4,009	1,751
26	Gloucester Township	-0.83	29.8	195	64,034	23,422
27	Berlin Borough	-0.58	29.1	206	7,612	2,750
28	Collingswood Borough	-0.54	29.0	210	13,969	6,023
29	Gibbsborro Borough	0.55	26.0	247	2,183	774
30	Audubon Borough	0.69	25.6	255	8,736	3,500
31	Vorhees Township	1.21	24.2	286	29,386	10,929
32	Cherry Hill Township	2.06	21.8	341	71,204	26,356
33	Haddon Township	2.25	21.3	350	14,612	5,820
34	Haddon Heights Borough	2.65	20.1	373	7,530	2,921
35	Pine Valley Borough	4.51	15.0	472	4	2
36	Haddonfield Borough	5.72	11.6	519	11,428	4,195
37	Tavistock Borough	9.89	0.0	565	4	2
CCMUA Service Area-Wide Weighted by # of Households		**(4.71)**	**40.6**	**79**	**511,106**	**188,031**

6.5 Institutional Context

6.5.1 System Ownership, Operation and Maintenance Responsibilities

The Cities of Camden and Gloucester own their respective municipal sewerage consisting of primarily combined collection systems and sanitary collection systems and stormwater collection and conveyance systems in limited areas of each municipality. The combined sewer portions of their collection systems are operated under permits NJ0108812 (Camden) and NJ0108847 (Gloucester). The Camden County Municipal Utilities Authority (CCMUA) provides wastewater conveyance (via the Baldwins Run pump station and force main) and treatment services for Camden and Gloucester along with thirty-five suburban municipalities within Gloucester County. CCMUA's one CSO associated with the C-32 regulator structure upstream of the Baldwin's Run pump station operates under permit number NJ0026182. The two combined sewered municipalities are responsible for the operation and maintenance of their respective systems.

6.5.2 Legal Framework

The Camden and Gloucester combined sewer systems are owned and operated by the cities pursuant to Title 40A of New Jersey Statutes (Municipalities and Counties). New Jersey municipalities are authorized and empowered to:

- "…acquire, construct, improve, extend, enlarge or reconstruct and finance sewerage facilities and to operate, manage and control all or part of these facilities and all properties relating thereto…"
- "To issue bonds of the local unit or units to pay all or part of the costs of the purchase, construction, improvement, extension, enlargement or reconstruction of sewerage facilities";
- "To make and enter into all contracts and agreements necessary or incidental to the performance…";
- "To fix and collect rates, fees, rents and other charges…"
- "To prevent toxic pollutants from entering the sewerage system.";
- "To exercise any other powers necessary or incidental to the effectuation of the general purpose of N.J.S.40A:26A-1 et seq."[6-23]

The financial management of the cities' combined sewer systems are regulated under Chapter 4 of Title 40A. Municipalities are required to establish public utility funds to isolate sewer system costs and revenues from the municipal general funds:

> "All moneys derived from the operation of publicly owned or operated utility or enterprise and any other moneys applicable to its support, shall be segregated by the local unit and kept in a separate fund which shall be known as "utility fund" and shall bear a further designation identifying the utility or enterprise and, except as provided

[6-23] N.J.S.40A:26A-1 et seq. Municipal and County Sewerage Act.

> in section 40A:4-35, shall be applied only to the payment of the operating and upkeep costs, and the interest and debt redemption charges upon the indebtedness incurred for the creation of such utility or enterprise."[6-24]

The annual budgets for municipal sewerage systems are controlled through the Local Budget Law, codified at N.J.A.40A:4-1 et seq. Annual operating, debt service, revenue and five-year capital improvement budgets are developed using forms and excel templates specified by the New Jersey Department of Community Affairs. The draft budgets are reviewed and approved by the Department prior to final adaption of the budget by the municipalities prior to the start of the fiscal year.

CCMUA owns and operates its regional conveyance interceptor system and the Water Pollution Control Facility # 1 under the New Jersey Municipal and County Utilities Authorities Law.[6-25] Municipal Utility Authorities are empowered to provide water, wastewater, solid waste and hydroelectric power generation and distribution services in a defined service area (district). These services may be provided directly to end-user properties (retail services) or indirectly through service contracts with the municipalities.

CCMUA provides wholesale wastewater conveyance and treatment to Camden, Gloucester and the other municipalities within its service area under the terms of the Service Agreement of December 1986 with its participant municipalities. Under the terms of the Service Agreement the participant municipalities are individually responsible for the operation, maintenance, expansion and replacement of their local collection systems.[6-26] However, CCMUA has the option at its sole discretion but not the obligation to address inflow and infiltration on a regional basis where cost-effective.[6-27] Taken together, these provisions appear to preclude CCMUA from assuming the costs of combined sewer control in Camden or Gloucester beyond those relating to facilities that may provide incidental or equivalent reductions in inflow and infiltration.

Municipal utility authorities have broad powers to acquire, build, own, be the lessor or lessee, operate and maintain wastewater and other public works systems.[8-28] They can finance capital improvements through revenue bonds. With the exception of retail services provided outside of their geographic districts, municipal authorities can set wholesale and retail rates (as applicable) without review by the New Jersey Board of Public Utility Commissioners. The annual budget process for municipal utility authorities is proscribed in the Local Authorities Fiscal Control Law[6-29] and closely parallels that used by municipal governments under the Local Budget Law.

6-24 N.J.S.40A:4-62

6-25 N.J.S.40:14B-1 et seq.

6-26 Section 502 – Operation and Maintenance of the Local Sewerage System

6-27 Section 503 – Authority's Option to Correct Infiltration and Inflow.

6-28 N.J.S.40:14B-20 (Powers)

6-29 N.J.S.40A:5A-1 et seq.

6.6 Potential Impacts of the COVID-19 Pandemic on Affordability

The projections and conclusions concerning the affordability of the CSO control program proposed in this SIAR by CCMUA, the City of Camden and Gloucester City and their respective financial capabilities to finance the CSO control program are premised on the baseline financial conditions of the three permittees as well as the economic conditions in New Jersey and the United States generally at the time that work on this SIAR commenced. While the impacts of the COVID-19 pandemic on the long-term affordability of the CSO LTCP are obviously still unknown, it is reasonable to expect that there will be potentially significant impacts. There are several dimensions to these potential impacts, including reduced utility revenues and household incomes.

6.6.1 Potential Wastewater Utility Revenue Impacts

This Financial Capability Assessment cannot reflect the currently unknowable impacts on wastewater utility revenues stemming from the national economic upheaval resulting from the COVID-19 pandemic. It is however extremely likely that CCMUA, the two Cities and municipal wastewater utilities in general across the United States will face significant and potentially permanent declines in revenues from households unable to pay their water and sewer bills and the sudden decline in industrial and commercial demands for potable water and wastewater treatment.

On March 20, 2020 the National Association of Clean Water Agencies (NACWA) issued a press release stating that:

> **"NACWA conservatively estimates the impact to clean water utilities nationwide of lost revenues due to coronavirus at $12.5 Billion.** This is a low-end estimate, assuming an average loss of revenue of 20% which is well within the range of what individual utilities are already projecting. Some utilities are anticipating closer to a 30% or 40% loss in revenue. This estimate is based on the substantial historical utility financial data NACWA has on file through its Financial Survey and recent reports from NACWA members on the decrease in usage they are observing in their systems over the last few weeks."[6-30]

The impact of a 20% to 40% revenue loss, along with increased costs that have been and will continue to be experienced by water and wastewater utilities such as overtime and the writing off of customer accounts receivable could have a profound impact on the affordability of the proposed CSO controls and the ability to finance them.

Most of the costs of a municipal wastewater system are relatively fixed within broad operating ranges. Debt service and other capital costs are fixed once incurred. Some operating costs are somewhat variable with wastewater flows, e.g. chemical and electrical power usage but this variability is lessened by the reality that inflow, infiltration and stormwater flow in a combined system are not affected by billed water consumption. Labor costs are not directly variable, e.g. a twenty percent reduction in billed flow would not result

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[6-30] NACWA press release: Coronavirus Impacting Clean Water Agencies; Local Utilities and Ratepayers Need Assistance March 20, 2020

in a need for twenty percent less labor. Maintenance costs might go down somewhat as equipment operating times may be reduced.

As costs do not decline proportionately to billed flow, it can be expected that user charge rates must be raised to generate sufficient revenue to sustain current operations. The relationship between changes in costs and revenues and the resultant changes in user charge rates is complex and has not yet been fully analyzed. At this point it can be assumed that user rate increases may be necessary to simply maintain current operations, and these rate increases will potentially erode the financial capabilities to fund the CSO LTCP.

6.6.2 Potential Median Household Income Impacts

The impacts of the pandemic on median household incomes in Camden, Gloucester and the entire CCMUA service area cannot be determined at this point. Historical analogies may provide some useful, albeit disturbing, context but are not presented as predictive:

- U.S. median household income fell by 6.2% from $53,000 in 2007 to $49,000 in 2010. In New Jersey, the MHI decreased by around 4.0% for the same period.[31]
- The U.S. unemployment rates rose from 5.0% in December of 2007 to 9.9% in December of 2009.[32]
- Data on impacts of the Great Depression on median household income are not available. As a proxy, the personal income per capita data are available. For 1929 this was $700. By 1933 this figure bottomed out at $376, a decline of 46%. Unemployment for the same period rose from around 3.0% to 25%.[33]

While a quantifiable assessment of the impact of the pandemic on median household income is not feasible at this time, reduction in base year MHI can be expected. This will further exacerbate the impacts of the revenue reductions described above on LTCP affordability, as higher base user charge rates will absorb an increased portion of lower MHI.

6.2.3 Implications for the Long Term CSO Control Program

CCMUA, Camden and Gloucester anticipate that the financial implications of the COVID-19 pandemic will be discussed with NJDEP during the review of the SIAR and as the 2021 – 2025 NJPDES permit is developed.

Given the current and likely continuing uncertainties as to the New Jersey and national economic conditions, Permittees will be reticent to commit to long term capital expenditures for CSO controls without the incorporation of adaptive management provisions, including provisions to revise and reschedule the long term CSO controls proposed in this SIAR based on emergent economic conditions beyond the permittees' control. As detailed in Section 8 of this SIAR, these provisions could include scheduling the implementation of specific CSO control measures to occur during the five year NJPDES permit cycles. A revised affordability

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[31] Source: Fact Sheet: Income and Poverty Across the States, 2010 Joint Economic Committee, United States Congress, Senator Robert P. Casey, Jr. Chairman.

[32] Source: Bureau of Labor Statistics data series LNS1400000

[33] Source: Federal Reserve Economic Data (FRED) data series: A792RC0A052NBEA

assessment should be performed during review of the next NJPDES permit to identify controls that are financially feasible during that next permit period.

6.7 USEPA Proposed Revisions to the Financial Capability Assessment Process

CCMUA, Camden and Gloucester are aware of these pending changes to EPA's guidance on Financial Capability Assessment (FCA) announced on September 15, 2020. This new guidance is still under review and not yet final, but it is recognized that it may impact the FCA and in turn the LTCP implementation schedule presented in this report. If the final guidance prompts changes to the FCA and the implementation schedule, these elements of this LTCP may be modified and resubmitted to NJDEP for review and approval.

7

Section 7
Selected Long Term Control Program

7.1 Selected Long Term Control Program Overview

The selected long term control program consists of six program elements that will have phased and overlapping implementation schedules (detailed in Section 8). These six elements are:

1. ***Completion of Current Projects -*** Timely completion of ongoing control projects including the capacity expansion of CCMUA's Delaware Water Pollution Control Facility # 1 to 185 MGD, the restoration of the hydraulic capacity of Camden's combined collection sewer system through a comprehensive sewer cleaning and rehabilitation program and related capital improvements such as the upgrading of Camden's Arch Street pump station capacity.

2. ***Efficacy Evaluation*** - The evaluation of the efficacy of these current improvements through comprehensive flow monitoring which will inform the refinement and recalibration of the existing hydrologic / hydraulic model to then current conditions. This will establish a new baseline of overflow statistics informed by the wet weather operating history with these capacity improvements in place. Similar evaluations may occur after the implementation of the formalized green stormwater infrastructure and the street flooding mitigation program elements.

3. ***Formalized Green Stormwater Infrastructure Program*** – Accelerating green stormwater infrastructure through a coordinated, formalized and expanded GSI Implementation Program with the goal of achieving a ten percent reduction in the directly connected impervious areas contributing stormwater runoff to the combined sewer system.

4. ***Street Flooding Mitigation Program*** – The development and rapid implementation of a comprehensive Street Flooding Mitigation Program will be developed within the City of Camden to provide an empirical understanding of the frequency, location and extent of street flooding remaining after the Camden sewer system is cleaned. This will serve as the basis for short and long term operational and capital improvements.

5. ***Cooper River Water Quality Optimization Program*** – The Cooper River is an important environmental, recreational and economic asset for the City of Camden's economic redevelopment. Eliminating Camden's CSOs from the Cooper River is not financially feasible and would not result in water quality compliance. CCMUA and the City of Camden are committing to the work with the other Cooper River municipalities, stakeholders and NJDEP to develop a **Cooper River Water Quality Optimization Strategy** during the first NJPDES permit cycle after this SIAR is approved.

6. ***Additional Structural Controls*** – Within the limitations imposed by affordability constraints, structural controls in each of the five sub-systems that will raise the level

of CSO capture in each sub-system and system-wide to no less than 85% of wet weather flows during the Typical Year.

Due to the extremely limited affordability and financial capabilities of the Cities of Camden and Gloucester, as demonstrated in Section 6, these controls will require significant external funding and will likely need to be implemented over an extended period of time as resources permit.

Each of these program elements are described in further detail in Sub-section 7.2. The anticipated cumulative CSO control performance as the program is implemented is shown on Table 7-1.

Table 7-1 – Project Cumulative CSO Control Levels as the Program is Implemented

Program Element		System Wide	Delaware River - Camden	Delaware River- Gloucester	Delaware River – Back Channel	Cooper River	Newton Creek
Baseline	**Baseline Conditions**						
	Percent Capture	69%	71%	69%	69%	69%	79%
	Overflow Volume (MGY)	822.9	404.7	75.8	140.2	170.5	31.7
	Modeled Street Flooding (MGY)	79.7	52.3	6.5	1.9	8.7	10.4
Program Element 1	**System Optimization - Completion of Current Projects**						
	Percent Capture	78%	89%	69%	69%	70%	85%
	Overflow Volume (MGY)	579.9	167.3	75.3	142.0	170.4	24.8
	Modeled Street Flooding	33.0	13.8	6.4	0.6	6.9	5.2
Program Element 2	**Efficacy Evaluation**	This program element will evaluate the levels of control achieved after the completion program elements 1 and may also be conducted as needed after program elements 3 and 5.					
Program Element 3	***Formalized Green Stormwater Infrastructure Program (results of 10% DCIA reduction)***						
	Percent Capture	81%	91%	74%	72%	75%	87%
	Overflow Volume (MGY)	487.0	135.3	63.9	125.3	141.5	20.9
	Modeled Street Flooding	24.4	10.3	4.7	0.3	4.9	4.2
Program Element 4	***Street Flooding Mitigation Program***	The CSO control impacts of the street flooding mitigation cannot be quantified prior to its development and implementation.					

Program Element		System Wide	Delaware River - Camden	Delaware River- Gloucester	Delaware River – Back Channel	Cooper River	Newton Creek
Program Element 5	***Cooper River Regional Water Quality Optimization Strategy***	This program element will not directly impact CSO overflow levels. It will identify steps that CCMUA, Camden, NJDEP and the other Cooper River municipalities can take to improve water quality and enhance safe recreational use of the Cooper River.					
Program Element 6	***Additional Structural Controls*** (statistics are for satellite storage for Del-GL and Cooper)						
	Percent Capture	86%	91%	85%	85%	85%	87%
	Overflow Volume (MGY)	341.5	135.3	35.2	68.0	82.2	20.9
	Modeled Street Flooding	<24.4	<10.3	<4.7	<0.3	<4.9	<4.2

7.2 Program Element 1 – Completion of Current Projects

7.2.1 Treatment Plant Capacity Expansion

In 2016 CCMUA proactively undertook the expansion of treatment capacity at its Delaware Water Pollution Control Facility No. 1 from 150 MGD to 185 MGD. Improvements required for this increase include:

- ***Influent Pump Upgrades*** – CCMUA is completing a major capacity expansion of its influent pumping capacities including upgrading two of the four pumps from 45 MGD to 60 MGD, resulting in a firm pumping capacity of 180 MGD with one pump out of service and a total pumping capacity of 240 MGD. Improvements also include new high efficiency variable frequency drive motors and related upgrades to the power distribution equipment.
- ***Process Train Hydraulic Improvements*** – CCMUA is reducing hydraulic bottlenecks in the primary sedimentation tankage piping and channels to enable full treatment of up to 185 MGD.

7.2.2 City of Camden Hydraulic Capacity Restoration

The City of Camden is currently undertaking a number of projects intended to restore and optimize the use of the design hydraulic capacities of its collection system:

- ***Collection System Cleaning and Spot*** Repairs – Through its collection system contract operator, American Water Operations & Maintenance LLC, Camden has embarked on a multi-year project to address deferred cleaning and to make spot repairs within its collection system.
- ***Regulator Rehabilitation*** – Camden undertook a comprehensive system-wide inspection of its regulator structures which determined that the regulator mechanisms required extensive repairs. Repairs have been prioritized for the regulator mechanisms for Camden regulators C-1 through C-9, thereby enabling the control of

flows into the Camden interceptors. Flows to the other Camden regulators can be controlled through the Arch Street, Pine Street and Baldwin's Run pump stations and through a control gate immediately upstream of the treatment plant, eliminating the need for the regulator controls. To maintain maximum flexibility should the need arise in the future to re-use these regulators as a part of flood prevention, the deteriorated mechanisms will be removed and their anchor systems replaced with stainless steel plates.

- ***Overflow Outfall Cleaning*** - Concurrent with its regulator rehabilitation project, Camden is addressing blockages that it has identified blockages at some of the CSO outfalls. Dredging is required to remove to clear these blockages. The City of Camden has been working closely with CCMUA and NJDEP to complete this program as expeditiously as possible. Two projects were developed with CCMUA currently working on the most critical nine of these outfalls and a second project by City for the clearing the remainder will commence in parallel with regulator project.
- ***Arch Street Lift Station Upgrades*** – Camden and CCMUA are upgrading the capacity of the Arch Street Lift Station by replacing the three existing 75 horsepower motors with new 100 horsepower motors and replacing the three existing 22.25" impellers with 24.25" impellers.
- ***Institutionalization of Green Stormwater Practices for Redevelopment*** – the stormwater control ordinance Article III (725-12 through 725-22) is applicable to any site plan or subdivision that requires preliminary or final site plan approval. Section 725-14 of Camden's stormwater control ordinance requires that (that "to the maximum extent practicable, the (stormwater quantity and quality) standards … shall be met by incorporating nonstructural stormwater management strategies…into the design of the project" (725-14.E).

As shown in Table 7-1, with the expansion of CCMUA's treatment capacity to 185 MGD and the restoration of the Camden collection system's hydraulic capacity, the annual overflow volumes are projected to decrease from 823 MGY to 582 and the system-wide capture rate increase from 69% to 78%. In addition, the volume of modeled surface flooding would be reduced by roughly 50% from 80 million gallons to 33 million gallons annually. The projected capital costs for these current wet weather control related projects total roughly $47 million as shown on Table 7-2. These figures do not include the investments by the Cities and CCMUA for green infrastructure to date.

Table 7-2 – Ongoing Wet Weather Control Capital Investments

Current Control Project	Capital Costs ($ millions)
CCMUA – Expansion of WPCF # 1 to 185 MGD	
Influent Pump Upgrades	$10.1
Wet Weather Improvements	$3.8
Influent Junction Separation	$8.0

Current Control Project	Capital Costs ($ millions)
Subtotal CCMUA	$21.9
City of Camden	
Collection System Cleaning (estimated, ongoing)	$12.0
Regulator Improvements	$5.4
Outfall Dredging	$5.2
Arch Street Lift Station Upgrade	$2.1
Subtotal Camden	$24.7
Grand Total	$46.6

7.3 Program Element 2 – Iterative Efficacy Evaluation

The second element of the long term control program will be iterative flow monitoring and recalibration of the hydrologic / hydraulic model to reflect changing conditions. The first round of flow monitoring will occur after the completion of the initial cleaning of the Camden collection system. By that time, CCMUA will have accumulated operating experience with the WPCF capacity at 185 MGD which will enable the model to reflect CCMUA's system control rules and understanding of the wet weather behavior of the three trunk lines going into the plant. It is anticipated that an efficacy evaluation will be repeated after the formalized GSI and the street flooding mitigation efforts have been implemented for a period sufficient to determine how much green is likely to be accomplished over a reasonable planning horizon.

7.4 Program Element 3 – Formalized Green Stormwater Infrastructure Program

As detailed in Section 3, CCMUA and the Cities of Camden and Gloucester are targeting a 10% or around a 145 acre reduction in impervious areas that are directly connected to the combined sewer system (DCIA) through the installation of GSI. CCMUA and the Cities are proposing the establishment of a framework for the implementation of GSI that would formalize, expand upon and support the current efforts of groups such as the Camden SMART initiative. The framework is targeted for completion during 2021, with work to commence upon NJDEP approval of this SIAR. The framework will include specific performance targets for GSI implementation, e.g. 30 acres per five year NJPDES permit cycles.

7.5 Program Element 4 – Street Flooding Remediation Program

The forth Long Term Control Program element will be the implementation of a Comprehensive Street Flooding Mitigation Program as detailed in Section 4 of this document.

The objective is to establish a framework for a comprehensive program to reduce the occurrences of and mitigate the impacts street flooding. The program will establish the empirical basis for street flooding mitigation and assign responsibilities for the prevention of and response to street flooding events. It is anticipated that a detailed program plan will be completed early in the initial (2021 – 2026) NJPDES permit cycle following the approval of this SIAR.

7.6 Program Element 5 – Cooper River Regional Water Quality Optimization Strategy

The fifth Long Term Control element will be the development of a regional strategy to optimize water quality in the Cooper River. This strategy will take a watershed-based approach to reducing the discharge of pathogens and other pollutants into the Cooper River that degrade it's recreational and economic redevelopment usage as well as its aquatic habitat. Pending refinement by stakeholders, two preliminary goals are identified:

- Achieving water quality standards for pathogens during dry weather; and
- Reducing wet weather impacts, including recovery time.

The intent of the strategy is to identify *what, how, and who* – is needed to achieve these goals. It will be developed during the first NJPDE permit cycle following the approval of this SIAR (2021 – 2025). A stakeholders working group (may be derived from existing groups and interested parties). Anticipated initial activities could include:

1. Compilation and review of existing data and planning efforts such as the Tri-County Water Quality Management Plan, the circa 2003 TMDL for fecal coliform in Watershed Management Area 18, the most recent NJDEP Section 303 Integrated WQ Report, current NJPDES MS4 stormwater permits, development and land use plans for the 40 square mile Cooper River watershed.
2. Development of Cooper River recreational usage policies and best practices e.g.:
    - Determine the need for and implementation as warranted a post-wet weather sampling program to determine when pathogen levels in the river meet state standards for recreational secondary (e.g. boating) or primary (e.g. swimming) contact.
    - Develop and implement a public notification program using the internet, call-in and/or visual notification (e.g. orange "CSO" flags flown at marina's in Pittsburgh during and after CSO events).
3. Identify opportunities to support and expand recreational usage of the Cooper River and stewardship of its aquatic habitat as a critical local environmental resource and as a catalyst for economic growth and community revitalization.
4. Identify and support opportunities for funding and cooperation with other groups and agencies for riparian improvements, e.g. multi-purpose stream bank stabilization with recreational trails, invasive species control and habitat enhancement and restoration, etc.

5. Identify and support feasible and implementable green stormwater management, other source reduction and modifications as appropriate of municipal and county land use and redevelopment regulations and policies that enhance compliance with MS-4 requirements and reduce the impacts of non-point source runoff.

7.7 Program Element 6 – Sub-System Additional Structural Controls to Achieve 85% Capture

Subject to changing conditions and understanding, e.g. as a result of flow monitoring and model updates under program element 2, CCMUA and the Cities of Camden and Gloucester propose the following suite of structural controls that along with the GSI will achieve the 85% wet weather capture during the Typical Year control performance goal.

- ***Delaware River – Camden***: CCMUA will undertake modifications to the C-3 regulator structure and implement revised wet weather operating procedures. These, coupled with the completion of the capacity expansion at WPCF # 1 to 185 MGD will enable 85% capture from the Delaware River – Camden sub-system.
- ***Delaware River – Gloucester***: A satellite control facility will be installed to capture overflows from the G-4 and G-5 regulators. This could be either a 2.4 million gallon storage tank or a 31.9 high rate wet weather treatment facility that would provide at least the equivalent of primary treatment as well as for disinfection and dechlorination (as necessary depending on the disinfection approach selected).
- ***Cooper River***: Satellite control facilities will be installed in two locations. One facility will capture flows from Camden regulators C-22 and C-22A and have either a storage capacity of 1.2 million gallons or a 20 MGD treatment capacity. It is anticipated that the location will be adjacent to or in the vicinity of Camden's Federal Street pump station. The second facility will capture flows from Camden's C-27 regulator and from the Thorndyke Street outfall, which receives flows from several upstream regulators. This facility would have a storage capacity of 3.0 million gallons or a treatment capacity of 20.1 MGD located near the Thorndyke outfall.
- ***Delaware River Back Channel***: The 85% control target will be achieved in the Delaware River Back Channel through two projects. First, the stormwater (?) wet weather/ combined sewer flows that are currently discharged from the Pennsauken Township sanitary [storm] sewer system into the Camden combined system via Pennsauken's High Street regulator structure will be re-routed for discharge to the Delaware River back channel after treatment and disinfection. The second component of the Delaware Back Channel controls will be the modification and reconfigurations of regulator structures and power supplies associated with the Baldwins Run pump station to enable full utilization of its 25 MGD capacity.
- ***Expansion of CCMUA's WPCF #1 Wet Weather Treatment Capacity:*** As detailed in Section 2 of this SIAR; CCMUA has evaluated the potential to expand the wet weather treatment capacity of its WPCF up to 220 MGD as determined necessary in the future.

CCMUA and the Cities recommend against the selection between satellite storage and treatment at this time. As will be detailed in Section 8 (Implementation), the proposed structural controls outlined above are proposed not to occur until after the results of program

elements one through four are fully implemented and their impacts on CSO evaluated though flow monitoring and modeling. Moreover, additional advancements in wet weather treatment and storage technologies and in are likely to occur. In addition, water quality standards or other regulatory requirements may change, e.g. as a result of DRBC's current water quality monitoring efforts.

Another reason to defer a decision on the satellite control technology is uncertainty as to the feasibility of reaching the 10% DCIA reduction target. The targeted 10% reduction in DCIA is aggressive and unlike structural controls such as satellite storage or treatment, the implementation of green infrastructure, the timing and scope of green stormwater projects are not completely under the control of the Cities.

Should the 10% DCIA goal prove to be unachievable in a regulatorily acceptable time-frame, the capacities of the satellite treatment facilities described in Section 4 that are anticipated to be necessary to achieve 85% system-wide wet weather capture would be upsized. The estimated revised facility sizes required with a zero percent reduction in DCIA are shown on Table 7-3 to bracket the sizes needed.

Table 7-3 – Control Facility Sizing Implications of Zero DCIA Reduction

Sub-System	Locations	Required Capacities			
		Storage (MGY)		Treatment (MGD)	
		0% DCIA Reduction	10% DCIA Reduction	0% DCIA Reduction	10% DCIA Reduction
Delaware River – Gloucester	G-4 / G-5	0.6	1.2	4.1	6.8
	G-1	0.5	0.7	2.3	4.4
Cooper River Newton Creek	C-22 / C-22A	1.3	2.6	20	21
	C-27 / Thorndyke	3	3.5	20.4	38.5
	C-17	NA	0.4	NA	4.8

The final size requirements of satellite facilities will be finalized after the GSI Implementation Program has been implemented long enough to determine the level of GSI that is achievable and the system performance with the green and other improvements has been quantified through future flow monitoring and modeling.

7.8 Implications of the Financial Capability Assessment

7.8.1 Problem Statement

The long term CSO control planning process set forth in the NJPDES permits is based on the logical progression from system characterization to a broad evaluation of control alternatives to the selection of the optimal control strategy for a given permittee. Included in this process is a consideration of the impacts of the long term controls on ratepayer affordability and on the permittee's financial capability to finance the controls. Per the USEPA CSO Control Policy, these financial factors serve to inform the setting of the implementation schedule for the long term controls.

The logic of the long term control planning process is challenged when as documented in Section 6, the affordability of CSO controls for Camden and Gloucester is extremely limited. As shown on Table 7-4, there is a huge gap between the estimated costs of the selected long term control program and the economic and financial resources of the residents and municipal governments of Camden and Gloucester.

Table 7-4 – Financial Capability and Control Program Capital Costs

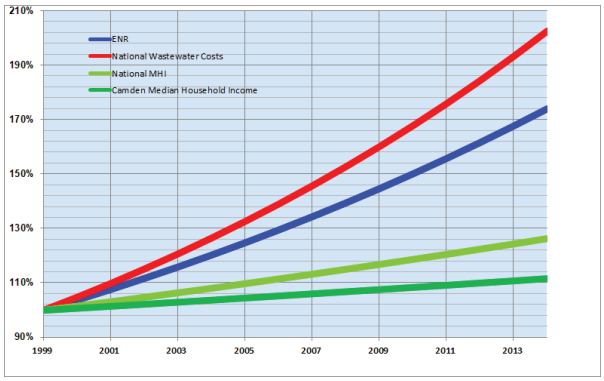
Item	Permittee	
	Camden	Gloucester
Future Capital Costs Triggering a 2.0% Residential Indicator in 2042 ($ millions)		
With Inflation	$0.0	$1.7
Without Inflation	$30.0	$12.5
Estimated Total Capital Costs of 85% Capture Long Term Program by Permittee (in 2019 dollars)		
Least Cost	$101.9	$27.1
Most Cost	$129.6	$44.8
Projected Residential Indicator After Full Implementation in 2042[a]		
	With Inflation	
Least Cost	4.8%	4.0%
Most Cost	5.0%	4.7%
	Without Inflation	
Least Cost	2.5%	3.0%
Most Cost	2.6%	3.7%

[a] 2042 is used for example only. It is based on the approval of the SIAR in 2021 and implementation of the long term control program through 2041. These dates may not be appropriate for Camden and Gloucester.

As shown on Table 7-4 the least capital cost option for Camden is $101.9 million while the amount of future capital costs causing the residential indicator to exceed the USEPA 2.0% high burden trigger is $30 million assuming no inflation while the figures for Gloucester are $12.5 million in current dollars.

7.8.2 Impacts of Inflation

The 1997 USEPA guidance document on affordability and financial capability assessment does not account for inflation beyond bringing older cost or income data to the current year. This simplification eliminates the need to project economic trends such as household income or construction costs. However, if the potential effects of inflation are not considered, the affordability of long term CSO controls can be overstated. Nationally, the growth in the cost of wastewater services have outpaced the growth in household incomes. A comparison of national cost trends and the growth in household incomes for Camden and Gloucester for the period of 1999 through 2013 is shown on Figure 7-1.



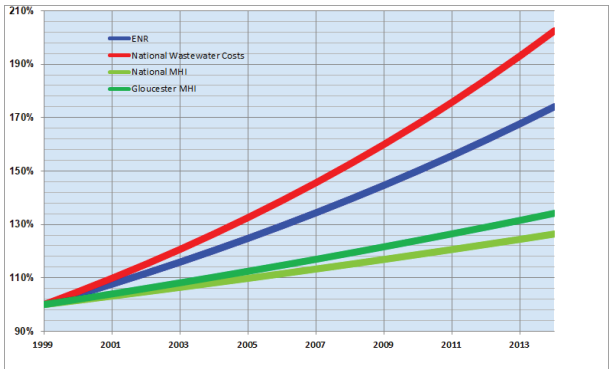


Figure 7-1 – Comparison of Rates of Growth of Wastewater System Costs Nationally with Growth in Camden's (left) and Gloucester's (right) Median Household Income. [sources: NACWA, US Census]

The graphs demonstrate the potential erosion in affordability if the growth of costs is greater than the growth in household incomes. If inflation is considered in projecting affordability, the $30 million new capital expenditure figure that causes Camden's residential indicator to cross the 2.0% high burden threshold disappears. Based on the historically based inflation rates used in the affordability model, Camden's residential indicator is projected to rise to 3.55% with no new capital expenditures through 2041. Projected inflation erodes the $12 million new capital trigger for Gloucester down to $1.7 million.

Obviously, the future rates of inflation cannot be known. Therefore, the scope and schedule for implementing the long term control program outlined above will need to be based on iterative re-evaluations of affordability and financial capability under the adaptive management process detailed in Section 8 of this document. This adaptive management strategy will include empirical triggers for reconsidering the type, scale and scheduling of control elements within the context of interim targets to be established in future NJPDES permits.

7.8.3 Alternative Implementation Schedules

The base case affordability / financial capability assessment assumes a 22 year implementation schedule based on the durations for facilities planning, design and construction shown in Table 7-5.

Table 7-5 – Base Case Implementation Schedule for Affordability and Financial Capability

Start Date	2021
Facilities Planning	1
Design & Permitting	3
Construction	17
Total Years to Implement LTCP (inclusive)	21

The assumed start date is based on the submittal and approval of the SIAR in 2020 and coincides with the effective date of the next NJPDES permit. The impacts of extending this implementation period has been evaluated. The impacts of extending the implementation schedule on the residential indicators depend on whether or not inflation is considered as shown in Table 7-6.

Table 7-6 – Impacts of Implementation Scheduling on the Residential Indicators

Implementation Duration in Years	Camden Residential Indicator		Gloucester Residential Indicator	
	With Inflation	Without Inflation	With Inflation	Without Inflation
22	4.8%	2.5%	4.0%	3.0%
32	6.0%	2.7%	4.2%	2.2%
42	7.2%	2.2%	4.1%	2.1%

If as is assumed in the base-case affordability model that costs will continue to outpace income growth, affordability decreases as the implementation period is extended. If inflation is not included in the analysis, extending the implementation period does improve affordability, however even with an implementation period extending more than forty years, the residential indicators for both Camden and Gloucester are projected to remain well over the 2.0% high burden threshold.

7.8.4 Annual Pay-as-You-Go Funding

The amounts that each city could spend on an annual basis without causing their respective residential indicators to exceed 2.0% have also been calculated and are shown on Table 7-7.

Table 7- 7 – Maximum Annual Expenditures Without Trigger a 2.0% Residential Indicator

Implementation Duration in Years	Camden		Gloucester Residential Indicator	
	With Inflation	Without Inflation	With Inflation	Without Inflation
22	None	~$1.0 million	$80,000	$530,000
32	None		None	
42	None		None	

7.8.5 External Funding Needs

As documented above, the least capital cost 85% control options would result in residential indicators of well over the 2.0% high burden threshold with or without factoring in inflation. Conversely, put on an annual expenditure basis, Camden and Gloucester could only afford around $1.0 million and $530,000 respectively before triggering the high burden. Moreover, increasing the implementation schedule out past 2060 would not resolve the affordability problem even at zero inflation. In addition, the amounts of capital expenditures that could be incurred by the two cities include necessary renewal, replacement and other non-CSO control project costs.

A meaningful CSO control program is not feasible for Camden or for Gloucester without either a significant reduction in capital costs through the reduction in the targeted level of controls or through external funding that would effectively reduce the capital expenditures by the two cities. It has been demonstrated in Section 5.4 (cost and performance considerations) that a Presumption based control strategy targeting 85% control of Typical Year wet weather is the lest-cost path towards compliance with the performance metrics in the CSO Policy and in the NJPDES permits. Therefore, the path forward must include significant external funding through the State of New Jersey or through a yet to be promulgated federal funding program. Shown on Table 7-8 are the impacts of various levels of external capital funding and/or

capital cost reduction on the residential indicators over a twenty-two and thirty-two year implementation schedule.

Table 7- 8 – External Funding and/or Capital Cost Reduction Impacts on Residential Indicators

Grant / Capital Cost Reduction	Camden Residential Indicator				Gloucester Residential Indicator			
	With Inflation		Without Inflation		With Inflation		Without Inflation	
	22 Years	32 Years	22 Years	32 Years	22 Years	32 Years	22 Years	32 Years
0%	4.9	6.0	2.5	2.3	4.0	4.2	3.0	2.2
25%	3.8	5.8	2.3	2.2	3.6	3.9	2.5	2.0
50%	4.2	5.4	2.2	2.0	3.2	3.6	2.2	1.8
75%	3.8	5.1	2.0	1.9	2.8	3.3	1.8	1.7
100%	3.6	4.9	1.9	1.9	2.4	3.0	1.6	1.6

The combinations of implementation schedule and external funding or cost reductions that would result in a projected residential indicator of 2.0% or less are highlighted in green.

No combinations of schedule and funding work if inflation is included. Camden's program could be workable from an affordability standpoint with either a 22 year or 32 year implementation schedule and funding of 75% or more of the capital costs. For Gloucester's program to be considered as affordable over a 22 year schedule, funding of around 60% would be required. If the Gloucester implementation period were extended to 32 years, 25% or greater funding would result in the residential indicator not exceeding 2.0%

The examples shown in this section and in the entire SIAR are the results of the myriad assumptions and estimations used in the development of control program costs and future economic conditions. These will change and be refined as the long term control program moves into implementation; but as presented are sufficiently accurate to form the basis for the development of a regulatory compliance strategy moving forward.

7.9 Construction and Financing Schedule

Paragraph G-8(a) of the NJPDES permits requires the submittal of a Construction and Financing Schedule as an early long term control program deliverable to NJDEP. Due to the financial constraints facing Camden and Gloucester the scope of this document will need to be broadened into a comprehensive program financing and funding strategy that addresses from a financial perspective ***what is doable and when?***

Developing a workable funding strategy will require a partnership between the two Cities, CCMUA, NJDEP and likely other state and regional agencies such as the New Jersey Department of Community Affairs and Department of Transportations. Allied and related agencies such as Camden County will likely also play a role; the former in leveraging County road and highway projects to support green stormwater infrastructure or sewer line renewal and replacement coincident with road work.

State Programs beyond the New Jersey Clean Water Revolving Loan Program that target low income areas, transportation or economic redevelopment potentially could be leveraged with specific CSO projects, e.g. coordinating local sewer separation with the water and sewerage needs of a redevelopment or roadwork project. In addition, new

state legislation and appropriations actions may be required by the State Legislature. These could be pursued with and through NJDEP and the other New Jersey combined sewered municipalities and authorities.

Current federal funding for public water and wastewater systems is limited pending new Congressional action on infrastructure programs. Existing programs such as the Water Infrastructure Finance and Innovations Act (WIFIA) – which provides loans from the US Treasury Department (Administered by USEPA) are likely of limited applicability to Camden and Gloucester. In the past Congressional appropriations to the US Army Corps of Engineers Civil Works funding through Sections 219 and 206 of the Water Resources Development Act have been used successfully in other regions towards CSO control funding.

While current federal funding is not robust, long term consideration could be given towards crafting new pushes for federal assistances if conditions appear to be propitious. Previous successful examples include Rouge River Program in the Detroit area and the 3 Rivers Wet Weather Program (Pittsburgh) which together channeled more than $300 million in federal funding towards municipal wet weather and CSO control projects.

The Construction and Financing Schedule and all aspects of the long term control program implementation will incorporate adaptive management as described more fully in Section 8 of this document. As detailed in Section 8, CCMUA and the Cities propose that the implementation schedule for the CSO control program be synchronized with the five year NJPDES permit cycles. Specific enforceable CSO control program targets will be negotiated during the NJPDES renewal process. These targets will be subject to revision due to forces beyond the control of CCMUA and the Cities including but not limited to natural disasters (e.g. hurricane), pandemics or other disasters along with resultant sever economic downturns which disrupt the revenues available to the three permittees or the abilities of the rate payers to pay their sewer bills. It is proposed that the Construction and Financing Schedule include specific metrics defining triggering events.

A key component of adaptive management will be the inclusion of an affordability and financial capability trigger in the Construction and Financing Schedule. The projects and activities to be included in each five-year permit cycle would be selected and scheduled such that the residential indicator in either City and in the CCMUA service area not exceed the 2.0% of median household income triggering the USEPA high burden definition. Should economic or other conditions occur such that the residential indicators exceed 2.0% during a permit cycle or lead to reasonable expectations that the 2.0% value be exceeded in subsequent permit cycles the projects and activities in subsequent permit cycles will be modified in cooperation with NJDEP.

8

Section 8 Implementation Schedule & Adaptive Management

8.1 Implementation Scheduling Context

The implementation of CSO controls by CCMUA, the City of Camden and Gloucester City will require a long term commitment of scarce financial resources. The reduction of CSOs also presents an intergenerational opportunity to serve as a catalyst for sustainable redevelopment and growth in Camden and Gloucester.

The implementation scheduling strategy proposed in this SIAR has been informed by the following:

- CCMUA and the Cities will focus initially on projects that will provide significant near-term overflow and street flooding benefits such as the expansion of the WPCF # 1 and the restoration of the hydraulic capacity of the Camden collection system;
- The projected costs to fully implement the CSO control strategy are far greater than the financial resources currently available to the Cities of Camden and Gloucester ; and
- The complete implementation of the CSO control strategy presented in this SIAR will span decades; and will be implemented in the midst of changes and uncertainties. Therefore, ongoing performance monitoring and adaptive management will be required to adjust the control program to match conditions.

8.2 Proposed Implementation Schedule

The implementation schedule will synchronize projects, milestones and activities to coincide with the five year NJPDES permit cycles. The proposed implementation schedule synchronized with NJPDES permit cycles is provided in Table 8-1 (following page)

8.3 Adaptive Management

The implementation schedule outlined in Table 8-1 above includes an evaluation at the completion of each five year NJPDES permit cycle. Based on these evaluations, CCMUA and the Cities will revise the LTCP as necessary with NJDEP's coordination and approval. This process exemplifies the concept of adaptive management.

Adaptive Management, as defined by the EPA, is "the process by which new information about the health of a watershed is incorporated into the watershed management plan."[8-1] In the context of the SIAR adaptive management assumes that while the CSO control goals will remain constant, the tactical approaches to achieving the goals must be adjustable.

[8-1] Watershed Analysis and Management Guide for Tribes (2000) EPA Watershed Analysis and Management Project. Step 5 page 1.

Table 8-1 – Implementation Schedule (Based on five-year NJPDES permit cycles)

Time Frame	Activities
2020	• Continued cleaning of Camden CSO outfalls • Completion of Camden regulator mechanism rehabilitation • Completion of Arch Street PS capacity expansion • NJPDES renewal discussions with NJDEP. The NJPDES permit will include the implementation schedule for the implementation of the long term CSO control plan as defined in the SIAR
2021 – 2025: First Five Year NJPDES Permit Cycle	• Completion of initial Camden collection system and outfall cleaning ***- Program Element 1 (system optimization)*** • Completion of the expansion of CCMUA's WPCF # 1 to 185 MGD ***- Program Element 1*** • Ongoing collection system maintenance, inspection & cleaning • Submission of a Construction and Financing Schedule as required by paragraph G-8(a) of the NJPDES permits • Development and Implementation of GSI Program Plan - target reduction of 2% (30 acres) - ***Program Element 3 (green first)*** • Development and implementation of Camden Street Flooding Mitigation Program – ***Program Element 4*** • Develop the Cooper River Regional Water Quality Optimization Strategy – ***Program Element 5*** • (2025) Permit Cycle 1 Progress Evaluation: – Evaluate the impacts of the expansion of the WPCF # 1 to 185 MGD over a range of wet weather including the potential to increase wet weather flows from CCMUA's Gloucester City pump station, thereby potentially reducing overflows in Gloucester City. – GSI implementation status (acres of DCIA reduction) – Street flooding mitigation status to ascertain the efficacy of cleaning the Camden pipes and outfalls and of the expansion of the WPCF # 1 wet weather treatment capacity to 185 MGD – Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit. ***Program Element 2 (iterative evaluation)***
2026 – 2030: Second Five Year NJPDES Permit Cycle	• Continued Implementation of GSI Program and the Street Flooding Mitigation Program - ***(Program Elements 3 and 4)*** – (2030) Revise GSI Program based as needed based on lessons learned during previous five years – Target reduction of DCIA by 2.0% (30 acres) – (2030) Revised Street Flooding Mitigation Program as needed based on lessons learned during previous five year cycle • Reduction of wet weather flow from Pennsauken into the Camden combined sewer system in sewershed C-32 – ***Program Element 6.*** • Efficacy Evaluation - ***Program Element 2***. • Feasibility study for further expansion of WPCF # 1 up to 220 MGD as necessary – ***Program Element 6.*** • Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit - ***Program Element 2***.

2031 – 2035: Third Five-Year NJPDES Permit Cycle	• Continued implementation of GSI and Flood Mitigation Program – ***Program Elements 3 & 4*** • Update Long Term Control Plan – ***Program Element 2.*** – Adjust the target for GSI based on prior performance experience. – Refine the need for additional controls for long term achievement of 85% system-wide capture based on the results of the update system performance characterization. – Other evolving environmental, regulatory and community conditions • Design and construction of the expansion of WPCF # 1 up to 220 MGD if needed – ***Program Element 6*** • Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit - ***Program Element 2***.
Subsequent five-year NPDES permit cycles	• Continued implementation of the GSI Program (target 2% DCIA removal – 30 acres) each five-year cycle • Continued implementation of the Camden Street Flooding Mitigation Program • Implementation of additional controls that were identified as being needed to reach the 85% capture goal. • Compliance Monitoring Program upon completion of the additional controls • Updated Financial Capability Assessment and Construction & Financing Schedule for inclusion in next NJPDES Permit.

CCMUA and the Cities will also be subject to a variety of future conditions beyond their controls which may materially affect the benefits, feasibility and scheduling of the CSO controls described in this SIAR, thereby triggering a need to revise the LTCP. Examples of such triggering conditions include:

- External changes requiring modifications to the fundamental planning and design bases used in the development of the LTCP or in subsequent design due to changing demographics, municipal collection system conditions, climate change and other external changes, etc.;
- Emergent regulatory requirements specific to the receiving streams (e.g. TMDLs) or in general (e.g. the promulgation of a National SSO Policy);
- Emergent economic and other developments and trends that could materially affect the affordability and CCMUA's and the Cities' abilities to finance the CSO controls that would be expected to cause the residential indicator for any of the permittees to exceed 2.0% of median household income.
- Changes to water quality standards and guidance that could affect the types and levels of wet weather controls necessary to meet the program objectives;
- Innovative and alternative technologies that could enhance water quality and/or reduce costs thereby enabling expanded control efforts.
- The unavailability of supplies, materials, contractors or labor necessary to implement the LTCP as scheduled in the LTCP due to conditions beyond CCMUA's and the Cities control such as a natural disaster or other emergency; and

- Local, state or federal legal impediments to the timely or orderly implementation of the LTCP e.g. lengthy litigation over land acquisition or inability to obtain required permits.

CCMUA and the Cities will inform NJDEP upon becoming aware of circumstances such as those listed above as to:

- An analysis of the issues and implications posed by the condition;
- An analysis of the impacts on the implementation of the LTCP or the efficacy of the controls; and
- A proposed plan of action to address the adverse conditions that will preserve CCMUA's and the Cities' compliance with their NJPDES permits and the requirements of the CSO Control Policy.