CLEAN WATER PROJECT

Hartford Metropolitan District

Executive Summary

The Metropolitan District is embarking on its most ambitious program to improve the area's water quality and protect the health and safety of citizens. The Clean Water Project will address approximately one billion gallons of combined wastewater and stormwater currently released each year to area waterways. This wastewater is discharged by 38 combined sewer overflow (CSO) and eight sanitary sewer overflow (SSO) locations, frequently sending diluted sewage into the Connecticut River and its tributaries.

The Clean Water Project formally responds to an EPA SSO federal consent decree and a Connecticut DEP CSO consent order to achieve the Federal Clean Water Act goals by 2020. It is estimated in 2006 dollars to cost approximately $1.63 billion and will be funded by the District's Capital Improvement Plan. The District is pursuing more than 50% of the funding from state and federal sources, with the rest expected from General Obligation Bonds.

Initially the Clean Water Project focused on CSOs but has expanded to encompass other requirements. It now comprises three components:

- CSO reduction
- SSO elimination
- Nitrogen removal

Projects will range from new sewer and drainage systems to greater wastewater treatment capacity to new tunnel storage and conveyance. These projects will help to eliminate sewage overflows to area waterways during an average year, significantly improving water quality. Community infrastructure, including utilities and streets, will also be enhanced.

Work will be completed in at least two phases. Phase 1 will cover the first six years of the program and is budgeted at $800 million, including inflation. The referendum for this phase is in November 2006. For the remaining work, a second referendum is planned for November 2012 after an assessment of Phase 1 projects.

CSO Reduction

CSOs will be significantly reduced through the Clean Water Project, greatly enhancing the quality of the region's waterways.

Hartford relies on a combined sewer system—common in urban areas throughout the United States—to manage wastewater. In a combined sewer system a single pipe carries both sewage and stormwater, so when it is raining, stormwater enters the pipe with the sewage. As these sewers become overloaded, they spill sewage and stormwater into open waters as a result of pipe surcharging. In some areas, sewage and stormwater back up into streets, yards and basements.

The Clean Water Project will greatly reduce these CSOs within Hartford's sewer system through various sewer separation and infrastructure-related projects. As a result, sewage will be removed from stormwater and basements, and sent instead to Hartford's water pollution control facility (WPCF). Water quality in the Connecticut and Park rivers as well as tributaries and other water bodies will improve significantly.

Sewer separation projects for Phase 1 of the CSO reduction program cover the following areas:

- Franklin Avenue
- Tower Avenue
- Granby Street
- Upper Albany
- Farmington Avenue
- Park River

Additional Phase 1 work will include two new tunnels—the south conveyance and the deep rock, restoration of Gully Brook, and other new pipelines to relieve water bodies from unwanted discharges.

The figure on the following page summarizes the Phase 1 work. A second figure depicts all the CSO reduction projects in both phases of the program.

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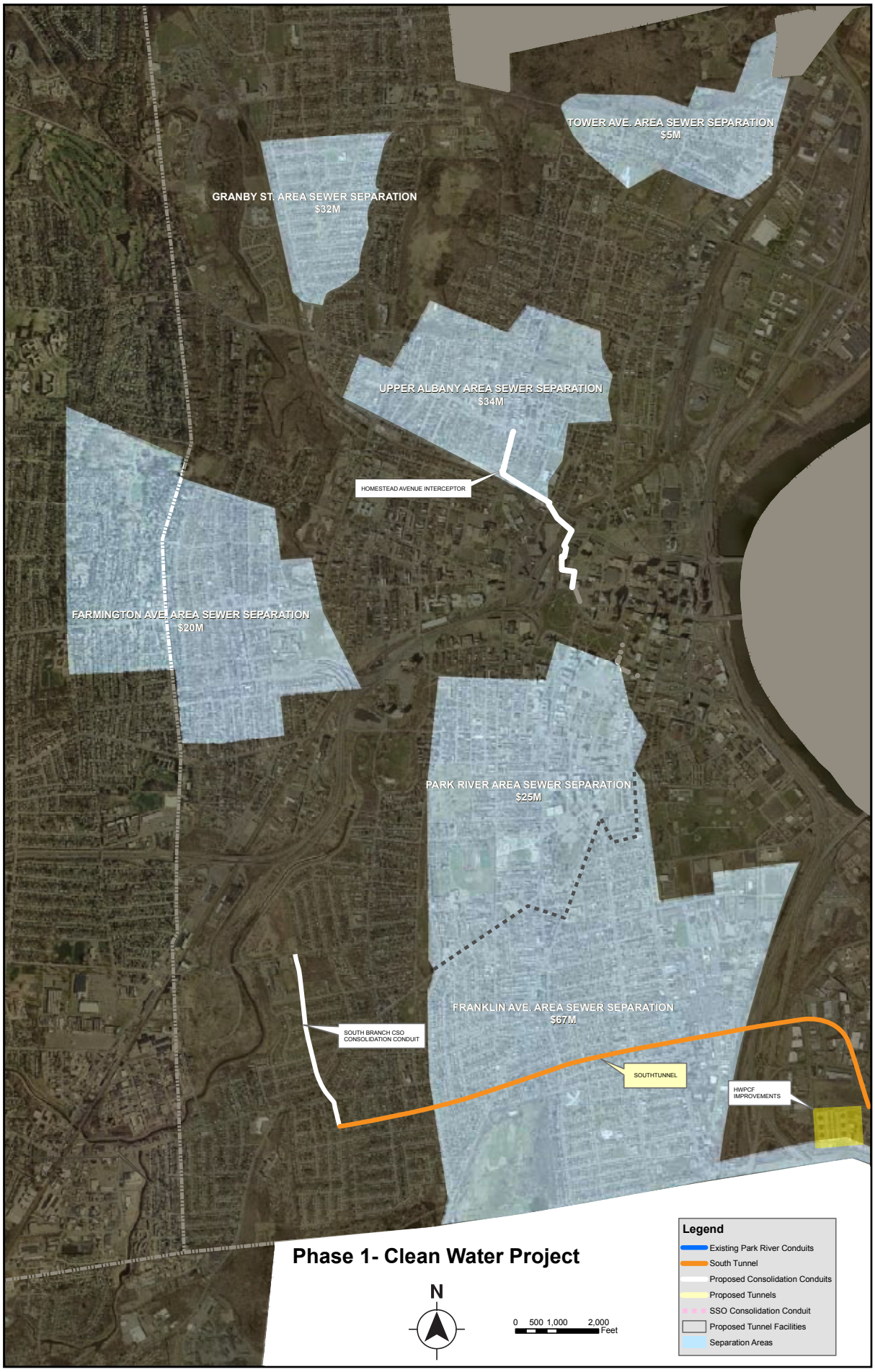
TOWER AVE. AREA SEWER SEPARATION
$5M
GRANBY ST. AREA SEWER SEPARATION
$32M
UPPER ALBANY AREA SEWER SEPARATION
$34M
HOMESTEAD AVENUE INTERCEPTOR
FARMINGTON AVE. AREA SEWER SEPARATION
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PARK RIVER AREA SEWER SEPARATION
$25M
FRANKLIN AVE. AREA SEWER SEPARATION
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SOUTH BRANCH CSO CONSOLIDATION CONDUIT
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HWPCF IMPROVEMENTS
Phase 1- Clean Water Project
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Legend
Existing Park River Conduits
South Tunnel
Proposed Consolidation Conduits
Proposed Tunnels
SSO Consolidation Conduit
Proposed Tunnel Facilities
Separation Areas

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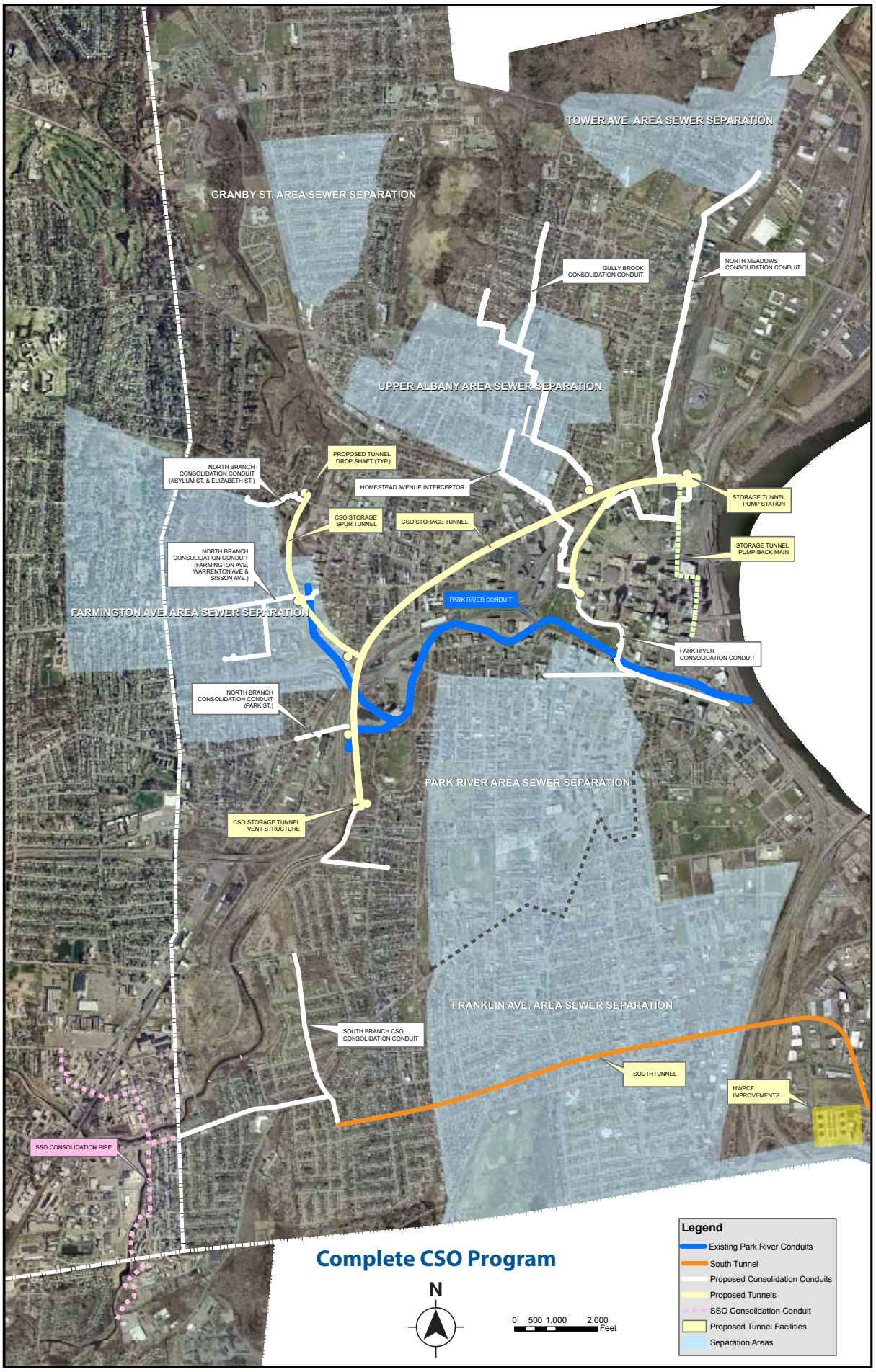
TOWER AVE. AREA SEWER SEPARATION
GRANBY ST. AREA SEWER SEPARATION
GULLY BROOK CONSOLIDATION CONDUIT
NORTH MEADOWS CONSOLIDATION CONDUIT
UPPER ALBANY AREA SEWER SEPARATION
PROPOSED TUNNEL DROP SHAFT (TYP.)
NORTH BRANCH CONSOLIDATION CONDUIT (ASYLUM ST. & ELIZABETH ST.)
HOMESTEAD AVENUE INTERCEPTOR
STORAGE TUNNEL PUMP STATION
CSO STORAGE SPUR TUNNEL
CSO STORAGE TUNNEL
STORAGE TUNNEL PUMP-BACK MAIN
NORTH BRANCH CONSOLIDATION CONDUIT (FARMINGTON AVE., WARRENTON AVE. & SISSON AVE.)
PARK RIVER CONDUIT
FARMINGTON AVE. AREA SEWER SEPARATION
PARK RIVER CONSOLIDATION CONDUIT
NORTH BRANCH CONSOLIDATION CONDUIT (PARK ST.)
PARK RIVER AREA SEWER SEPARATION
CSO STORAGE TUNNEL VENT STRUCTURE
FRANKLIN AVE. AREA SEWER SEPARATION
SOUTH BRANCH CSO CONSOLIDATION CONDUIT
SOUTHTUNNEL
HWPCF IMPROVEMENTS
SSO CONSOLIDATION PIPE
Complete CSO Program
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0 500 1,000 2,000 Feet
Legend
Existing Park River Conduits
South Tunnel
Proposed Consolidation Conduits
Proposed Tunnels
SSO Consolidation Conduit
Proposed Tunnel Facilities
Separation Areas

MDC

CSO Reduction

Phase 1 Projects

Projects for Phase 1 of the CSO reduction are summarized below.

Franklin Avenue Area Sewer Separation

The Franklin Avenue area is the largest of the separation areas, with the entire drainage district comprising more than 1,200 acres (excluding Goodwin Park). This is a critical project because separation in this area will prevent overflows to the Wethersfield Cove, a local, sensitive receiving water, as well as to the Connecticut River.

With the existing combined sewer system, the lower (southern) section of Franklin Avenue experiences sewer backups and overflows to the drainage system during wet weather. This is partially due to a lack of capacity in the Franklin Avenue Interceptor, the main sewer pipe that delivers sewage from the entire Franklin Avenue area to the Hartford water pollution control facility (WPCF). Under the CSO reduction plan, a new interceptor to the WPCF is proposed to relieve the existing interceptor.

Another problem in Franklin Avenue's lower section is the elevation of the stormwater outfall pipe from the drainage system to Wethersfield Cove, and ultimately to the Connecticut River. It is low enough to be affected by the river's water elevation. Ultimately, stormwater cannot discharge from the drainage system until it backs up, flooding the lower Franklin Avenue area.

In general, all of the sewer separation area will receive new sanitary sewer pipes, and the existing combined sewers will remain in place as dedicated storm drains. The Airport Road Pumping Station is being upgraded and will redirect the force main, from the lower region up to Wethersfield Avenue, southward to the Franklin Avenue interceptor. Re-routing the pipe will prevent sewer surcharging and backups on Standish Street.

New sewers and an additional interceptor to the Hartford WPCF will prevent sewer overflows to the drainage system during storm events, so that sewage flows to the WPCF and not to Wethersfield Cove.

CSO Reduction

Tower Avenue Area Sewer Separation

During wet weather the combined sewer system in the Tower Avenue area is overloaded, resulting in sewer backups along Tower Avenue and Main Street. Additionally, the increased flow in the combined sewer results in discharges of combined sewage into the Connecticut River.

New sewer lines will complete the planned separation of the combined sewer within the Tower Avenue area. They will be located north of the Tower Avenue and Main Street intersection, extending to just below the Windsor town line; south of the Tower Avenue and Main Street intersection, extending to the intersection of Cleveland Avenue and Main Street; and west of Main Street near the upper portion of the Tower Brook conduit. This work will be preceded by a conduit extension project, which had a groundbreaking in April 2006 and will provide the infrastructure to handle stormwater flowing through the Tower Avenue area.

Granby Street Area Sewer Separation

The recommended plan for the 185-acre Granby Street area sewer separation project is to construct approximately six miles of new sanitary sewers, 0.7 miles of combined sewers to carry flows from unseparated areas north of Westminster Street, one new storm drain outfall parallel to the N2 CSO outfall, converting the N4 CSO outfall to a drainage outfall, as well as some additional drains in Granby Street. Approximately 750 homes and two schools will require re-plumbing and connection to the new pipes.

The proposed sewer system is sized to accommodate flow from the combined area north of the Granby Street project area, if this area is separated.

Upper Albany Sewer Separation

The Upper Albany Avenue sewer separation area will receive mostly new storm drain pipes to accommodate drainage, since existing sanitary/combined sewers have limited capacity for it. The existing combined sewers will remain in place as dedicated sanitary sewers, and new sanitary pipes will be constructed in limited areas, where sanitary discharges must be removed from drains. Also recommended is the replacement of many undersized storm drains, removal of direct sewage discharges to the Gully Brook conduit within the Upper Albany sewer separation area, and installation of new sewers on Pliny Street, Bedford Mall, and Mather Street.

CSO Reduction

Farmington Avenue Area Sewer Separation

Combined sewers in the Farmington Avenue area will be separated, removing sewage in basement backups during storm events and reducing the number and volume of CSOs in the area.

The recommended plan converts the existing combined sewers to drains, and constructs new sewers. Approximately 35,000 feet of new sewer is proposed, serving about 625 homes and three schools. Two special structures may be required to connect new sewers to existing ones—at the intersections of Farmington Avenue and Tremont Street and West Boulevard and South Whitney Street. Existing drains in the project area will remain. Approximately 12,500 feet of new drain is proposed in several streets adjacent to Farmington Avenue to use existing adequately sized sewers and service connections. These sewers will be removed from the combined sewer system and connected to the sewer on Farmington Avenue.

Park River Area Sewer Separation

Because of topography and flow of combined sewage within the Park River area, 560 acres of it must be separated to mitigate sewer backups as well as CSO discharges to the Park River. All of the sewer separation area will generally receive new sanitary sewer pipes, and combined sewers will remain in place as dedicated storm drains.

Wastewater and stormwater within this area—highly urbanized and bounded by New Britain Avenue on the south, Summit Street on the west and Main Street/Wethersfield Avenue on the east—flows generally north toward the Park River. The river in this area is contained in the Park River conduit (PRC), which consists of twin 19- by 30-foot conduits that convey river flows from the North and South branches of the Park River through the separation area to the Connecticut River. The PRC has sufficient capacity to accept stormwater flows associated with the entire area's design storm.

South Conveyance Tunnel

Completion of the south conveyance tunnel (SCT) is important to meet the requirements of the CSO consent order and SSO consent decree. It will be designed during Phase 1 and constructed over an estimated three years. Initially, CSOs from the southwestern part of Hartford (Flatbush Avenue and Chandler Street areas) will be captured and directed to the SCT, and later SSOs from West Hartford and Newington will be captured and routed to the SCT. This work will relieve the South Branch of the Park River drainage area and reduce the storage otherwise required of the new deep rock tunnel , which is discussed below.

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CSO Reduction

Deep Rock Tunnel

The deep rock storage tunnel planned in Hartford will store captured CSOs during rain events, and the captured flow will be pumped back to the Hartford WPCF once the rain event subsides. The tunnel will have capacity to store the remaining volume of overall CSO required to afford a one-year level of CSO control.

Gully Brook Restoration

This project will restore Gully Brook, which currently receives sanitary and combined sewer flows. One phase of this two-part effort is the Homestead Avenue interceptor extension (HAIE), which will disconnect the Homestead Avenue interceptor (HAI) from the Gully Brook conduit (GBC) and convey this flow downstream to where the interceptor system has sufficient capacity to accept and convey it to the Hartford WPCF. The second phase is the Gully Brook consolidation conduit (GBCC), which will carry overflows (up to a one-year storm event) that now enter the Gully Brook interceptor (GBI) through a northern and a southern conduit downstream to the deep rock storage tunnel described above, thus removing them from the GBC.

The end result will be removal of sewage contributions to the GBC. After this is accomplished, the GBC can be routed directly to the Park River, as was originally intended. Currently, the GBC is routed into the combined sewer system because it receives sanitary sewage inputs. This practice contributes large volumes of clean water, increasing treatment needs at the Hartford WPCF unnecessarily.

Consolidation Conduits

The consolidation conduit projects will install new pipelines that will carry overflows away from receiving waters, downstream to the deep rock storage tunnel or SCT described above. These large-diameter pipeline projects will convey CSOs and SSOs from many major drainage areas of Hartford and the member communities.

CSO Reduction

Hartford WPCF Upgrade

CSOs will also be reduced by maximizing flow conveyed to and treated at the Hartford WPCF. To handle the increased flow, the WPCF will undergo several enhancements, including a new influent pumping station, new grit removal and wet weather treatment facilities.

These improvements will also enable the District to eliminate SSOs through the improved system conveyance provided by the SCT. Nitrogen removal facilities will also incorporated into the WPCF improvements. This work is discussed in the Nutrient Removal section.

A new influent pumping station, and new grit removal and wet weather treatment facilities will help handle increased flow to the Hartford WPCF.

SSO Reduction

SSOs, which contribute to flooding, will be eliminated throughout the District's member communities.

Sanitary sewer systems use two pipes to keep sewage separate from stormwater. Many of the pipes in the District's communities are more than 100 years old, and thus allow groundwater to infiltrate them through age-related cracks and breaks. The problem gets worse when it rains as sewer pipes fill with stormwater (or water from sump pumps, downspouts, and illegal drainage connections). Once the system reaches capacity, it overflows into the rivers and streams at any of eight SSOs in the area. The Clean Water Project will eliminate structural SSOs in Wethersfield, West Hartford, Windsor, Rocky Hill and Newington.

SSO Reduction Projects

Several state- and federal-mandated remedial measures will be taken to address SSOs under the Clean Water Project. These are discussed below.

CMOM Program

The District must submit a Capacity, Management, Operation and Maintenance (CMOM) program to the Environmental Protection Agency (EPA) and Department of Environmental Protection (DEP). This program will be a self-assessment of the District's collection system maintenance procedures, showing that its CMOM program will eliminate SSOs from the collection system. A corrective action plan and implementation schedule will accompany it. Once the plan has been approved, the District will implement the CMOM program.

Long-Term Preventative Maintenance Program

This program will incorporate the findings of the CMOM program. It will include physical inspection and testing procedures, preventative and routine maintenance schedules and procedures, a tracking system for all maintenance activities, staffing, organization and resource commitments, a plan and schedule for priority and routine maintenance cleaning of the collection system, description of all activities to be used and their frequency, proposed budget for implementation, and a five-year preventative maintenance expenditure plan.

SSO Reduction

Hydraulic Model and Report

The District will develop and submit a model of its sanitary collection system for Hartford and several other member communities—Windsor, West Hartford, Newington, Rocky Hill and Wethersfield—using a hydraulic modeling software package. The model will evaluate portions of the sanitary collection system that include interceptor sewers 12 inches in diameter or greater within both the upstream and downstream limits of all structural SSO outfalls. It will enable the District to assess the hydraulic capacity of each sewershed tributary to, or which contributes to, a capacity-related SSO, identify the appropriate remedial measures to address capacity limitations in the sanitary collection system, understand in detail the system's response to wet-weather events, and evaluate the impacts of the proposed remedial measures and removal of extraneous flows.

Sanitary Collection System Capacity Assessment

Following approval of the modeling report, the District will submit an evaluation of the conveyance capacity of sewersheds tributary to, or which contribute to, capacity-related SSOs. Using the model, this assessment will evaluate all interceptor sewers, pumping stations, force mains and siphons, known areas of sanitary collection system surcharges, known overflow points and areas with known building/private property backups, and other system issues necessary for a technically sound evaluation of the causes of all SSOs.

Assessment of Voluntary I/I Removal Incentive Programs

The District will submit a report assessing the participation rates and effectiveness of its voluntary private inflow source removal program. This assessment will note each voluntary removal, summarize the work performed and estimate the cost. It will also describe the results of the District's follow-up inspections and post-removal flow monitoring. The District will also poll property owners that did not participate in the program to determine why they did not participate.

Implementation of Prior I/I Remediation Recommendations

The District must review recommendations in prior I/I flow investigation reports since January 1, 1995, and submit a consolidated plan that includes a schedule for implementation of each remaining report recommendation. If the District does not plan to implement a specific recommendation, the plan must provide the rationale for that decision.

SSO Reduction

Additional Extraneous Flow Investigations

Results of additional I/I investigations necessary to identify and quantify those sources of extraneous flow within the sewersheds tributary to, or which contribute to, all capacity-related SSOs must be reported. In addition to describing these sewersheds, this report must also: include the rationale for excluding additional I/I investigations; quantify groundwater and rainfall-induced infiltration and inflow components of extraneous flow during periods of high groundwater for each sewershed; and identify and quantify the level of peak rainfall-induced infiltration by evaluating continuous flow monitoring records.

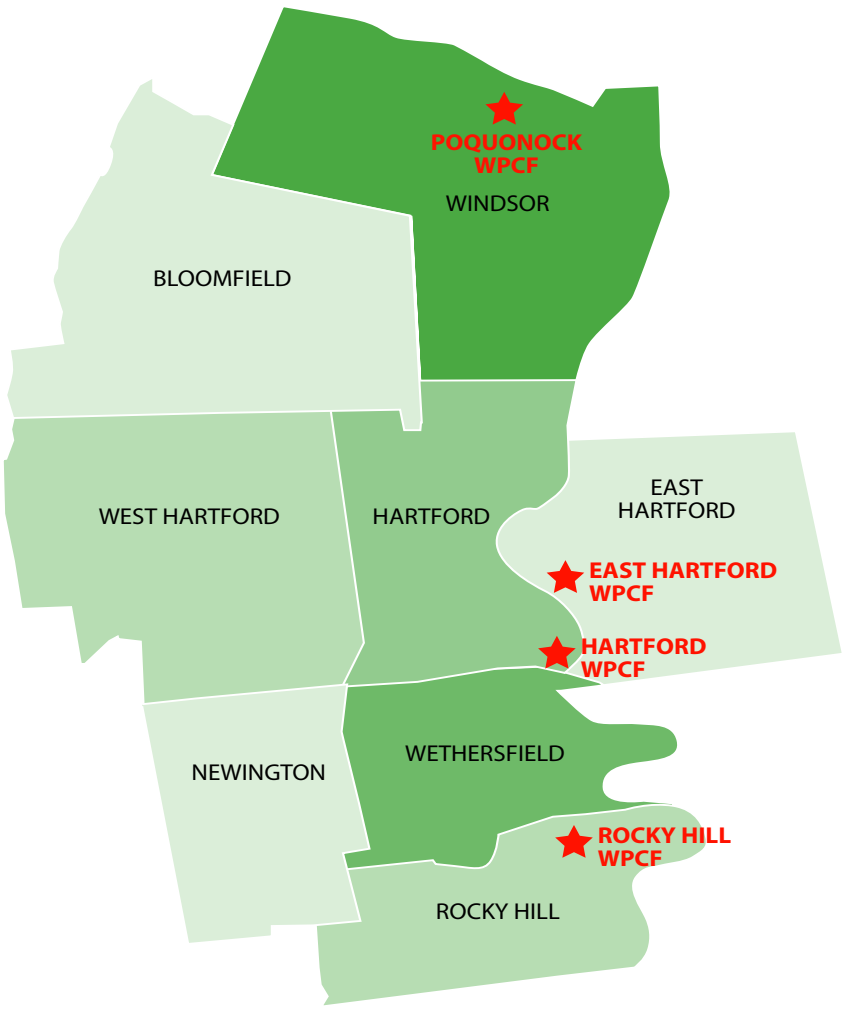
Sewer System Evaluation Report

Following EPA and DEP approval of the Additional Extraneous Flow Investigations report, the District will implement the Sewer System Evaluation Survey (SSES) report. This report will identify extraneous flow sources that are cost-effective to remove as well as itemize and provide a schedule for the measures to eliminate each capacity-related SSO. It will include public and private I/I sources.

Elimination of Discharges from Structural SSO Outfalls

All structural SSO outfall discharges from the District's collection system serving Windsor, Wethersfield and Rocky Hill will be eliminated within five years from the date that the SSES implementation schedule is approved by the EPA and the DEP. Similarly, all structural SSO outfall discharges from the collection system serving Newington and West Hartford must be eliminated 10 years from approval of the SSES schedule. The south conveyance tunnel discussed above will further help mitigate SSOs by capturing overflows and conveying them to the Hartford WPCF.

Nitrogen Removal



The District's four water pollution control facilities will have to address nitrogen reduction to meet requirements by 2014.

The District owns and operates four water pollution control facilities—Hartford, East Hartford, Rocky Hill and Poquonock—as well as the associated wastewater collection systems and sanitary pumping stations that convey flow to each WPCF. The discharge permits for the facilities establish the level of required treatment both for conventional pollutants, including total suspended solids (TSS) and biological oxygen demand (BOD), as well as for nitrogen. The plants were originally designed and constructed to treat only the conventional pollutants, so to achieve the nitrogen removal limits requires modifications or additions or both to them concurrent with receiving and conveying the significant and rapid increase in flow during wet weather events.

Nitrogen Reduction

To address this issue, a recent facilities plan identified and recommended near- and long-term strategies to reduce nitrogen in discharges from each WPCF. The aim is to achieve the goals of the Long Island Sound study, the Comprehensive Conservation and Management Plan, and the state's General Permit for the discharge of nitrogen, in which Connecticut must bring the average concentration of nitrogen in WPCF discharges down to a state-wide average of 5.6 mg/l by 2014.

Plant upgrades are necessary to meet the nitrogen removal requirements of the General Permit by 2014. The state has implemented a nitrogen credit trading program that allows plants not in compliance with their effluent total nitrogen (TN) to "buy credits" and those that achieve their annual TN discharge limit to "sell credits." Because of the high capital and operational cost of complying with these limits, planning, design and construction time needed for new treatment processes, and necessity to maximize the return on the District's limited financial resources, the facility plan analyzed the economics of implementing biological nitrogen removal (BNR) technology compared with buying credits to meet its permits. The

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Nitrogen Removal

cost of purchasing credits compared with implementing nitrogen removal upgrades is the most important driver of this facilities plan.

The facilities plan recommends that implementation of BNR technology at three of the District's four facilities (East Hartford, Hartford, Rocky Hill) together with the purchase of some credits through 2014. The facility plan also recommended no BNR upgrades for the Poquonock WPCF, since it is less costly to purchase credits. By implementing nitrogen removal processes in phases, the District can refine this plan based on proven performance of the installed technologies and minimize the number of credits that need to be purchased.

Hartford WPCF

The plan recommends a phased approach to BNR. Phase 1 would convert the plant's six aeration tanks to be operated as a step-feed BNR process. Step-feed BNR optimizes the biological uptake of nitrogen and facilitates the growth of favorable bacteria by controlling the location in the biological process that the wastewater is introduced for treatment. Some flow is introduced at the beginning of the aeration tanks where the biological treatment occurs, some later in the tank, and the rest still later in the tank. Step-feed has several advantages, including maximizing use of the existing aeration tanks, allowing process requirements under various storm flow conditions to prevent loss of biomass and possible permit violations, allowing rapid recovery of the BNR process from high flows, and providing an operating mode familiar to staff. Phase 2 would add methanol (carbon source) and a high biomass process such as integrated fixed film activated sludge (IFAS) when the cost of nitrogen credits exceeds $4/lb. Fixed film biological organisms—similar and related to the algae growth found on rocks in natural streams—utilize different nitrogen species from suspended growths and when combined with a suspended-growth biological reactor increase a system's nitrogen removal.

Phase 1 offers lower capital cost and a quickly implemented nitrogen reduction program to minimize potential credit costs. Full-scale nitrification/denitrification performance data collected can be utilized more efficiently to design subsequent phases, if necessary and cost-effective, depending on credit costs. Phase 2 would add significant nitrogen removal.

The plan's recommendation provides a baseline of facility and costs for nitrogen removal facilities. Because development and implementation of nutrient removal facilities is an ongoing rapid technological development, the plan's recommendation should be reassessed as the plan's layouts progress and as alternative technologies are further defined over the next 12 to 24 months.

Nutrient Removal

East Hartford WPCF

The East Hartford WPCF recently had an upgrade on its existing tanks and is under design for a second phase of upgrades. To reduce nitrogen, the plan recommends implementing a nitrogen removal process within the existing tanks when nitrogen credit costs exceed $7/lb.. This process establishes distinct zones within the biological process tankage that do not have oxygen present, known as anoxic zones, as well as areas that do have oxygen present. The bacteria present in each zone have differing uptake of nitrogen and by combining both treatment zones increases the nitrogen removal rate within that tankage. This upgrade will enable the facility to achieve an annual average total nitrogen concentration of 10.5 mg/l as required by the state's General Permit for nitrogen removal.

Rocky Hill WPCF

The plan recommends implementing a similar treatment process to that for the East Hartford WPCF to achieve the appropriate nitrogen concentration when nitrogen credits exceed $9.65/lb. These upgrades will achieve a nitrogen concentration of 10mg/l as required by the state's General Permit for nitrogen removal.

Poquonock WPCF

No suitable alternative technologies would enable this plant to meet its obligations under the General Permit that were less costly than purchasing credits.

With the comprehensive Clean Water Project, greater Hartford will realize broad-ranging benefits for years, and the areas waterways will continue to be cleaned up and enhanced, providing much needed protection of such critical resources.