Supplemental CSO Team – Session 5

PVSC Service Area
North Bergen MUA Service Area (Woodcliff Treatment Plant)
Long Term Control Plan

October 16, 2017

CLEAN WATERWAYS
Healthy Neighborhoods

Agenda

- PVSC Plant Tour
- Introduction and Recap
- Introduction to Alternative Analysis
- Stimulating Green Infrastructure on Private Property

  presented by: Larry Levine and Alisa Valderrama
  National Resources Defense Council (NRDC)
- Bayonne CSO Treatment Demonstration Project

  presented by: Stanley V. Cache Jr., PE.
  Manager Director's Office, Division of Water Quality, NJDEP
- Other Issues
- Questions
- Adjourn

CLEAN WATERWAYS
Healthy Neighborhoods

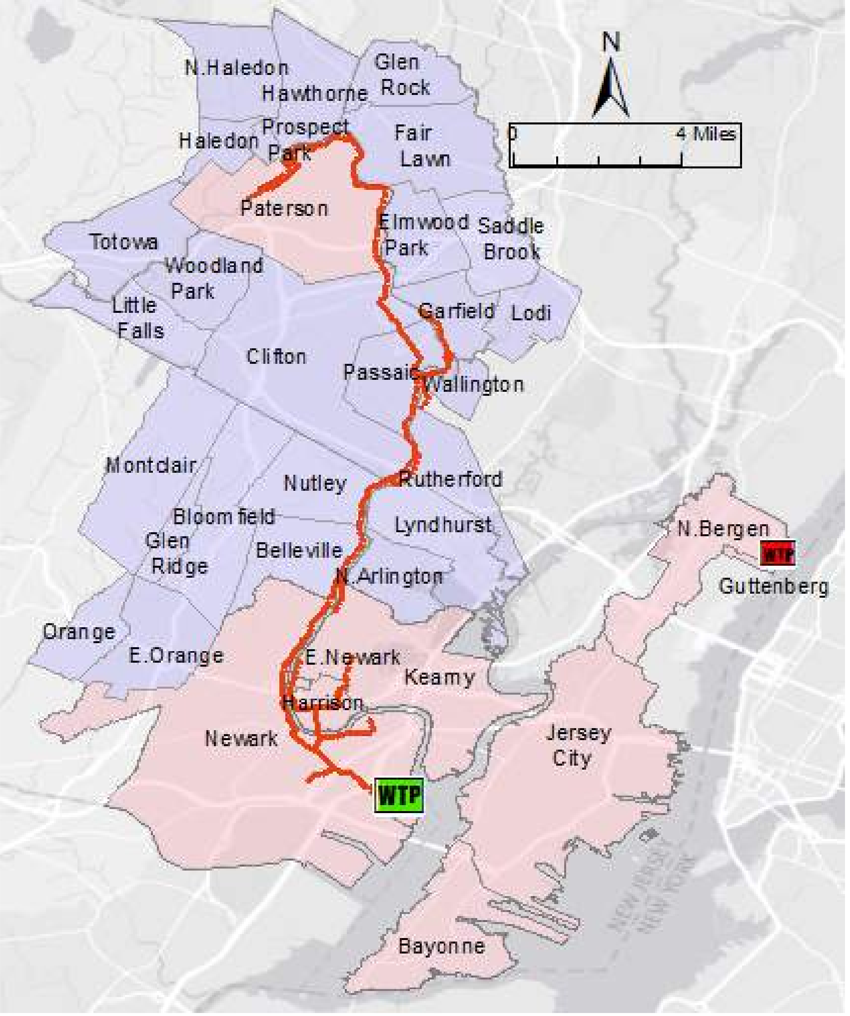
Introduction and Recap

Supplemental CSO Team Members

Member	Organization		Member	Organization
Matt Dorans	Bayonne Chamber of Commerce		Sandra Meola	Paterson Smart
David P. Donnelly	Jersey City Redevelopment Agency		Ruben Gomez	City of Paterson Economic Development
Nicole Miller	Newark DIG		Sheri Ferreira	Greater Paterson Chamber of Commerce
Drew Curtis	Ironbound Community Corporation		Betty Jane Boros	New Jersey Business & Industrial Association
Robin Dougherty	Newark Greater Conservancy/Newark Business Partnership		Debbie Mans	NY/NJ Baykeeper
Jorge Santos	Newark Community Economic Development Corporation		Meiyin Wu, Ph.D	Montclair State University - Passaic River Institute
Christopher Pianese	Township of North Bergen		Christopher C. Obropta, Ph.D	Rutgers University - Cooperative Extension Water Resources
Janet Castro	Hudson Regional Health Commission Town of North Bergen		Captain Bill Sheehan	Hackensack Riverkeeper
Thomas Stampe	North Bergen "Sustainable Jersey" group		Harvey Morginstin	Passaic River Boat Club & Passaic River Superfund CAG
Nancy Kontos	Bunker Hill Special Improvement District		Laurie Howard	Passaic River Coalition
Alison Cucco	Jersey City Environmental Commission		Ben Delisle	Passaic River Rowing Association

Permittees

Permittee	Municipality	WWTP	CSOs
Bayonne MUA	Bayonne	PVSC	30
Borough of East Newark	East Newark		1
Town of Harrison	Harrison		7
Jersey City MUA	Jersey City		21
Town of Kearny	Kearny		5
City of Newark	Newark		18
North Bergen MUA	North Bergen		7
City of Paterson	Paterson		23
PVSC	-		0
Town of Guttenberg	Guttenberg	Woodcliff	1
North Bergen MUA*	North Bergen		1
	Total		114



** North Bergen MUA conveys flows to both PVSC and Woodcliff WWTPs*

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Overview of Progress To Date (Current Permit)

- Advisory/Warning Signs Posted Near Outfalls
- CSO Notification System *(http://njcso.hdrgateway.com)*
- CSO Monthly Discharge Monitoring Reporting (DMRs)
- Work Plans/QAPPs Submitted to NJDEP
  - Baseline Compliance Monitoring Program QAPP – Approved
  - System Characterization and Landside Modeling Program QAPP – Approved
  - Pathogen Water Quality Model QAPP - Approved
  - Other Existing System Characterization Documents - Approved
- Monthly Meetings Amongst the Permittees
- Evaluation of Previous Models and Further Model Development
- Completed Flow Monitoring Program
- Actively Updating Hydrologic and Hydraulic Collection System Models
- Actively Performing Water Quality Monitoring and Model Development

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59-Month Program Schedule and Milestones

Permit Effective Date
July 1st, 2015

We Are Here

January 1, 2016
- ✓ Coordinates of pumps, regulators, and outfalls
- ✓ System Characterization Work Plan
- ✓ Baseline Compliance Monitoring Program Work Plan

July 1, 2016
- ✓ Map of Combined and Separate Sewer Areas

July 1, 2018
- System Characterization Report
- Public Participation Process Report
- Compliance Monitoring Program Report
- Consideration of Sensitive Areas Plan

July 1, 2019
- Development and Evaluation of Alternatives Report

June 1, 2020
- Selection and Implementation of Alternatives Report in the Final LTCP

Permit Due Date

Introduction to Alternatives Analysis

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Presumption vs. Demonstration

- Two approaches for evaluating compliance with the water quality based requirements of the Clean Water Act
  - Presumption Approach
    achieving one of the following:
    - *No more than an average of four overflow events per year*
    - *The elimination or the capture for treatment of no less than 85% by volume of the combined sewage collected in the CSS during precipitation events*
    - *The elimination or removal of no less than the mass of the pollutants… for the volumes that would be eliminated or captured with 85% capture*
  - Demonstration Approach
    - Demonstrate, through monitoring and modeling, that the LTCP will not preclude the attainment of water quality standards or the receiving water's designated uses.

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Permit Requirements

- Evaluate the feasibility of potential control alternatives, including:
  - ***Green infrastructure***
  - Increased storage capacity in the collection system
  - Treatment expansion or storage at PVSC
  - Inflow and Infiltration (I/I) reduction
  - Sewer separation
  - ***Treatment of CSO discharge***
  - CSO related bypass of secondary treatment at PVSC

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Green Infrastructure Evaluation

- Less Runoff Reaching the Combined Sewer System = Less Overflow
- Use H&H models to determine the potential overflow reductions from GI.
- Evaluate varying levels of GI control as a percentage of impervious cover controlled

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Increased Collection System Storage Evaluation

- Capture and hold volume until conveyance and treatment capacity return
- Tanks, tunnels, pipes, etc.
- Use regional H&H models to size and evaluate the overflow reduction of potential storage solutions.

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Treatment Expansion or Storage at PVSC Evaluation

- Convey additional flow to PVSC for treatment Plant is already at wet weather capacity, so it would require plant expansion
- The interceptor has limited capacity
- Use H&H models to evaluate the potential overflow reductions of sending more flow to PVSC

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Inflow and Infiltration Reduction Evaluation

- I&I is water that enters the collection system through cracks, joints, etc.
- Rainfall and groundwater driven
- Some I&I is expected
- Excessive I&I uses conveyance and treatment capacity that would otherwise be available for combined sewage, and adds to CSOs
- Use H&H model to evaluate overflow possible overflow reductions from reducing excessive I/I

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Sewer Separation

- Eliminate CSOs
  - Stormwater discharges still remain

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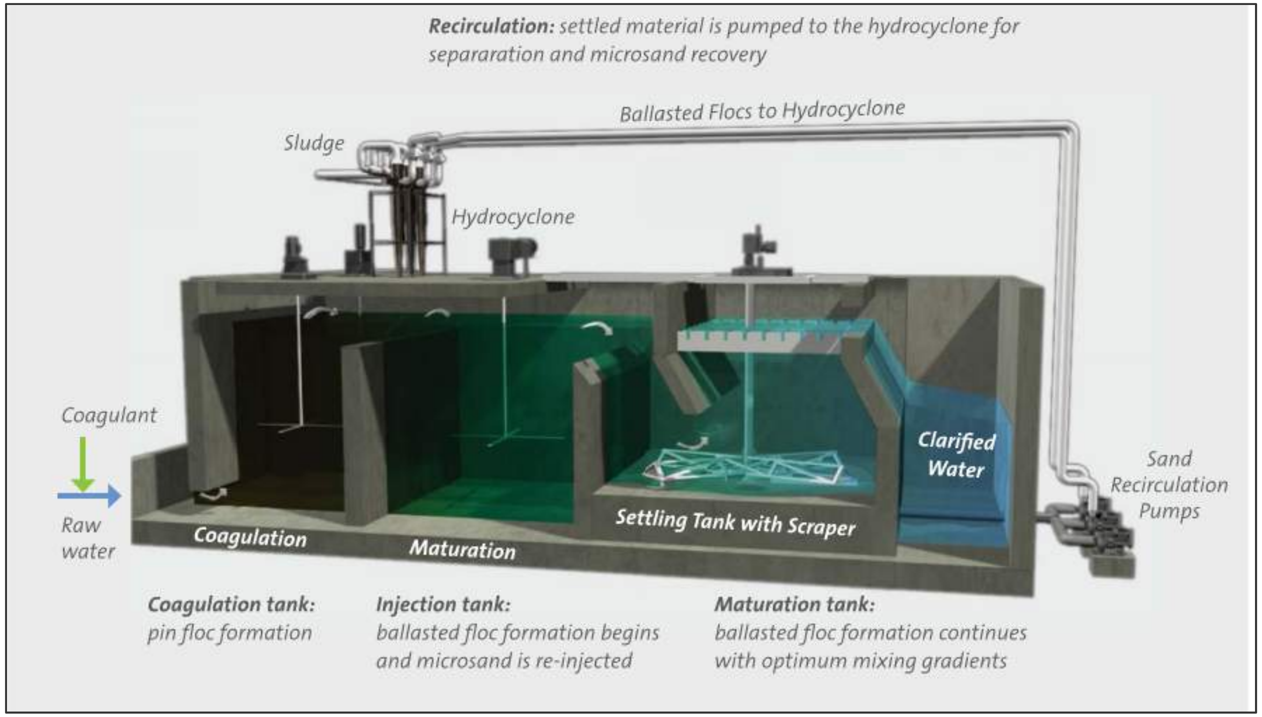
Treatment of CSO Discharge Evaluation

- Use the H&H models to size the required disinfection facilities



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Secondary Treatment Bypass Evaluation

- Convey additional flow to PVSC for treatment.
- Bypass secondary/biological treatment
- Additional conveyance required

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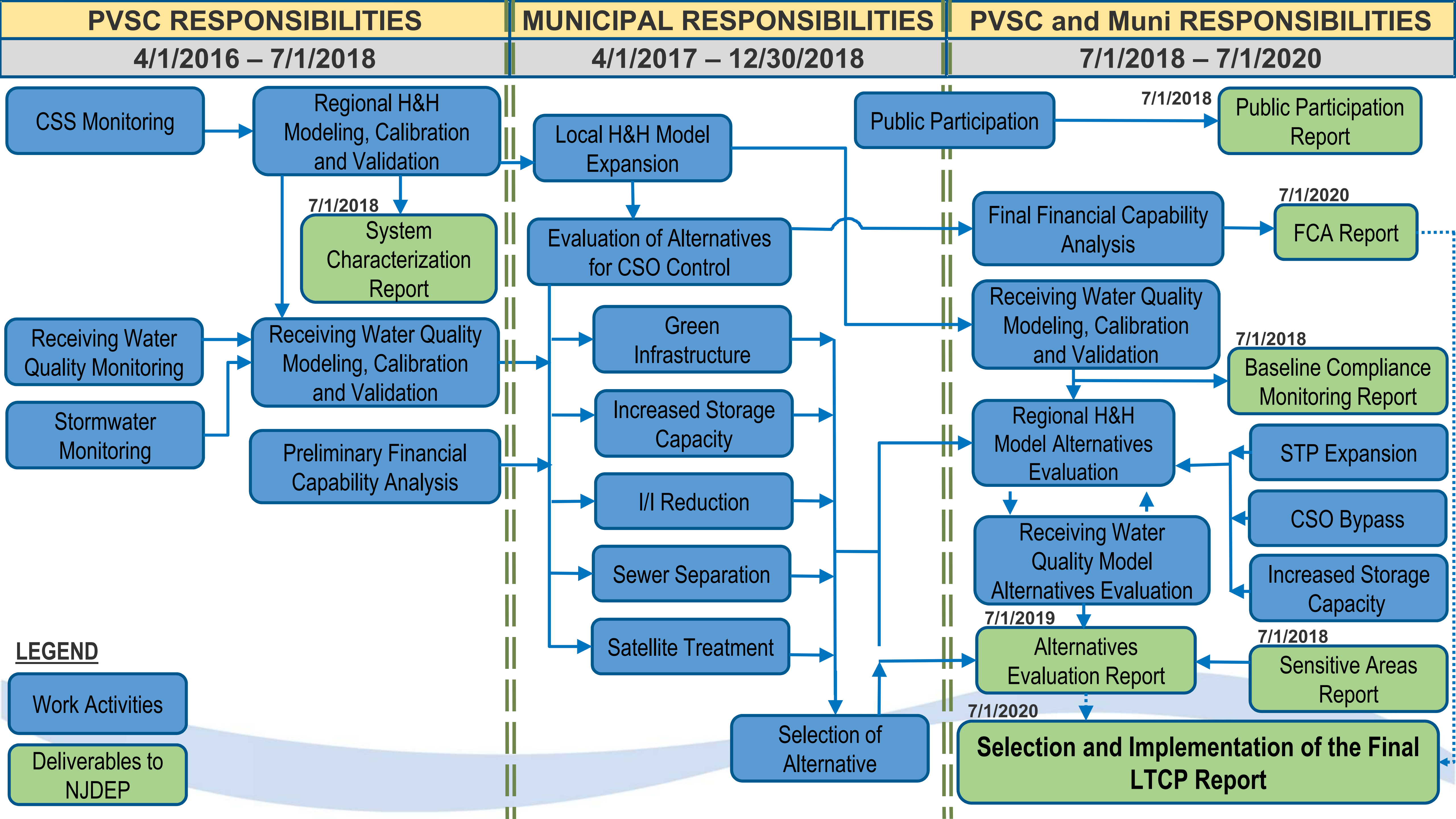

PVSC RESPONSIBILITIES
4/1/2016 – 7/1/2018
MUNICIPAL RESPONSIBILITIES
4/1/2017 – 12/30/2018
PVSC and Muni RESPONSIBILITIES
7/1/2018 – 7/1/2020
CSS Monitoring
Regional H&H Modeling, Calibration and Validation
7/1/2018
System Characterization Report
Receiving Water Quality Monitoring
Stormwater Monitoring
Receiving Water Quality Modeling, Calibration and Validation
Preliminary Financial Capability Analysis
Local H&H Model Expansion
Evaluation of Alternatives for CSO Control
Green Infrastructure
Increased Storage Capacity
I/I Reduction
Sewer Separation
Satellite Treatment
Selection of Alternative
Public Participation
7/1/2018
Public Participation Report
Final Financial Capability Analysis
7/1/2020
FCA Report
Receiving Water Quality Modeling, Calibration and Validation
7/1/2018
Baseline Compliance Monitoring Report
Regional H&H Model Alternatives Evaluation
STP Expansion
CSO Bypass
Increased Storage Capacity
Receiving Water Quality Model Alternatives Evaluation
7/1/2019
Alternatives Evaluation Report
7/1/2018
Sensitive Areas Report
7/1/2020
Selection and Implementation of the Final LTCP Report
LEGEND
Work Activities
Deliverables to NJDEP

Stimulating Green Infrastructure on Private Property

presented by: Larry Levine and Alisa Valderrama

National Resources Defense Council (NRDC)

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Healthy Neighborhoods

Catalyzing Green Infrastructure Opportunities on Private Property

NRDC

October 2017

Alisa Valderrama

Motivation

- An increasing number of cities and municipalities are committed to “green” approaches to meet their Clean Water Act goals and keep polluted runoff out of waterways.
- Green infrastructure (GI) mimics natural hydrologic processes to capture, infiltrate, and evapo-transpire rainwater at or near the site where it falls.
- These approaches work in many soil conditions; highly infiltrative soils are not required for adequate functioning of the majority of GI with proper design and installation.
- Green stormwater strategies are attractive because they provide a range of public benefits that traditional “gray” solutions lack, including:
    - improved air quality
    - regulation of urban temperatures
    - reduce flood risk (in some cases)
    - opportunities to improve property values in underserved communities
    - improved urban resiliency overall
- Siting GI on public property and publicly controlled rights-of-way comes most naturally--however, very low-cost green infrastructure opportunities exist on private property.

Example: Green City Clean Waters

Philadelphia commits to "greening" approx. 10,000 acres within the combined sewershed by 2036.* Three key sources of greened acres:

1) **Retrofits on public land/public right-of-way (ROW)**
   Managing stormwater from streets, sidewalks, parks, and other publicly-owned impervious areas

2) **Private property retrofits <u>required</u> by on-site capture standards for new and re-development**
   Local rule requiring new and re-development projects above a threshold size to manage first inch of stormwater as a condition of permit approval

3) **<u>Voluntary</u> private property retrofits obtained through incentives**
   Subsidies for private property retrofits and a stormwater billing system that enables stormwater fees to be reduced if owners retrofit.

*To "green" an acre in Philadelphia means to manage first inch of stormwater from an acre of impervious area.

Stormwater fees: necessary but not sufficient for a robust GI market

- To stimulate private property retrofits, Philadelphia instituted an impervious-area (IA) based stormwater fee for commercial property owners
- Fee included up to 80% discount on monthly stormwater fees for property owners who installed GI.
- Based on fee savings alone, if a property owner wanted to break even on the retrofit cost within four years, it would mean that a project would need to cost less than ~$ 0.40 per square foot.
- Fee discount alone insufficient to encourage GI retrofits

GI practice	Retrofit cost ranges ($/ft^2) * **
Downspout disconnections	$0.33-0.38
Vegetated Swales	$0.64- 2.13
Infiltration Trenches	$1.38-$1.58
Rainwater Harvest/Reuse	$1.28- 5.33
Rain gardens	$3.88-4.43
Porous Pavement	$4.88-5.58
Green Roof	$30.70-63.97

**Costs estimated in 2012 dollars.*
***Cost ranges represent Philadelphia capital cost estimates. Costs estimates do not include O&M. Costs vary greatly by city and on a case-by case basis. As such, these ranges are most useful as points of comparison across practice types.*

Policy framework for stimulating private property retrofits

…Projects need to be economically attractive to private property owners…

- Fees and discounts are most effective when used in combination with subsidies or grants that cover bulk of costs to "green" private property
- Impervious-area based stormwater fees and discounts are useful not as a motivation to retrofit but rather as a "pay for performance" contract to ensure long-term maintenance
- Combination is needed of requirements for new and re-development + area-based stormwater fees + grants

Of the total ~10,000 acres that Philadelphia has committed to "green" over 25 years, Philadelphia projects that roughly 2/3 of its green infrastructure from private property retrofits!

Philadelphia’s grant programs: key points

- Philadelphia’s grant programs cover the upfront costs of stormwater management opportunities on private land. **Grants cover nearly all the costs of typical GI retrofits**—between $100,000 to $150,000 per acre of impervious area managed.

- Long-term maintenance: **Applicants agree to install GI and to maintain** the GI practice on behalf of the City for a 45-year period in exchange for the grant dollars.

  - ✓ The stormwater fee discount will remain in effect so long as the owner maintains the GI.

  - ✓ Max. potential fee savings amount was designed to more than cover the cost of the maintenance to enable some cash savings for owners.

- Grant programs **enable “project developers” to identify viable projects and take the lead** in application process

What we have learned from other cities' efforts

Impervious-area based stormwater fees and strong onsite capture rules

+

Grants that cover the costs of GI retrofits on private land

+

User-friendly GI grant program structure

=

Elements of a user-friendly grant program (1 of 2)

- Provide a direct financial benefit to property owners—beyond reimbursing the direct costs for green infrastructure.
  - ✓ Cash savings on stormwater fee that is more than sufficient to cover GI maintenance
  - ✓ Fund retrofits that provide enhanced property value (for example, through improved aesthetics, onsite flooding risk reduction, amenity value)

- Design the program to be as transparent, simple and flexible as possible for property owners.
  - ✓ Enabling owners or project developers to submit applications
  - ✓ Potential participants need certainty and straightforward contractual terms
  - ✓ Project economics should be simple and clear for applicants: programs should offer subsidy per gallon of stormwater captured or square foot of impervious area managed, or subsidy by GI practice type (e.g., green roof, porous pavers, etc)

User-friendly grant program (2 of 2)

- If necessary, engage a third-party to administer the new program
  - ✓ Third party can engage on property owner and project developer education and outreach, as well as program financing, long-term O&M, community engagement functions

- Bring community-based organizations into the program early on as partners to help the program succeed and help achieve citywide environmental and social goals

- Look to affordable housing as an opportunity for green infrastructure to support both clean water goals and broader municipal goals.

- Stormwater and GI-enabling policies should be mainstreamed throughout all relevant city agencies, programs, and policies.

Conclusions

- Likely that in many cities, a hybrid gray/green approach to runoff management that utilizes both private and public land is most cost-effective
- Strategic policies can play an important role in helping cities leverage the most economic GI projects, including on private property
  - ✓ On-site capture requirements for new and re-development
  - ✓ Impervious-area based stormwater fees can help encourage voluntary retrofits
- Fee discount unlikely on it's own to motivate voluntary retrofits. Instead, fees can be adjusted to motivate owners to maintain GI
- Direct subsidies (i.e., grant program) are required to achieve voluntary GI retrofits on private property
- In order to operate on a large scale, grant programs meant to stimulate private property retrofits need to be easy to work with and provide direct financial benefit to property owners

Thank you

avalderrama@nrdc.org

Appendices

Motivating private property retrofits in Philadelphia

GI practices Example strategies

	Off-site Mitigation	Aggregation	$0.50/ft² Subsidy	$1.00/ft² Subsidy	$3.00/ft² Subsidy	$3.50/ft² Subsidy
Downspout Disconnection	■	■	■	■	■	■
Swales		◧	◧	■	■	■
Infiltration Trenches			◧	■	■	■
Rainwater Harvest & Reuse			◧	◧	◧	◧
Rain Gardens					◧	■
Reducing Impervious (Hard) Surfaces					◧	■
Flow-Through Planters					◧	◧
Porous Pavements						
Green Roofs						
New Potential Greened Acres	658	215	2,532	2,252	1,015	344
Total Potential Greened Acres	658	873	3,405	5,656	6,671	7,015
Progress to 9,564 Greened Acres Goal	7%	9%	36%	59%	70%	73%

Key points from table above: At a subsidy rate of **$3.50/ft²** (~$150k/acre) a lot of private property retrofits can happen. Even at that rate of subsidy, the costs for private property GI projects in Philadelphia are much lower than retrofits in the public ROW, where capital cost estimates at the time were ~$250k/acre, or **$5.74/ft²**.

Source: Creating Clean Water Cash Flows (NRDC, TNC, & Encourage Capital, 2013)

Bayonne CSO Treatment Demonstration Project

presented by: Stanley V. Cache Jr., PE.
Manager Director's Office
Division of Water Quality, NJDEP

CLEAN WATERWAYS
Healthy Neighborhoods

Wet Weather Flow Treatment and Disinfection Demonstration Project

"A Cost-Effective 21st Century Solution to a 20th Century Problem"

Supplemental CSO Team
PVSC
Oct. 16, 2017

Stanley V. Cach Jr., P.E., P.P., BCEE., D.WRE
NJDEP Project Manager
Division of Water Quality

Wet Weather Flow Treatment & Disinfection Demonstration Project

Stanley V. Cach Jr., P.E., P.P., BCEE., D.WRE
NJDEP Project Manager
Division of Water Quality

&

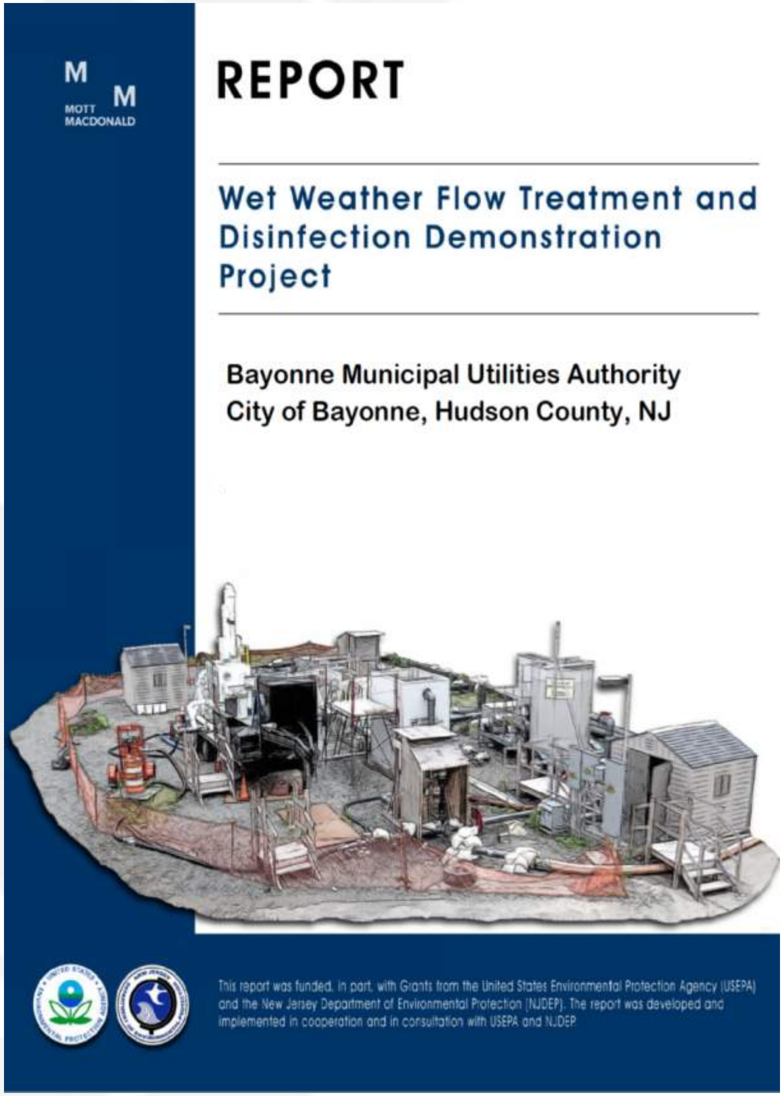
John Dening, CFM, P.E.
Mott MacDonald
Senior Project Manager

Acknowledgements

- Bayonne MUA
- USEPA
- NJDEP
- Technical Advisory Committee
- Regulatory Oversight Team
- PVSC
- United Water / SUEZ
- Equipment Suppliers
- Sampling Team

The Report

- Background
- Project Objectives
- Project Collaboration
- Technologies Tested
- Findings
- Conclusions

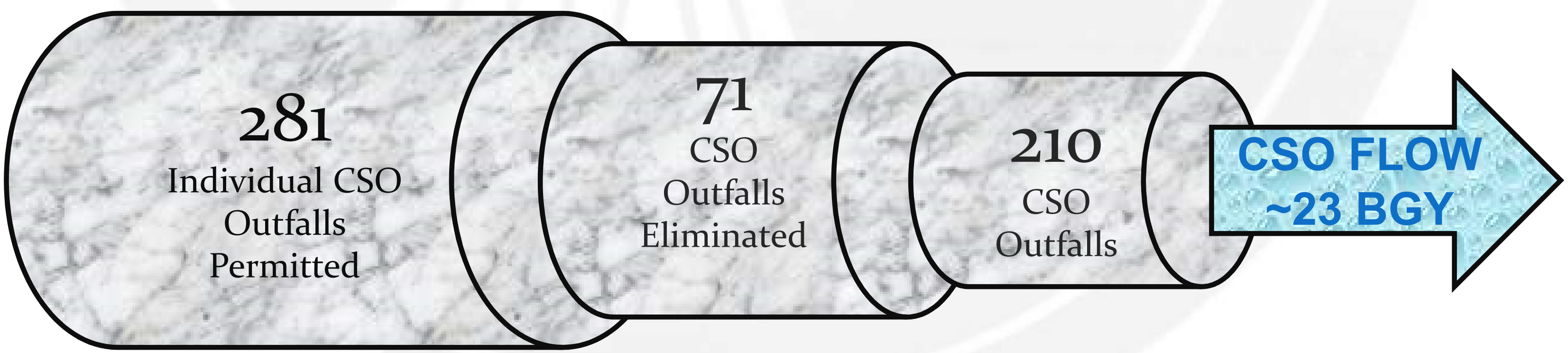


September 2017

Background: CSO Options

ELIMINATE	REDUCE/STORE	TREAT
Separate	Green	POTW
I/I Reduction	Gray	Satellite/End of Pipe
	LID	

S/F Removed 700 Tons/YR



Background: A Cost Effective Alternative

- Satellite/End of Pipe Technologies
  - CSO Feasibility Studies (2005-2007)
    - Technologies were limited & not fully proven
    - Performance was not independently validated
  - SSO Abatement Alternative Analysis (2014)
    - Satellite technologies chosen instead to storage, transport and treat at POTW

One Comprehensive Study:
Wet Weather Flow Treatment & Disinfection Demonstration Project

- One study for all CSO permittees
- **Purpose:** verify performance & costs
- **Duration:** over 2 years (2014-2015)
- **Location:** Oak Street Facility, City of Bayonne
- **Collaboration**:
  - Technical Advisory Committee
  - Regulatory Oversight Team

Project Endorsement

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NATIONAL RISK MANAGEMENT RESEARCH LABORATORY
WATER SUPPLY AND WATER RESOURCES DIVISION
2890 WOODBRIDGE AVENUE, BUILDING 10, MS-104
EDISON, NJ 08837

February 8, 2007

OFFICE OF
RESEARCH AND DEVELOPMENT

Stanley V.Cach, Assistant Director
State of New Jersey
Department of Environmental Protection
Division of Water Quality
Municipal Finance & Construction Element
401 East State Street
Trenton, NJ 08625-0425

Re: CSO High-Rate Disinfection Demonstration Project Proposal

Dear Mr. Cach,

We here in the Edison EPA National Urban Wet-Weather Flow (WWF) Research Program are excited to learn that the New Jersey Department of Environmental Protection (NJDEP) proposed combined sewer overflow (CSO) disinfection research demonstration project is progressing towards fruition. We admire your ability to bring together governments, CSO communities, technology vendors, consultants and researchers, and other concerned stakeholders for the purposes of gathering interest in the project and leveraging their resources. We are also happy to hear that New Jersey CSO communities, including the city of Bayonne Municipal Utilities Authority(BMUA), communicated their willingness to support such a project.

The reason for our strong support for this venture, outside of our research interest of course, is that the project will not only result in local municipal and state benefits but will make a significant beneficial national impact as well. This is because it will be an evaluation of new and improved high-rate disinfection technologies, required to satisfy the intent of National and State CSO Control Policies and mandates. Further, high-rate disinfection will be of lower cost and greater effectiveness than conventional disinfection. The proposed project stands to save the State and the Nation hundreds of millions of dollars while reducing risks to human health.

BMUA's willingness to be involved with this project, is welcomed at this juncture because EPA's research budget is low. We are aware that a full-scale demonstration of this nature is estimated to cost a few million dollars and the BMUA is offering their abandoned primary wastewater treatment plant to conduct the demonstration. Such a facility is hard to find elsewhere. Equally impressive is the willingness of new technology manufacturers and vendors (i.e., per-acetic acid, bromine, UV and fuzzy-filter) to contribute resources to this project. All the above contributions will add to the NJDEP's resources to make this project become a reality.

"The reason for our strong support for this venture, outside of our research interest of course, is that the project will not only result in local municipal and state benefits but will make a significant beneficial national impact as well."

– Richard Field, P.E., D.WRE of United States Environmental Protection Agency

Project Collaboration

Project Leadership

NJDEP
Division of Water Quality

Bayonne Municipal Utilities Authority

Mott MacDonald
(Project Manager)

Operational Support

Passaic Valley Sewerage Commission

Suez/ United Water

Technical Advisory Committee (7)

NJDEP
Division of Water Quality

USEPA
Office of Research and Development – Cincinnati/ Edison

Rutgers University

Mott MacDonald

Moffa and Associates Consulting Engineers

Regulatory Oversight Team (15)

NJDEP
Division of Water Quality

Division of Water Monitoring & Standards

Office of Quality Assurance

Office of Science

USEPA
Office of Research and Development – Edison

Quality Assurance Staff

Rutgers University

Project Collaboration:
Technical Advisory Committee

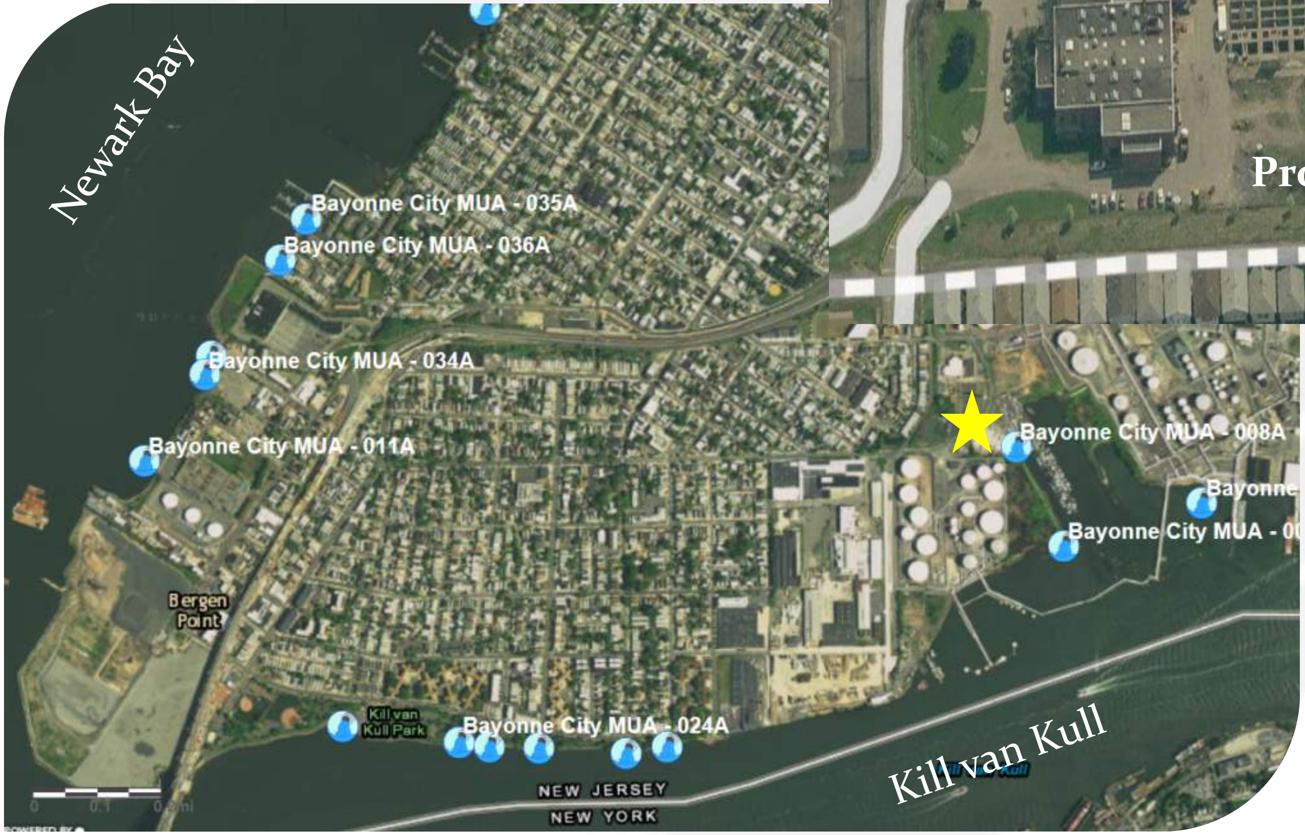
Committee Members:

- **Peter Moffa, P.E.**
- **Richard Field P.E., D.WRE, BCEE** (EPA ORD, Retired)
- **Jurek Patoczka, PhD, P.E.**
- **Daniel Murray, P.E.** (EPA ORD)

Committee Members (cont'd):

- **Qizhong Guo, PhD, P.E.** (Rutgers)
- **Stanley Cach, P.E., D. WRE BCEE** (NJDEP)
- **Shadab Ahmad, P.E.** (NJDEP)

Demonstration Project Site



Project Objectives

- Select & verify the performance of end of pipe technologies to treat CSO discharges
  - Under field conditions
  - For solids removal & disinfection
  - At remote satellite locations

- Improve engineering practitioners understanding of wet weather technologies
  - Reliability
  - Scalability
  - Anticipated capital and O & M costs

Technologies Tested:

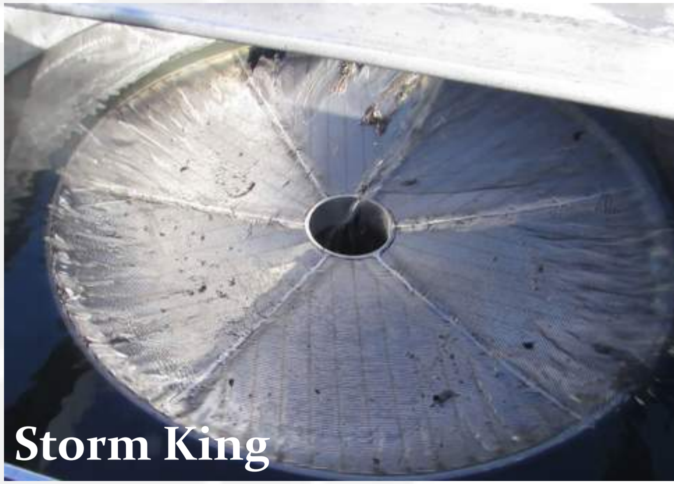
SIX (6) PILOT TECHNOLOGIES

- **18** treatment scenarios during **9** storm events
- **200-300** samples per event

Technology	Type	Function
Storm King	Vortex	Solid removal
Terre Kleen	Plate settler unit	Solid removal
Flex Filter	Compressed media filter	Enhanced solid removal
Trojan	Low pressure UV	Disinfection
Aquionics	Medium pressure UV	Disinfection
Injexx/Verdent	Peracetic acid (PAA)	Disinfection

Why These Technologies?

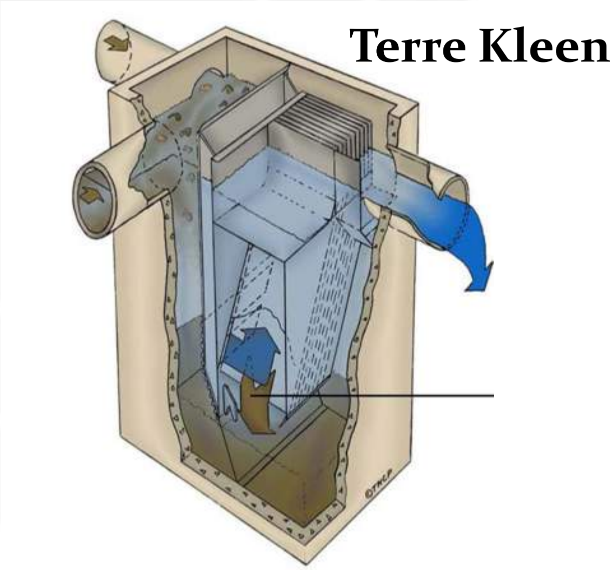
- Technologies were chosen for their:
  - Suitability for remote satellite facilities
  - Documented performance
    - Ability to meet CSO performance limits
  - Simple operation
  - Small footprint
  - Ease of maintenance
  - Cost
    - Construction and O&M



Why High-rate Solids Removal?

- **Vortex type- Storm King**
  - A vortex hydrodynamic solids separation w/ swirl self-cleaning screen
  - No moving parts & non powered
  - Remote & self-activating
  - Anticipated reduction:
    - TSS: 30-50%
    - BOD: 20-30%

- **Plate Settler Unit- Terre Kleen**
  - Gravimetric solids separation



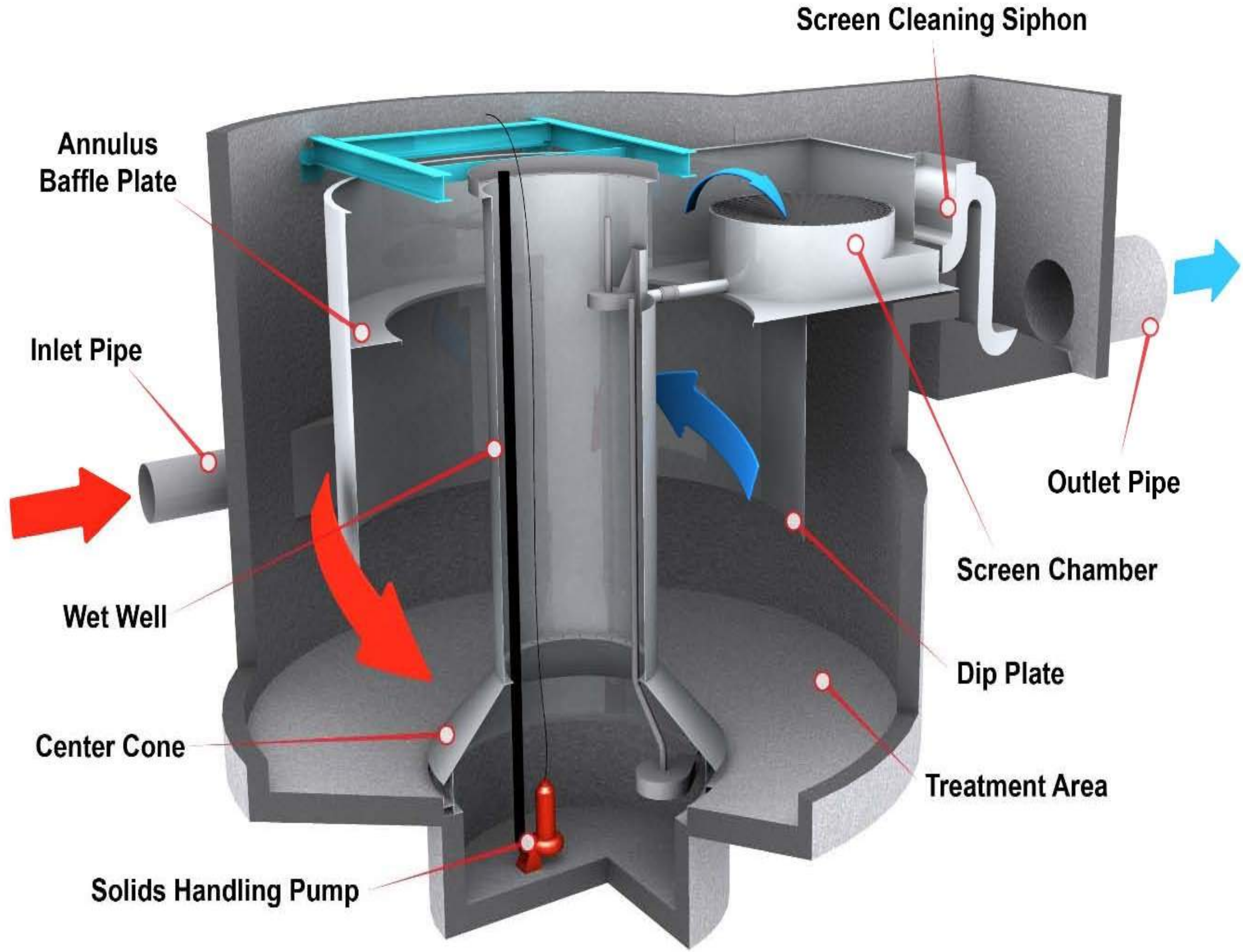


Fig.1 Storm King with Swirl Cleanse Operational Diagram

Courtesy of Hydro International

Why Enhanced High-rate Solid Removal?

- **Compressed Media Filter – FlexFilter**
  - Innovative technology
  - Remote, simple operation
  - No chemicals required
    - No ramp up time
  - Anticipated reduction:
    - TSS: 85-90%
    - BOD: 50-60%
  - Self contained & easy retrofit

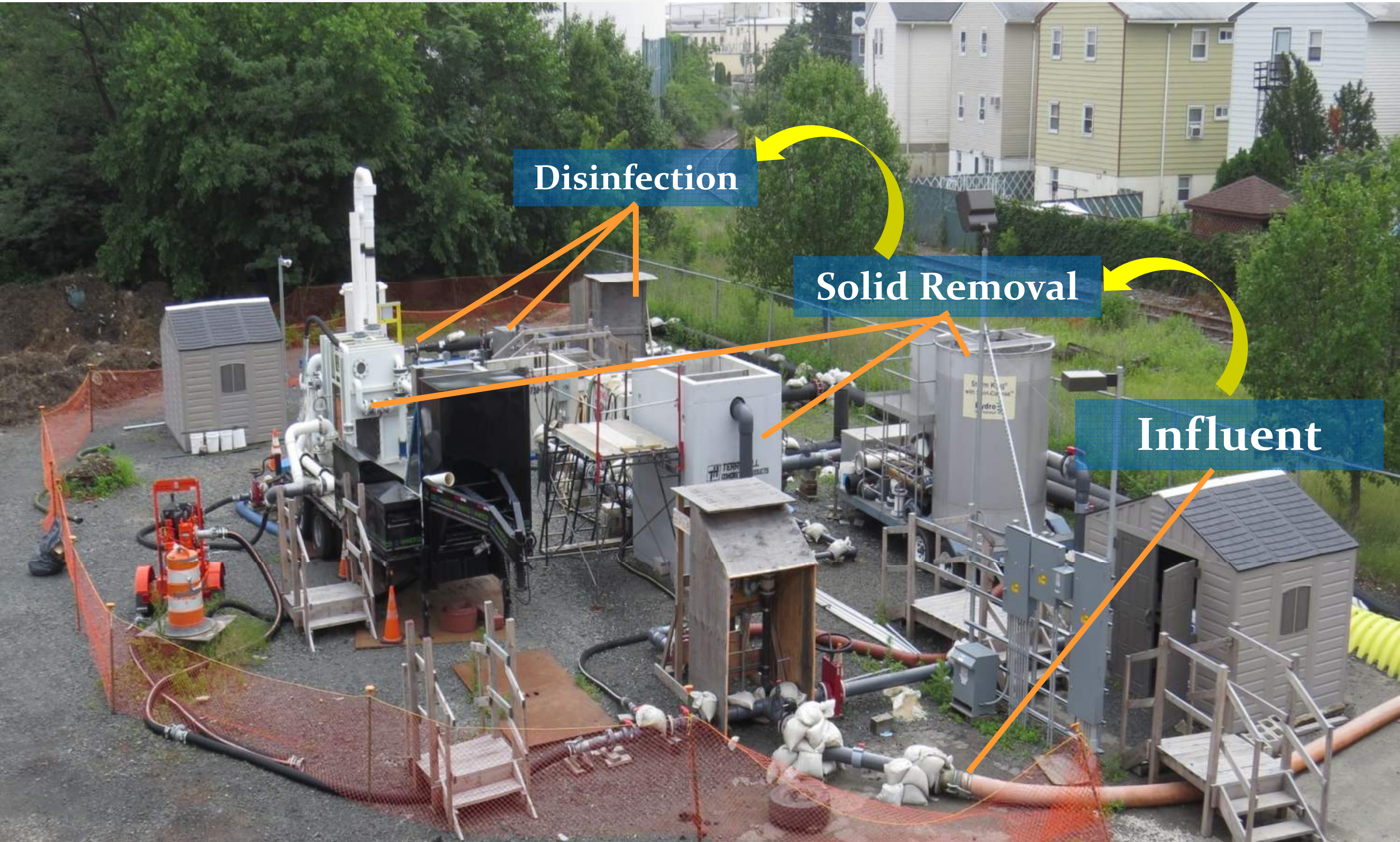
Why Chemical Disinfection?

- **Peracetic Acid** - Injexx/Verdent
  - Emerging technology per USEPA
  - High rate disinfectant
    - Stronger oxidant than hypochlorite
    - No harmful by-products
    - Could require no neutralizing agents
    - Longer effective shelf life
    - Contact time less than 5 minutes
  - Can be used in combination w/ UV

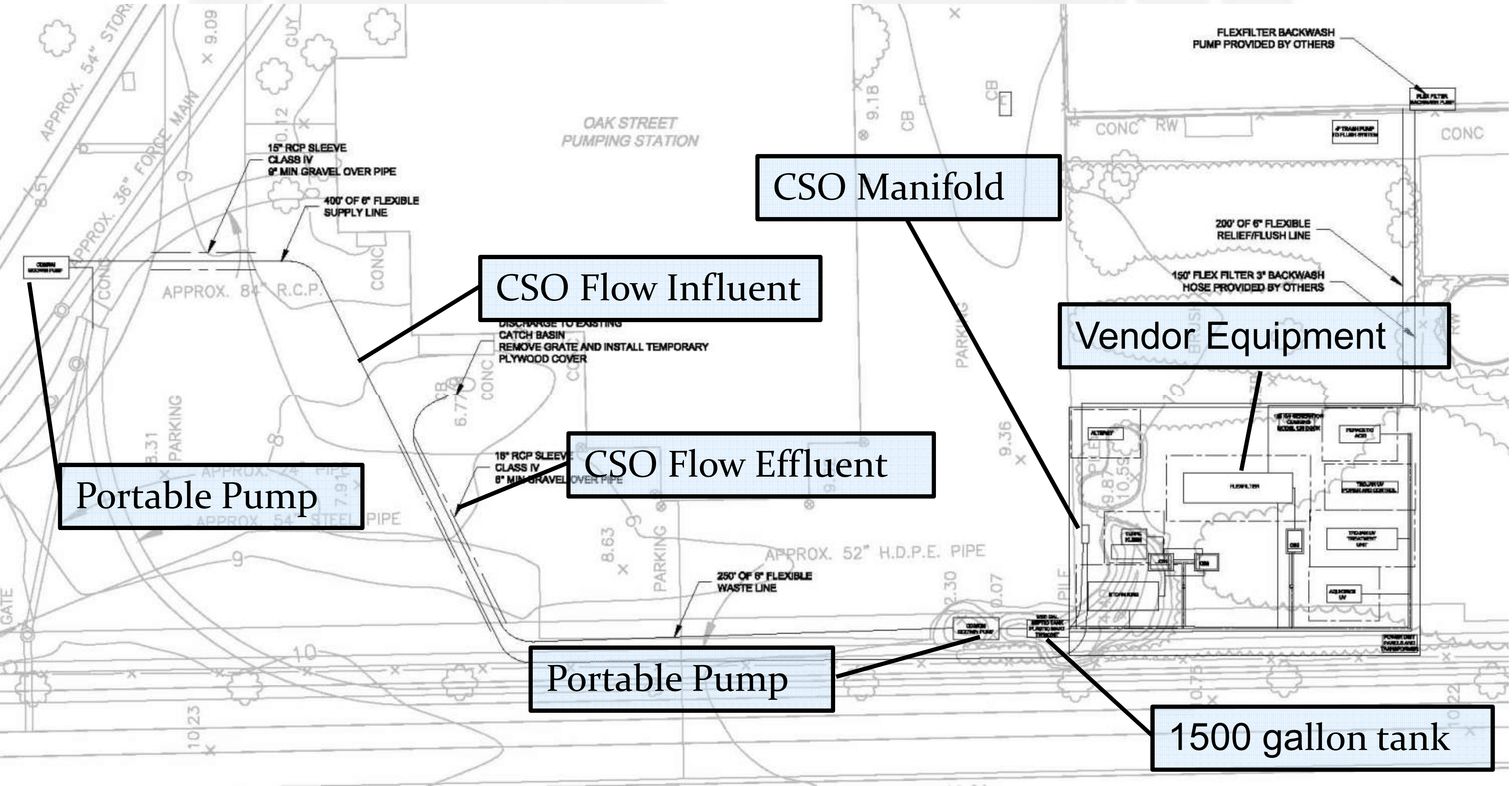
Project Summary & Timeline

- **Aug 2013:** Agreement with BMUA
- **Sept 2013:** Vender Proposal
- **Nov 2013:** Vender Recommendation Report
- **Feb 2014:** Submission of Draft QAPP
- **June 2014:** Approval of Final QAPP
- **Jan-Apr 2014:** Pilot Design/Modifications
- **June 2014:** Pilot Authorization
- **Sept 2014:** Completion of Pilot
- **Sept 2014:** Dry Run of Pilot
- **Oct-Nov 2014:** Four pilot runs
- **Nov 2014:** Winterization of Pilot
- **Jul 2015:** Re-establish Pilot
- **Jul-Sept 2015:** Three wet weather events
- **Oct 2015:** Two blended events

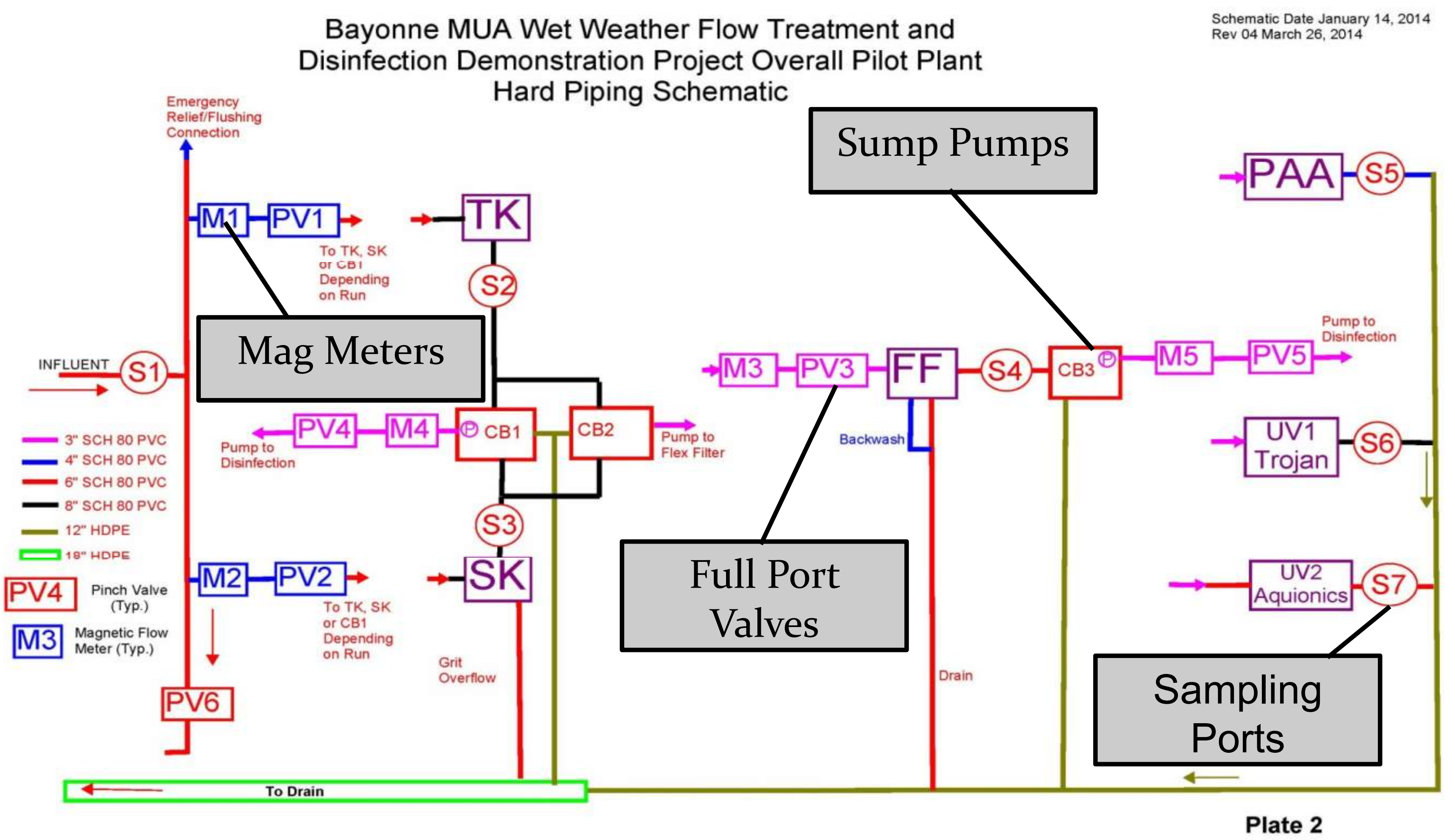
Demo Project Site (Aerial View)



Project Site Layout



Hard Piping Schematic



The Project: Pictures and Videos

For more pictures and videos of the Demo Project…

…check us out on Flickr:
flickr.com/gp/155170897@N08/Lc87W5

WWETCO
Bio-FlexFilter™
(Compressed Media Filter)

Backwash Ends

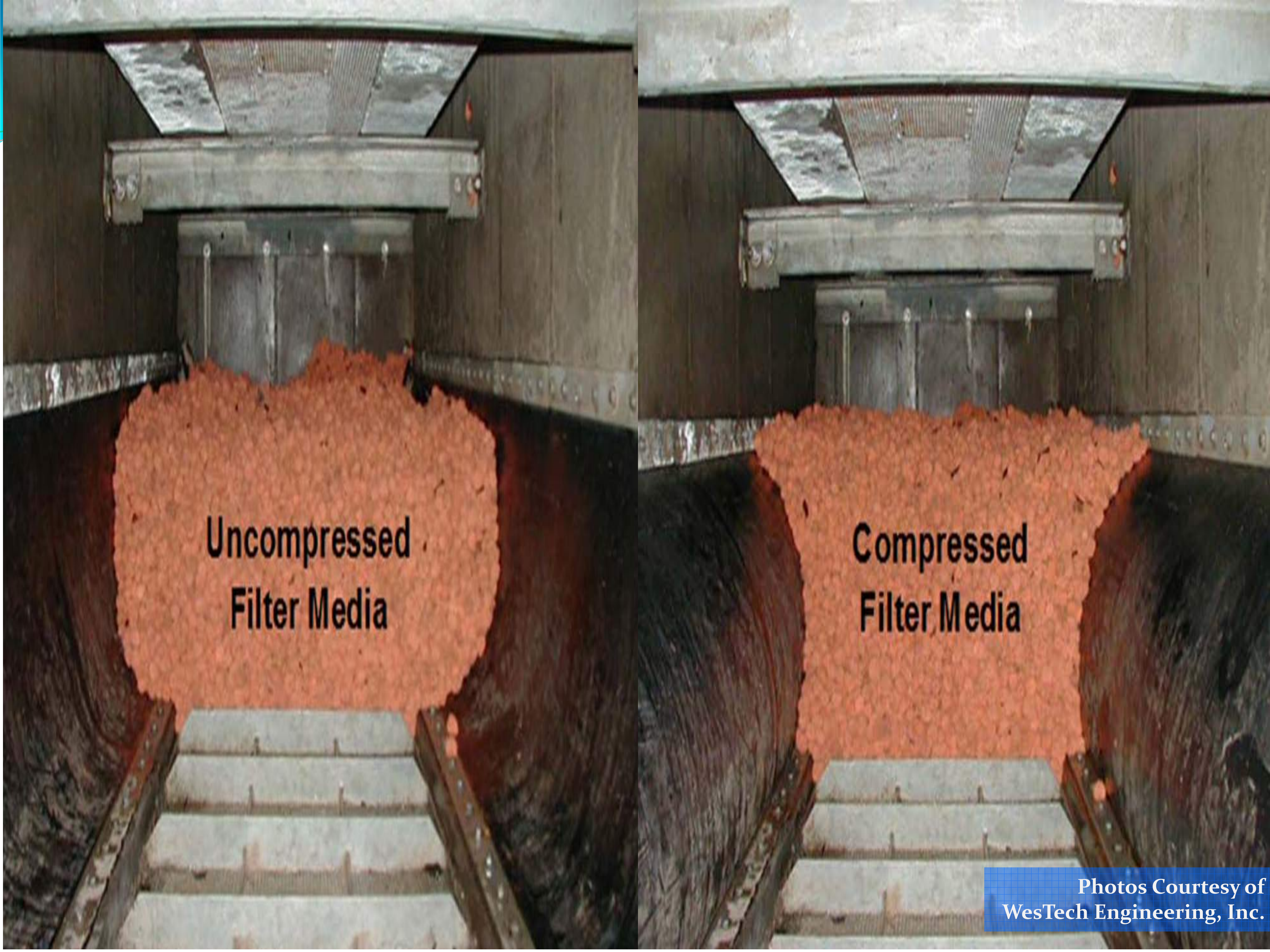
Filter Drain

Media Compression

Filtration

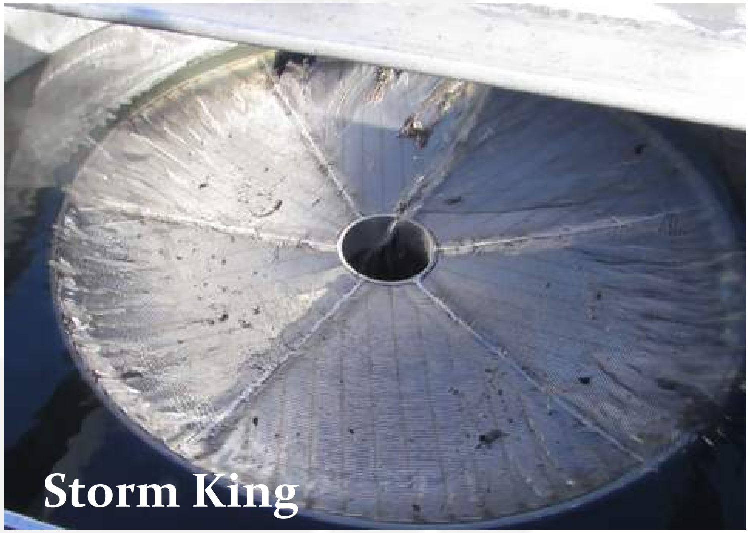
Backwash

Video courtesy of WesTech


Uncompressed
Filter Media
Compressed
Filter Media
Photos Courtesy of
WesTech Engineering, Inc.

Technology Findings

1. **Storm King & Terre Kleen** (High-rate Solid Removal)
   - Effective treatment for grit removal/inorganics
   - Unable to reduce lighter solids for UV disinfection treatment



2. **Flex Filter** (Enhanced High-rate Solid Removal)
   - Effectively reduces **TSS (90%)** for UV or chemical disinfection treatment
   - Flex Filter effluent concentrations for **TSS & CBOD averaged 25 & 48 mg/l** respectively (excluding the first event)

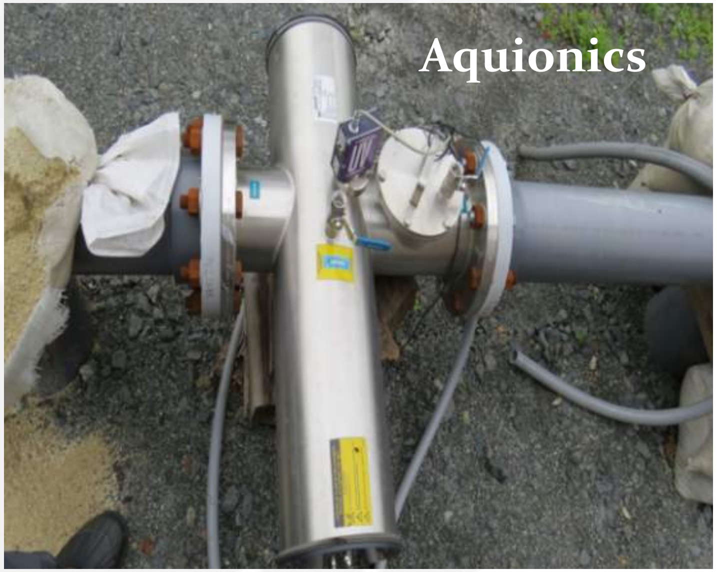
Technology Findings (cont'd)

3. **Trojan** & **Aquionics** (UV)

- The **Trojan** UV 3000Plus unit using low-pressure-lamps:
  - Required approx. **25 mJ/cm²** irradiation energy input
  - Achieved **3 log (ave.) inactivation** of pathogen indicators
- The **Aquionics** 250+W unit using medium-pressure lamps:
  - Required more than **45 mJ/cm²** irradiation energy input
  - Achieved a **3 log (ave.) inactivation** of pathogen indicators

Technology Findings (cont'd)

4. **Trojan** & **Aquionics** (UV)
   - As expected, there was a strong correlation between water transmittance and water quality parameters concentrations for TSS, $CBOD_5$ & COD
   - As these parameters' concentration increased, UVT decreased



Technology Findings (cont'd)

5. **Injexx/Verdent** (**Peracetic Acid – PAA** at 12% solution)
   - Positive correlation between the **applied dose of PAA** as normalized by COD present in the wastewater and the log **reduction of pathogen indicators**
   - PAA dose of 0.01 mg/l of PAA per mg/l of COD present in wastewater resulted in **3 log reduction of fecal coliforms** (on average) with slightly **higher effectiveness for E. coli** and slightly **lower for Enterocci**
   - **Increasing the relative dose** to above 0.015 mg/l of PAA per mg/l of COD **increased log reduction to 4** (limited data)
   - Hydraulic retention time ~ **3 minutes**


Injexx/Verdent

Technology Conclusions

1. **Coarse screens** (1/2” opening) should precede any treatment scenarios
2. **Compressed media filter – Flex Filter**
   - Most consistent and effective solids-removal technology
3. **UV**
   - Effectively achieve water quality objectives at **40% UV transmissivity or greater**
   - **Compressed media filtration**, or equivalent, must precede UV
   - The effluent from the **Flex Filter** averaged **approx. 27 mg/l for TSS & 40%** on UVT (excluding simulation runs)

Technology Conclusions(cont'd)

4. **Peracetic Acid**
   - Effective disinfectant for wet weather flows
   - Compared to chlorine:
     - Similar or lower dosages needed
     - Shorter contact time required (typ. 3 mins.)
     - No neutralizing agent required
     - Potentially less toxic then chlorine
     - Longer shelf life
5. **Flex Filter - Compressed media filter**, followed by **UV and/or Peracetic acid** disinfection, can achieve water quality standards (suspended solids and disinfection)

Costs Conclusions

- Construction and Operation & Maintenance (O&M) Costs ⬇
  - can be **significantly lower** than regional solutions (transport and treatment or sewer separation)
- Equipment and O&M cost curves are available in section 12 of the report

Estimated Footprint, Construction and O&M Costs:

Compressed Media Filter

Design Flow (MGD)	Filter Matrix Cell (width x length)[1]	Matrix Foot Print[2] Square Feet -Acres		Construction Cost [3] ($M)	Annual O/M Cost[4] ($)
5	5(6x12)	1,700	0.04	3.1	17,200
10	5(6x24)	2,200	0.05	4.0	23,400
25	5(13x30)	5,400	0.11	9.8	36,600
100	10(27x30)	21,000	0.48	38.0	104,800
250	24(27x30)	50,000	1.15	90.5	226,000

Project Conclusions

High-performance satellite end-of-pipe treatment can:

- **be used to protect public health and aquatic biology**
- **be a cost effective alternative**
- **provide incremental CSO reductions**
- **offer green spaces & other community amenities**

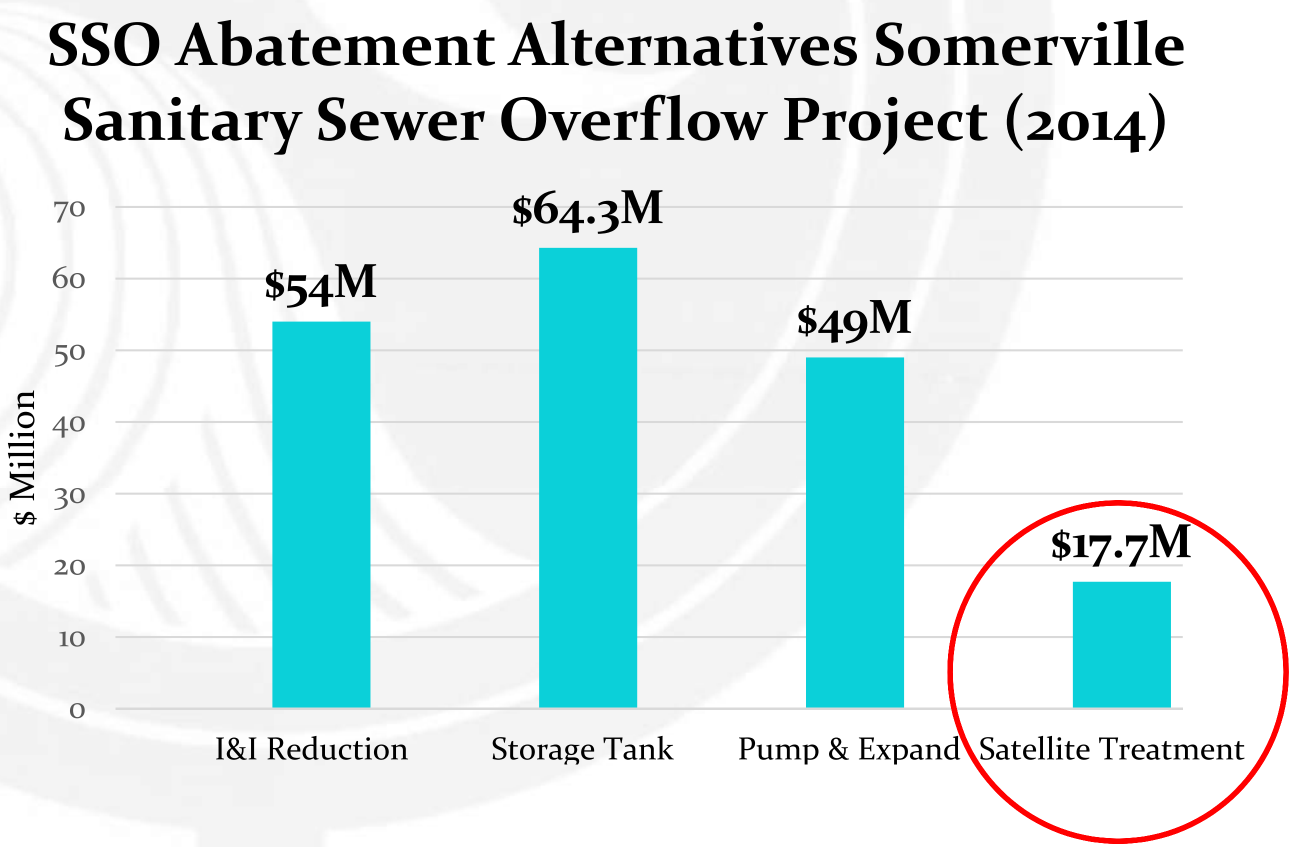
Satellite Treatment facilities can be:

- **Unmanned**
- **Odor free**
- **Adaptable to multiple locations**
  - Small footprint
  - Below grade

Applicability: NJ Case Study
(Somerset Raritan Valley Sewerage Authority)

Chart Courtesy of Kleinfelder

- Satellite/End of Pipe Treatment (Cost Effective)
  - **Enhanced Solid Removal** (Flex Filter)
  - **Disinfection** (UV)
  - **Permitted** and **proceeding to bid** in 2017



We are not alone….

- **Satellite/remote CSO treatment** is being utilized in the country

Springfield, Ohio – WTP (40 MGD)

Uptown Park CSO Facility
Columbus, GA

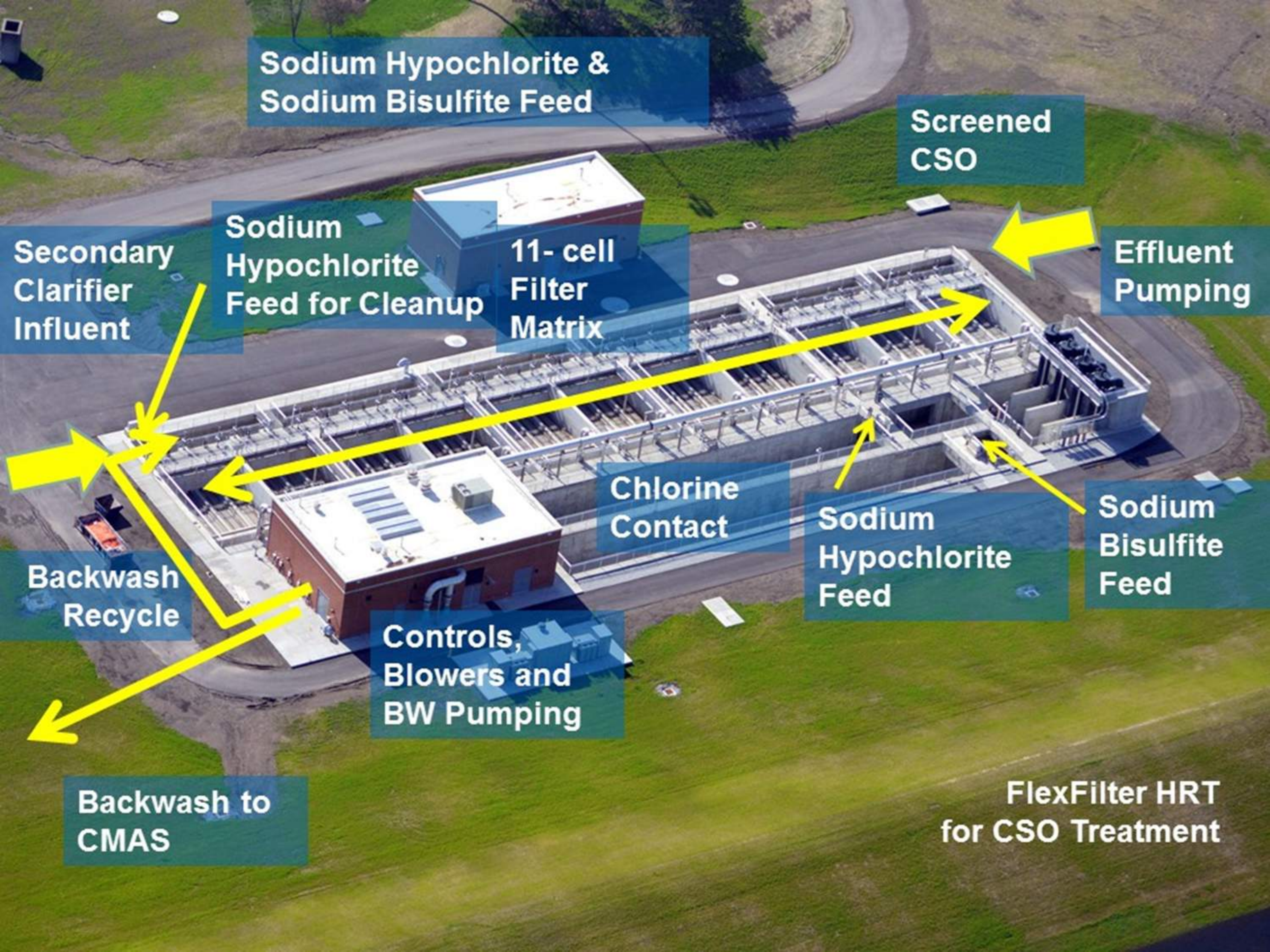
Photos Courtesy of Black & Veatch

Springfield, Ohio – WTP:

Auxiliary EHRT Facility

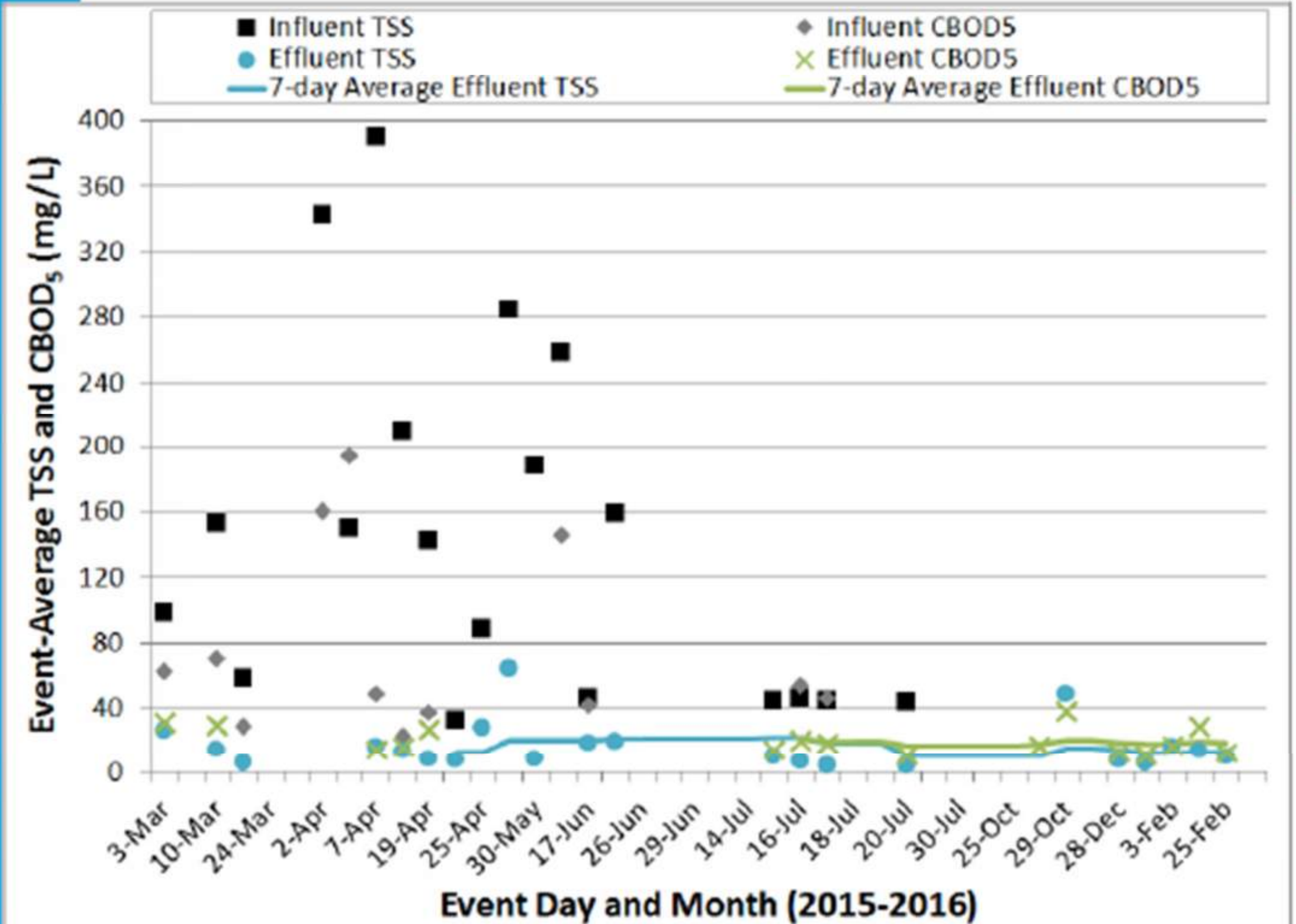
- High-rate/ High-performance CSO treatment
- Compressed media filter and chemical disinfection technologies
- Operating Power: < $5 per MGD for CSO treatment
- Small footprint


100 MGD WWETCO FlexFilter
EHRT for CSO Treatment
Backwash
CMAS
Secondaries
Primaries
Disinfection
& Post Air
Up to
100 MGD
CSO
Trickling
Filters
Headworks
Digestion
Bio-solids
Handling
Springfield, OH
100 MGD HRT for CSO
40 MGD WWTP
B&V Design
Construction by Kokosing
½" CSO
Screening


Sodium Hypochlorite &
Sodium Bisulfite Feed
Screened
CSO
Sodium
Hypochlorite
Feed for Cleanup
11- cell
Filter
Matrix
Secondary
Clarifier
Influent
Effluent
Pumping
Chlorine
Contact
Sodium
Hypochlorite
Feed
Sodium
Bisulfite
Feed
Backwash
Recycle
Controls,
Blowers and
BW Pumping
Backwash to
CMAS
FlexFilter HRT
for CSO Treatment

Courtesy of Black & Veatch

Performance of Auxiliary EHRT Facilities



Effluent Averages *		
TSS	mg/L	16
$CBOD_5$	mg/L	20
NH_3-N	mg/L	2.5
TP	mg/L	0.6
DO	mg/L	8.7
TRC **	mg/L	0.02
E. Coli	#/100 mL	56

* 41 events 3/3/15 – 2/25/16

** 1.0 – 8.4 mg/L NaOCl dose

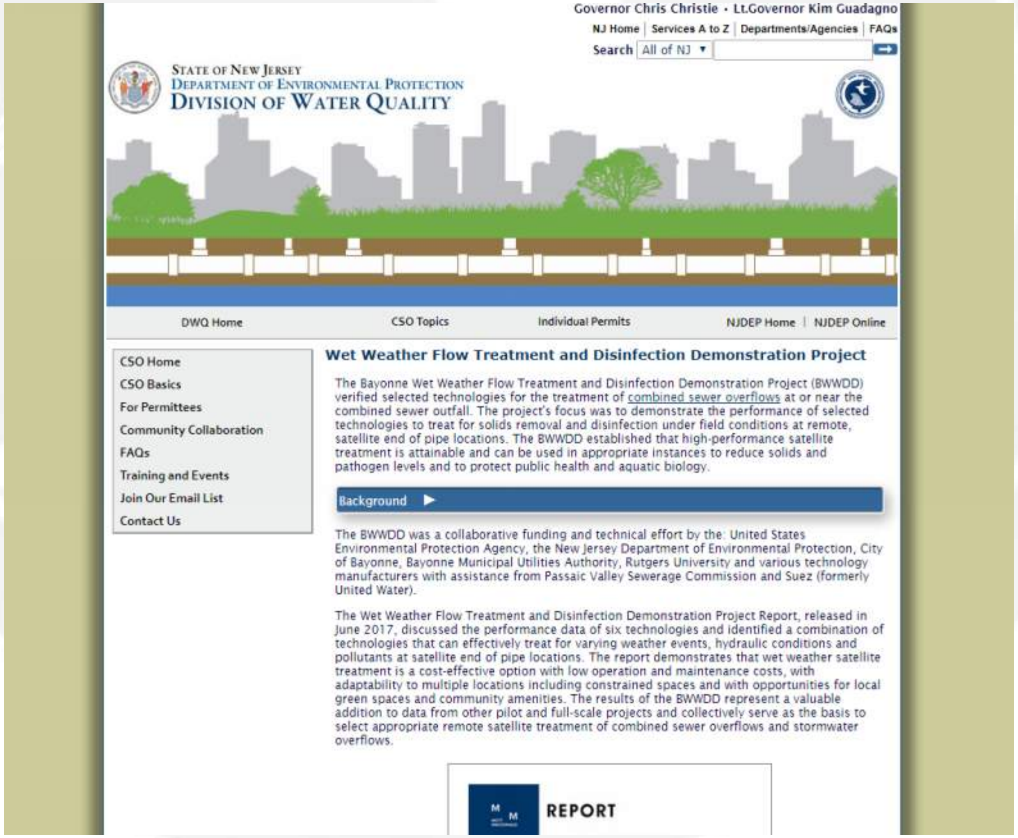
Excellent effluent quality and disinfection

Interested in Pursuing Satellite Treatment?

- If you're a CSO community, contact your team leader.
- If you're interested in learning more about the Demonstration Project's treatment technologies, contact Stan Cach at Stanley.Cach@dep.nj.gov.

Access the Full Report

nj.gov/dep/dwq/cso-wet.htm



Wet Weather Flow Treatment & Disinfection Demonstration Project

nj.gov/dep/dwq/cso-wet.htm

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&

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Mott MacDonald
Senior Project Manager

Questions and Final Discussion

CLEAN WATERWAYS
Healthy Neighborhoods