



Metropolitan Water Reclamation District of Greater Chicago

WELCOME

TO THE AUGUST EDITION

OF THE 2019

M&R SEMINAR SERIES

BEFORE WE BEGIN

- **SAFETY PRECAUTIONS**
 - PLEASE FOLLOW EXIT SIGN IN CASE OF EMERGENCY EVACUATION
 - AUTOMATED EXTERNAL DEFIBRILLATOR (AED) LOCATED OUTSIDE
- **PLEASE SILENCE CELL PHONES OR SMART PHONES**
- **QUESTION AND ANSWER SESSION WILL FOLLOW PRESENTATION**
- **PLEASE FILL EVALUATION FORM**
- **SEMINAR SLIDES WILL BE POSTED ON MWRD WEBSITE**
(<https://mwrdd.org/seminars>)
- **STREAM VIDEO WILL BE AVAILABLE ON MWRD WEBSITE**
(<https://mwrdd.org/seminars> - after authorization for release is arranged)

Paul V. Rush, P.E.

- Mr. Rush serves as Deputy Commissioner for the New York City Department of Environmental Protection's (DEP) Bureau of Water Supply and is responsible for operating New York City's upstate water supply system that delivers more than 1.1 billion gallons of water daily to over eight million residents of New York City and one million more in four upstate counties. His responsibilities include source water protection, infrastructure maintenance and operation north of New York City and ensuring drinking water quality throughout the entire system that includes the 2,000 square mile watershed and the City itself. Mr. Rush was appointed deputy commissioner in 2006 and has worked for DEP since 1992. Prior to his employment with New York City he served on active duty in the Army as an Engineer Officer.
- Mr. Rush holds a Master of Science degree in Civil Engineering from Michigan Technological University and Bachelor of Science degree in Civil Engineering from the United States Military Academy. He is a registered professional engineer in the state of New York.



Overview of the New York City Water Supply

Paul V. Rush, P.E.
Deputy Commissioner, Bureau of Water Supply

August 23, 2019

- DEP Overview
- Water Supply System Overview
- Bureau of Water Supply Mission
- Water Supply History
- Filtration Avoidance Determination
- Operations
- Water Quality
- Treatment
- Current Challenges
- Summary/Questions





Operating Bureaus:

- Bureau of Water Supply
- Bureau of Water & Sewer Operations
- Bureau of Wastewater Treatment

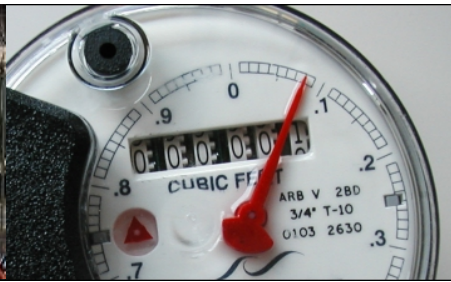


Major Supporting Bureaus:

- Bureau of Engineering, Design and Construction
- Bureau of Police and Security
- Bureau of Environmental Planning and Analysis
- Bureau of Customer Service



The Agency has 10 other supporting bureaus/offices



System Overview



- Primarily a surface water supply
- 19 reservoirs & 3 controlled lakes
- System Capacity: 570 billion gallons
- Serves 9.4 million people (1/2 of population of New York State)
- Delivers approx. 1.1 billion gallons per day
- Source of water is a 2,000 square mile watershed in parts of 8 upstate counties

The mission of the Bureau of Water Supply is to reliably deliver a sufficient quantity of high quality drinking water to protect public health and quality of life of the City of New York.



History of NYC's Water Supply

- **Early 1600s**: 48-acre pond in lower Manhattan
- **1677**: First public well dug in lower Manhattan
- **1776**: First reservoir constructed on East side of Manhattan – groundwater also pumped from wells
- **1799**: State legislation confers exclusive authority to the Manhattan Company to convey water to the City of New York
- **Early 1800s**: Inadequate water supply leads to public health (disease) & safety (fires) problems
- **1832**: The Manhattan fire
- **1842**: Croton Aqueduct placed in service



CROTON WATER CELEBRATION 1842

*A grand meeting to test of progress within New York to 2 1/2 miles in the North River, at the Eastern End of the State of New York
Published by J. F. Atwell, 241 Broadway*



VIEW OF THE GREAT FIRE IN NEW YORK, DEC 10, 1835

Freeman Report (1900)

Adirondacks

Lake
George

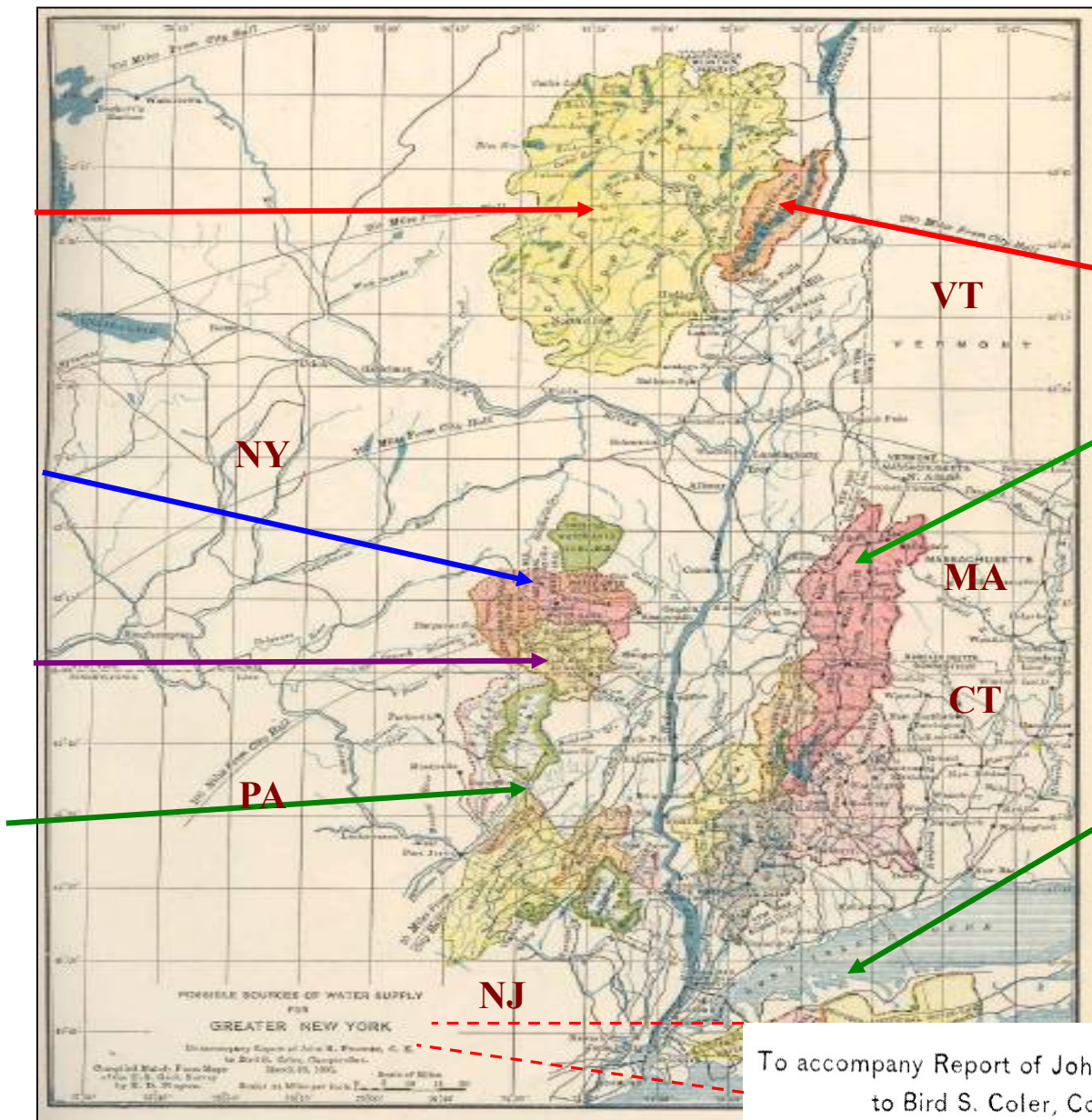
Upper
Catskills

Berkshires

Lower
Catskills

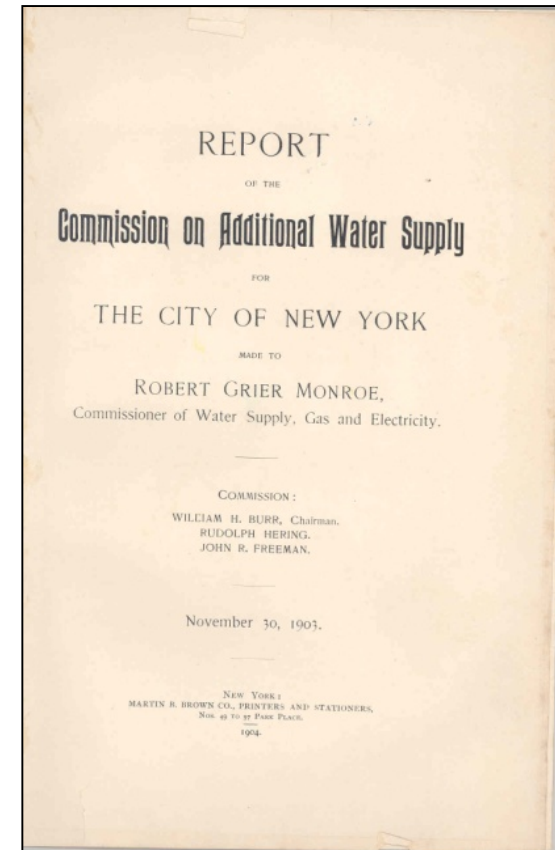
Wallkill/
Ramapo &
Moodna

Long
Island



To accompany Report of John R. Freeman, C. E.
to Bird S. Coler, Comptroller
March 23, 1900.

- General Problem
 - Provide greater New York area with an abundant quantity of water with satisfactory quality
- Requisite Qualities of Public Water Supply
 - Free of organisms
 - Agreeable appearance
 - Odorless and tasteless
 - Not too hard
 - Not contain substances that are liable to corrode pipes
 - Should have cool and equable temperature



Water Supply Act of 1905

- Board of Water Supply created to develop system
- NYC required to allow municipal connections to system in counties with water supply infrastructure
- Fishing & boating to be permitted



The Delaware System

- City next selected Rondout Creek and Delaware River headwaters for development
- 1924-1927 New York and New Jersey attempt to negotiate for Delaware Reservoir development
- In 1928 the City moved forward with Delaware Basin development
- In 1929 New Jersey goes to Supreme Court to stop NYC development
- In 1931 U.S. Supreme Court upheld the right of New York City to develop supply from Delaware River headwaters
- 1954 Supreme Court Decree amended allowing Cannonsville development

Delaware River Basin

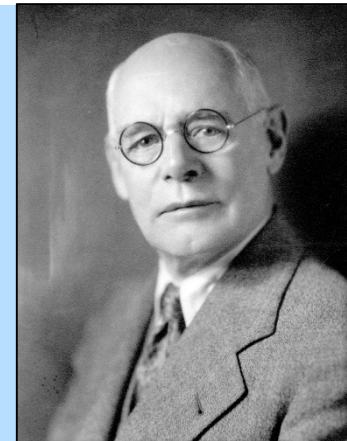


- Source water protection important from the earliest days
- NYC built wastewater plants and septic systems in watershed
- NYC acquired buffer lands at time of reservoir construction and planted trees around reservoirs to prevent erosion
- Regulations promulgated in 1917



The Grand Gorge “sewerage system” - 1929

“It is important that vigilance should be exercised to maintain the quality of all the present supplies by protecting them from pollution and treating them by approved modern methods, and that the structures should be kept constantly in good repair.” - J. Waldo Smith, 1917



- EPA promulgated Surface Water Treatment Rule in 1989
- Requires water systems to filter and disinfect surface water sources
- Systems eligible for a filtration waiver if they meet criteria for water quality and watershed protection
 - Fecal or total coliform
 - Turbidity
 - Adequate disinfection
 - Maintain a program to control “all human activities which may have an adverse impact on the microbiological quality of the source water”



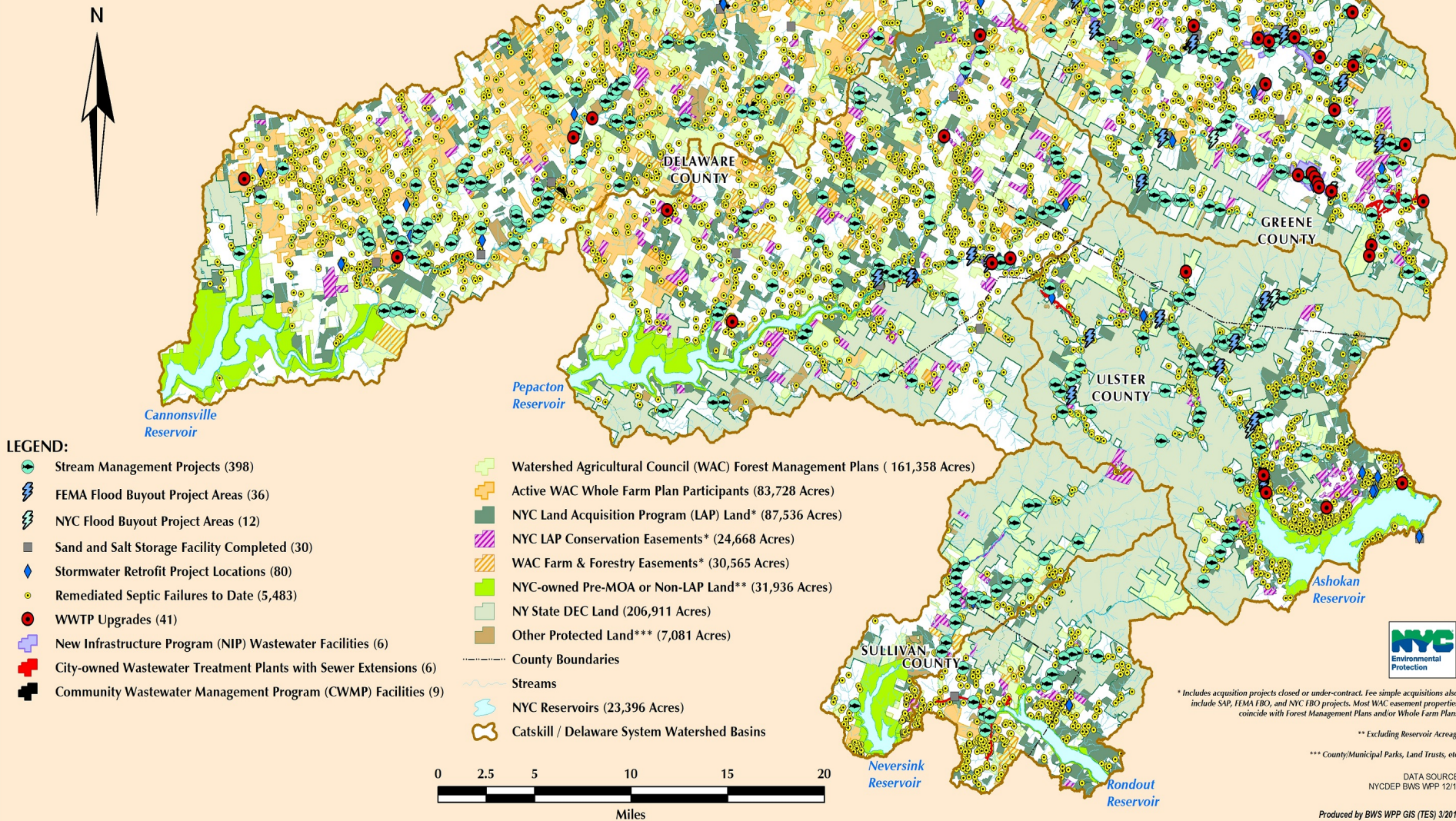
- Comprehensive source water protection, including
 - Regulations governing new development
 - Land acquisition
 - Wastewater programs including upgrades of existing WWTPs, septic system repairs and construction of new wastewater infrastructure
 - Stormwater programs
 - Agricultural program
 - Stream management program
 - Kensico and EOH programs
- First Filtration Avoidance Determination (FAD) issued by EPA in January 1993
- Watershed MOA signed January 1997
- FAD renewed in 2002, 2007, 2014, and 2017



2018 Implementation Status

New York City West-of-Hudson Watershed Protection & Partnership Programs

As of December 2018



* Includes acquisition projects closed or under-contract. Fee simple acquisitions also include SAP, FEMA FBO, and NYC FBO projects. Most WAC easement properties coincide with Forest Management Plans and/or Whole Farm Plans.

** Excluding Reservoir Acreage

*** County/Municipal Parks, Land Trusts, etc.

FAD Program Costs

Program	Total Funding Committed (1993 - 2019)	
	<u>Catskill/Delaware</u>	<u>Croton</u>
City WWTPs	\$210,000,000	\$61,264,000
WWTP Upgrades	\$247,129,000	\$359,932,000
New Wastewater Facilities	\$254,626,000	\$0
Sewer Programs	\$22,410,000	\$0
Septic Programs	\$107,201,000	\$0
Stormwater Programs	\$76,848,000	\$0
Land Acquisition Program	\$674,165,000	\$38,500,000
Watershed Agricultural Program	\$236,802,000	\$17,074,000
Stream Management Program	\$212,885,000	\$0
Kensico Programs	\$16,241,000	\$0
East-of-Hudson Programs	\$51,630,000	\$110,900,000
Catskill Turbidity Program	\$77,701,000	\$0
Catskill Fund for the Future	\$59,745,000	\$0
Other Protection Programs	\$79,220,000	\$18,767,000
TOTAL	\$2,326,603,000	\$606,437,000

- Essential Tasks
 - Meet the supply needs of New York City
 - Meet all reservoir release & diversion requirements
 - 1954 U.S. Supreme Court Decree
 - Interstate Agreements
 - SPDES permits
 - Consent orders
- Objectives
 - Divert the best quality water available
 - Maintain balanced system
 - Provide downstream habitat and flood mitigation benefits w/o water supply impact



Reservoir Operations

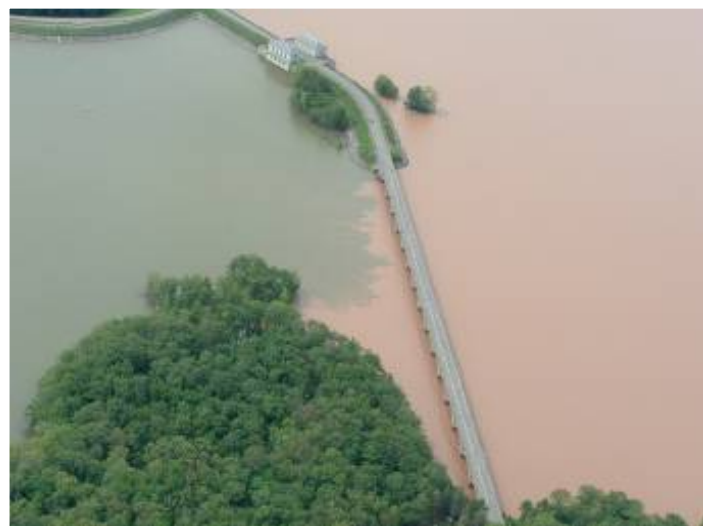
Operational decisions are made based on the following:

- Water Quality
- Demand
- Modeling
- Weather forecasts
- Maintenance
- Hydrological conditions



Rondout

Ashokan

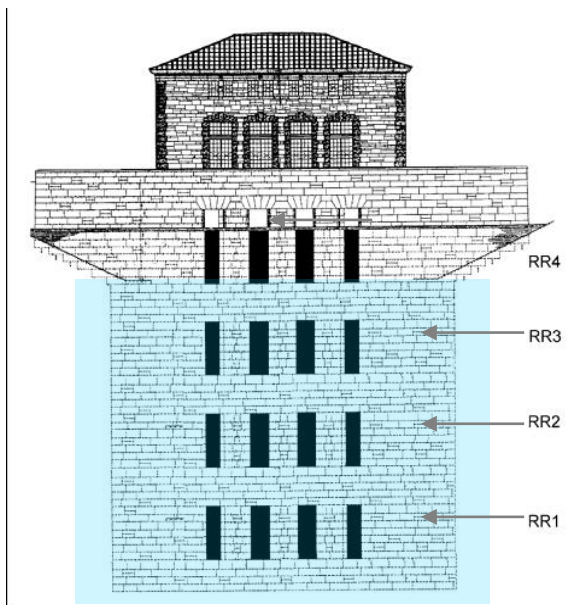


New Croton

Not all NYC systems water quality is created equal

Water Quality and Operational Decisions

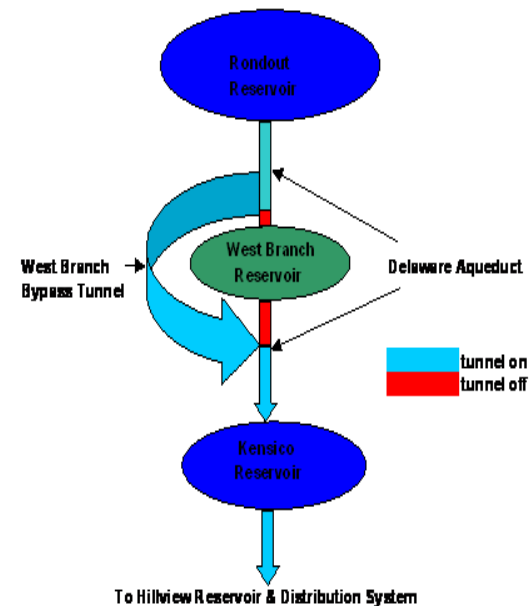
Water delivered is selected or mixed based on available quantity and quality



Selective Withdrawal



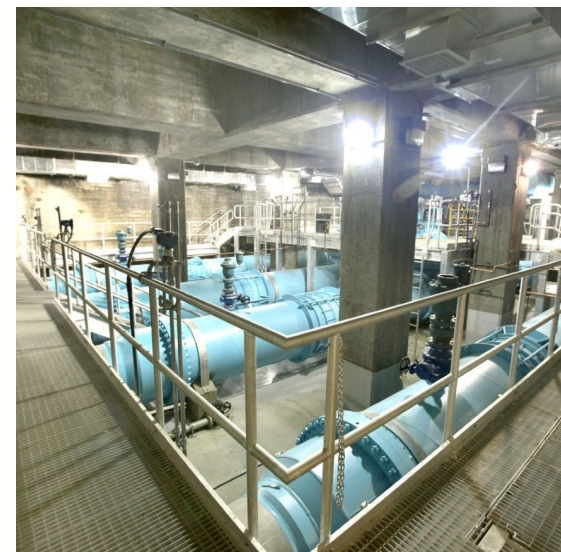
Selective Diversion

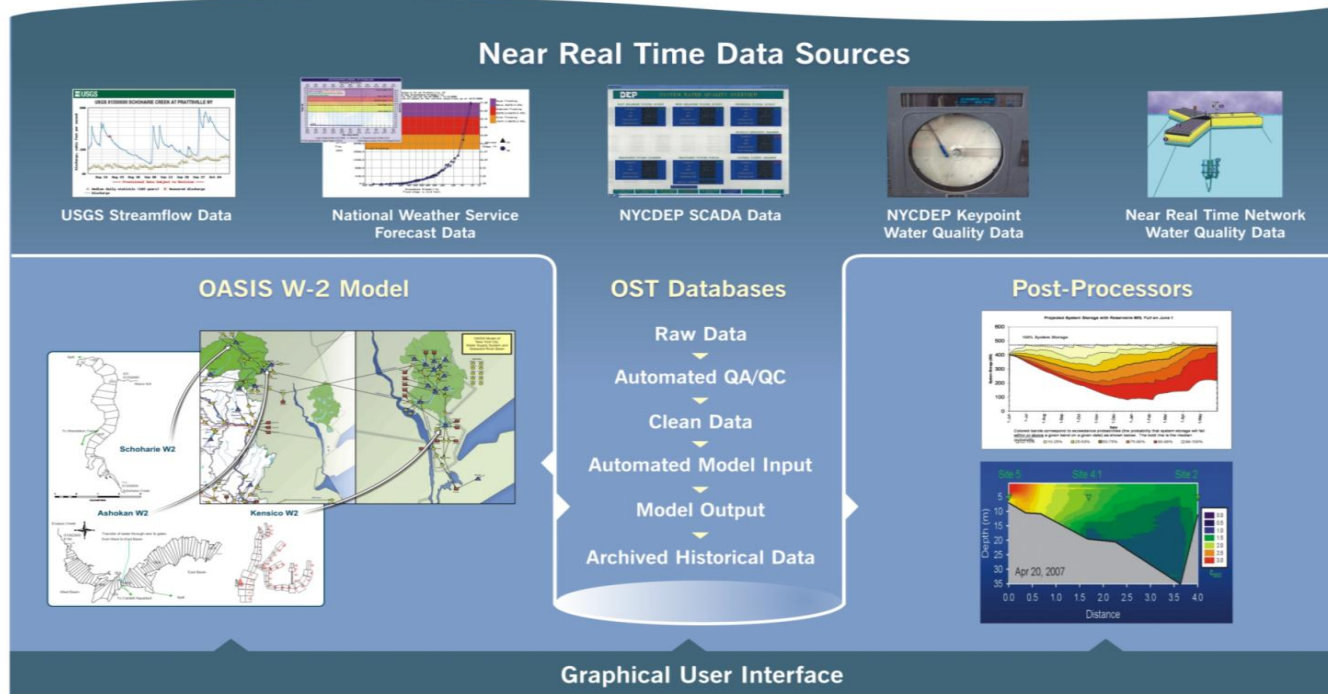


Treatment Operations



Blending Operations





- Probabilistic foundation for water supply reliability
 - More accurate assessment of likely future inflows, release requirements, storage levels—better drought warning triggers
- Better defines system capacity to meet water quality & environmental objectives
- System implemented in November 2013

Water Treatment Operations Facilities



Delaware Shaft 18 – Kensico Reservoir

- Intake for Kensico Reservoir for the Catskill and Delaware systems
- Chemical treatment provided:
 - Chlorination (Cl_2 gas): average daily use 9,654 lbs
 - Fluoridation (Hydrofluosilicic Acid)



Catskill-Delaware UV Disinfection Facility

- Treatment capacity of 2,020 MGD
- 56 UV reactors
- 11,760 lamps in facility



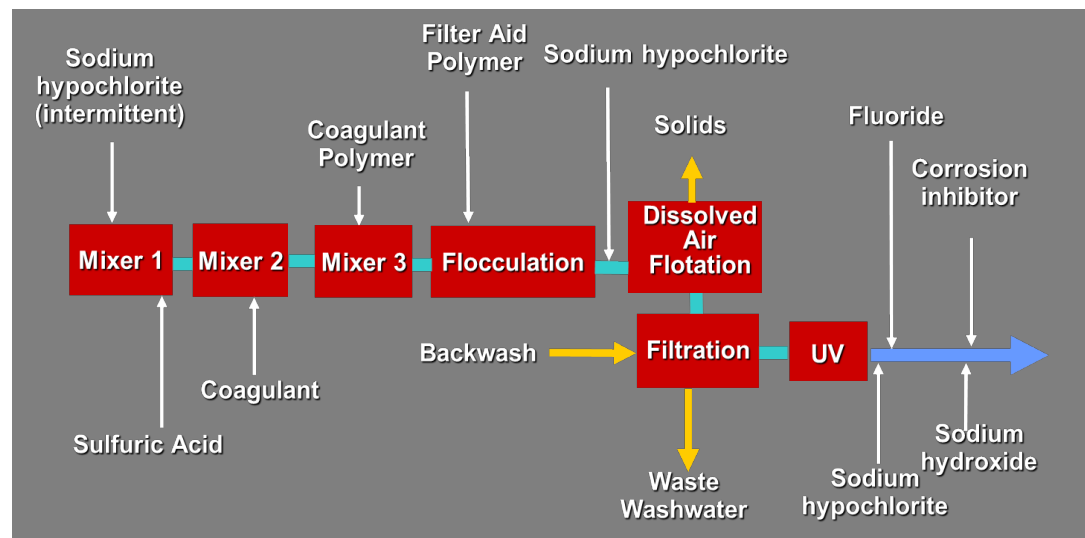
Hillview Reservoir

- 1 BG uncovered finished water storage reservoir
- Final treatment before distribution to City through Tunnels 1, 2, and 3, can be used for disinfection credits if needed
- Chemical treatment provided:
 - Chlorination, average daily use: Cl_2 gas-3900 lbs and hypochlorite 1130 gallons
 - Phosphoric acid
 - Sodium hydroxide
- Under consent order to cover by 2047



Croton Filtration Plant

- Capacity of 290 MGD
- Treatment provided:
 - Coagulation-flocculation: aluminum sulfate and coagulant polymer
 - Dissolved air flotation
 - Filtration: sand and anthracite
 - UV disinfection
 - Chemical treatment provided:
 - Chlorination (hypochlorite): average daily use 2100 gallons at 150 MGD
 - Sodium hydroxide
 - Phosphoric acid
- Located completely underground from the Mosholu Golf Course



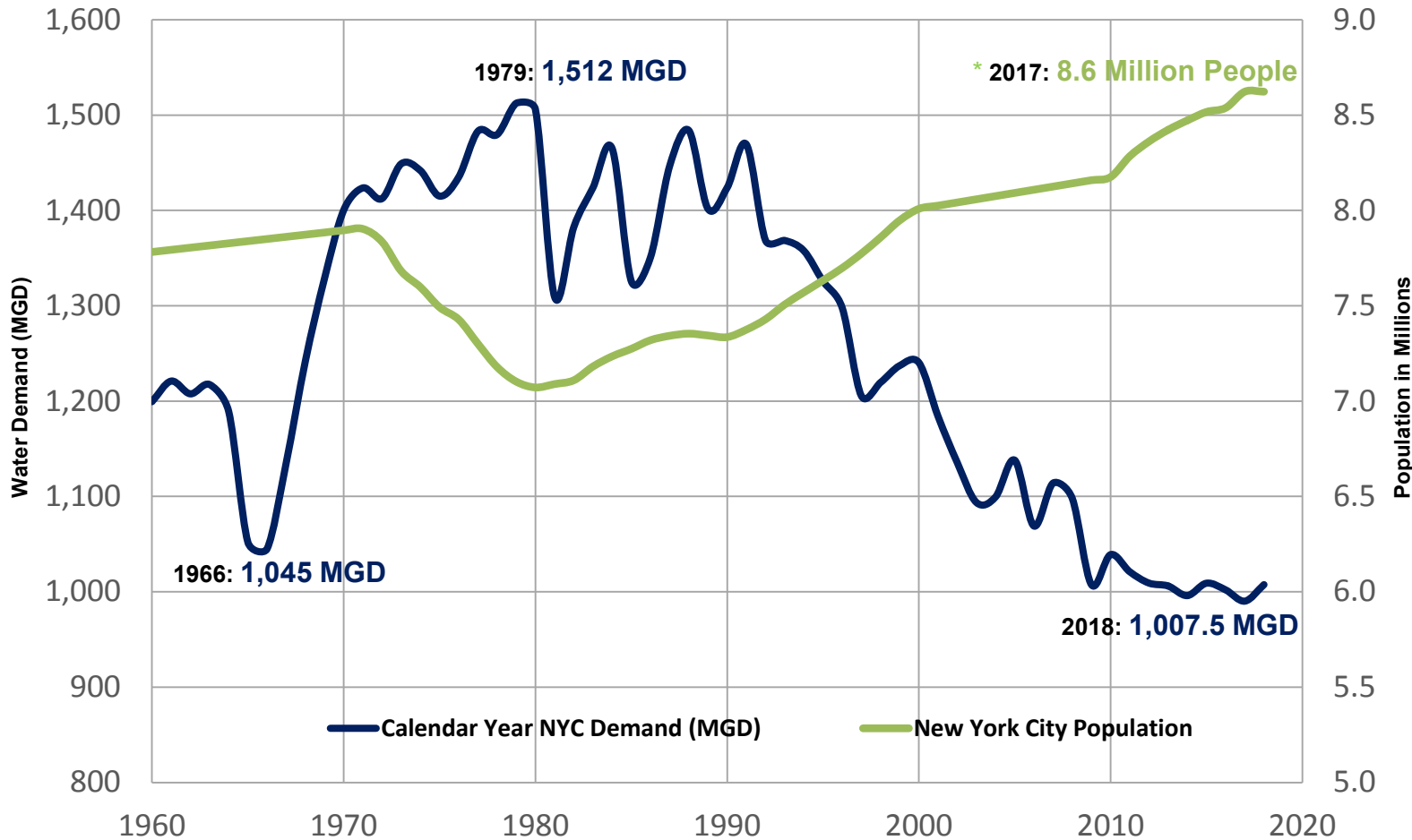
Current Challenges

- Maintain FAD long term
- Maintain aging infrastructure
 - Delaware Aqueduct
 - Catskill Aqueduct
 - Dams
 - Bridges
 - Wastewater Treatment Plants
- Regulatory compliance
 - Stage II DPB rule
 - LT2
- Future regulatory compliance
 - Lead and Copper Rule
 - Revised DPB Rule
 - Emerging contaminants
- Long term agreement on releases from Delaware Reservoirs



Historical Water Demand and Population

- Distribution has declined more than **30%** since the early 1990s – despite increasing population
- Since 2009, water usage has been below the 1960s drought-of-record
- Daily demand peaked in 1979 at over 1.5 billion gallons (per capita of 213 gallons)

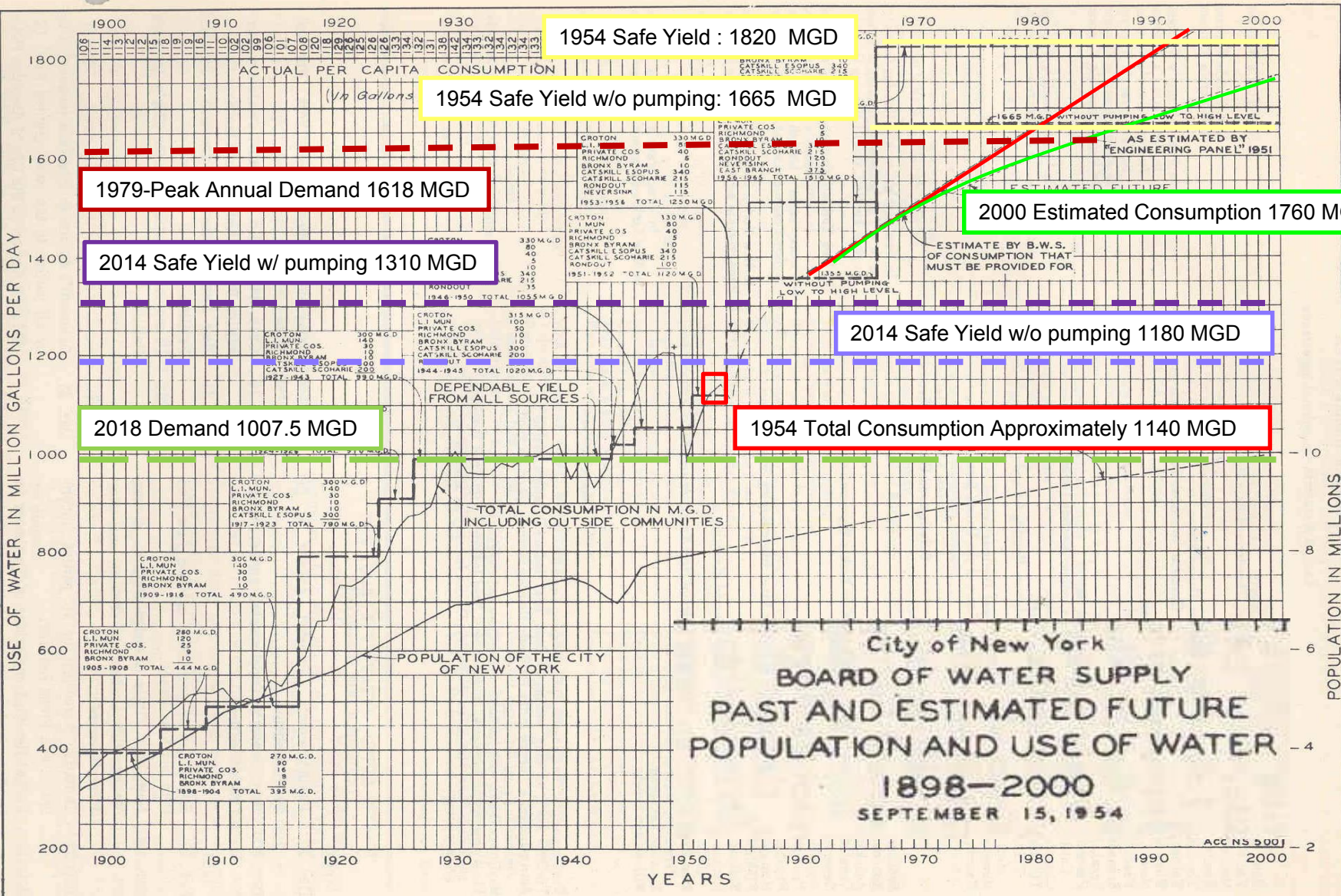


Average Daily Demand (MGD)	
2010:	1,039
2011:	1,021
2012:	1,009
2013:	1,006
2014:	996
2015:	1,009
2016:	1,002
2017:	990
2018:	1,007.5

Per Capita Demand (GPD)	
2010:	127
2011:	123
2012:	121
2013:	119
2014:	118
2015:	118
2016:	117
2017:	115
2018:	117

* Official 2017 New York City Department of City Planning Estimate

Historical Water Demand and Population



1979-Peak Annual Demand 1618 MGD

2014 Safe Yield w/ pumping 1310 MGD

2018 Demand 1007.5 MGD

1954 Safe Yield : 1820 MGD

1954 Safe Yield w/o pumping: 1665 MGD

1954 Total Consumption Approximately 1140 MGD

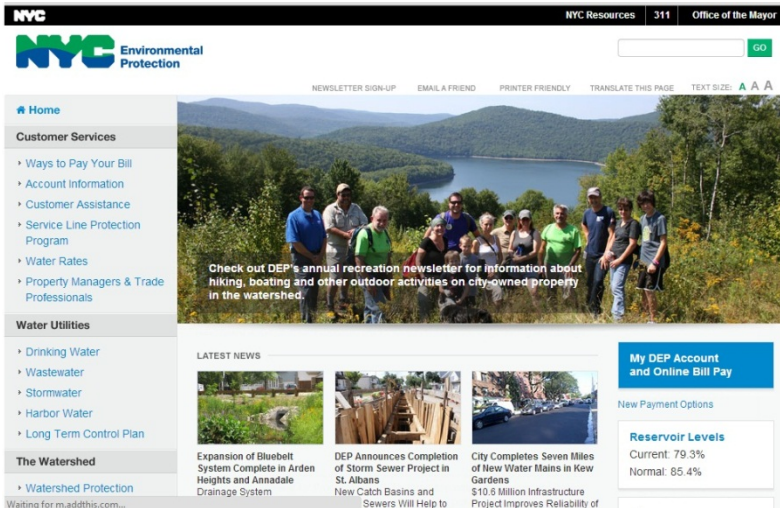
2014 Safe Yield w/o pumping 1180 MGD

2000 Estimated Consumption 1760 MGD

Summary/Questions

- NYC DEP is the largest combined water and wastewater utility in the country
- Complex water supply system built with flexibility to meet future challenges
- Many challenges lie ahead that demand the best science and engineering to support decisions





Visit the DEP website at www.nyc.gov/dep



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