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The Role of Demand Management in New York City's Water for the Future Program

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Overview

- Describe Water for Future Program
- Identify key entry points for efficiency and conservation initiatives
- Characterize selected analyses and outputs

New York City Water Supply

- **1,972 square miles of watershed**, extending to the Catskill Mountains, up to 125 miles north of the city
- 19 reservoirs and 3 aqueducts service **1 billion gallons** to more than **9.3 million people daily**
- Catskill and Delaware watersheds currently supply 100 % of demand
- With completion of Croton filtration plant, Croton watershed will be able to meet up to 30 % of demand

Rondout-West Branch Tunnel (RWBT)

- Conveys Delaware System Supply across Hudson River
  - In service since 1944
  - Last drained 1957
  - 45 miles long
  - 13.5 feet diameter
  - 300 to 2,400 feet below ground
- Conveys more than half of total daily supply

Rondout-West Branch Tunnel (RWBT)

- Delaware Aqueduct has significant leakage in the Rondout-West Branch Tunnel (RWBT) section
- RWBT needs to be fixed to ensure future stability and supply
- During shutdown to repair the tunnel, **NYC will need water from other sources**
- **Water conservation and efficiency**

DEP's Water for the Future Program

Demand Management Plan Element

Goal: Achieve a 5% citywide reduction from current demand (prioritizing revenue neutral sources)

- Primary entry points for water demand evaluations
  - Assess water efficiency potential in City facilities
  - Estimate impact of water shortage management actions
  - Evaluate spatial characteristics of water demand
  - Identify and characterize top users

Water Efficiency in City Facilities

- Fire Departments and Schools—fixture replacement
- Parks—spray showers
- Waste Water Treatment Plants (WWTPs)—processes

Plumbing Fixture Replacement at Elementary and Secondary Schools

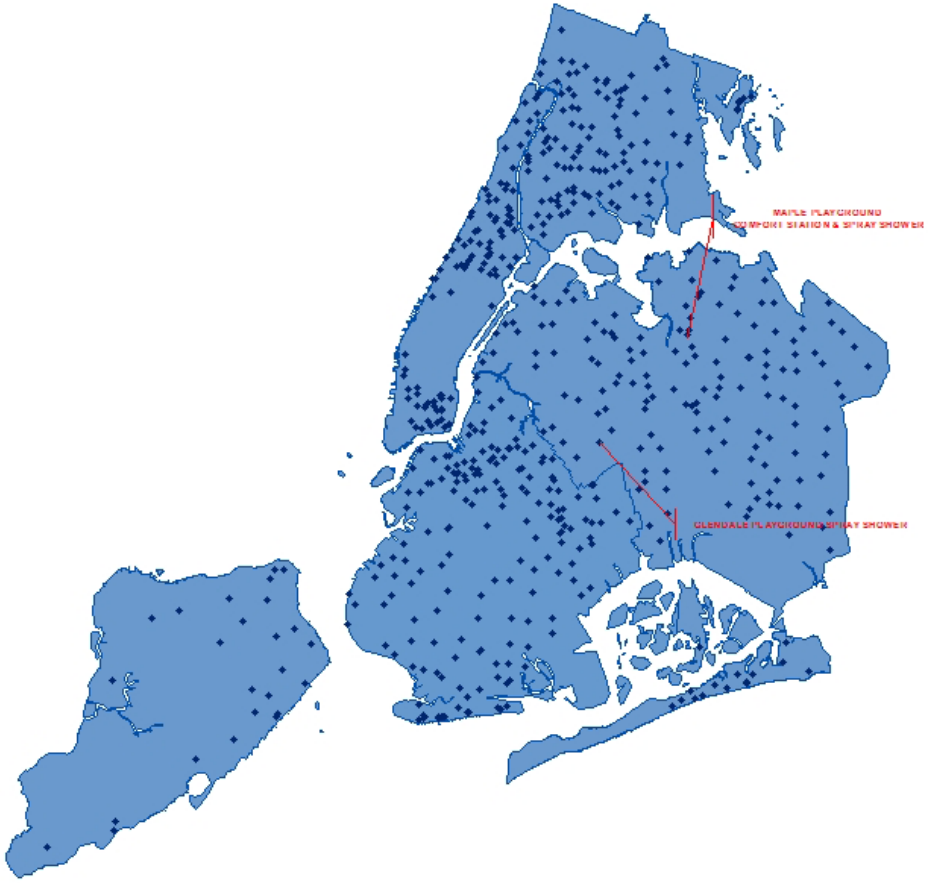
Department of Education / School Construction Authority
Total potential reductions: 8 MGD

Goal: replace fixtures at 500 schools
Pilots: Bayside and Hillcrest High Schools

Upgrade Park Spray Showers

Parks Department
Total potential reductions: 1.5 MGD

Goal: retrofit 400 spray showers
Pilots: Maple and Glendale playgrounds

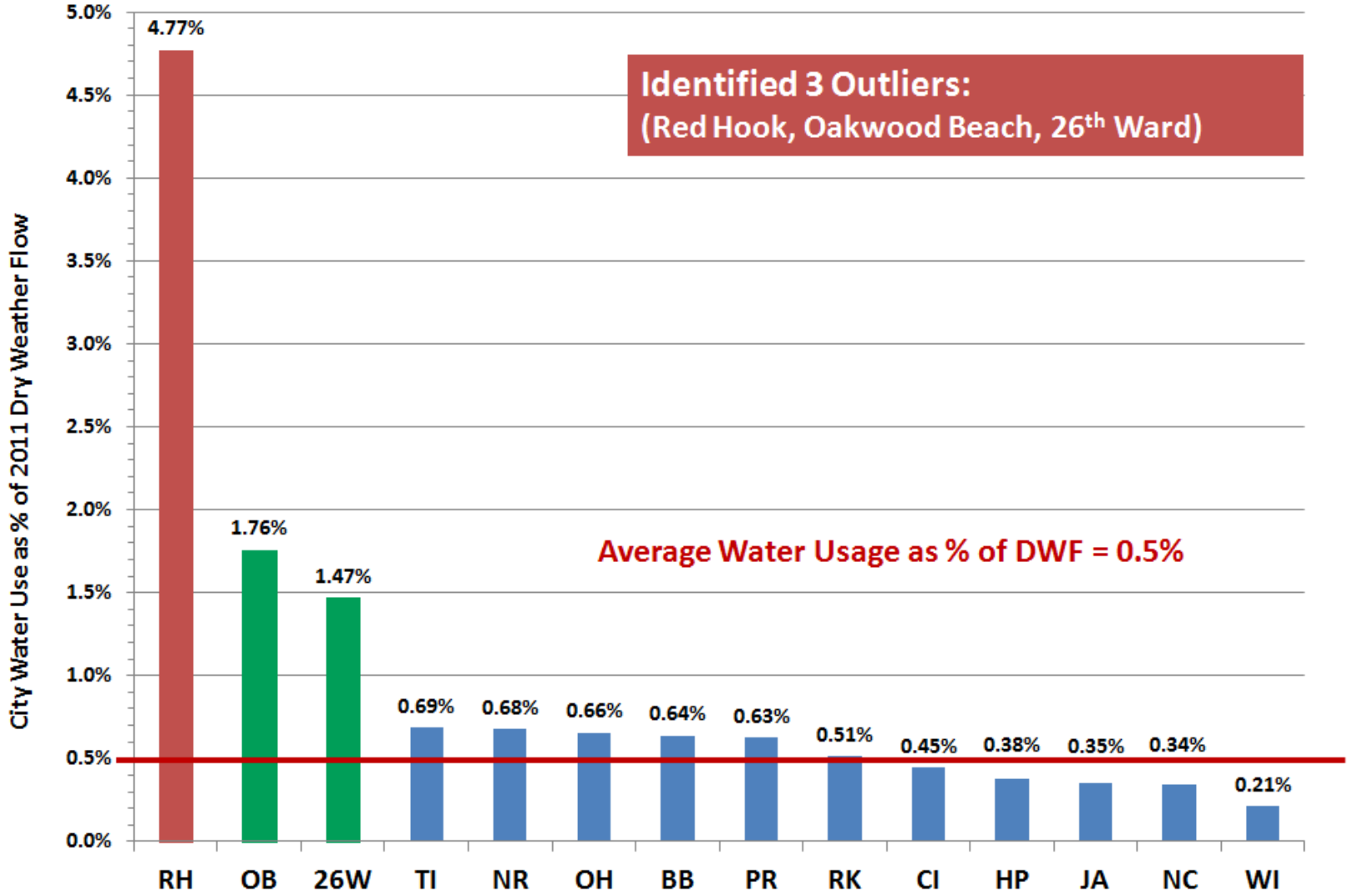


Reduce Water Use at Waterwater Treatment Plants (WWTPs)

- 14 WWTPs in operation
- 7.3 MGD of City water demand
- Identified eight process areas with potential high water consumption

- ✓ Main Sewage Pumping
- ✓ Primary Treatment
- ✓ Secondary Treatment
- ✓ Chlorine Disinfection
- ✓ Solids Handling Facilities
- ✓ Dewatering
- ✓ Heating/Cooling
- ✓ Cleaning

WWTP Water Usage as % of Dry Weather Flow



Sample Case Study: Red Hook WWTP

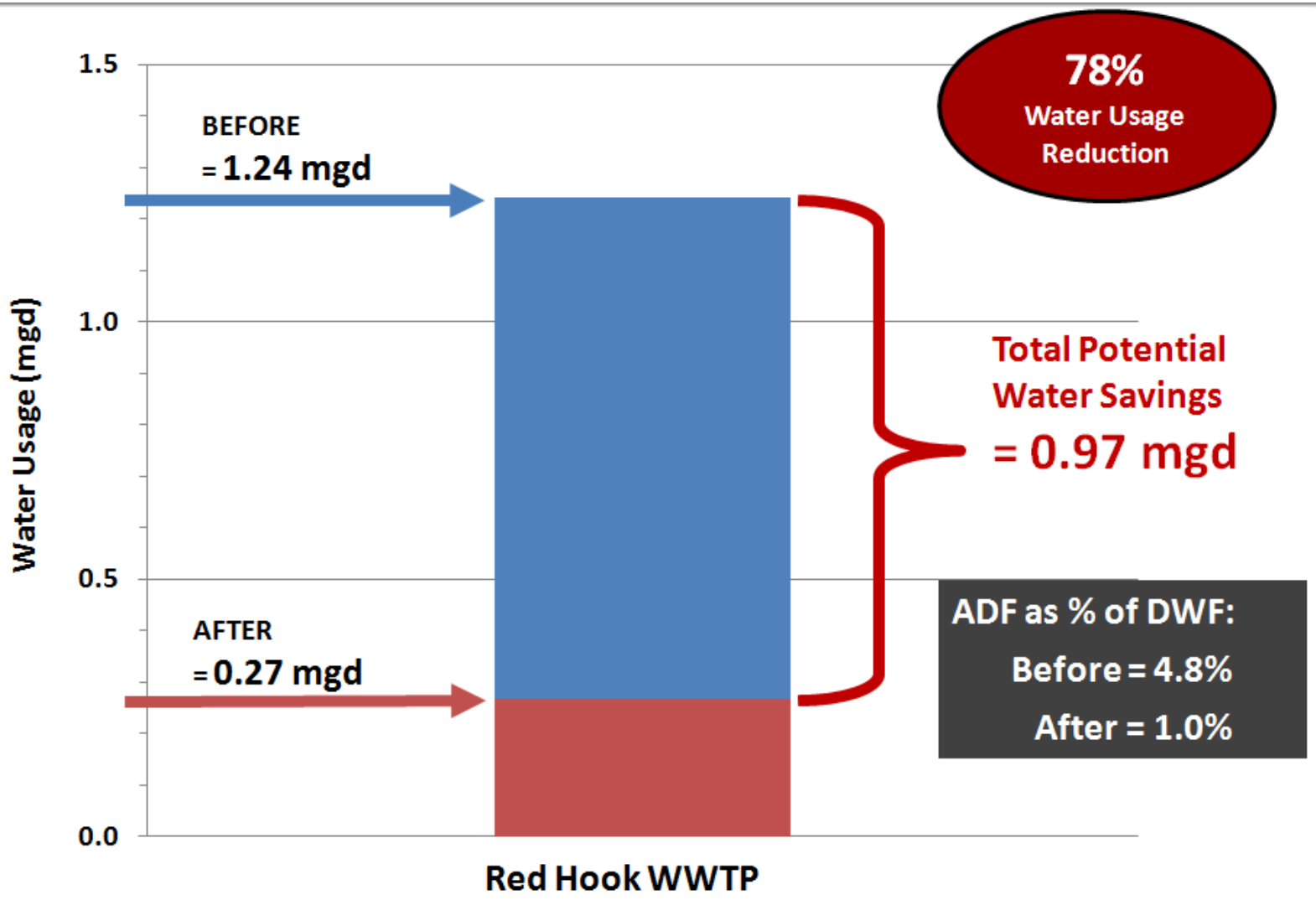
- Selected due to its high water usage (1.24 mgd) as compared to its relatively low dry weather flow (26 mgd)

- Identified Four Key Water Conservation Opportunities:
  1. Effluent Strainer Replacement
  2. Break Tank Float Valve Replacement
  3. Connect Polymer System to Plant Effluent Header
  4. Pump Mechanical Seal Retrofits

Effluent Strainer Replacement

- Effluent strainer is out of service—used to remove residual debris/particulates in the effluent
- City water is being used where plant effluent was previously used for:
  - Grit Suspension (100 gpm)
  - Hypochlorite Dilution (300 gpm)
  - Chiller Condenser Water (600 gpm)
- Estimated city water savings by replacing strainer is **860,000 gpd**
- Estimated installed cost for new strainer is **$266,000**

Total Water Savings Summary



Assessment of Water Shortage Actions

- Reviewed contents and actions in existing *Drought Management Plan and Rules*
- Refined definitions and actions
- Evaluated means of compliance with voluntary and mandatory restrictions
- Estimated potential water savings
  - Specified activities
  - Water shortage rate structure
  - Use of AMR/AMI and assumptions based on literature

AMR Data used to Evaluate Lawn Irrigation Practices

- Existing Rule
  - Stage I: permitted to water every other day Apr-Oct
  - Stages II-IV: prohibited
- For Existing Rule to have an impact residents would need to be watering their lawns more frequently than 3.5 days per week

AMR Data used to Evaluate Lawn Irrigation Practices

- Recommended change to Stage I Rule
  - Permit watering 1 day per week on designated day

Estimated Average Days per Week of Lawn Irrigation
By In-City Households Living in One Family Dwelling Units

Borough	Irrigation Season - April to November	Peak Irrigation Season - June through August	Shoulder Months - April, May, Sept, Oct. & Nov.
Manhattan	1.37	1.82	1.10
Bronx	1.78	2.38	1.41
Brooklyn	2.09	2.39	1.92
Queens	1.88	2.49	1.51
Staten Island	1.73	2.33	1.38
All	1.85	2.58	1.76

Estimated Demand Management Savings (DRAFT)

Summary of SUMMER Water Savings of DEP's In-City Water Customers From Mandatory Water Use Restrictions by Stage

End Use Being Restricted	Stage I	Stage II	Stage III	Stage IV
Vehicle Washing Ban	1.45	1.45	1.45	1.45
Washing streets, sidewalks, driveways, steps & structures	3.97	3.97	3.97	3.97
Ban for Ornamental Purposes such as ponds, waterfalls & reflecting pools	0.01	0.01	0.01	0.01
Swimming Pools	1.11	1.34	1.34	1.40
Watering lawns/turf and non-turf plants	17.16	37.87	41.09	41.09
Plant watering by nurseries & commercial plant users	0.01	0.02	0.03	0.11
Fire Hydrants	18.37	18.37	18.37	19.56
City water-cooled air conditioning & refrigeraton	4.46	4.46	36.00	36.00
Customer Leak Detection and Repair (indoor plumbing, not including irrigation systems)	16.37	16.37	16.37	16.37
Total Water Use Reduction in MGD (%)	**62.91 (5.3%)**	**83.86 (7.1%)**	**118.63 (10.0%)**	**119.96 (10.2%)**

Estimated Maximum Demand Management Savings (DRAFT)

Potential Summer Water Use Reductions by DEP Customers During Water Shortage Emergency In Average Daily MGD by Stage

(Impact of Public Communication & Education Program & Emergency Rate Structure Included in These Estimates)

Sector and Use	MGD Reduction in Water Use (% of 1,182 average daily mgd in summer (a))			
	Stage I	**Stage II**	**Stage III**	**Stage IV**
Mandatory use restrictions - All Customers Other Than NYC Agencies	41.97 (3.55%)	61.73 (5.22%)	94.50 (8.00%)	95.76 (8.10%)
Mandatory use restrictions - NYC Agencies	20.94 (1.77%)	22.14 (1.87%)	24.13 (2.04%)	24.20 (2.05%)
Additional water use reductions from actions other than mandatory restrictions:				
Residential - In-C	31.82 (2.69%)	47.74 (4.04%)	63.65 (5.38%)	79.56 (6.73%)
Non-Residential -	6.52 (0.55%)	9.78 (0.83%)	13.05 (1.10%)	16.31 (1.38%)
Customers outsid Rate	0.08 (0.01%)	0.23 (0.02%)	0.49 (0.04%)	0.91 (0.08%)
Total	**101.34 (8.57%)**	**141.61 (11.98%)**	**195.81 (16.57%)**	**216.74 (18.34%)**

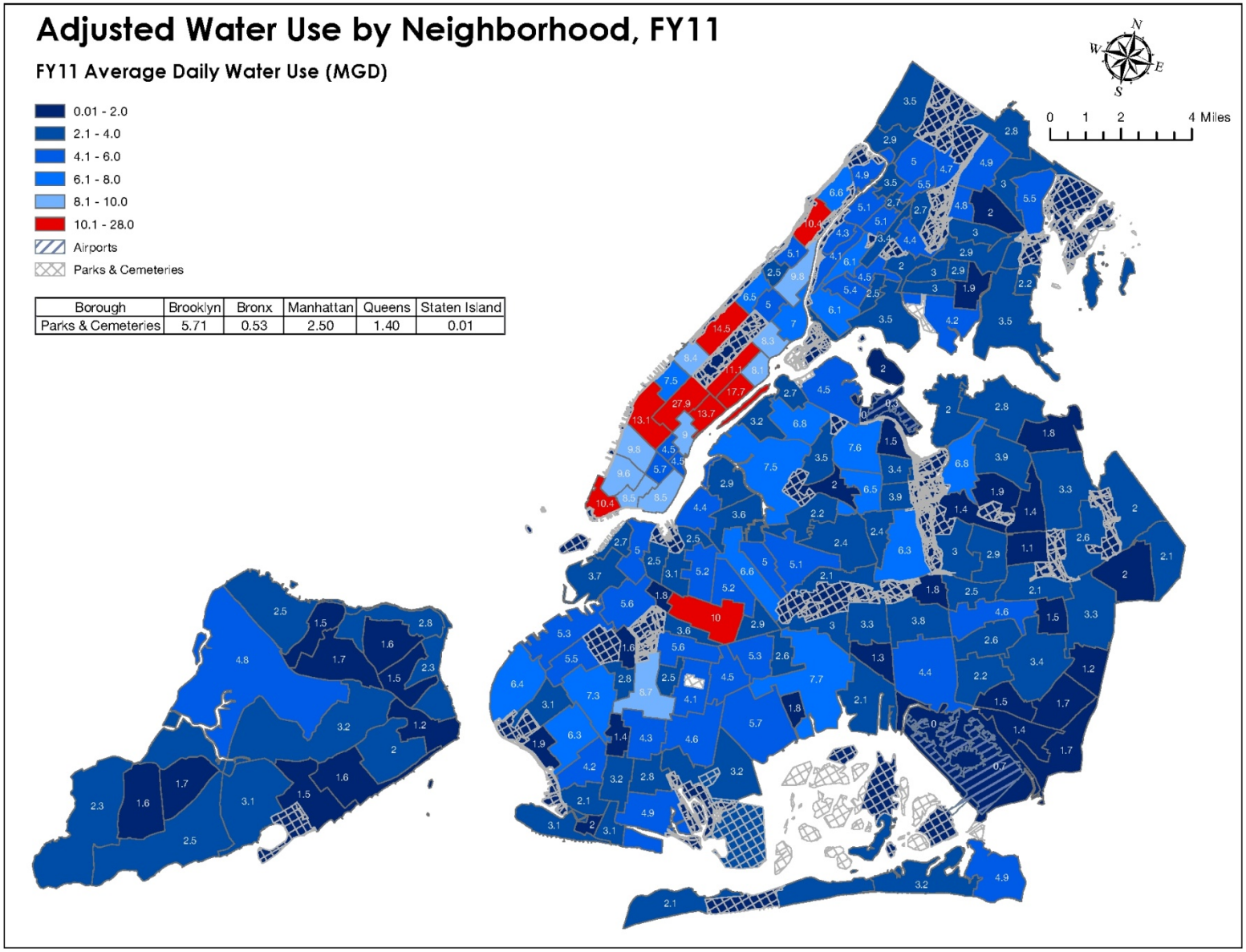
Including voluntary conservation actions an 18% reduction in demand is reasonable maximum

Residential and Non-Residential in-City water use reductions from measures other than the mandatory restrictions assume a customer participation of 20% under Stage I; 30% under Stage II; 40% under Stage III and 50% under Stage IV.

Spatial Patterns of Demand

- Evaluating spatial patterns of demand critical for determining
  - "Hot Spots" of consumption
  - Implications for design of water supply augmentation projects and movement of water in the City
- Consumption mapped by Borough and Neighborhood
- Integrated additional information and analyses
  - Building types and land use data
  - Prediction of water use for missing observations
  - Use of AMR/AMI data for evaluating seasonal variability

Spatial Patterns of NYC Demand

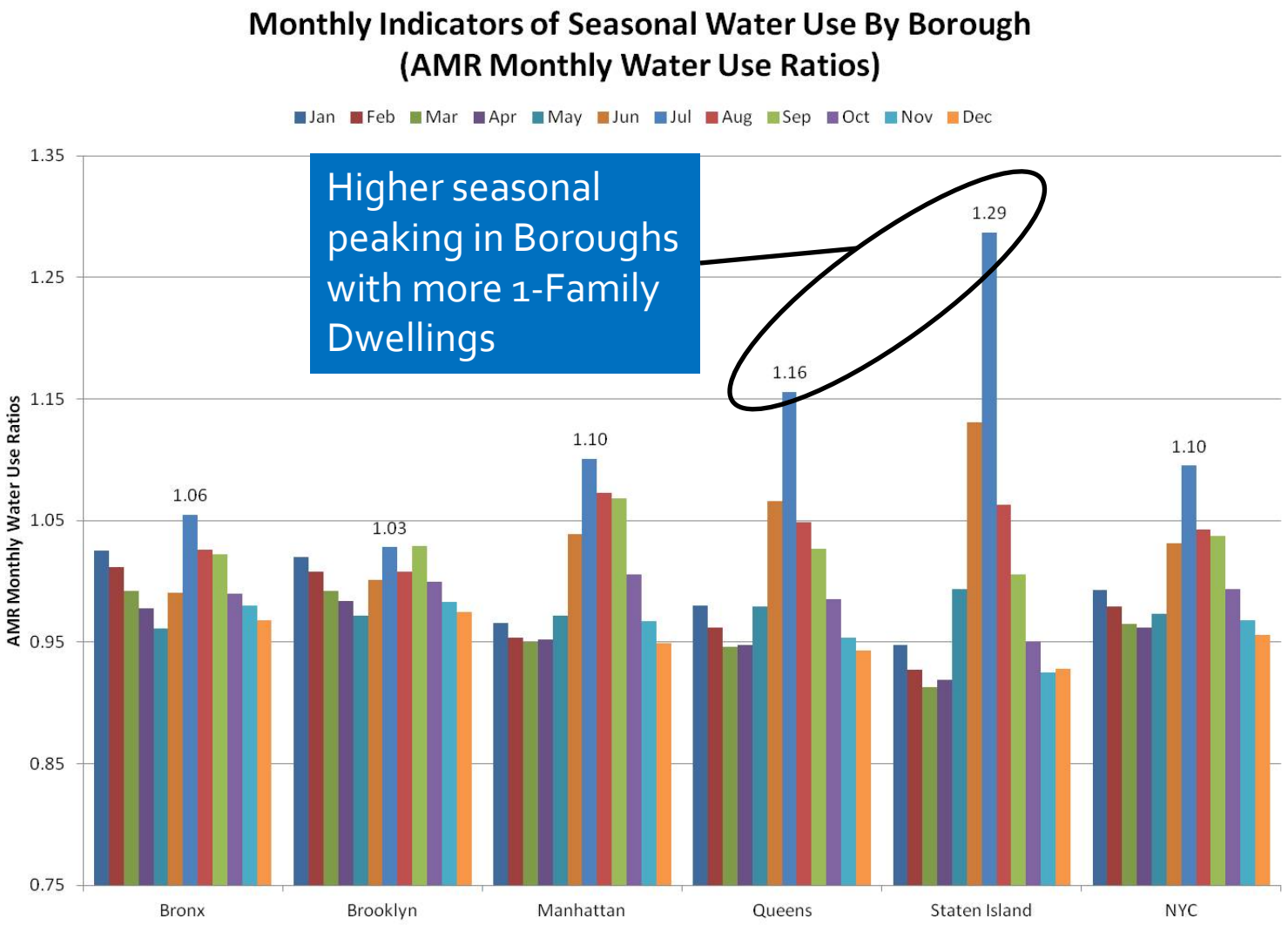


Borough	Brooklyn	Bronx	Manhattan	Queens	Staten Island
Parks & Cemeteries	5.71	0.53	2.50	1.40	0.01

Spatial Patterns of Demand

Lower Manhattan

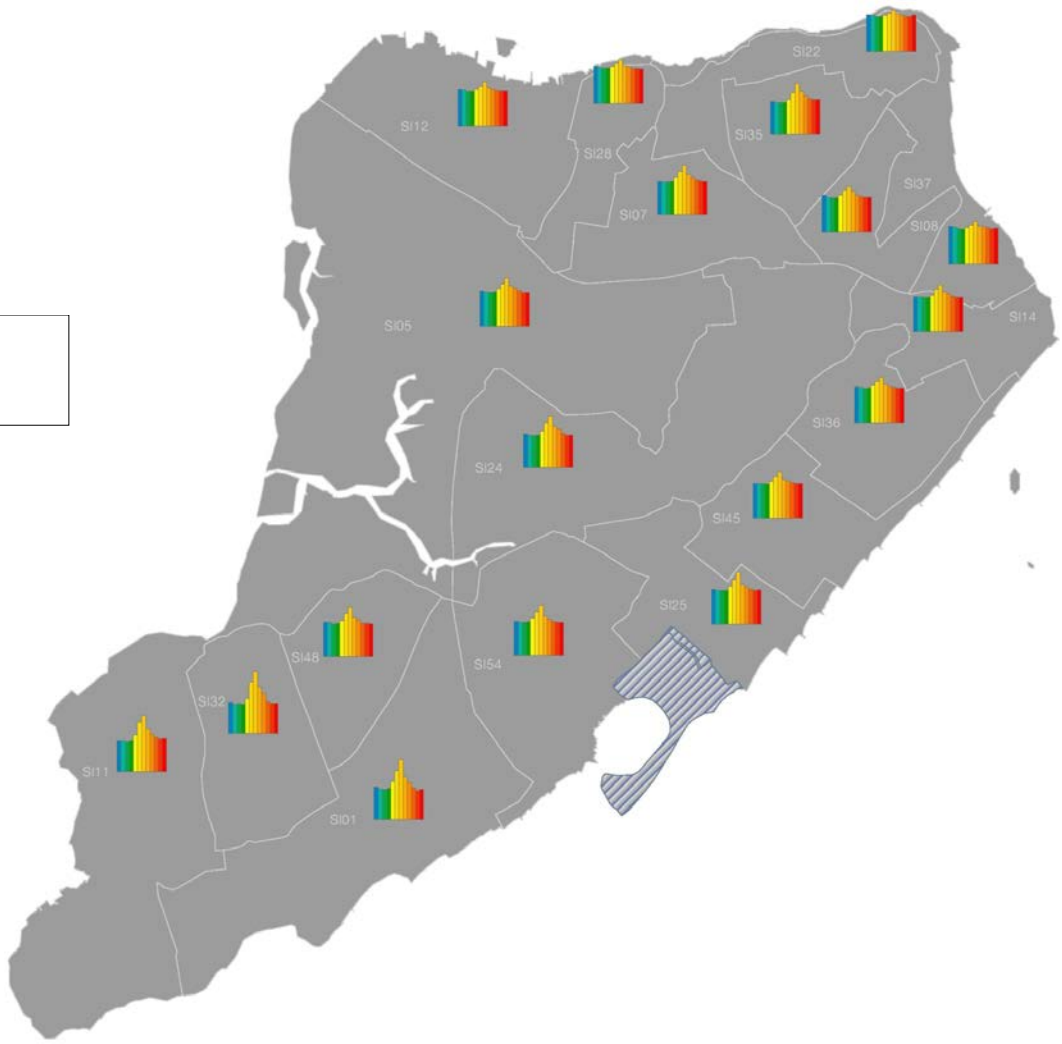
Seasonal Variability by Borough



Spatial Patterns of NYC Demand

Seasonal Variability Index

Staten Island Seasonality



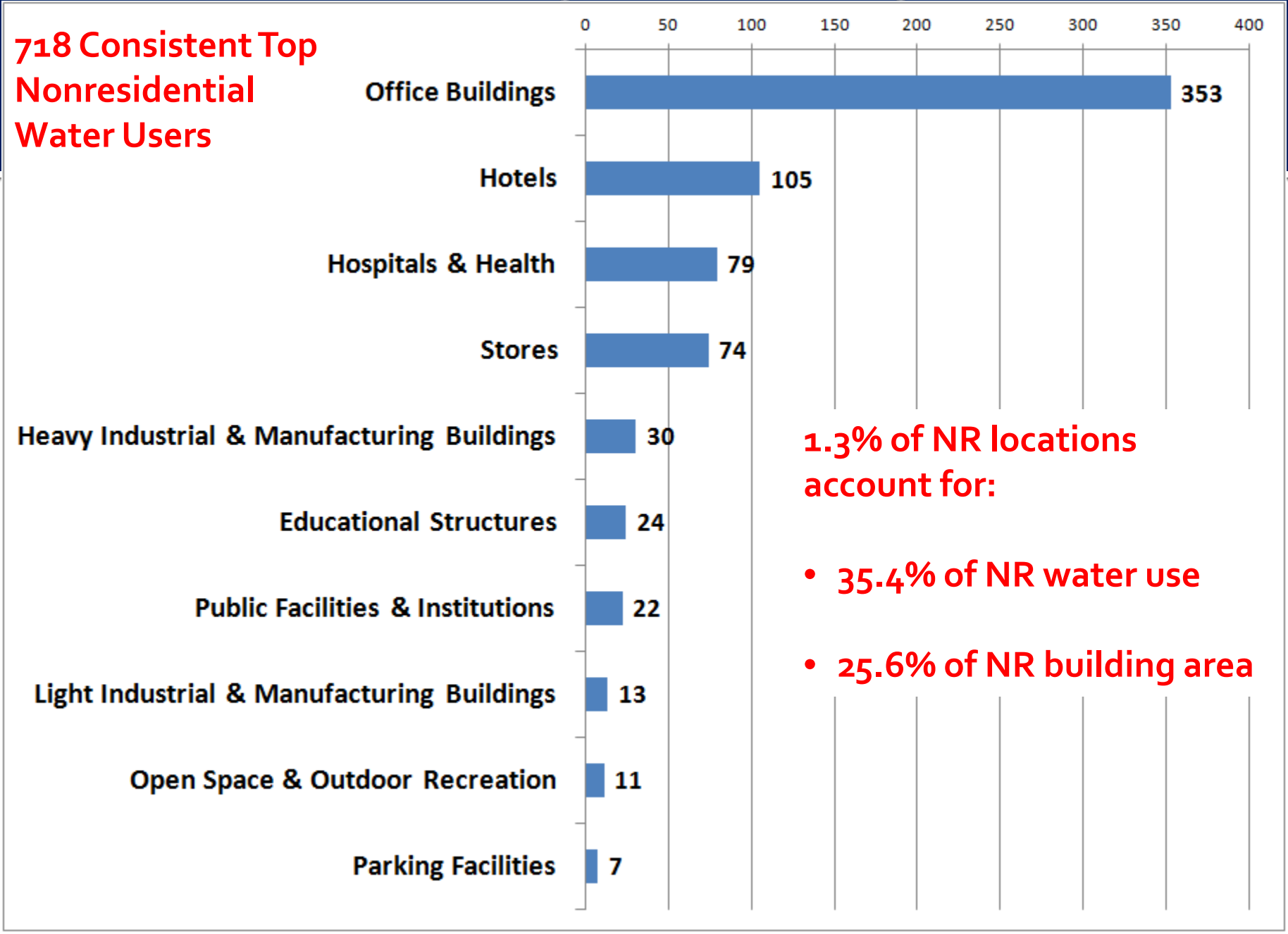
Identification of Top Nonresidential Water Users

- Large water users important for strategy development
- Potentially greatest bang for buck for efficiency improvements
- Potentially greatest impacts from water shortage conditions

Identification of Top Nonresidential Water Users

- Create unique ID representing location
  - Accounts and metered consumption
  - Land use and tax appraiser data
- Rank consumption by location for each of 4 years (FY08-FY11)
- Identify locations in top 1000 users across all time periods—Consistent Top Users

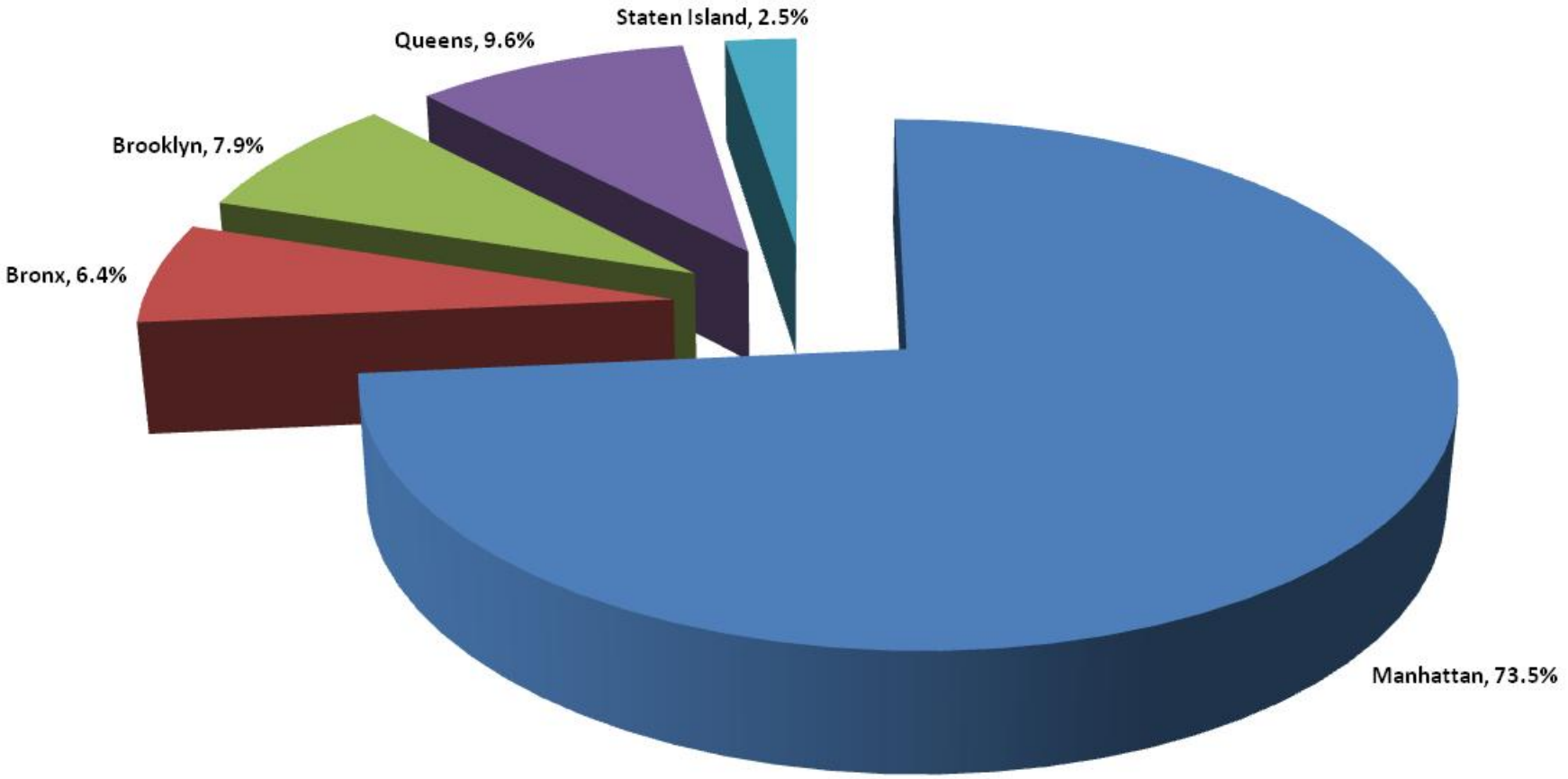
718 Consistent Top Nonresidential Water Users



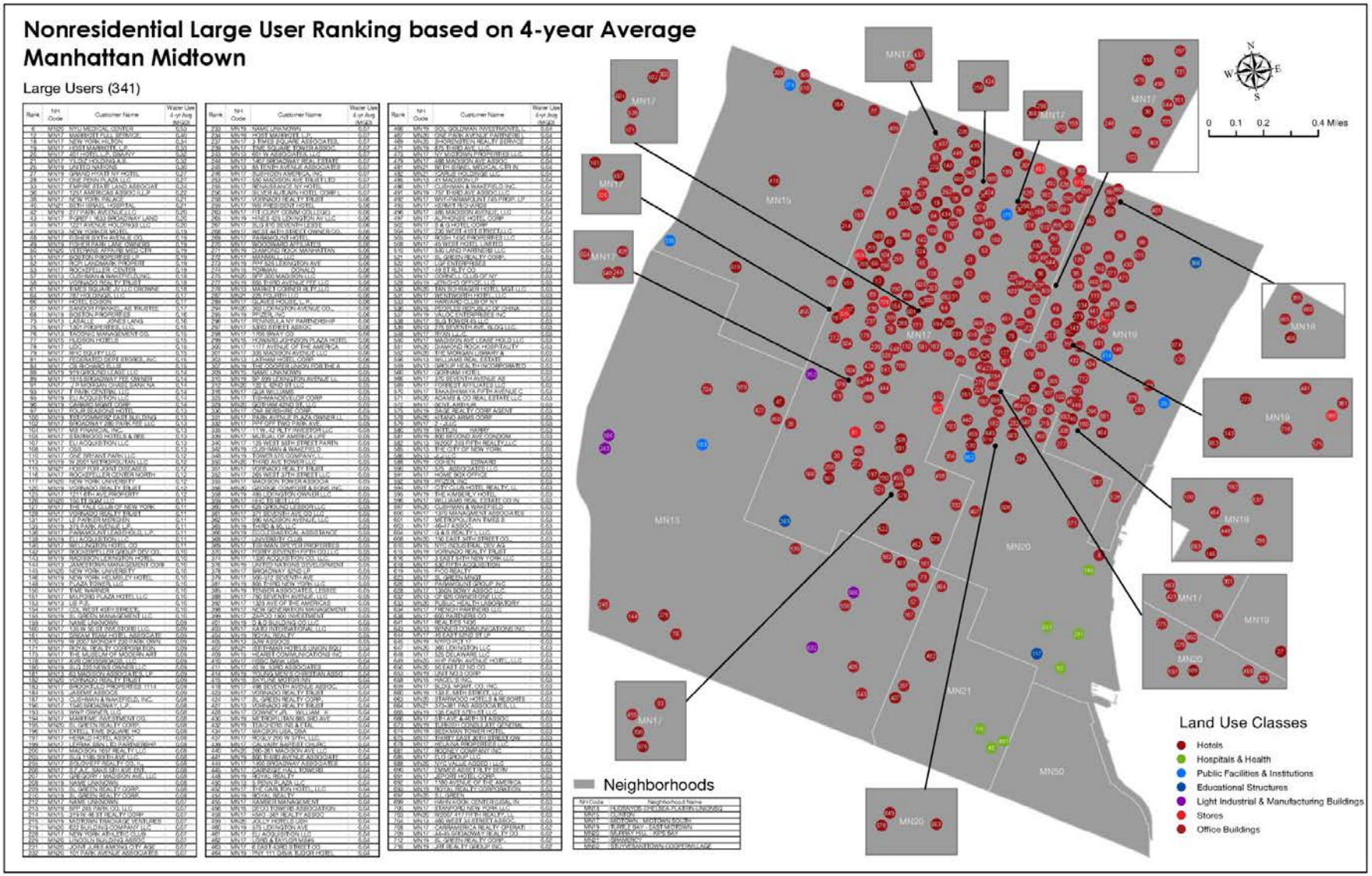
1.3% of NR locations account for:

- 35.4% of NR water use
- 25.6% of NR building area

Distribution of Consistent Nonresidential Top Users by Borough



Mapping of Large Users



Many Top Nonresidential Users Large in terms of Use per Sq.Foot

Metric for Water Use Intensity: Water Use per Square Foot of Building Area

Quartiles of Annual Average Water Use per Square Foot and Theoretical Potential Water Use Reductions								
	Quartiles of Annual Average Water Use per Square Foot (gallons per SQFT per day)							
Land Use Class	Min	P25	P50	P75	Max	# Large Users	% Large Users in Upper Quartile	Water Savings Potential @ P75 Benchmark (MGD)
Office Buildings	0	0.03	0.06	0.11	8.16	353	25%	3.0
Hotels	0	0.15	0.22	0.34	1.23	105	30%	0.4
Hospitals And Health	0	0.06	0.11	0.22	2.42	79	67%	3.9
Stores	0	0.05	0.16	0.37	36.43	74	65%	1.2
Heavy Industrial & Manufacturing Buildings	0	0.02	0.04	0.07	24.59	30	93%	3.0
Educational Structures	0	0.03	0.08	0.08	10.85	24	83%	1.1
Public Facilities & Institutions	0	0.04	0.04	0.1	21.98	22	68%	0.7
Light Industrial & Manufacturing Buildings	0	0.01	0.04	0.08	14.88	13	62%	0.4
Open Space & Outdoor Recreation	0	0	0.01	0.02	7.82	11	55%	1.3
Parking Facilities	0	0.05	0.11	0.31	27.73	7	29%	0.1
TOTAL						**718**	**42%**	**15.1**

Theoretical Water Use Benchmarks

15.1 MGD in Potential Water Savings

Summary

- Water demand management is a key component of NYCDEP's Water for the Future Program with focus on
  - Cost-effective and revenue neutral efficiency options in City facilities
  - Water shortage and efficiency improvement actions as risk reduction measure for RWBT fix
  - Use of actionable intelligence from data analysis

Lessons Learned

- Replacing fixtures in older structures may involve unanticipated costs
- Large users are diverse and water use highly variable—more work necessary to estimate efficiency potential more precisely
- AMR/AMI data is and will become even more valuable
  - Unprecedented analysis capabilities
  - Several processing items need to be addressed and standardized

Thank You!

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