Water Balance Analysis

ASHRAE Headquarters, Atlanta GA

March 28, 2019

Water Conservation Goals and Opportunities

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PROJECT GOALS

Achieve All 11 LEED Water Efficiency Points **(ASHRAE OPR)**:

(2 pts) No Permanent Irrigation

(6 pts) 50% Reduction in Indoor Water Use

(2pts) Optimize cooling tower water cycles (>10 CoC) or use minimum 20% recycled water (If applicable).

(1pt) Install permanent water meters for 2+ water subsystems

Recover/Reuse water to the greatest extent possible **(ASHRAE OPR) :**

Investigate opportunities to reuse for non-potable uses recovered water from HVAC condensate, rooftop stormwater. Potential non-potable uses include cooling tower make-up, toilet flushing, irrigation.

Optimize Use of Existing stormwater Pond **(ASHRAE OPR)**

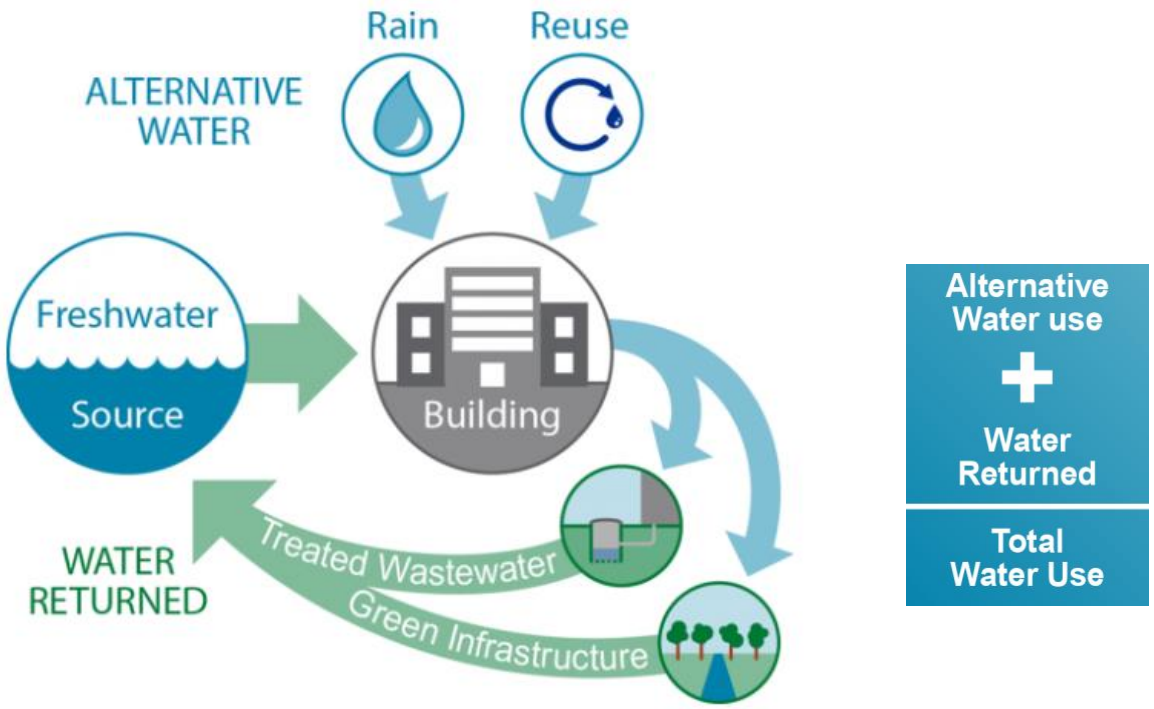
Zero Water Waste (Target Project Goal)

No potable water use for non-potable demands

LEED Zero Water (Net Zero Water)

Treat and Return water from building systems (green infrastructure for stormwater, on-site wastewater treatment, etc.)

Net Zero Water Definition



"Net zero water creates a water-neutral building where the amount of alternative water used and water returned to the original water source is equal to the building's total water consumption"

https://www.energy.gov/eere/femp/net-zero-water-building-strategies

Business-As-Usual Water Flow Diagram

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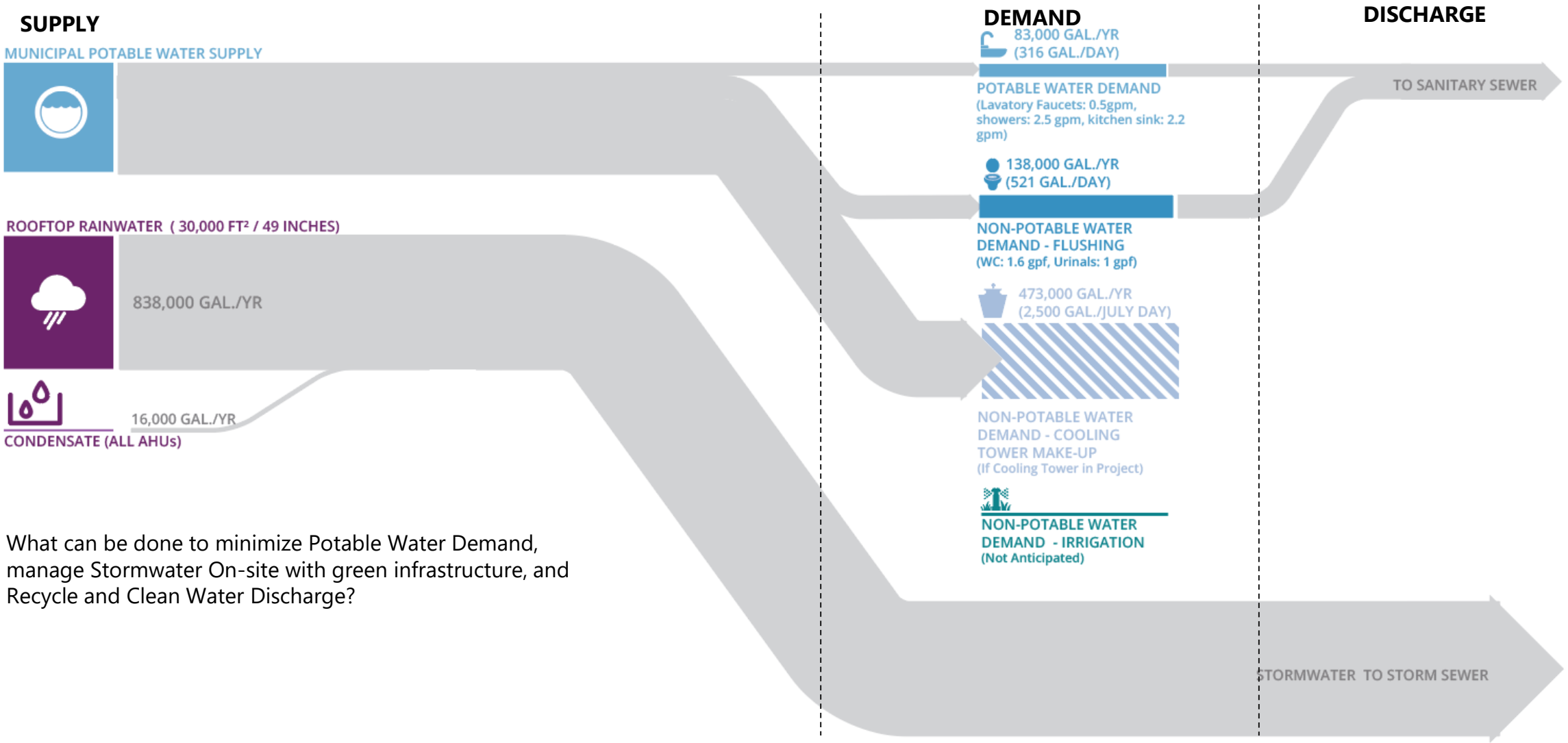

What can be done to minimize Potable Water Demand, manage Stormwater On-site with green infrastructure, and Recycle and Clean Water Discharge?

Potential Best Practice - Water Flow Diagram

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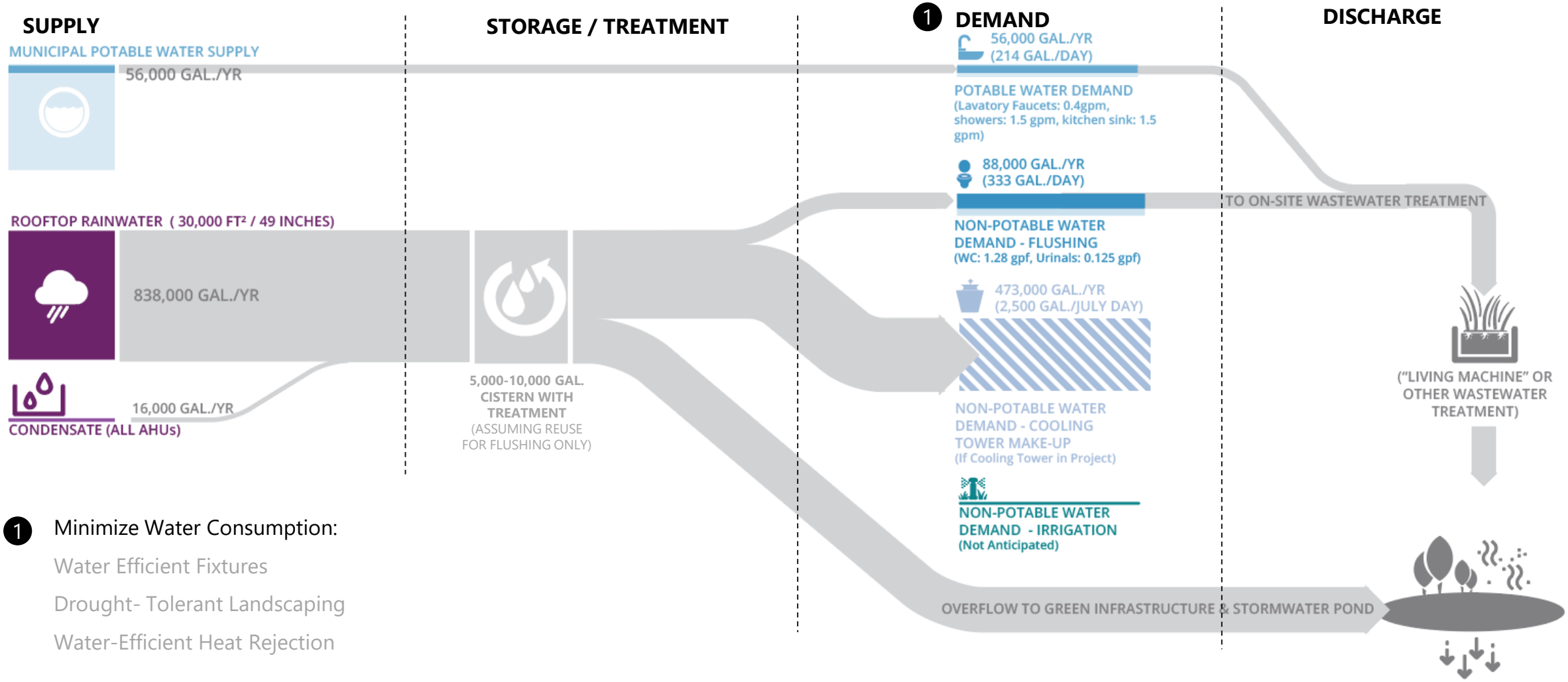

1 Minimize Water Consumption:

- Water Efficient Fixtures
- Drought- Tolerant Landscaping
- Water-Efficient Heat Rejection

Potential Best Practice - Water Flow Diagram

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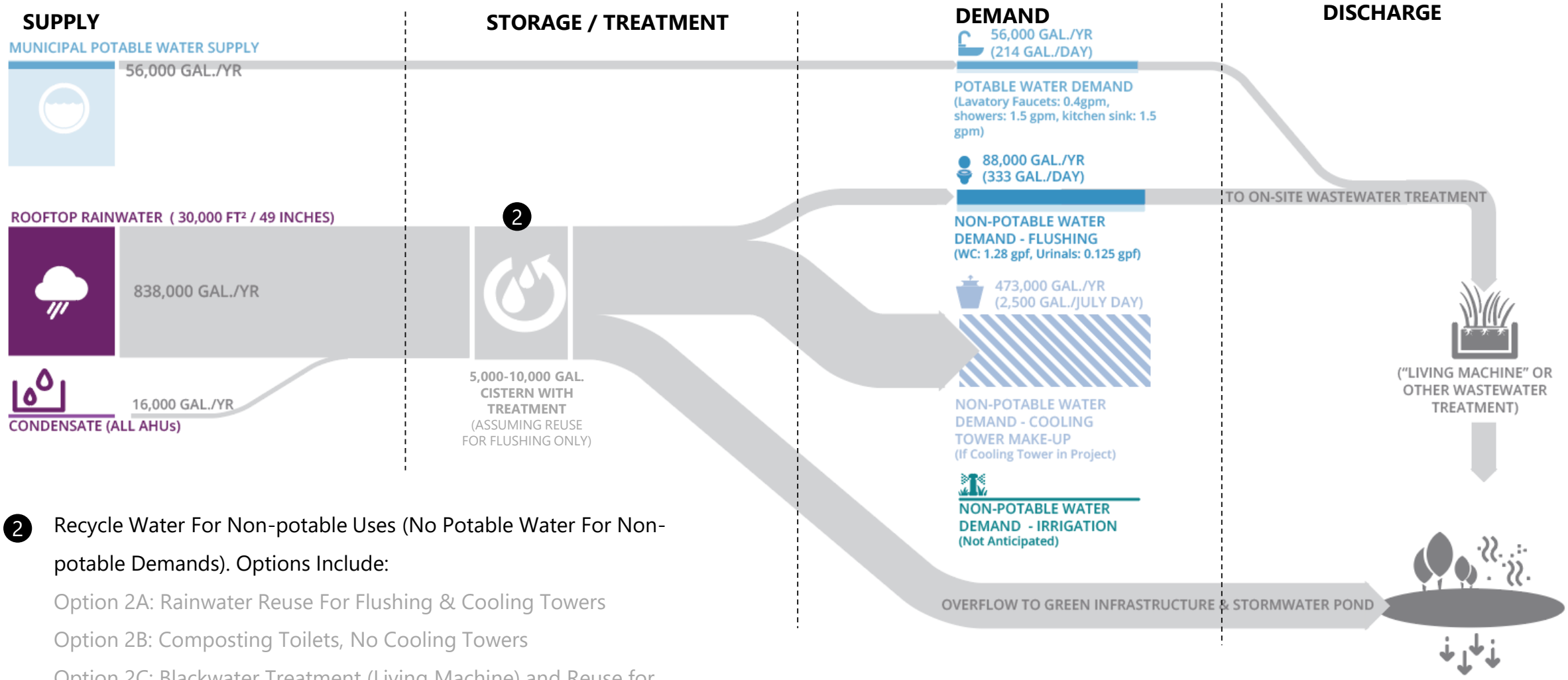

2 Recycle Water For Non-potable Uses (No Potable Water For Non-potable Demands). Options Include:

Option 2A: Rainwater Reuse For Flushing & Cooling Towers

Option 2B: Composting Toilets, No Cooling Towers

Option 2C: Blackwater Treatment (Living Machine) and Reuse for Toilet Flushing

Potential Best Practice - Water Flow Diagram

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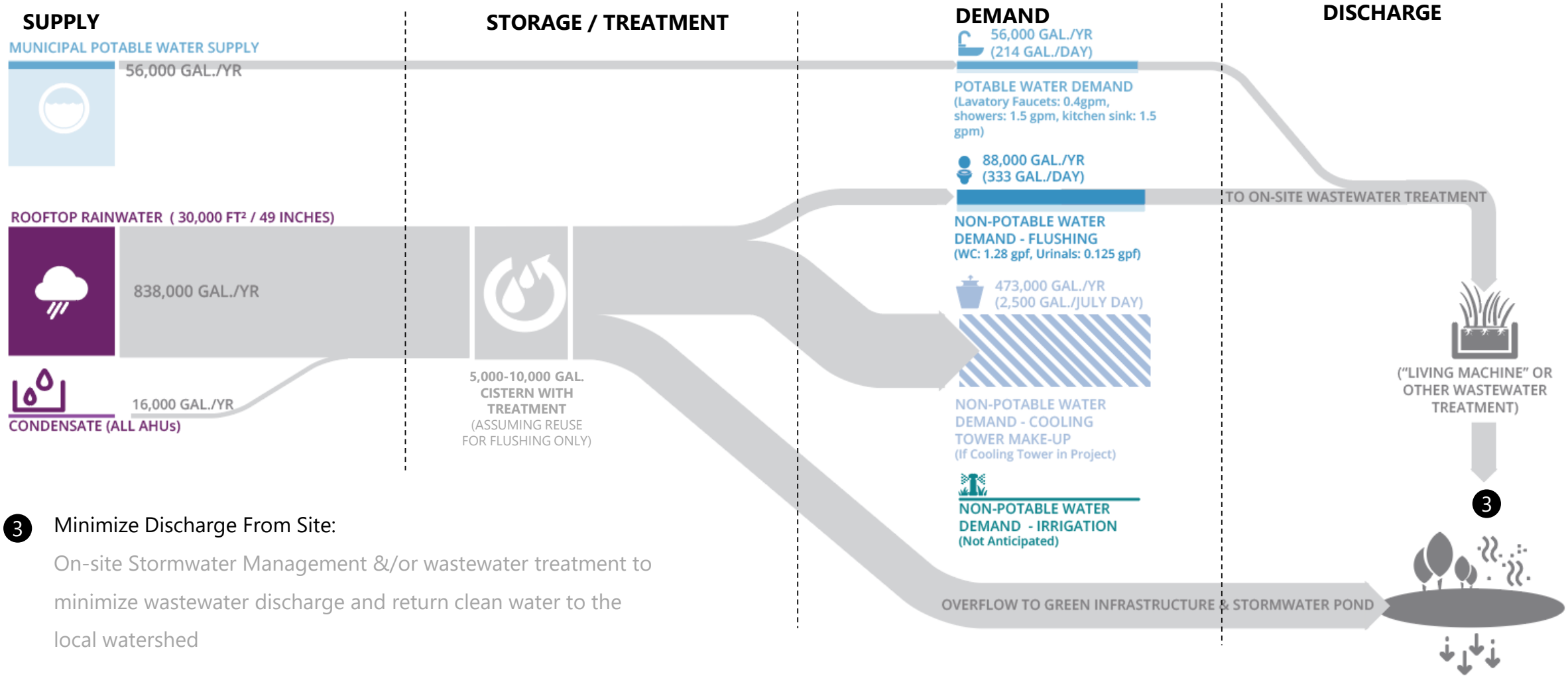

3 Minimize Discharge From Site:

On-site Stormwater Management &/or wastewater treatment to minimize wastewater discharge and return clean water to the local watershed

Monthly Water Balance Analysis

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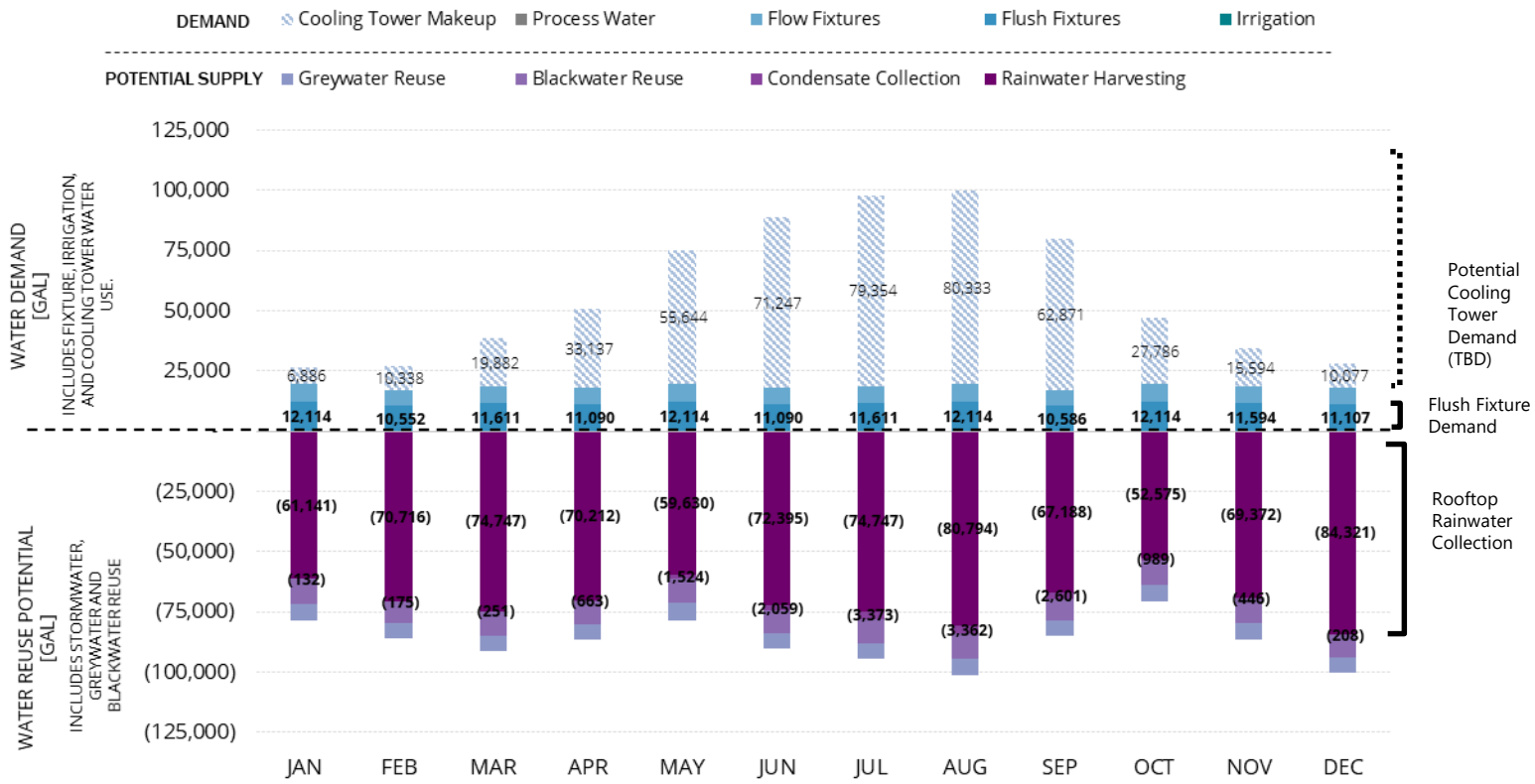
Monthly Supply vs. Demand:

- **Water Demands:** the major anticipated water demands are toilet flushing followed by water use for flow fixtures including showers and lavatory sinks. There is no anticipated permanent irrigation demand and cooling towers are one of many heat rejection options being evaluated.
- **Recycled Water Supply:** By far, the greatest potential recycled water source is rooftop rainwater, followed by blackwater, greywater, and HVAC Condensate.
- Based on current anticipated demands, there is sufficient rainwater from the building roof to offset most, if not all water consumed for toilet flushing with a 5,000-10,000 gallon cistern. A larger cistern will be required if cooling towers are included in the project.

MONTHLY ANTICIPATED WATER SUPPLY & DEMAND



Indoor Water Savings Potential

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POTENTIAL INDOOR WATER USE REDUCTION (No Cooling Towers or Irrigation)

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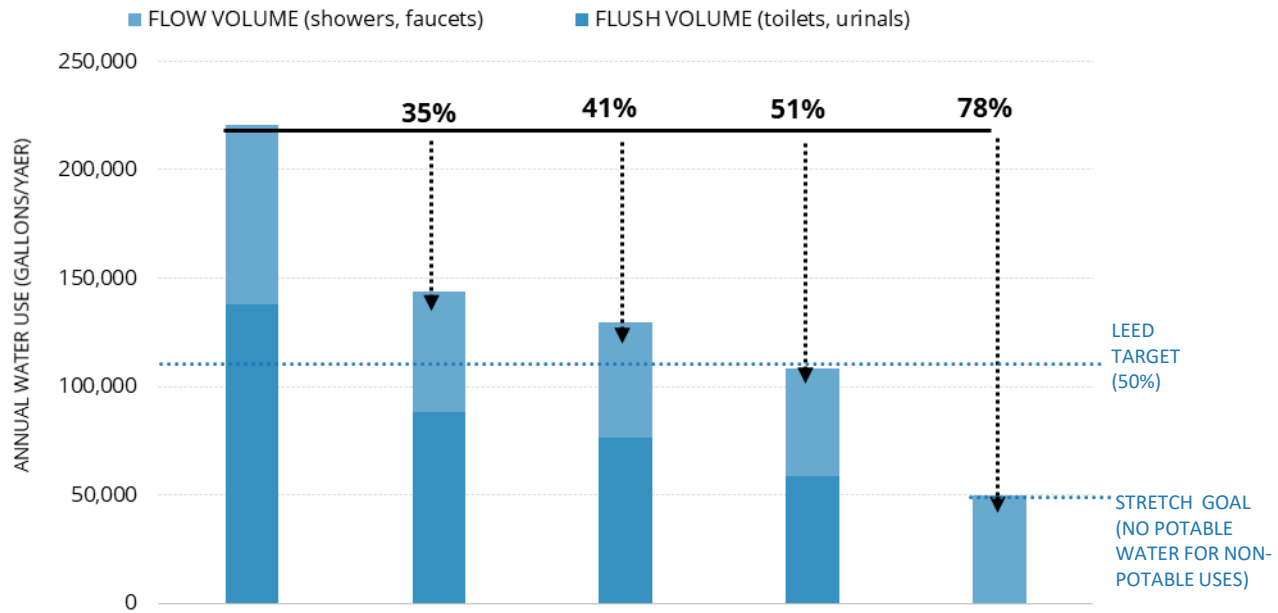

WC	1.6	1.28	1.1	0.9	With a 5,000-10,000 gallon cistern
Urinal	1	0.125	0.125	waterless	
Lavatory Faucet	0.5	0.4	0.35	0.35	
Shower	2.5	1.5	1.5	1.5	
Kitchen Sink	2.2	1.5	1.5	1	

Key Findings:

- **Option 3 (LEED 50% Reduction): :** Assuming that there is no cooling tower make-up or irrigation demand, the project could potentially reduce indoor water use by over 50% with the use of ultra-low-flow fixtures. While technically possible, we do not recommend the *Ultra Low Flow Fixture* rates case due to maintenance concerns with waterless urinals and ultra low-flow toilets.
- **Option 4 (Stretch Goal):** Target a 35% reduction in indoor water use with *Standard Low-Flow Fixtures* and offset the remaining non-potable demand with recycled rooftop rainwater and HVAC Condensate. Catchment area, cistern location, and treatment requirements to be determined.
- As an alternative to Option 4, ASHRAE could also consider foam-flush composting toilets to significantly reduce water use for toilet flushing while also reducing sewage discharge.
- Another alternative is to include blackwater recycling, such as a “living Machine” or packaged blackwater treatment system.

Key Water Balance Analysis Assumptions

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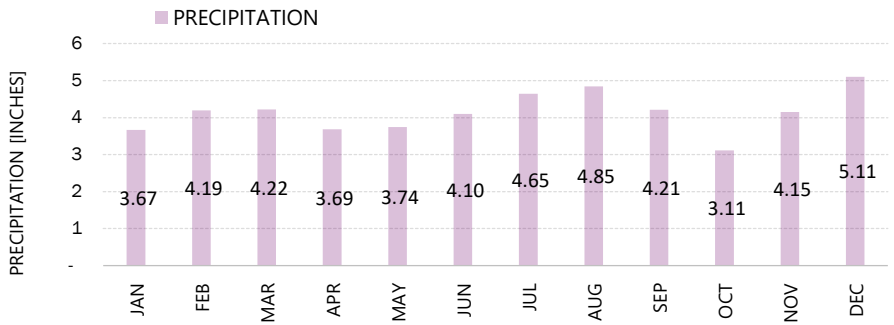
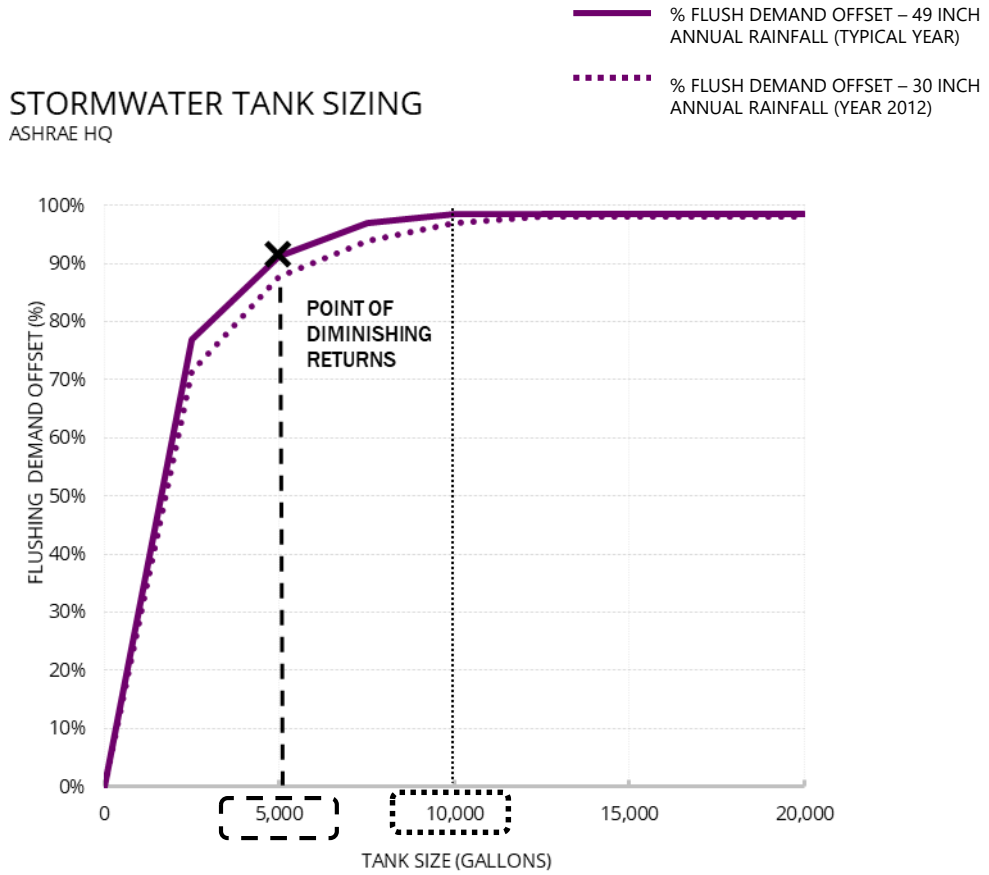


KEY ANALYSIS INPUTS		
Rooftop Rainwater Collection Area	30,000 Ft2	
Rooftop Runoff Coefficient	0.95	
Average Annual Rainfall (2006-2018 Dekalb-peachtree)	49.7 Inches	
INDOOR WATER USE		
# Full-time Occupants	124 PEOPLE, 260 DAYS/YEAR (Source: OPR)	
3 Visitors	100 People, 2 Weekend Days Per Month (To Be Verified)	
FIXTURE FLOW RATES	EPA BASELINE	STANDARD LOW-FLOW
Toilets [gpf]	1.6	1.28
Urinals [gpf]	1	0.125
Lavatory faucet [gpm]	0.5	0.4
Shower [gpm]	2.5	1.5
Kitchen sink [gpm]	2.2	1.5
ADDITIONAL RESOURCES		

https://www.dca.ga.gov/sites/default/files/2009_ipc_appendixi_rainwater.pdf



88-91% Reduction in potable water use for flushing with a 5,000 gallon cistern

97-100% Reduction in potable water use for flushing with a 10,000 gallon cistern

Georgia Rainwater Harvesting Guidelines

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Next Steps – Rainwater Reuse:

1. Determine roof catchment area feeding into rainwater harvesting system. Collecting rainwater from only one or the two rooftops may be sufficient to meet flushing demands while reducing piping runs.
2. Locate space for a 5,000- 10,000 Gallon Storage Tank
3. Incorporate filtration and disinfection as required by the local plumbing code
4. Consider incorporating a "Day Tank" for the storage of a limited supply of filtered water to potentially reduce pump run-hours.