Transbay Transit Center
Graywater Reuse System
Overview

June
2009

rana creek

Transbay Transit Center

WATER GOALS.

- Proposed goal: Minimize the use of potable water where non-potable water could be used.

- Design strategies & options:
  - –water conserving fixtures in bathrooms and commercial kitchens
  - –cooling tower water conservation
  - –Landscape design & efficient irrigation
  - –reuse of stormwater and graywater

Contents

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WATER GOALS.

- Water is related to energy. Synergies between water conservation and energy conservation should be considered.
- Off-site impacts of water use should be considered, including the impacts and energy use needed to get water from its source to San Francisco.
- Water is related to habitat & heat island effect mitigation; synergies between these should be considered.

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WATER ORDINANCES.

San Francisco Green Building Ordinance.

- Requires all private development to meets LEED and other requirements. Requirements become more stringent over time, and are assigned based on the date of site permit approval.

For large commercial buildings, the water requirements are as follows:

- 2009, meet LEED WEc1.1, Water Efficient Landscaping, reduce by 50%
- 2009, meet LEED WEc3.1, Water Use Reduction, 20%
- 2011, meet LEED WEc3.2, Water Use Reduction, 30%

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WATER ORDINANCES.

San Francisco Green Building Ordinance.

Stormwater

- 2009, meet SSc6.1 and SSc6.2, Stormwater Management with special requirements.

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WATER ORDINANCES.

San Francisco Stormwater Design Guidelines

- Draft guidelines have been published by the City of San Francisco, CPUC, and the Port of San Francisco. The goal is to have mandatory guidelines in place by the end of 2008 for areas with separate storm and sewer systems. Guidelines for locations with combined sewers will follow.

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WATER ORDINANCES.

San Francisco Stormwater Design Guidelines

All projects over 5,000 sq.ft. must meet one of these performance requirements:

- Capture and treat the flow of stormwater runoff resulting from a rain event equal to at least 0.2 inches per hour intensity
- Capture and treat 80% of the annual stormwater runoff volume

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WATER CODES.

All new construction in California is required to be double-plumbed to accommodate reclaimed water from a future municipal source.

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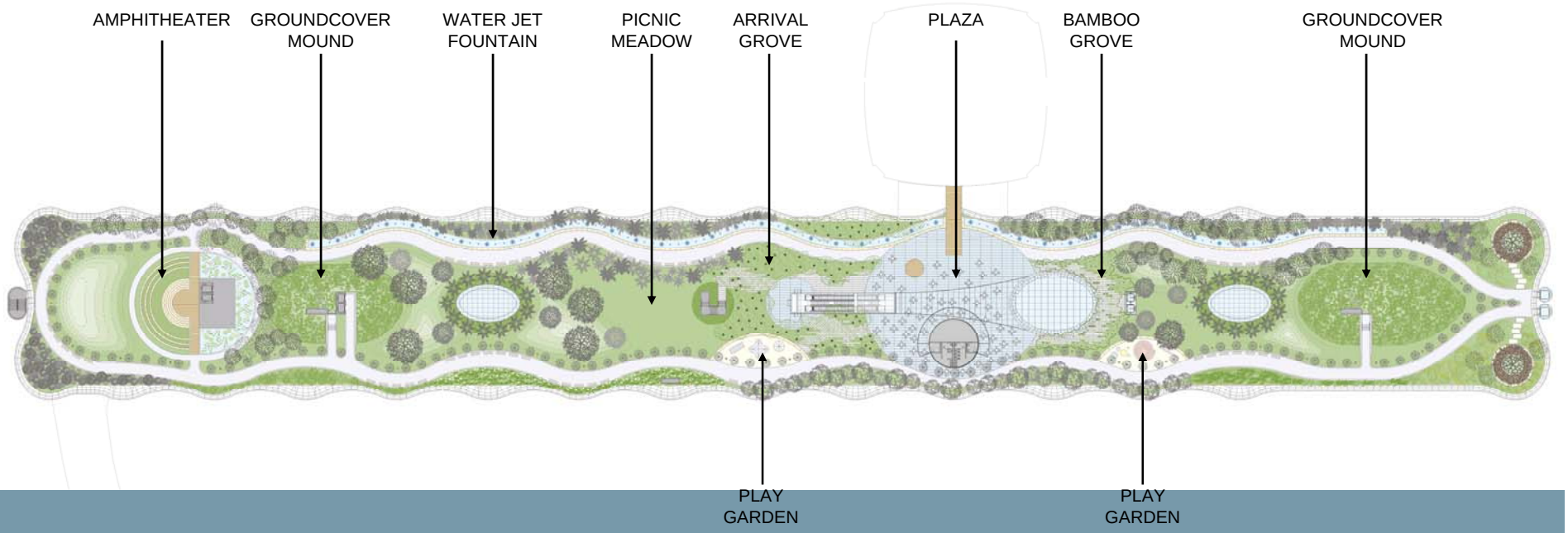
Water Reuse System

Sources

- Stormwater (Roof)
- Graywater (Sinks)
- Potable back-up

Destination

- Toilet Flushing



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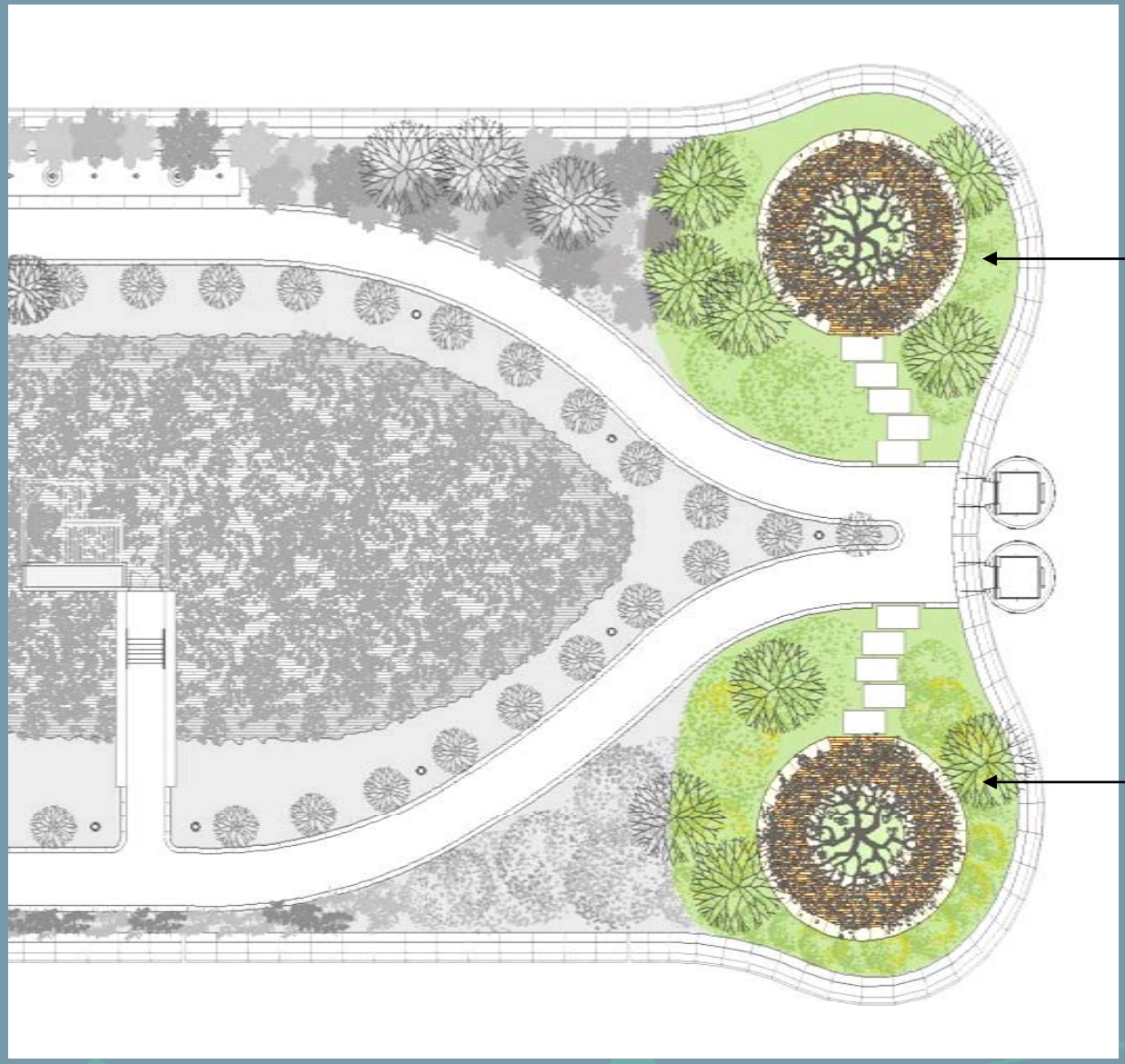

POSSIBLE GREY WATER TREATMENT ZONES

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Graywater Regulations

Chapter 24 Appendix G

- Permit by Local Authority
- No Public Contact With Untreated Graywater
- Collection Tank, No Treatment System Specified

IAPMO Code IGC 207-2006b

1 ppm of Chlorine in the Toilet Water

Three Phases of Graywater Treatment

1° Primary

- Activated Carbon & Sand Filter

2º Secondary

- Subsurface Constructed Wetland

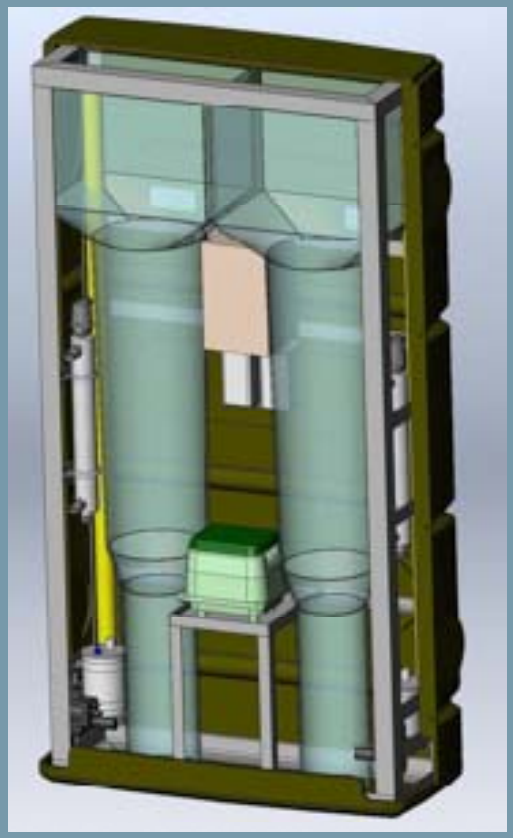
3º Tertiary

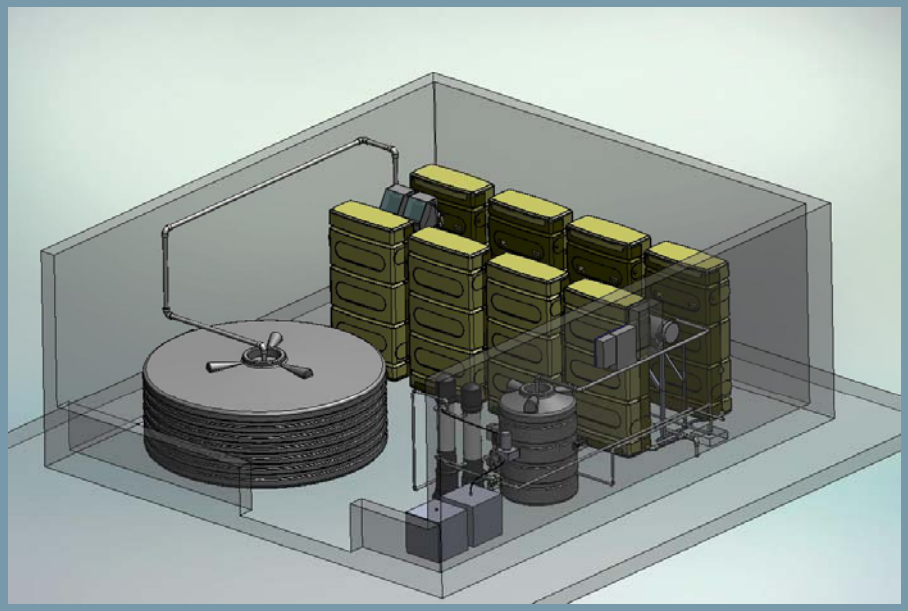
- Ozone Sterilization

Activated Carbon & Sand Filter

Nubian

-Commercial Graywater Treatment System





Nubian System Operations

Services

–Power consumption approx 0.0038 KWh/gallon

–Compressed air

Maintenance

–Year 1 –twice monthly

–Years 2 onwards –three times monthly

–Service duration approx. 2 people for 3 hours

Water tests

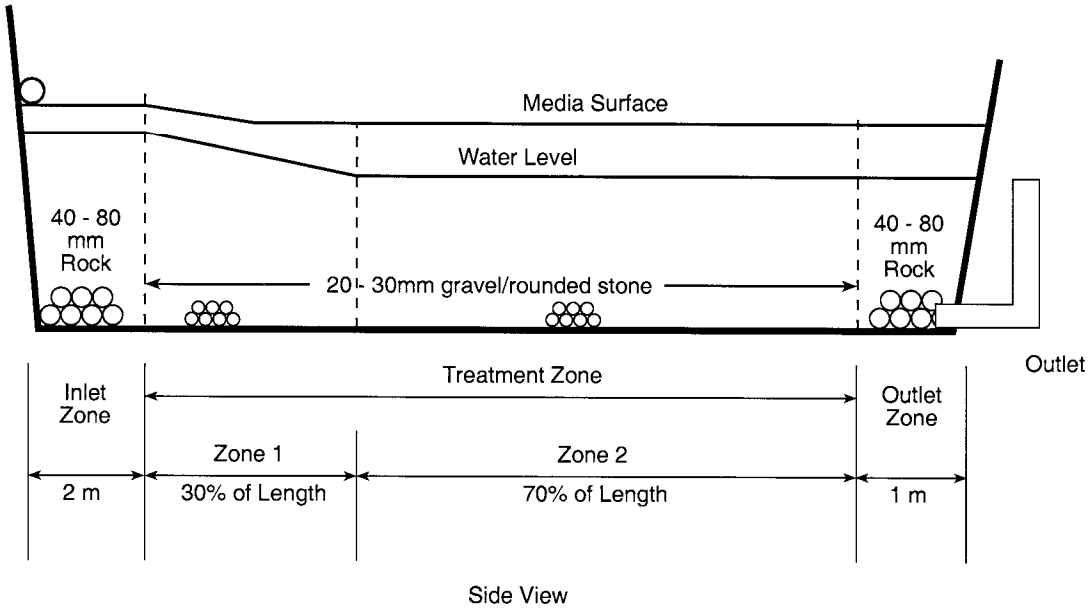
–On-line monitoring of pH, free chlorine, turbidity

–Periodic E.Coli and virus testing may be required by regulators

System Monitoring

–Can be remotely monitored

Subsurface Constructed Wetland



Ozone Sterilization System

Regulations

-According to the IAPMO Code IGC 207-2006b there must be 1 ppm of chlorine residual in the Toilet Water

Ozone Sterilization System

Oxidation

- –Breaks cell walls
- –Precipitates suspended molecules

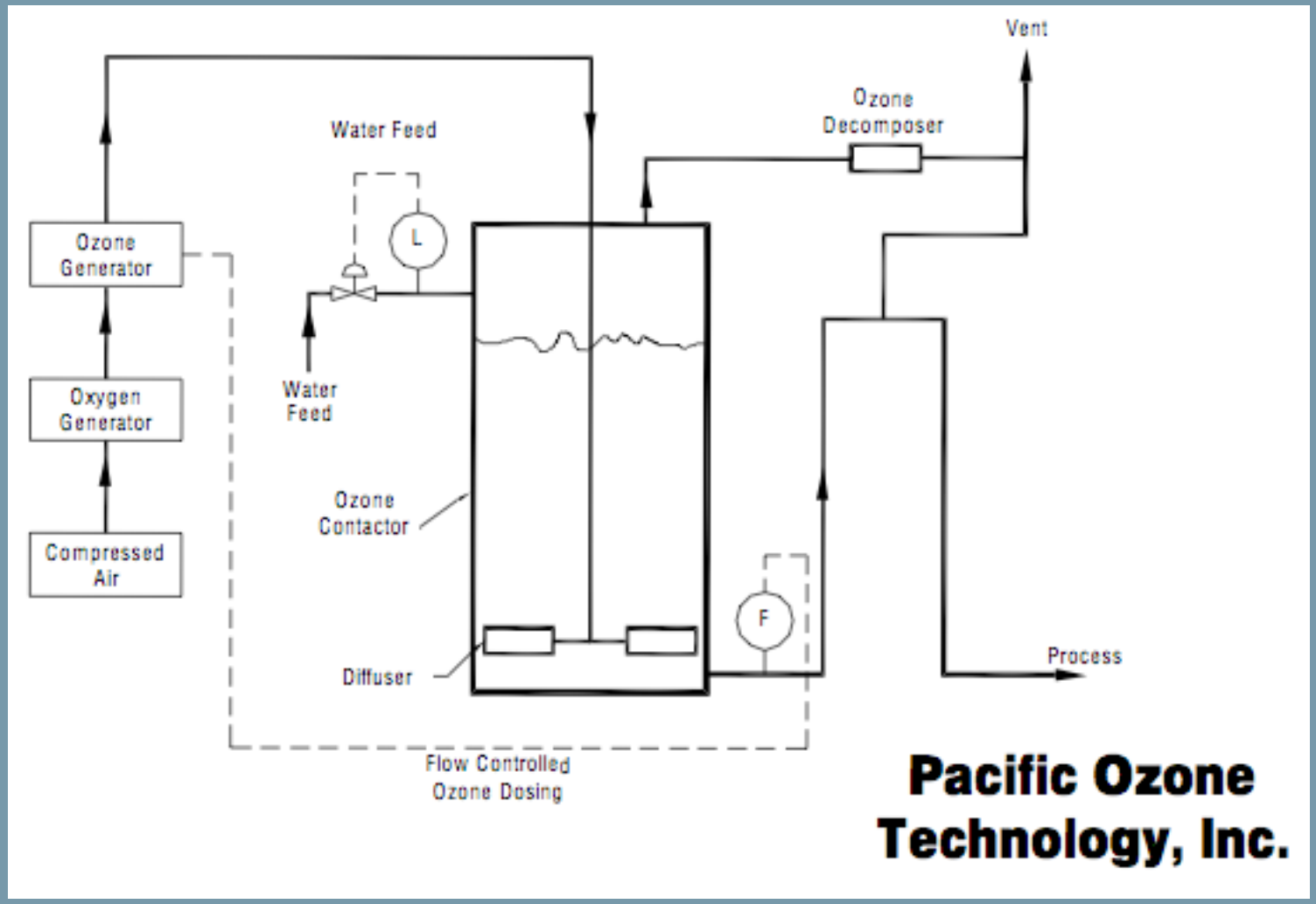
Disinfection

- –Kills bacteria, viruses, molds, cysts, parasites
- –Effective against all common food borne pathogens

Decomposition

- –Decomposes to oxygen

Typical Ozone Bubble Diffusion



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Effectiveness of Ozone

Ozone is the most powerful food-grade antimicrobial agent available

Effective against E. coli 0157:H7, Salmonella, and all known bacteria, viruses, yeast, molds and mildew

Ozone is fifty times more effective than chlorine and 3100 times faster at killing bacteria

Ozone is a highly adaptable broad-spectrum solution for surface sanitation.

Regulatory Approvals

- FDA Direct Food Contact
- USDA Disinfectant
- EPA Sustainable Technology Platform
- USDA Organic Guidelines
- Approved for Kosher Processing
- Approved for Halal Processing

Ozone Summary

–The most powerful commercially available disinfectant

–Destroys all food borne pathogens

–A green technology

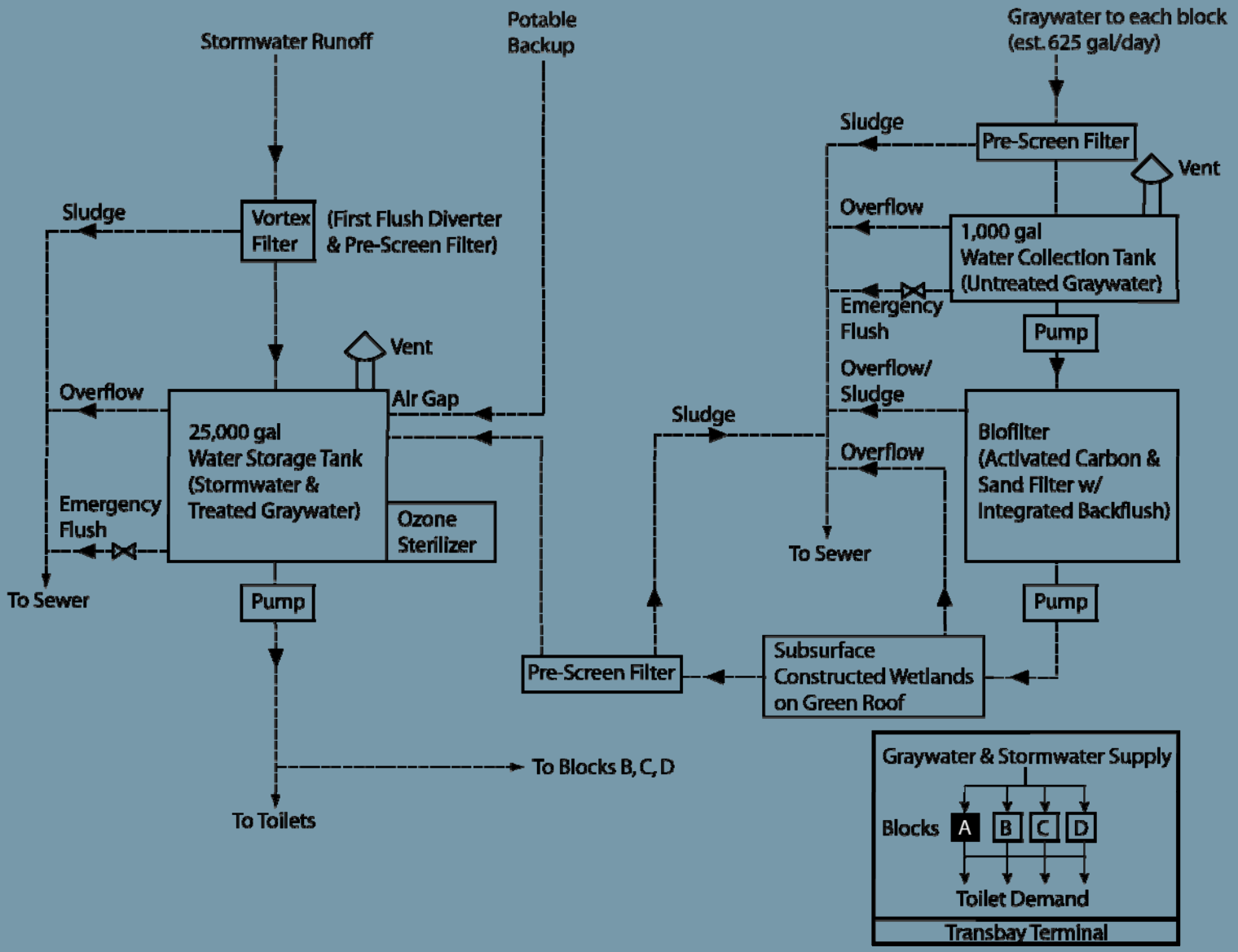
–Saves energy

–Conserves water

–Replaces dangerous chemicals

–Saves time and money

–Ozone is safe



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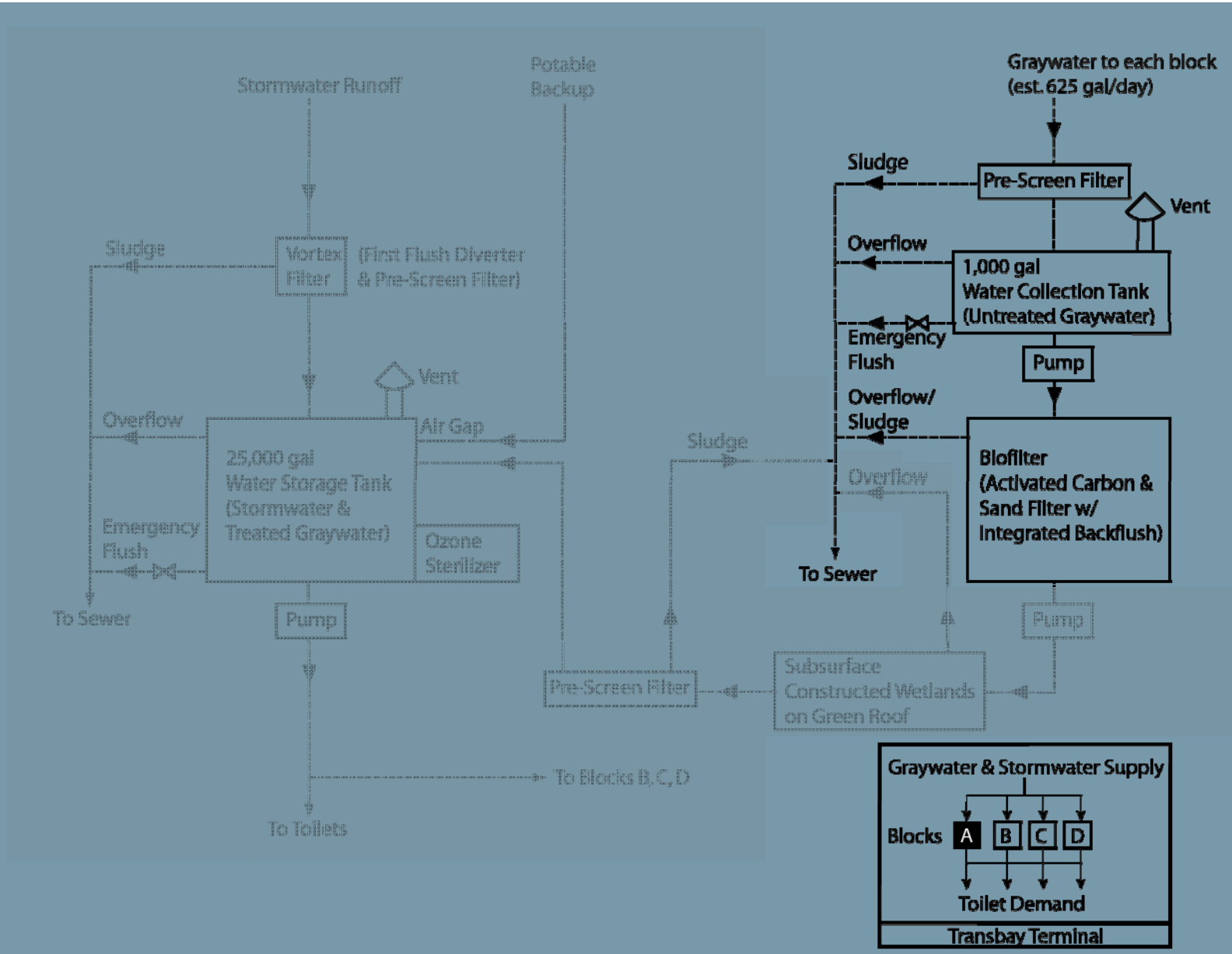

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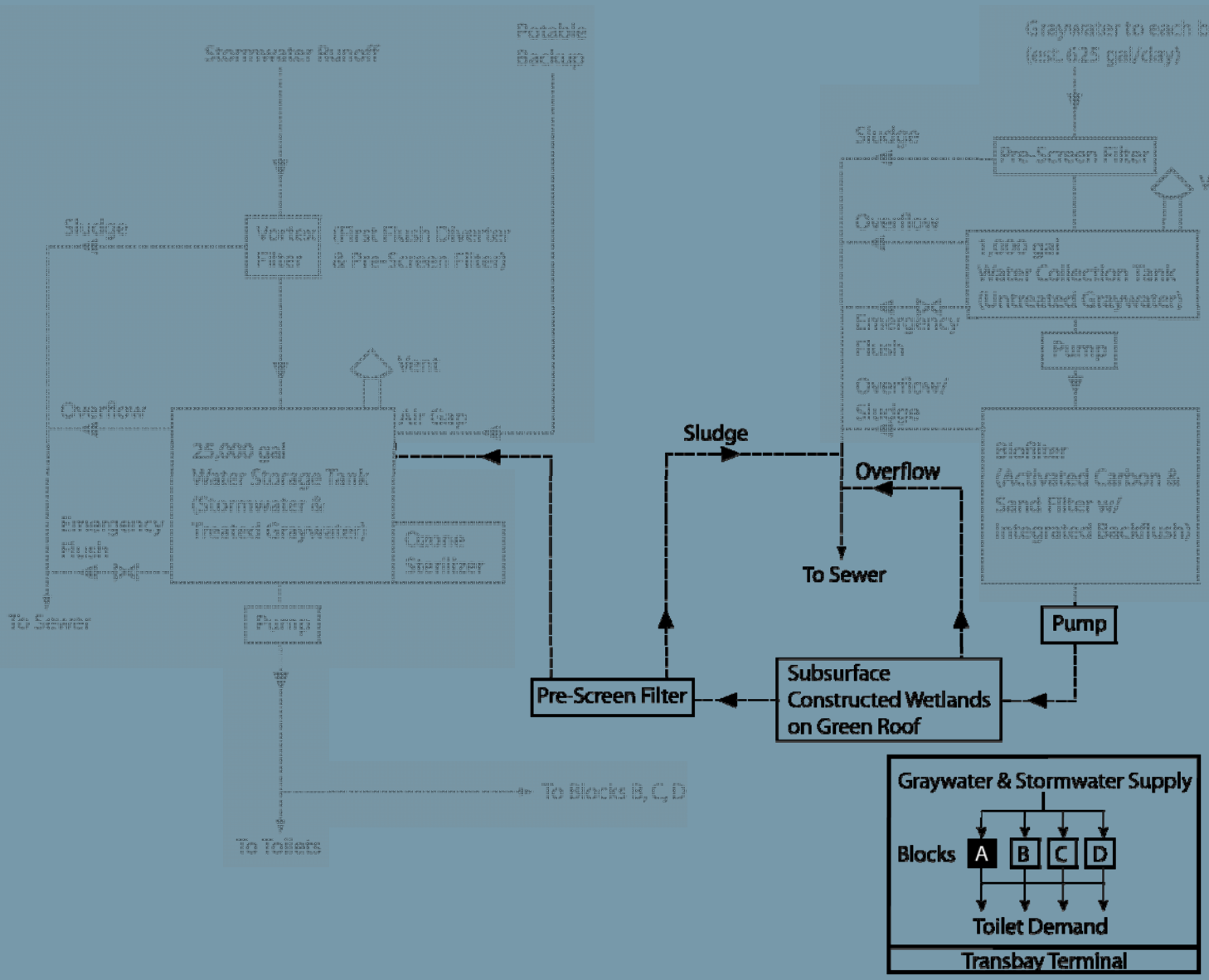

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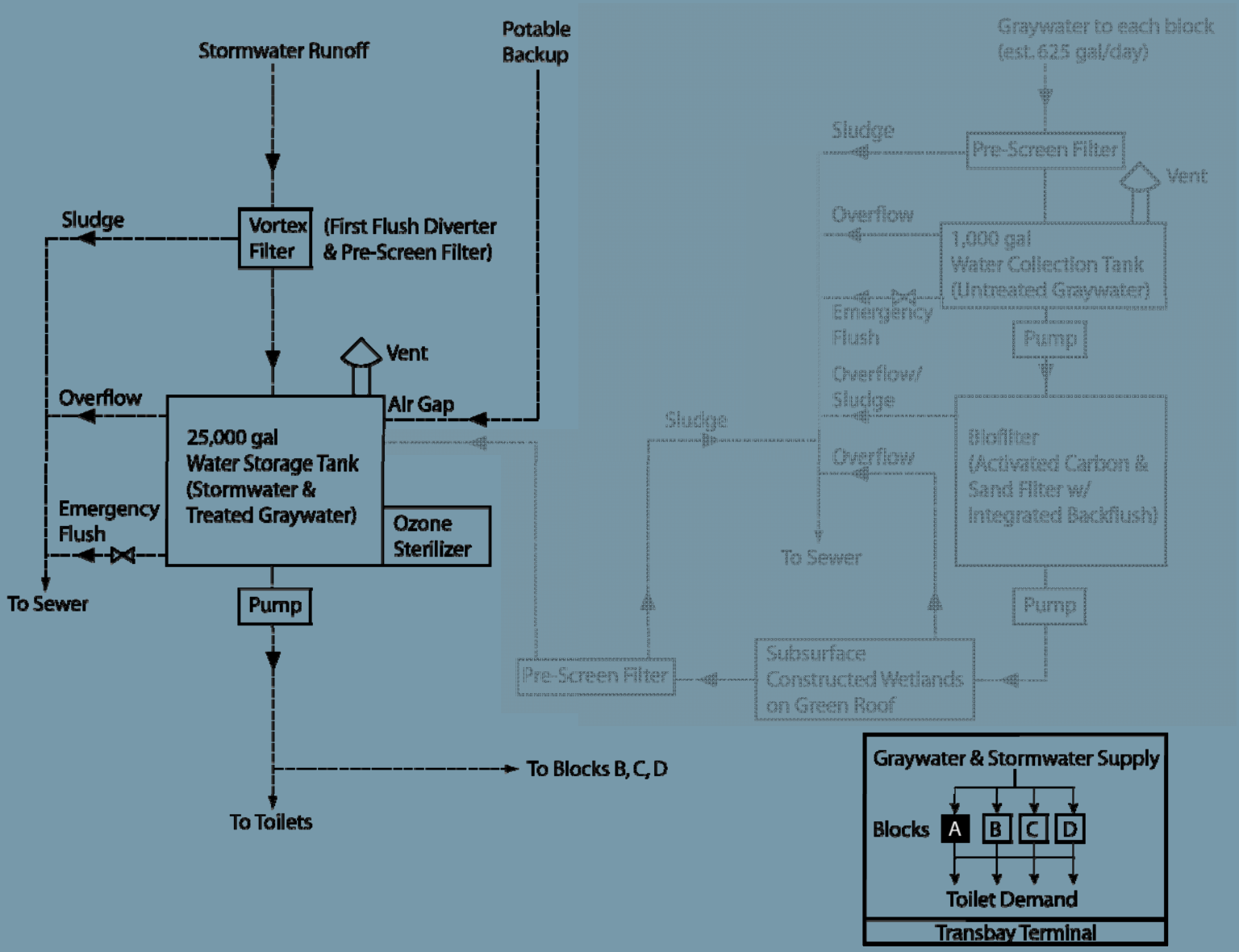
Stormwater Treatment

Pre-Screen Filter

First Flush Diverter

Ozone Sterilization



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Graywater Precedent

THE ECOHOUSE
DIG Cooperative
Berkeley, CA

- Demonstration home and garden
- Combination of biological and mechanical treatment of 100% the building's graywater
- Wetland adjacent to the house
- Graywater is never allowed to surface
- Irrigation Reuse
- Permitted in 2007

Graywater Precedent

Little Bay Apartments

Nubian Water Systems

New South Whales, Australia

- 42 Apartments
- 100% of Graywater
- Capacity 4,500 gal/day
- Toilet flushing reuse
- Permitted & Installed 2008

Ozone Precedent

Coca Cola Bottling Plant
Pepsi Bottling Plant
DS Water
Nestle
Cadbury Schwepps

- Sanitizes 90% of water

Variances

California Plumbing Code Title 24 Section 301.2

"Alternate Materials and Methods of Construction"

- Green Roof Constructed Wetland
- Ozone Sterilization System

Graywater Permitting Package

- Process flow diagram illustrating water sources, processing, and destinations
- Summary of the graywater treatment system, including a detailed explanation of the water treatment process.
- Permit Document Set, illustrating the mechanical systems, plumbing, treatment wetland(s), planting plan, subsurface irrigation system and additional components of the Transbay Terminal graywater treatment system.
- Follow all codes and requirements for graywater treatment systems as described in California Building Code Title 24.
- Precedents of other commercial graywater treatment systems already permitted and installed.

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	Scenario	Potable Water Demand/year (gallons)	Cost of Potable Water/year $2.92/100 cu. ft.	Amount of Sewer Discharge/year (gallons)	Cost of Sewer Discharge/year $6.55/cu. ft.	**Total Cost/year**
1	LEED base case	37,922,568	$148,039.97	39,545,598	$346,288.32	$494,328.29
2	Water conserving fixtures, native veg, & efficient irrigation.	20,778,366	$81,113.41	21,357,025	$187,016.73	$268,130.13
3	Hybrid-Geothermal Heat Exchange	20,065,102	$78,329.01	21,000,393	$183,893.81	$262,222.82
4	Greywater Reuse	19,567,128	$76,385.05	19,392,529	$169,814.26	$246,199.30
5	Stormwater & Greywater Reuse - with current tank size	17,997,511	$70,257.66	17,822,912	$156,069.61	$226,327.28

Transbay Transit Center

	Scenario	Total Gallons Used	Total Gallons Saved	Percentage Reduction from Base	Total LEED Credits Achieved	Annual Water Cost Savings
1	LEED base case	37,922,568	0	0%	0	$0.00
2	Water conserving fixtures, native veg, & efficient irrigation.	20,778,366	17,144,202	45%	4	$226,198.16
3	Hybrid-Geothermal Heat Exchange	20,065,102	17,857,466	47%	4	$232,105.47
4	Greywater Reuse	19,567,128	18,355,440	48%	4	$248,128.99
5	Stormwater & Greywater Reuse - with current tank size	17,997,511	19,925,057	53%	5	$268,001.02