

# Overview of Current Standards and Water Quality Parameters in the U.S.

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# San Francisco Public Utilities – Reuse for toilet flushing



# Eloy Correctional Facilities Complex, Shower Water Recycling

- *Permit issued:* 2008
- *Design flow:* 225,000 gpd
- *Source:* Showers for 6492 beds are treated to Class A standard & reused for toilet flushing
- 57 6600-gal storage tanks, primary & secondary filtration, chlorination
- Weekly fecal coliform monitoring
- Blue dye added
- Saves 20 gpd/prisoner of potable water



**Four facilities,  
8178 beds total**



**Recycling equipment,  
Valentine Engineering**

# Graywater Irrigation: Tiers

State	Tier 1			Tier 2			Tier 3		
	Flow (gpd)	Water quality	Permit required	Flow (gpd)	Water quality	Permit required	Flow (gpd)	Water quality	Permit required?
Arizona	400	None	No	400-3000	None	Yes	> 3000	Yes	Yes
California	< 250	None	Yes	> 250	None	Yes	-	-	-
New Mexico	< 250	None	No	< 2000	Yes	Yes	-	-	-
Oregon	< 300	Yes	Yes	300 - 1200	Yes	Yes	> 1200	Yes	Yes
Washington	< 60	None	Yes	< 3500	None	Yes	> 3500	Yes	Yes

# Water Quality:

## Graywater Use to Flush Toilets

	BOD <sub>5</sub> (mg L <sup>-1</sup> )	TSS (mg L <sup>-1</sup> )	Turbidity (NTU)	Total Coliform (cfu/ 100ml)	<i>E. Coli</i> (cfu/ 100ml)	Disinfection
California	10	10	2	2.2	2.2	0.5 – 2.5 mg/L residual chlorine
New Mexico	30	30	-	-	200	-
Oregon	10	10	-	-	2.2	-
Georgia	-	-	10	500	100	-
Texas	-	-	-	-	20	-
Massachusetts	10	5	2	-	14	-
Wisconsin	200	5	-	-	-	0.1 – 4 mg L <sup>-1</sup> residual chlorine
Colorado	10	10	2	-	2.2	0.5 – 2.5 mg/L residual chlorine
Typical Graywater	80 - 380	54 -280	28-1340	10 <sup>7.2</sup> – 10 <sup>8.8</sup>	10 <sup>5.4</sup> – 10 <sup>7.2</sup>	N/A

# Stormwater: Indoor Use



	<b>Turbidity (NTU)</b>	<b><i>E. Coli</i> (CFU/100ml)</b>	<b>Total Coliforms (CFU/100ml)</b>
California	10	< 100	-
Texas	-	< 100	< 500
Georgia	-	< 100	< 500

**Graywater Use for Toilet Flushing:**  
Total Coliforms: 2.2 – 500 CFU/100ml  
*E. Coli*: 2.2 – 200 CFU/100ml

# National Sanitation Foundation

## 350 Water Quality for Graywater Use for Toilet Flushing

Parameter	Class R <sup>a</sup>		Class C <sup>b</sup>	
	Test Average	Single Sample Maximum	Test Average	Single Sample Maximum
CBOD <sub>5</sub> (mg/l)	10	25	10	25
TSS (mg/l)	10	30	10	30
Turbidity (NTU)	5	10	2	5
<i>E. coli</i> (MPN/100 ml)	14	240	2.2	200
pH (SU)	6.0-9.0		6.0-9.0	
Storage vessel residual chlorine (mg/l)	≥ 0.5 - ≥ 2.5		≥ 0.5 - ≥ 2.5	

<sup>a</sup> Class R: Flows through graywater system are less than 400gpd

<sup>b</sup> Class C: Flows through graywater system are less than 1500gpd

# NSF 350

- **Beneficial**

- Rigorous performance standards for systems to meet for certification
- Courageous effort to set a standards
  - *Has enabled projects to move forward*



# NSF 350

- **Has some limitations**
  - Not risk based

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# NSF 350



- **Has some limitations**
  - Not risk based
  - Requires extensive treatment processes for graywater

# Graywater Treatment to Achieve NSF Standards

- **Turbidity: 2 NTU**
  - Ultrafiltration or smaller
  - Biological treatment (MBR, plant based)
  - Not achievable via sand filtration
- **BOD<sub>5</sub>: 10 mg/L**
  - Biological treatment (MBR, plant based)
  - Membranes
    - *Nanofiltration or smaller*
    - *Dissolved organic matter is low molecular weight*
  - Activated carbon
  - Not achievable via sand filtration, micro- or ultra- filtration

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# NSF 350



- **Has some limitations**
  - Not risk based
  - Requires extensive treatment processes for graywater
  - Does not include guidance for long term monitoring
  - Does not require redundancy to ensure reliability
- **Appearing in many state regulations**
  - Colorado
  - California
  - Oregon



LOS ANGELES COUNTY  
DEPARTMENT OF PUBLIC HEALTH



**Guidelines for Alternate Water Sources for Indoor Non-Potable Uses<sup>1</sup>**  
**October 2015**

Tier IA	<b>On-site Collection and On-Site Use of Rainwater in Rain Barrels/Non-Pressurized Cisterns in Gravity Flow Systems</b>
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Limitations due to lack of a pumping system. Specially designed gravity feed systems for indoor uses shall follow Tier IB

Tier IB	<b>On-site Collection and On-site Use of Rainwater: Pressurized Systems</b>
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Source: precipitation on any public or private parcel that has not entered an offsite storm drain system or channel, a flood control channel, or any other stream channel, and has not previously been put to beneficial use (excluding stormwater, dry weather run-off and recycled water).  
Application Range Includes: Single Family Dwellings (SFD), R1, R2, Commercial, and Institutional facilities.

Requirements	Types of Use	Minimum Water Quality Standard	Treatment Process	Monitoring & Reporting
<ul style="list-style-type: none"> <li>• Shall obtain Building &amp; Safety Building Permit</li> <li>• Shall follow all applicable regulations governing dual plumbing systems</li> <li>• Shall incorporate failsafe designs and diversion to a protected potable source when treated water is out of specification<sup>2</sup></li> <li>• Shall not be connected to any unprotected conveyance piping potable water plumbing<sup>2</sup></li> <li>• Shall exclude rainwater collected from locations zoned for manufacturing or industrial use</li> <li>• Shall be installed in accordance with manufacturer's installation instructions, and installation requirements of local agencies</li> <li>• Public Health Review and Approval</li> <li>• Cross-Connection Test</li> <li>• Water quality monitoring suspended during quarters when cisterns are dry and shall be reported as non-operational.</li> </ul>	<p>Toilet &amp; Urinal Flushing</p> <p>Cooling Tower Make-up</p> <p>Trap Primers</p> <p>Laundry Washing (LW)</p>	<p>Chp. 17 CPC E. coli &lt; 100 CFU/100 ml, turbidity &lt; 10 NTU</p> <p>or</p> <p>NSF 350 w/ disinfection</p> <p>or</p> <p>Title 22 Recycled Water Quality Equivalence at the point of use</p>	<p>Chp. 17 CPC Table 1702.9.4 Pre-screening &amp; 100 µm filtration w/ disinfection</p> <p>Evaluated on a case-by-case basis per project</p>	<p>Owner Occupied SFD Upon Installation &amp; Change of Ownership</p> <p>R1 &amp; R2 - Annually Quarterly w/ LW</p> <p>Commercial/ Institutional/ Industrial – Annually Quarterly w/ LW</p>

## In Summary....



- **State health departments and regulatory agencies have lacked guidance on appropriate water quality standards**
- **Current water quality standards are not risk based**
- **Everyone has been looking to others for development of standards**
- **Guidance on requirements for process redundancy to ensure reliability is needed**



**..... A risk based approach that is practical for implementation is needed**

