

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 ₅ (mg L ⁻¹)	TSS (mg L ⁻¹)	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 ⁻¹ 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 ^{7.2} – 10 ^{8.8}	10 ^{5.4} – 10 ^{7.2}	N/A

Stormwater: Indoor Use



	Turbidity (NTU)	<i>E. Coli</i> (CFU/100ml)	Total Coliforms (CFU/100ml)
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 ^a		Class C ^b	
	Test Average	Single Sample Maximum	Test Average	Single Sample Maximum
CBOD ₅ (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	

^a Class R: Flows through graywater system are less than 400gpd

^b 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
- **BOD₅: 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 Uses¹
October 2015

Tier IA	On-site Collection and On-Site Use of Rainwater in Rain Barrels/Non-Pressurized Cisterns in Gravity Flow Systems
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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	On-site Collection and On-site Use of Rainwater: Pressurized Systems
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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"> • Shall obtain Building & Safety Building Permit • Shall follow all applicable regulations governing dual plumbing systems • Shall incorporate failsafe designs and diversion to a protected potable source when treated water is out of specification² • Shall not be connected to any unprotected conveyance piping potable water plumbing² • Shall exclude rainwater collected from locations zoned for manufacturing or industrial use • Shall be installed in accordance with manufacturer's installation instructions, and installation requirements of local agencies • Public Health Review and Approval • Cross-Connection Test • Water quality monitoring suspended during quarters when cisterns are dry and shall be reported as non-operational. 	<p>Toilet & Urinal Flushing</p> <p>Cooling Tower Make-up</p> <p>Trap Primers</p> <p>Laundry Washing (LW)</p>	<p>Chp. 17 CPC E. coli < 100 CFU/100 ml, turbidity < 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 & 100 µm filtration w/ disinfection</p> <p>Evaluated on a case-by-case basis per project</p>	<p>Owner Occupied SFD Upon Installation & Change of Ownership</p> <p>R1 & 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

