SENATE BILL 597 BUILDING STANDARDS FOR RESIDENTIAL RAINWATER CATCHMENT SYSTEMS

DRAFT Research and Recommendations

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Executive Summary

Senate Bill 597 (SB 597) requires the California Department of Housing and Community Development (HCD) to develop recommendations for building standards governing the installation of rainwater catchment systems for nonpotable uses in newly constructed residential dwellings. To support this work, HCD contracted with the University of California, Irvine (UCI) to conduct research and assist in developing these recommendations. SB 597 also requires HCD to submit a report to the Assembly Committee on Housing and Community Development and the Senate Housing Committee detailing the research findings and resulting recommendations by January 1, 2027.

The safety and performance of rainwater catchment systems depend heavily on local climate and water quality, requiring building standards that balance statewide consistency with flexibility for varying conditions. In California, Chapter 16 of the California Plumbing Code (CPC), together with referenced standards like American Rainwater Catchment Systems Association (ARCSA), the American Society of Plumbing Engineers (ASPE), and the American National Standards Institute (ANSI) 63, establish the requirements for the installation, construction, alteration, and repair of nonpotable rainwater catchment systems.

The recommendations in this report highlight two main points: (1) retaining the voluntary nature of these provisions preserves flexibility in system design and use while preventing stranded resources, and (2) the statewide adoption of the California Plumbing Code, Chapter 16, along with its referenced standards, already offers sufficient guidance for builders, designers, and local enforcing agencies.

SB 597 Stakeholders

SB 597 requires HCD to consult with specific state agency and non-governmental stakeholders to support the development of the recommendations. To facilitate input from stakeholders, HCD held a comment period from August 24, 2026, to September 10, 2026, to collect feedback on the rainwater catchment system building standards for newly constructed residential dwellings research. The goal of the comment period is to garner participation from stakeholders in the development of recommendations, and to collaborate on research relevant to the scope of SB 597.

The SB 597 stakeholders include the State Water Resources Control Board, the Department of Water Resources, the State Department of Public Health, local water agencies and districts, and other interested parties, including but not limited to, public water system representatives, product manufacturers, local building officials, California-licenses contractors, the building industry, and interested members of the public.

Report Objectives and Scope

The purpose of this report is to present the research findings and recommendations required under SB 597 for the installation of nonpotable rainwater catchment systems in newly constructed residential dwellings in California. This report is submitted to the Assembly Committee on Housing and Community Development and the Senate Housing Committee.

Research Objectives

1. Evaluate existing peer-reviewed research, codes, and standards related to rainwater catchment systems and their installation in newly constructed residential dwellings.
2. Evaluate the cost, benefits, and feasibility of installing rainwater catchment systems.
3. Assess existing rainwater catchment system mandates in other jurisdictions.
4. Assess existing California building standards that regulate nonpotable rainwater catchment systems.
5. Review areas of the California Building Standards Code (California Code of Regulations, Title 24) that may be appropriate for recommending proposed amendments regarding rainwater catchment systems for nonpotable use in newly constructed residential dwellings.

Research Methodology

The research and recommendations provided here are based on a review of (i) peer-reviewed literature, (ii) international and uniform building standards (e.g., the International Code Council (ICC) 2022 CSA B805-22/ICC 805-2022 Rainwater Harvesting Systems and the International Association of Plumbing and Mechanical Officials (IAPMO) 2024 Uniform Plumbing Code, and (iii) literature from state and federal agencies, city governments, and state governments on local rainwater harvesting system regulations.

The Costs, Benefits, and Feasibility of Including Some or All of the Provisions of the California Plumbing Code Regulating Nonpotable Rainwater Catchment Systems on a Statewide Basis

The 2025 California Green Building Standards Code (CALGreen), contained in Title 24, Part 11 of the California Code of Regulations, includes rainwater catchment system voluntary measures in Section A4.304.1 that local enforcing agencies may choose to adopt.

The 2025 California Plumbing Code (CPC) contained in Title 24, Part 5 of the California Code of Regulations, based on IAPMO's 2024 Uniform Plumbing Code, regulates the permitting and design requirements for nonpotable rainwater catchment systems in Chapter 16: Nonpotable Rainwater Catchment Systems. These provisions apply to rainwater catchment systems when installed in newly constructed residential buildings. Chapter 16 incorporates several referenced standards, including:

- ARCSA/ASPE/ANSI 63 (Section 1602.1: Nonpotable Rainwater Catchment Systems)
- IAPMO IGC 324 (Section 1603.4: Minimum Water Quality)
- NSF/ANSI 350 (Section 1603.4: Minimum Water Quality)
- IAPMO/ANSI Z1002 (Section 1603.5: Rainwater Storage Tanks)

Table 1 summarizes the standards referenced in California Plumbing Code Chapter 16: Nonpotable Rainwater Catchment Systems.

Table 1: Standards relevant to rainwater catchment systems.

Standard	Use
IAPMO Uniform Plumbing Code, Chapter 16: Nonpotable Rainwater Catchment Systems	Basis for the California Plumbing Code, Chapter 16, rainwater catchment systems requirements.
ARCSA/ASPE/ANSI 63-2020: Rainwater Catchment Systems	Referenced in California Plumbing Code Section 1602.1: Nonpotable Rainwater Catchment Systems; "Rainwater catchment systems for collecting precipitation from rooftops shall comply with ARCSA/ASPE/ANSI 63."
IAPMO IGC 324-2019: Alternate Water Source Systems for Multifamily, Residential, and Commercial Use	Provides water quality requirements where local authority does not specify. Referenced in California Plumbing Code Section 1603.4: Minimum Water Quality.
NSF/ANSI 350: Onsite Residential and Commercial Water Reuse Treatment Systems	Provides water quality requirements where local authority does not specify. Referenced in California Plumbing Code Section 1603.4: Minimum Water Quality.
IAPMO/ANSI Z1002-2020: Standard for Rainwater Harvesting Tanks	Specified requirements for rainwater storage tank design. Referenced in Section 1603.5: Rainwater Storage Tanks.
ASTM D1253-14: Standard Test Method for Residual Chlorine in Water	Compliance to this standard referenced in California Plumbing Code Section 16033.4.1: Disinfection.

Current statewide building standards of rainwater catchment system installation focus on minimum requirements for water quality (see Table 1603.4 in the California

Plumbing Code), debris removal and other filtering systems, cross-connection inspection, and separation from potable systems.

Table 2 includes itemized estimates of parts, service, and maintenance consistent for different types of rainwater catchment systems under the current California Plumbing Code requirements. System costs can vary widely between small rain barrels and large cisterns. For example, most rain barrel maintenance can be done free or cheaply by residents, while larger and more complex cisterns may need significant yearly service to operate effectively.

Filtration, water quality, and pumping requirements also vary based on end use. For outdoor irrigation, rain barrels can be used for gravity-fed irrigation and may not require pumping/electricity and have fewer filtration requirements. Indoor uses require connections to the indoor plumbing and pumps for water delivery. Note that more stringent treatment required for potable end uses is not included here.

Table 2: Itemized cost estimates for residential rainwater catchment systems under the current California Plumbing Code.

Category	**Item**	**Purpose and expected frequency**	**Cost estimate and source**
Installation	Rain barrel	One time installation cost for small scale residential harvesting	100 gallon rainwater harvesting tank: **$500** (source: rainharvestingsupplies)
	Cistern	One time installation cost for larger scale residential harvesting	1,000 gal underground water tank: **$2,700** (source: rainharvestingsupplies)
Filtration (not required for irrigation < 360 gal)	Debris screen	One time installation cost for filtration (may need to replace after several years)	**$25** (Source: rainharvestingsupplies)

Category	**Item**	**Purpose and expected frequency**	**Cost estimate and source**
	First flush diverter	One time installation cost for filtration (may need to replace after several years)	**$50** (source: rainharvestingsupplies) **$320** for in-ground system (Source: rainharvestingsupplies)
	100 micron filter	One time installation cost for filtration (may need to replace after several years)	**$40** (Source: rainharvestingsupplies)
Maintenance	Home water testing	Test for E.Coli and total dissolved solids concentration (TDS) periodically. Frequency up to user; not required.	Bacteria test kit: **$15** (Source: Home Depot) TDS test kit: **$15** (Source: Home Depot)
	Rain barrel maintenance	Seasonal cleaning can be done by user; small systems don't require permitting/inspection	**$0**
	Cistern maintenance	Yearly maintenance including inspection, cleaning, pump replacement (less frequent but normalized yearly), system flushing (less frequent but normalized yearly).	**~$1,000** (Source: epa.gov report)
Pump and electricity – indoor nonpotable uses			*Depends on flow rate needs and heads*

Category	Item	Purpose and expected frequency	Cost estimate and source
Rebates	California rebates. Source: socalwatersmart	Negative values indicate reductions in cost.	Rain Barrel (50-199 gallons): **-$35** Cistern (200-500 gallons): **-$250** Cistern (501-999 gallons): **-$300** Cistern (1000+ gallons): **-$350**

Below are sample low-end and high-end residential configurations under the current California Plumbing Code.

- Rain barrel for irrigation only:
  - Up front: $500 barrel - $35 rebate = $465
  - Annual: $30 per TDS and E. Coli test
- Large underground cistern for indoor non-potable uses:
  - Up front: $2,700 cistern - $350 rebate + $400 filtration = $2,750, plus additional costs if installed professionally.
  - Annual: $1,000 maintenance and service + electricity costs associated with pumping water indoors.

Review of Peer-Reviewed Research on Residential Rainwater Catchment Systems

Water use reduction. Rainwater harvesting alone can provide meaningful savings but is often unreliable without supplemental sources, especially in drought conditions (Haque et al., 2016; Vaz et al., 2026). Integrated rainwater–graywater systems improve reliability over rainwater systems alone, including for single-family residences (Marinoski & Ghisi, 2019), with the tradeoff of increased cost and complexity (Alim et al., 2020; López Zavala et al., 2016). One modeling study showed that one 50 gallon rain barrel can provide 50 percent water-saving efficiency for nonpotable indoor water demand in the East Coast, Southeast, Midwest, and Pacific Northwest regions, but <30 percent water-saving efficiency in cities of the Mountain West, Southwest, and most of California (Steffen et al., 2013). However, the same study found that rainwater harvesting can more effectively reduce stormwater runoff in semiarid regions compared to wetter climates. Rainwater harvesting yields depend on tank size, roof catchment area, local rainfall patterns, and required quality (Sharma et al., 2016). Cost effectiveness depends on local yield rates.

Water quality. The quality of rainwater, including the presence of metals and bacteria, can vary by location, making effective water treatment processes important for the safety of harvested rainwater (Bañas et al., 2023). The chemical and microbiological quality of harvested rainwater can exceed drinking water guidelines, so more stringent treatment processes are required for indoor and/or potable uses (Sharma et al., 2016). The quality of harvested rainwater is a function of roofing material, land use, and maintenance (Sharma et al., 2016).

Uptake. Reviews of residential-scale non-potable water reuse (including rainwater harvesting in addition to other types of water reuse) identify toilet flushing, landscape irrigation, and laundry as the most technically feasible and socially acceptable residential applications (Chen et al., 2013; Gato-Trinidad et al., 2011; Mayer et al., 1999; Mazzoni et al., 2023; Tortajada, 2020; *Water Reuse*, 2012). Empirical studies indicate that combining efficient fixtures with alternative water sources can reduce residential potable demand by 40–80 percent, depending on climate, building configuration, and end-use mix (Ghisi & Ferreira, 2007; Muthukumaran et al., 2011; Rashidi Mehrabadi et al., 2013). Public acceptance research consistently finds greater support for low-contact uses (e.g., irrigation, toilet flushing) than for indoor personal-contact uses, though acceptance increases with clear standards, risk communication, and demonstrated performance (de Sousa & Dias Fouto, 2024; Domènech & Saurí, 2010; Hu, 2024). Importantly, public health impacts in residential reuse systems have generally been low when systems are properly designed and regulated (Guidelines for the Safe Use of Wastewater, Excreta and Greywater Volume 4 Excreta and Greywater Use in Agriculture, 2013; Tortajada, 2020). For residential applications, financial support from local agencies or regulatory incentive programs may be needed to make installation of rainwater catchment systems cost-effective (Summerville & Sultana, 2019).

Pre-plumbing. Integrated water reuse and alternative water supplies are increasingly recognized as critical for sustainable residential water management. Reviews and empirical studies report that greywater reuse, rainwater harvesting, and decentralized treatment systems reduce potable water use while maintaining safety and reliability (Abbaszadegan et al., 2025; Cook, 2016; Edwin et al., 2014; Elhegazy & Eid, 2020; Ferguson, 2009; Fernandes & Cunha Marques, 2023; Florides et al., 2024; GhaffarianHoseini et al., 2016; Kisakye & Van der Bruggen, 2018; Leonard & Gato-Trinidad, 2021; Rich et al., 2023; Tzanakakis et al., 2023; Willis et al., 2011). Incorporating pre-plumbing in new residential construction facilitates future adoption of non-traditional water sources and enhances cost-effectiveness by reducing retrofitting costs and enabling flexible adoption of rainwater catchment and reuse systems over time (Enriquez, 2025; Hoffman, 2008; Lackey et al., 2020; Olmos & Loge, 2013; Quon, 2023; Rajski et al., 2024; Scruggs & Thomson, 2017; Stillwell et al., 2011).

Impact to groundwater supply. California relies on groundwater supply for roughly 40% of its water supply, with more extracted during dry years (Greenspan et al., 2024). The scale of residential rainwater catchment systems is not expected to be problematic, but the impact of rainwater catchment on local groundwater recharge depends on the scale of collection and the current local infiltration from falling rainwater. Areas for which most rainfall would normally flow through sewers and storm drains, which describes many urban residential areas, would not see reduced natural groundwater recharge (Misra, 2019). Areas dependent on groundwater recharge from residential areas may need to consider limits to the amount of rainwater that can be collected. For non-irrigation uses, jurisdictions with critically overdrawn basins may want to impose stricter limits on the allowed storage size of rainwater storage tanks.

Rainwater Catchment System Mandates in Other States or Local Jurisdictions

California

San Francisco

The San Francisco Public Utilities Commission (SFPUC) has established regulatory frameworks and financial incentives to support rainwater harvesting and other types of reuse (Enriquez, 2025). The San Francisco Non-Potable Water Ordinance requires new developments (commercial and multi-family residential) over 100,000 square feet to install and operate onsite nonpotable water systems, which included rainwater catchment systems before 2022, though rainwater catchment systems are no longer a required alternate water source (SFPUC, 2025). To support the use of alternative water sources, the city has detailed permitting, treatment, monitoring, reporting, and ongoing operations requirements (San Francisco Public Utilities Commission, 2016). For single-family and small multi-family developments, SFPUC piloted a Green Infrastructure Grants for Homes program that funded installation of green infrastructure and rainwater cisterns for several residences to reduce the amount of runoff entering sewers (Duran, 2025).

Texas

Residential water efficiency in Texas emphasizes integrated approaches, including pre-plumbing for reuse and water-energy considerations, with attention to cost-effectiveness (Enriquez, 2025; Stillwell et al., 2011). Texas has pursued residential potable water reduction primarily through model code adoption, irrigation regulation, and voluntary standards, rather than statewide mandates. Texas has supported alternative supply measures, including rainwater harvesting standards (CSAB805/ICC805), to offset potable demand for residential end uses (2022 State Water Plan | Texas Water Development Board, n.d.; ICC, n.d.). Outcomes reported in case studies indicate meaningful outdoor water savings where ordinances are enforced, though overall effectiveness varies widely across jurisdictions due to Texas's decentralized governance and uneven adoption of codes and standards (Colby & Hansen, 2022; Leigh & Lee, 2020).

Texas requires rainwater catchment systems used for potable purposes to comply with both the state plumbing code and the Texas Administrative Code, which is administered by the state environmental agency. These provisions include treatment requirements and mandatory disinfection, water quality testing, maintenance, and backflow prevention. Unlike California, Texas requires operational monitoring and has requirements for meeting drinking water quality standards (2022 State Water Plan | Texas Water Development Board, n.d.).

Other Jurisdictions

Washington, California, Arizona, New Mexico, Texas, Georgia, North Carolina, Minnesota, and Virginia have state regulations for and encourage or incentivize rainwater harvesting (*FEMP Rainwater Harvesting Map*, 2026). Rainwater harvesting is also relatively widespread in Hawaii. The state's requirements for potable systems include treatment plan (including sediment filtration and UV disinfection), minimum storage and screening standards, maintenance requirements, and health department guidance incorporated in permitting pathways (Macomber, 2020). States who have adopted Chapter 16 of the Uniform Plumbing Code include California, Hawaii, Idaho, Iowa, Minnesota, Oregon, North Dakota, South Dakota, Washington, Alaska, New Mexico, Nevada and Montana. Other jurisdictions adopting it include Houston, Texas and Phoenix, Arizona.

The Cost and Feasibility of Installation and Overall Benefit to be Gained

Economic evidence from peer-reviewed studies and policy evaluations indicates that residential potable water use reduction measures (e.g., high-efficiency fixtures and appliances, pre-plumbing for non-potable systems, and onsite rainwater and greywater reuse) impose significant but generally manageable upfront costs on residential development, while yielding long-term private-sector and societal benefits from such systems and enabling cheaper installation of such systems at a later time by reducing the amount of retrofitting needed for pre-plumbing measures. Economic feasibility analyses of residential rainwater catchment systems consistently find that installation costs are sensitive to building size and system complexity, with multifamily dwelling units benefiting from lower per-unit costs, and with lifecycle cost-effectiveness strongly dependent on local water prices (Ghisi & Freitas, 2024).

Pre-plumbing requirements, in particular, are widely identified as a low-cost regulatory strategy that preserves future water reuse opportunities while minimizing near-term impacts on housing construction costs, a conclusion supported by state-level policy evaluations of residential water efficiency programs (2022 State Policy Scorecard for Water Efficiency and Sustainability, 2022). While some studies focus on macro-level investment and climate resilience, these insights provide context for the cost-benefit evaluation of household-scale residential water use reduction strategies (Becher et al., 2024; Galasso et al., 2022, 2022; Grobicki et al., 2015; Holway, 2009; Medland et al., 2024; Susskind & Kim, 2022; *The Case for Climate-Resilient Infrastructure – State of the Planet*, 2024; Tien, 2018; Ulibarri & Scott, 2019; Wang et al., 2025).

Installation and maintenance costs. Installation costs for rainwater harvesting systems vary widely depending on use (outdoor only or both indoor and outdoor) and piping type, size, and location (above or below ground). User-installed basic rain piping cost between $50-$300, while the cost including installation is around

$120-$1,200 (Martin, 2026). Cistern systems, which are needed cost between $1,000-$5,000 (above ground) and $3,000-$8,000 (below ground) (Martin, 2026). Table 2 details the installation and maintenance costs for different types of residential rainwater catchment systems, which are generally low for small rain barrel systems but around $1,000 annually for large cisterns requiring professional maintenance.

Benefits and water savings. The amount of water saved using rainwater catchment systems varies based on roof catchment area and rainfall regime (Sharma et al., 2016). Drought prone areas do not save water as efficiently, but may be more effective at reducing stormwater runoff compared to wetter climates (Steffen et al., 2013). Local water savings can be estimated with a calculator such as the Rainwater Harvesting Calculator available on energy.gov.

In contrast with greywater reuse strategies, rainwater harvesting benefits are dependent on both roof area and local rainfall. Median roof sizes in California (including all building types) are roughly 2,600 square feet (OEDI, 2019). Combined with average statewide annual rainfall of 24 inches (NCDC, 2026), this yields approximately 39,000 gallons of water saved per household per year, though roof size estimates are not directly available for separate housing types and local rainfall varies widely across the state. Estimated median annual California water bills are roughly $600 (assuming 5,000 gal monthly use) (https://utility-rates.com/california), leading to an estimated $374 per household annual savings if a rainwater catchment system is implemented. Per the Table 2 cost and maintenance estimates, a simple rain barrel system for irrigation will pay for itself in about 2 years, though a larger, more complex cistern system would not without significantly more roof area from which to collect water. In such a case, stormwater harvesting (with the necessary system requirements, as described by Appendix S: Onsite Stormwater Treatment Systems of the California Plumbing Code) may increase water yield and help offset the costs of installing and maintaining a catchment system. Analysis of such a system is out of scope of this report.

Geographic Impacts

Rain rates and water quality runoff vary widely across California. Statewide water use reduction mandates should reflect the large variety of microclimates within California by allowing multiple compliance options, one of which is rainwater harvesting. IAPMO's Water Efficiency and Sanitation Standard (WE-Stand) is a reach code that may act as a possible guideline for ensuring safe and efficient potable and nonpotable water capture across multiple reuse options statewide, despite variety in local conditions, including locally relevant estimates of the expected water savings of different alternative water sources.

Housing Affordability Impacts

Rainwater harvesting often has faster payback than greywater alone, and combined systems may improve economic feasibility, especially at larger scale (e.g., multifamily dwelling units) (Ghisi & Freitas, 2024). Combined rainwater-greywater systems also address the challenge that rainwater harvesting alone is typically insufficient for meeting water demand during droughts. Economic viability varies with water price levels, building type, and climate; in low water price contexts, payback can be long (Ghisi & Freitas, 2024). As such, mandating full systems in all buildings may disproportionately burden smaller or lower-cost housing unless incentives, rebates, or financing mechanisms are available.

Broader Economic, Environmental, and Quality-of-Life Impacts

The reviewed literature suggests that residential potable water reduction measures such as rainwater harvesting stimulate investment and innovation while delivering health, environmental, and quality-of-life benefits. Regulatory economic assessments further indicate that properly designed residential reuse standards protect public health while reducing pressure on freshwater ecosystems and energy-intensive water supply systems, contributing to improved environmental outcomes and long-term household water security (*Economic Impact Assessment Onsite Treatment and Reuse of Nonpotable Water Regulations*, 2024). These findings support the conclusion that residential nonpotable water use reduction measures, when designed with appropriate thresholds and flexibility, can provide positive outcomes for California.

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