

HCAP Rainwater Harvesting Design Standards and Specifications

This document was created by GovAI to synthesize the technical specifications identified in the Reference List section, with primary reliance on the *Virginia Rainwater Harvesting Manual, Second Edition (2009)*. All

GovAI-generated content was reviewed by human staff prior to use.

For retrofit systems using roof runoff only for outdoor non-potable uses

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Use of this Document

Mandatory requirements are written with the term 'shall.' Recommended supplemental practices are written with the term 'should.'

Supplemental practices are included where the Virginia Rainwater Harvesting Manual is not sufficiently specific for consistent plan review and where the supplemental guidance is useful for Virginia conditions.

Purpose

- Establishes design and review standards for residential rainwater harvesting systems that collect roof runoff and use the water only for outdoor, non-potable purposes such as landscape irrigation, flower beds, vegetable gardens, and similar outdoor uses.
- Collection from parking lots, paved areas, lawns, or other non-roof surfaces is outside the scope of this guidance.
- This guidance does not apply to indoor or potable use. Any proposed indoor or potable use shall be reviewed under separate requirements.
- This document does not apply to rainwater harvesting systems installed to satisfy VESPM regulatory requirements. Any system intended to meet site compliance requirements shall comply with the Virginia Stormwater Management Handbook.

General requirements

- A design shall include a site plan
- The design shall clearly show the contributing roof area, conveyance system, first-flush device, pretreatment components, storage tank, inlet, pump, distribution piping, overflow, details.
- The engineer shall identify all intended end uses
- The engineer shall provide a complete project narrative, plan view of practice, design details and calculations, roof material identification, manufacturer spec sheets, and an operations and maintenance plan.
 - Project narrative should include: A brief narrative prepared by the design professional that identifies the proposed rainwater harvesting system type, intended non-potable uses, contributing roof areas and roof materials, sizing assumptions, major treatment and storage components, overflow approach, backup water arrangement if any, and summary of how the plan meets code requirements.
- Plans shall show the location of the proposed rainwater harvesting tank and associated appurtenances in relation to existing buildings, structures, and property lines. At a minimum, the plan shall identify the horizontal distance from the tank to the nearest building and to all relevant property lines.
- Zoning and Building Review
 - As part of the design submittal, the City shall provide the plan set to the City's Zoning Administrator and Building Official for consultation. If the zoning and building review generates any comments, revisions, or

permit requirements, the engineer will be directed to work with the appropriate zoning or building staff before final approval will be given.

- The design shall meet the applicable provisions of the Plumbing Code— *2021 VPC Section 1303 Rainwater nonpotable water systems*- <https://up.codes/viewer/virginia/ipc-2021/chapter/13/nonpotable-water-systems#1303>
- The design shall emphasize low-maintenance components, protection of stored water quality, and prevent backflow to potable systems.

Catchment surfaces

- Only roof surfaces shall be used as contributing catchment areas.
- The plans shall identify each contributing roof area and the roof material for each area.
- Roofs made of copper, or roofs containing lead components that may influence runoff quality, shall not be used where harvested water will be used for fruit or vegetable gardening. If lead components are suspected to be present, a lead test kit will be an eligible expense.
 - Tile roofs should be used only with clear justification due to potential runoff quality concerns such as lead flashing and mortar use.
 - Wood shingle roofs shall not be accepted as contributing catchment surfaces.
 - Asphalt shingle roofs should be avoided where practicable. Where an existing asphalt shingle roof is proposed for use, the engineer shall address this in the design and note any end-use limitations. For example: Soil testing for zinc and thorough washing of produce irrigated with this water.
- Roof areas subject to unusual contamination sources, such as contaminant-producing vents, shall be excluded or specifically addressed in the design.

Water demand and storage sizing

- The engineer shall provide a roof collection analysis based on contributing roof footprint area, rainfall, and collection efficiency.
- The volume of rainwater collected shall be estimated using the following equation: $\text{Volume (gallons)} = \text{Roof area (square feet)} \times \text{collection efficiency} \times \text{rainfall depth (inches)} \times 0.62$.
 - Minimum rainfall depth to be used is 1.0 inches
 - Tank size selection can be rounded to nearest standard tank size

Gutters, downspouts, and conveyance

- Conveyance layout should minimize unnecessary buried pipe runs.
- Cleanouts or maintenance access points are shown on the design where needed.
- Where the contributing roof area has significant overhanging tree canopy or similar debris loading, the engineer may recommend gutter guards, leaf screens, or comparable debris exclusion measures to reduce maintenance needs and debris loading to the rainwater harvesting system; however, such measures are optional and are not considered an eligible component of this practice.

First-flush diversion and pretreatment

- A first-flush device or equivalent pretreatment arrangement shall be provided ahead of storage.
- First-flush discharge shall be directed to a pervious area, stormwater BMP, or other approved discharge location and shall not create erosion or nuisance conditions.

- Pretreatment shall remove particles larger than approximately 0.4 mm before water enters storage, or the design shall provide a settling chamber with stated annual cleaning requirements.
- Pretreatment components shall be accessible for inspection and cleaning and shall be suitable for the expected climate and operating season.
- Where practical, pretreatment devices should be self-cleaning or low-maintenance.

Storage tanks

- Storage shall be provided in watertight tanks intended for water storage.
- The plans shall identify tank material, capacity, location, and manufacturer.
- Aboveground tanks shall be opaque, UV-resistant, and supported on stable soil, a concrete pad, or an engineered support system.
- Belowground tanks shall be designed for the weight of soil cover and any anticipated traffic or surcharge loads and shall include bedding and backfill requirements.
- Each tank shall include a vent to allow air movement during filling and drawdown.
- Each tank shall include an access opening adequate for inspection and maintenance.
- Tanks shall be designed to exclude insects, animals, and debris.
- Manufacturer installation requirements shall be included in the design package and followed during installation.
- Aboveground tanks and exposed appurtenances shall be protected from freezing or drained and decommissioned seasonally.

Tank inlet

- The tank inlet shall be arranged to minimize disturbance of settled solids within the tank.
- The inlet arrangement should support oxygenation of inflow and should avoid unnecessary constrictions that reduce hydraulic performance.

Pump and distribution

- The pump system shall be sized to meet expected peak irrigation demand.
- The design shall identify pump type and model.
- All internal pumps shall include dry-run protection.
- Dry run protection should be considered for external pumps if there is concern of it running dry.
- Harvested water shall be withdrawn from an elevated intake point, such as a floating intake or other arrangement that keeps the intake off the tank bottom.
- External mounted pumps shall be protected from weather and located to allow inspection and maintenance.
- If drip irrigation is proposed, outlet filtration shall be provided as needed to meet the irrigation equipment manufacturer's requirements.
- No treatment beyond proper collection, first-flush diversion, and pretreatment is required for outdoor non-potable uses, unless site-specific conditions justify additional measures.

Overflow

- Each storage tank shall have an overflow with a diameter at least equal to the inlet diameter.
- Overflow shall discharge to a pervious area, stormwater BMP, or other approved receiving location where feasible.

- If discharge to a storm sewer is the only practical option, the design shall show the connection detail and enhanced backflow or backwater protection.
- The overflow shall be configured to withdraw water from the top water surface during overflow events so that floating debris, pollen, and similar buoyant material are skimmed from the tank.
- Overflow discharge shall not create erosion, nuisance ponding, or damage to adjacent improvements.

Backup water and cross-connection control

- The plans shall state that no potable or well-water connection is provided.
- The potable and rainwater systems shall remain fully separated.
- For non-residential properties/uses, connection to backup water sources may be considered on a case-by-case basis with justification and acceptable backflow prevention.

Identification and signage

- All outlets supplied by harvested rainwater shall be identified as non-potable.

Freeze protection and seasonal shutdown

- The design shall state whether the system is intended for year-round operation or seasonal use only.
- For systems subject to freezing conditions, the design shall include freeze protection or a seasonal shutdown and drain-down procedure that shows how the tank and piping will be bypassed, drained, or otherwise protected from freeze damage.

Operations and maintenance

- An operations and maintenance (O&M) plan shall be provided with the design.
- The O&M plan shall include inspection and cleaning procedures for gutters, screens, first-flush devices, pretreatment devices, tank vent screens, overflow components, pumps, valves, and irrigation filters.
- The O&M plan shall state the anticipated inspection and maintenance frequency for each major component.
- If a settling chamber is used instead of full pretreatment, the O&M plan shall require periodic sediment removal and shall identify annual cleaning at a minimum.

Reference list

- Primary source: Virginia Rainwater Harvesting Manual. Second Edition. The Cabell Brand Center. 2009.
- Supplemental guidance consulted for review detail and maintainability:
 - Ontario Guidelines for Residential Rainwater Harvesting Systems Handbook. 2010.
 - Georgia Rainwater Harvesting Guidelines. Draft for Public Comment. 2009.
 - Texas Manual on Rainwater Harvesting. Third Edition. Texas Water Development Board. 2005.