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**Plumbing works — Code of practice —
Part 8: Alternate water sources for non-
potable applications and non-potable
rainwater catchment systems**

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Foreword

Rwanda Standards are prepared by Technical Committees and approved by Rwanda Standards Board (RSB) Board of Directors in accordance with the procedures of RSB, in compliance with Annex 3 of the WTO/TBT agreement on the preparation, adoption and application of standards.

The main task of technical committees is to prepare national standards. Final Draft Rwanda Standards adopted by Technical committees are ratified by members of RSB Board of Directors for publication and gazettment as Rwanda Standards.

WDRS xxx-8 was prepared by Technical Committee RSB/TC 17, *Urban planning*.

In the preparation of this standard, reference was made to the following standard (s):

IAPMO: 2024 *Uniform plumbing code*

The assistance derived from the above source is hereby acknowledged with thanks.

DRS 644-8 consists of the following parts, under the general title *Plumbing works — Code of practice*:

- *Part 1: General*
- *Part 2: Plumbing fixtures and fixture fittings*
- *Part 3: Water supply and distribution*
- *Part 4: Sanitary and drainage system installation*
- *Part 5: Water heaters*
- *Part 6: Fuel gas piping and firestop protection*
- *Part 7: Healthcare facilities and medical gas and medical vacuum systems*
- *Part 8: Alternate water sources for non-potable applications and non-potable rainwater catchment systems*

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Committee membership

The following organizations were represented on the Technical Committee on *Urban planning* (RSB/TC 17) in the preparation of this standard.

City of Kigali

Institute of Engineering Rwanda (IER)

Ministry of Infrastructure (MININFRA)

Rwanda Housing Authority (RHA)

Rwanda Inspectorate, Competition and Consumer Protection Authority (RICA)

Rwanda Plumbers Organization (RPO)

Rwanda Polytechnic – Kigali College

Rwanda Polytechnic – Musanze College

Rwanda Transport Development Agency (RTDA)

Rwanda Utility Regulatory Authority (RURA)

Rwanda Water Resources Board (RWB)

University of Rwanda – College of Science and Technology (UR-CST)

Water and Sanitation Corporation (WASAC)

Water for People

Rwanda Standards Board (RSB) – Secretariat

Plumbing works — Code of practice — Part 8: Alternate water sources for non-potable applications and non-potable rainwater catchment systems

1 Scope

This Draft Rwanda Standard provides recommendations and guidelines for construction, alteration, and repair of alternate water source systems for non-potable applications.

It also provides the requirement for the installation, construction, alteration, and repair of non-potable rainwater catchment systems.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM E814-2013a (R2017), *Standard Test Method for Fire Tests of Penetration Firestop Systems*

3 Terms and definitions

For the purposes of this standard, the terms and definitions given in DRS 644-1 apply.

4 Abbreviated terms

ABS: Acrylonitrile butadiene styrene

PVC: Polyvinyl chloride

CFU: Colony-Forming unit

NTU: Nephelometric turbidity unit

5 Alternate water sources for non-potable applications

5.1 General

5.1.1 Allowable use of alternate water

Where approved or required by the Competent Authority, alternate water sources[reclaimed (recycled) water, gray water, and on-site treated nonpotable water] shall be permitted to be used instead of potable water for the applications identified in this standard.

5.1.2 System design

Alternate water source systems shall be designed in accordance with this chapter by a licensed plumbing contractor or a registered design professional. Components, piping, and fittings used in any alternate water source system shall be listed.

5.1.3 Exceptions

- i) A registered design professional is not required to design gray water systems having a maximum discharge capacity of 250 gallons per day (gal/d) (0.011 L/s) for single family and multi-family dwellings.
- ii) A registered design professional is not required to design an on-site treated nonpotable water system for single-family dwellings having a maximum discharge capacity of 250 gal/d (0.011 L/s).

5.1.4 Permit

It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered an alternate water source system in a building or on a premise without first obtaining a permit to do such work from the Competent Authority.

5.1.5 Component identification maintenance and inspection

5.1.5.1 System components shall be properly identified as to the manufacturer.

5.1.5.2 Alternate water source systems and components shall be inspected and maintained in accordance with Section 5.1.5.3 through Section 5.1.5.5.

5.1.5.3 Frequency

Alternate water source systems and components shall be inspected and maintained in accordance with Table 1 unless more frequent inspection and maintenance are required by the manufacturer.

5.1.5.4 Maintenance log

A maintenance log for gray water and on-site treated nonpotable water systems is required to have a permit in accordance with Section 5.1.4 and shall be maintained by the property owner and be available for inspection. The property owner or designated appointee shall ensure that a record of testing, inspection, and maintenance

in accordance with Table 1 is maintained in the log. The log will indicate the frequency of inspection and maintenance for each system.

5.1.5.5 Maintenance responsibility

The required maintenance and inspection of alternate water source systems shall be the responsibility of the property owner unless otherwise required by the Competent Authority.

Table 1 — Minimum alternate water source testing, inspection, and maintenance frequency

Description	Minimum frequency
Inspect and clean filters and screens, and replace (where necessary).	Every 3 months
Inspect and verify that disinfection, filters, and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Competent Authority	In accordance with manufacturer's instructions, and the Competent Authority.
Inspect pumps and verify operation	After initial installation and every 12 months thereafter
Inspect valves and verify operation	After initial installation and every 12 months thereafter
Inspect pressure tanks and verify operation	After initial installation and every 12 months thereafter
Clear debris from and inspect storage tanks, locking devices, and verify operation	After initial installation and every 12 months thereafter
Inspect caution labels and marking	After initial installation and every 12 months thereafter
Inspect and maintain mulch basins for gray water irrigation systems	As needed to maintain mulch depth and prevent ponding and runoff.
Cross-connection inspection and test*	After initial installation and every 12 months thereafter
* The cross-connection test shall be performed in the presence of the Competent Authority in accordance with the requirements of this chapter	

5.1.5.6 Operation and maintenance manual

An operation and maintenance manual for gray water and on-site treated water systems required to have a permit in accordance with Section 5.1.4 shall be supplied to the building owner by the system designer. The operation and maintenance manual shall include the following:

- a) Detailed diagram of the entire system and the location of system components

- i) Instructions for operating and maintaining the system
- ii) Details on maintaining the required water quality for on-site nonpotable water systems
- iii) Details on deactivating the system for maintenance, repair, or other purposes.
- iv) Applicable testing, inspection, and maintenance frequencies in accordance with Table 1
- v) A method of contacting the manufacturer(s).

5.1.6 Minimum water quality requirements

5.1.6.1 The minimum water quality for alternate water source systems shall meet the applicable water quality requirements for the intended application as determined by the Competent Authority. In the absence of water quality requirements, for on-site treated nonpotable systems, the water quality requirements of IAPMO/ANSI Z1324 or another approved standard shall apply.

5.1.6.2 Water treatment is not required for gray water used for subsurface irrigation.

5.1.7 Material compatibility

Alternate water source systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.

5.1.8 Commercial, industrial, and institutional restroom signs

5.1.8.1 A sign shall be installed in restrooms in commercial, industrial, and institutional occupancies using reclaimed (recycled) water and on-site treated water, for water closets, urinals, or both. Each sign shall contain 1/2 of an inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) are visible to users. The location of the sign(s) shall be approved by the Competent Authority and shall contain the following text:

To conserve water, this building uses * _____ * To flush toilets and urinals.

5.1.8.2 Equipment room signs

Each room containing reclaimed (recycled) water and on-site treated water equipment shall have a sign posted in a location that is visible to anyone working on or near nonpotable water equipment with the following wording in 1 inch (25.4 mm) letters:

Caution: nonpotable * _____ *, Do not drink. do not connect to drinking water system.

Note contact building management before performing any work on this water system.

* _____ * Shall indicate reclaimed (recycled) water or on-site treated water, accordingly.

5.1.9 System controls

Controls for pumps, valves, and other devices that contain mercury that come in contact with alternate water source water supply shall not be permitted.

5.2 Inspection and testing

5.2.1 General

Alternate water source systems shall be inspected and tested in accordance with Section 5.2.2 through Section 5.2.3.4.

5.2.2 Supply system inspection and test

Alternate water source systems shall be inspected and tested in accordance with this standard for testing of potable water piping.

5.2.3 Annual cross-connection inspection and testing

An initial and subsequent annual inspection and test shall be performed on both the potable and alternate water source systems. The potable and alternate water source system shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with Section 5.2.3.1 through Section 5.2.3.4.

5.2.3.1 Visual system inspection

Before commencing the cross-connection testing, a dual system inspection shall be conducted by the Competent Authority and other authorized authorities having as follows:

- (i) Meter locations of the alternate water source and potable water lines shall be checked to verify that no modifications were made and that no cross-connections are visible.
- (ii) Pumps and equipment, equipment room signs and exposed piping in equipment room shall be checked.
- (iii) Valves shall be checked to ensure that the valve lock seals are still in place and intact. Valve control door signs shall be checked to verify that no signs have been removed.

5.2.3.2 Cross-connection test

The procedure for determining cross-connection shall be followed by the applicant in the presence of the Competent Authority and other authorized authorities to determine whether a cross-connection has occurred as follows:

- (i) The potable water system shall be activated and pressurized. The alternate water source system shall be shut down, depressurized, and drained

(ii) The potable water system shall remain pressurized for a minimum period specified by the Competent Authority while the alternate water source system is empty. The minimum period the alternate water source system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and the alternate water source distribution systems, but in no case shall that period be less than 1 hour

(iii) The drain on the alternate water source system shall be checked for flow during the test and fixtures, potable and alternate water source, shall be tested and inspected for flow. Flow from an alternate water source system outlet indicates a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the alternate water source system

(iv) The potable water system shall then be depressurized and drained

(v) The alternate water source system shall then be activated and pressurized

(vi) The alternate water source system shall remain pressurized for a minimum period specified by the Competent Authority while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour

(vii) Fixtures, potable, and alternate water source shall be tested and inspected for flow. Flow from a potable water system outlet indicates a cross-connection. No flow from an alternate water source outlet will indicate that it is connected to the potable water system.

(viii) The drain on the potable water system shall be checked for flow during the test and at the end of the test

(ix) Where there is no flow detected in the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

5.2.3.3 Discovery of cross-connection

If a cross-connection is discovered, the following procedure, in the presence of the Competent Authority, shall be activated immediately:

(i) The alternate water source piping to the building shall be shutdown at the meter, and the alternate water source riser shall be drained

(ii) Potable water piping to the building shall be shutdown at the meter

(iii) The cross-connection shall be uncovered and disconnected

(iv) The building shall be retested in accordance with Section 5.2.3.1 and Section 5.2.3.2

(v) The potable water system shall be chlorinated with 50 parts-per-million (ppm) chlorine for 24 h

(vi) The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. Where test results are acceptable, the potable water system shall be permitted to be recharged.

5.2.3.4 Annual inspection

An annual inspection of the alternate water source system, following the procedures listed in Section 5.2.3.1 shall be required. Annual cross-connection testing, following the procedures listed in Section 5.2.3.2 shall be required by the Competent Authority, unless site conditions do not require it. In no event shall the test occur less than once in 4 years. Alternate testing requirements shall be permitted by the Competent Authority.

5.2.4 Separation requirements

Underground alternate water source service piping other than gray water shall be separated from the building sewer in accordance with this standard. Pipes carrying treated nonpotable water shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where horizontal piping materials do not comply with this requirement, the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the treated nonpotable water piping.

5.2.5 Abandonment

5.2.5.1 Alternate water source systems that are no longer in use or fail to be maintained in accordance with Section 5.1.5.2 shall be abandoned. Abandonment shall comply with section 5.2.5.2 and 5.2.5.3.

5.2.5.2 General

An abandoned system or part thereof covered under the scope of this standard shall be disconnected from remaining systems, drained, plugged, and capped in an approved manner.

5.2.5.3 Underground tank

An underground water storage tank that has been abandoned or otherwise discontinued from use in a system covered under the scope of this standard shall be completely drained and filled with earth, sand, gravel, concrete, or other approved material or removed in a manner satisfactory to the Competent Authority.

5.2.5.4 Sizing

Unless otherwise provided for in this chapter, alternate water source piping shall be sized in accordance with the requirements for sizing potable water piping.

5.3 Gray water systems

5.3.1 General

The provisions of this standard shall apply to the construction, alteration, and repair of gray water systems.

5.3.2 System requirements

5.3.2.1 Gray water shall be permitted to be diverted away from a sewer or private sewage disposal system, and discharge to a subsurface irrigation or subsoil irrigation system. The gray water shall be permitted to

discharge to a mulch basin for single-family and multi-family dwellings. Gray water shall not be used to irrigate root crops or food crops intended for human consumption that comes in contact with soil.

5.3.2.2 Surge capacity

Gray water systems shall be designed to have the capacity to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis to a subsurface irrigation field, subsoil irrigation field, or mulch basin without surfacing, ponding, or runoff. A surge tank is required for systems that are unable to accommodate peak flow rates and distribute the total amount of gray water by gravity drainage. The water discharge for gray water systems shall be determined in accordance with Section 5.3.8.2 or Section 5.3.8.3.

5.3.2.3 Diversion

The gray water system shall connect to the sanitary drainage system downstream of fixture traps and vent connections through a gray water diverter valve. The gray water diverter valve shall comply with the requirements of IAPMO PS 59 or other relevant applicable standard and be installed in an accessible location and clearly indicate the direction of flow.

5.3.2.4 Backwater valves

Gray water drains subject to backflow shall be provided with a backwater valve so located as to be accessible for inspection and maintenance.

5.3.3 Connections to potable and reclaimed (recycled) water systems

Gray water systems shall have no direct connection to a potable water supply, on-site treated nonpotable water supply, or reclaimed (recycled) water systems. Potable, on-site treated nonpotable, or reclaimed (recycled) water is permitted to be used as makeup water for a non-pressurized storage tank provided the connection is protected by an air gap in accordance with this standard.

5.3.4 Location

No gray water system or part thereof shall be located on a lot other than the lot that is the site of the building or structure that discharges the gray water, nor shall a gray water system or part thereof be located at a point having less than the minimum distances indicated in Table 2.

Table 2 — Location of gray water system⁷

Minimum horizontal distance in clear required from	Surge tank feet	Subsurface and subsoil irrigation field and mulch bed feet
Building structures ¹	5 ^{2,9}	2 ^{3,8}
Property line adjoining private property	5	5 ⁸
Water supply wells ⁴	50	100
Streams and lakes ⁴	50	50 ⁵
Sewage pits or cesspools	5	5
Sewage disposal field ¹⁰	5	4 ⁶

Septic tank	0	5
On-site domestic water service line	5	5
Pressurized public water main	10	10 ⁷

NOTE 1 For SI units: 1 foot = 304.8 mm

NOTE 2 Including porches and steps, whether covered or uncovered, breezeways, roofed carports, roofed patios, carports, covered walks, covered drive- ways, and similar structures or appurtenances

NOTE 3 The distance shall be permitted to be reduced to 0 foot for aboveground tanks where first approved by the Competent Authority

NOTE 4 Reference to a 45 °C (0.79 rad) angle from the foundation

NOTE 5 Where special hazards are involved, the distance required shall be increased as directed by the Competent Authority

NOTE 6 These minimum clear horizontal distances shall apply between the irrigation or disposal field and the ocean mean higher high tide line

NOTE 7 Add 2 feet (610 mm) for each additional foot of depth more than 1 foot (305 mm) below the bottom of the drain line

NOTE 8 For parallel construction or crossings, approval by the Competent Authority shall be required

NOTE 9 The distance shall be permitted to be reduced to 1 1/2 feet (457 mm) for drip and mulch basin irrigation systems.

NOTE 10 The distance shall be permitted to be reduced to 0 foot for surge tanks of 75 gallons (284 L) or less

NOTE 11 Where irrigation or disposal fields are installed in the sloping ground, the minimum horizontal distance between a part of the distribution system and the ground surface shall be 15 feet (4572 mm).

5.3.5 Plot plan submission

No permit for a gray water system shall be issued until a plot plan with data satisfactory to the Competent Authority has been submitted and approved.

5.3.6 Prohibited location

Where there is insufficient lot area or inappropriate soil conditions for adequate absorption to prevent the ponding, surfacing, or runoff of the gray water, as determined by the Competent Authority, no gray water system shall be permitted. A gray water system is not permitted on a property in a geologically sensitive area as determined by the Competent Authority.

5.3.7 Drawings and specifications

The Competent Authority shall require the following information to be included with or in the plot plan before a permit is issued for a gray water system, or at a time during the construction thereof:

- i) Plot plan drawn to scale and completely dimensioned, showing lot lines and structures, direction and approximate slope of surface, location of present or proposed retaining walls, drainage channels, water supply lines, wells, paved areas and structures on the plot, number of bedrooms and plumbing fixtures in each structure, location of private sewage disposal system and expansion area or building sewer connecting to the public sewer, and location of the proposed gray water system
- ii) Details of construction necessary to ensure compliance with the requirements of this standard, together with a full description of the complete installation, including installation methods, construction, and materials in accordance with the Competent Authority
- iii) Details for holding tanks shall include dimensions, structural calculations, bracings, and such other pertinent data as required
- iv) A log of soil formations and groundwater level as determined by test holes dug in proximity to proposed irrigation area, together with a statement of water absorption characteristics of the soil at the proposed site as determined by approved percolation tests
- vi) The Competent Authority shall permit the use of Table 3 instead of percolation tests
- v) Distance between the plot and surface waters such as lakes, ponds, rivers or streams, and the slope of the plot and the surface water, wherein close proximity.

5.3.8 Procedure for estimating gray water discharge

5.3.8.1 Gray water systems shall be designed to distribute the total amount of estimated gray water on a daily basis. The water discharge for gray water systems shall be determined in accordance with Section 5.3.8.2 or Section 5.3.8.3.

5.3.8.2 Single family dwellings and multi-family dwellings

The gray water discharge for single family and multi-family dwellings shall be calculated by water use records, calculations of local daily per person interior water use, or the following procedure:

(1) The number of occupants of each dwelling unit shall be calculated as follows:

(i) The number of occupants of each dwelling unit shall be calculated as follows:

First bedroom	2 occupants
Each additional bedroom	1 occupant

(ii) The estimated gray water flows of each occupant shall be calculated as follows:

Showers, bathtubs, and lavatories	25 gallons (95 L) per day/occupant
Laundry	15 gallons (57 L) per day/occupant

(iii) The total number of occupants shall be multiplied by the applicable estimated gray water discharge as provided above and the type of fixtures connected to the gray water system.

5.3.8.3 Commercial, industrial, and institutional occupancies

The gray water discharge for commercial, industrial, and institutional occupancies shall be calculated by utilizing the procedure in Section 5.3.8.2, water use records or other documentation to estimate gray water discharge.

5.3.9 Gray water system components

5.3.9.1 Gray water system components shall comply with **Section XXXX through Section XXXXX**.

5.3.9.2 Surge tanks

Where installed, surge tanks shall be in accordance with the following:

- (i) Surge tanks shall be constructed of solid, durable materials not subject to excessive corrosion or decay and shall be watertight. Surge tanks constructed of steel shall be approved by the Competent Authority, provided such tanks are in accordance with approved applicable standards
- (ii) Each surge tank shall be vented in accordance with this code. The vent size shall be determined based on the total gray water fixture units as outlined in this standard
- (iii) Each surge tank shall have an access opening with lockable gasketed covers or approved equivalent to allow for inspection and cleaning
- (iv) Each surge tank shall have its rated capacity permanently marked on the unit. Also, a sign stating Gray Water, Danger — Unsafe water shall be permanently marked on the holding tank
- (v) Each surge tank shall have an overflow drain. The overflow drains shall have permanent connections to the building drain or building sewer, upstream of septic tanks. The overflow drain shall not be equipped with a shutoff valve
- (vi) The overflow drainpipes shall not be less in size than the inlet pipe. Unions or equally effective fittings shall be provided for piping connected to the surge tank
- (vii) Surge tank shall be structurally designed to withstand anticipated earth or other loads. Surge tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1465 kg/m²) where the tank is designed for underground installation
- (viii) Where a surge tank is installed underground, the system shall be designed so that the tank overflow will gravity drain to the existing sewer line or septic tank. The tank shall be protected against sewer line backflow by a backwater valve installed in accordance with this standard
- (ix) Surge tanks shall be installed on dry, level, well-compacted soil where underground or on a level 3 inch (76 mm) thick concrete slab where aboveground
- (x) Surge tanks shall be anchored to prevent against overturning where installed aboveground. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground where empty. The combined weight of the tank and hold down system shall meet or exceed the buoyancy forces of the tank.

5.3.9.3 Gray water pipe and fitting materials

Aboveground and underground building drainage and vent pipe and fittings for gray water systems shall comply with the requirements for aboveground and underground sanitary building drainage and vent pipe and fittings in this standard. These materials shall extend not less than 2 feet (610 mm) outside the building.

5.3.9.4 Subsoil irrigation field materials

Subsoil irrigation field piping shall be constructed of perforated high-density polyethylene pipe, perforated ABS pipe, perforated PVC pipe, or other approved materials, provided that sufficient openings are available for distribution of the gray water into the trench area. Material, construction, and perforation of the pipe shall be in accordance with the appropriate absorption field drainage piping standards and shall be approved by the Competent Authority.

5.3.9.5 Subsurface irrigation field and mulch basin supply line materials

Materials for gray water piping outside the building shall be polyethylene or PVC. Drip feeder lines shall be PVC or polyethylene tubing.

5.3.9.6 Valves shall be accessible

5.3.9.5 Trap

Gray water piping discharging into the surge tank or having a direct connection to the sanitary drain or sewer piping shall be downstream of an approved water seal type trap(s). Where no such trap(s) exists, an approved vented running trap shall be installed upstream of the connection to protect the building from possible waste or sewer gases.

5.3.9.5 Backwater valve

A backwater valve shall be installed on gray water drain connections to the sanitary drain or sewer.

5.4 Subsurface irrigation system zones

5.4.1 General

Irrigation or disposal fields shall be permitted to have one or more valved zones. Each zone shall be of a size to receive the gray water anticipated in that zone.

5.4.2 Required area of subsurface irrigation fields, subsoil irrigation fields, and mulch basins

The minimum effective irrigation area of subsurface irrigation fields, subsoil irrigation fields, and mulch basins shall be determined by this standard for the type of soil found in the excavation, based upon a calculation of estimated gray water discharge under relevant applicable standards. For a subsoil irrigation field, the area shall be equal to the aggregate length of the perforated pipe sections within the valved zone multiplied by the width of the proposed subsoil irrigation field.

5.4.3 Determination of maximum absorption capacity

The irrigation field and mulch basin size shall be based on the maximum absorption capacity of the soil and determined using Table 3. For soils not listed Table 3, the maximum absorption capacity for the proposed site shall be determined by percolation tests or another method acceptable to the Competent Authority. A gray water system shall not be permitted, where the percolation test shows the absorption capacity of the soil is unable to accommodate the maximum discharge of the proposed gray water irrigation system.

5.4.4 Groundwater level

No excavation for an irrigation field, disposal field, or mulch basin shall extend within 3 feet (914 mm) vertical of the highest known seasonal groundwater level, nor to a depth where gray water contaminates the groundwater or surface water. The applicant shall supply evidence of groundwater depth to the satisfaction of the Competent Authority.

Table 3 — Design of six typical soils

Type of soil	Minimum square feet of irrigation area per 100 gallons of estimated gray water discharge per day	Maximum absorption capacity in gallons per square foot of irrigation/ leaching area for a 24-hour period
Coarse sand or gravel	20	5.0
Fine sand	25	4.0
Sandy loam	40	2.5
Sandy clay	60	1.7
Clay with considerable sand or gravel	90	1.1
Clay with small amounts of sand or gravel	120	0.8
For SI units: 1 square foot = 0.0929 m ² , 1 gallon per day = 0.000043 L/s		

5.4.5 Subsurface and subsoil irrigation field design and construction

5.4.5.1 Subsurface and subsoil irrigation field design and construction shall be in accordance with Section 5.4.5.3 through Section 5.4.7.4. Where a gray water irrigation system design is predicated on soil tests, the subsurface or subsoil irrigation field or mulch basin shall be installed at the same location and depth as the tested area.

5.4.5.2 Subsurface irrigation field

A subsurface irrigation field shall comply with Section 5.4.5.3 through Section 5.4.5.7.

5.4.5.3 Minimum depth

Supply piping, including drip feeders, shall be not less than 2 inches (51 mm) below finished grade and covered with mulch or soil

Not less than 140 mesh (105 microns) filter with a capacity of 25 gallons per minute (gpm) (1.58 L/s), or equivalent shall be installed. Where a filter backwash is installed, the backwash and flush discharge shall discharge into the building sewer or private sewage disposal system. Filter backwash and flush water shall not be used.

5.4.5.4 Emitter size

Emitters shall be installed in accordance with the manufacturer's installation instructions. Emitters shall have a flow path of not less than 1200 microns (μ) (1200 μm) and shall not have a coefficient of manufacturing variation (Cv) exceeding 7%. Irrigation system design shall be such that emitter flow variation shall not exceed 10%.

5.4.5.5 Number of emitters

The minimum number of emitters and the maximum discharge of each emitter in an irrigation field shall be in accordance with Table 4.

5.4.5.6 Controls

The system design shall provide user controls, such as valves, switches, timers, and other controllers, to rotate the distribution of gray water between irrigation zones.

5.4.5.7 Maximum pressure

Where pressure at the discharge side of the pump exceeds 20 pounds-force per square inch (psi) (138 kPa), a pressure-reducing valve able to maintain downstream pressure not exceeding 20 psi (138 kPa) shall be installed downstream from the pump and before an emission device.

Table 4 — Subsurface irrigation design criteria for six typical soils

Type of soil	Maximum emitter discharge gallons per day	Minimum number of emitters per gallon of estimated gray water discharge per day* gallons per day
Sand	1.8	0.6
Sandy loam	1.4	0.7
Loam	1.2	0.9
Clay loam	0.9	1.1
Silty clay	0.6	1.6
Clay	0.5	2.0
*For SI units: 1 gallon per day = 0.000043 L/s. The estimated gray water discharge per day shall be determined in accordance with Section 5.3.8.		

5.4.6 Mulch basin design and construction

5.4.6.1 A mulch basin shall comply with Section 5.4.6.2 through Section 5.4.6.5.

5.4.6.2 Single family and multi-family dwellings

The gray water discharge to a mulch basin is limited to single family and multi-family dwellings.

5.4.6.3 Size

Mulch basins shall be of sufficient size to accommodate peak flow rates and distribute the total amount of estimated gray water on a daily basis without surfacing, ponding or runoff. Mulch basins shall have a depth of not less than 10 inches (254 mm) below finished grade. The mulch basin size shall be based on the maximum absorption capacity of the soil and determined using Table 3.

5.4.6.4 Minimum depth

Gray water supply piping, including drip feeders, shall be not less than 2 inches (51 mm) below finished grade and covered with mulch.

5.4.6.5 Maintenance

The mulch basin shall be maintained periodically to retain the required depth and area, and to replenish the required mulch cover.

5.4.7 Subsoil Irrigation Field.

5.4.7.1 Subsoil irrigation fields shall comply with Section 5.4.7.2 through Section 5.4.7.4.

5.4.7.2 Minimum pipe size

Subsoil irrigation field distribution piping shall be not less than 3 inches (80 mm) diameter.

5.4.7.3 Filter material and backfill

Filter material, clean stone, gravel, slag, or similar material acceptable to the Competent Authority, varying in size from $\frac{3}{4}$ of an inch (19.1 mm) to $2\frac{1}{2}$ inches (64 mm) shall be placed in the trench to the depth and grade in accordance with Table 5. The perforated section of subsoil irrigation field distribution piping shall be laid on the filter material in an approved manner. The perforated section shall then be covered with filter material to the minimum depth in accordance with Table 5. The filter material shall then be covered with porous material to prevent the closure of voids with earth backfill. No earth backfill shall be placed over the filter material cover until after inspection and acceptance.

5.4.7.4 Subsoil irrigation field construction

Subsoil irrigation fields shall be constructed in accordance with Table 5. Where necessary on sloping ground to prevent excessive line slopes, irrigation lines shall be stepped. The lines between each horizontal leaching section shall be made with approved watertight joints and installed on the natural or unfilled ground.

Table 5 — Subsoil irrigation field construction

Description	Minimum	Maximum
Number of drain lines per valved zone	1	—
Length of each perforated line	—	100 feet
Bottom width of trench	12 inches	18 inches
Spacing of lines, center to center	4 feet	—
Depth of earth covers of lines	10 inches	—
Depth of filter material cover of lines	2 inches	—
Depth of filter material beneath lines	3 inches	—
Grade of perforated lines level	level	3 inches per 100 feet
For SI units: 1 inch = 25.4 mm, 1 foot = 304.8 mm, 1 inch per foot = 83.3 mm/m		

5.4.8 Gray water system color and marking information

Pressurized gray water distribution systems shall be identified as containing nonpotable water in accordance with relevant applicable standards

5.4.9 Other collection and distribution systems

5.4.9.1 Other collection and distribution systems shall be approved by the local Competent Authority, as allowed by relevant applicable standards

5.4.9.2 Higher requirements

Nothing contained in this chapter shall be construed to prevent the Competent Authority from requiring compliance with higher requirements than those contained herein, where such higher requirements are essential to maintaining a safe and sanitary condition.

5.4.10 Testing

Building drains and vents for gray water systems shall be tested in accordance with this standard. Surge tanks shall be filled with water to the overflow line prior to and during the inspection. Seams and joints shall be left exposed, and the tank shall remain watertight. A flow test shall be performed through the system to the point of gray water discharge. Lines and components shall be watertight up to the point of the irrigation perforated and drip lines.

5.4.11 Maintenance.

Gray water systems and components shall be maintained in accordance with Table 1.

5.5 Reclaimed (recycled) water systems**5.5.1 General**

The provisions of this section shall apply to the installation, construction, alteration, and repair of reclaimed (recycled) water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, aboveground and subsurface irrigation, industrial or commercial cooling or air conditioning and other uses approved by the Competent Authority.

5.5.2 Permit

It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered a reclaimed (recycled) water system within a building or on premises without first obtaining a permit to do such work from the Competent Authority.

5.5.2.1 Plumbing plan submission

No permit for a reclaimed (recycled) water system shall be issued until complete plumbing plans, with data satisfactory to the Competent Authority, have been submitted and approved.

5.5.3 System changes

No changes or connections shall be made to either the reclaimed (recycled) water system or the potable water system within site containing a reclaimed (recycled) water system without approval by the Competent Authority.

5.5.4 Connections to potable or reclaimed (recycled) water systems

Reclaimed (recycled) water systems shall have no connection to a potable water supply or alternate water source system. Potable water is permitted to be used as makeup water for a reclaimed (recycled) water storage tank provided the water supply inlet is protected by an air gap or reduced-pressure principle backflow preventer in accordance with this standard.

5.5.5 Water pressure

Reclaimed (recycled) water systems supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the reclaimed water supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed.

5.5.6 Initial cross-connection test

A cross-connection test is required in accordance with Section 5.2.3. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Competent

Authority and other authorized authorities. The test shall be ruled successful by the Competent Authority before final approval is granted.

5.5.7 Reclaimed (recycled) water system materials

Reclaimed (recycled) water supply and distribution system materials shall comply with the requirements of this standard for potable water supply and distribution systems unless otherwise provided for in this section.

5.5.8 Reclaimed (recycled) water system color and marking information

Reclaimed (recycled) water systems shall have a colored background and marking information in accordance with relevant applicable standards.

5.5.9 Valves

Valves, except fixture supply control valves, shall be equipped with a locking feature.

5.5.10 Hose bibbs

Hose bibbs shall not be allowed on reclaimed (recycled) water piping systems located in areas accessible to the public. Access to reclaimed (recycled) water at points in the system accessible to the public shall be through a quick-disconnect device that differs from those installed on the potable water system. Hose bibbs supplying reclaimed (recycled) water shall be marked with the words: "CAUTION: NONPOTABLE RECLAIMED WATER, DO NOT DRINK," and the symbol in figure1.



Figure 1 — Hose bibbs

5.5.11 Required appurtenances

The reclaimed (recycled) water system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required for a cross-connection test in accordance with Section 5.2.3.

5.5.12 Same trench as potable water pipes

Reclaimed (recycled) water pipes shall be permitted to be run or laid in the same trench as potable water pipes with 12 inches (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where piping materials do not meet this requirement, the minimum horizontal separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the reclaimed (recycled) water piping. Reclaimed (recycled) water pipes laid in the same trench or crossing building sewer or drainage piping shall be installed in accordance with this standard for potable water piping.

5.5.13 Signs

Signs in rooms and water closet tanks in buildings using reclaimed (recycled) water shall be in accordance with Section 5.1.8.1 through Section 5.1.8.2.

5.5.14 Inspection and testing

Reclaimed (recycled) water systems shall be inspected and tested in accordance with Section 5.2.1.

5.6 On-site treated nonpotable water systems.

5.6.1 General

The provisions of this section shall apply to the installation, construction, alteration, and repair of on-site treated nonpotable water systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, above and belowground irrigation, and other uses approved by the Competent Authority.

5.6.2 Plumbing plan submission

No permit for an on-site treated nonpotable water system shall be issued until complete plumbing plans, with data satisfactory to the Competent Authority, have been submitted and approved.

5.6.3 System changes

No changes or connections shall be made to either the on-site treated nonpotable water system or the potable water system within a site containing an on-site treated nonpotable water system without approval by the Competent Authority.

5.6.4 Connections to potable or reclaimed (recycled) water systems

On-site treated nonpotable water systems shall have no connection to a potable water supply or reclaimed (recycled) water source system. Potable or reclaimed (recycled) water is permitted to be used as makeup water for a non-pressurized storage tank provided the makeup water supply is protected by an air gap in accordance with this standard.

5.6.5 Water pressure

On-site treated nonpotable water systems supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the on-site treated non-potable water supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed.

5.6.6 Initial cross-connection test

A cross-connection test is required in accordance with relevant applicable standards. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Competent Authority and other authorized authorities. The test shall be ruled successful by the Competent Authority before final approval is granted.

5.6.7 On-site treated nonpotable water system materials

On-site treated nonpotable water supply, and distribution system materials shall comply with the requirements of this standard for potable water supply and distribution systems unless otherwise provided for in this section.

5.6.8 On-site treated nonpotable water devices and systems

Devices or equipment used to treat on-site treated nonpotable water to maintain the minimum water quality requirements determined by the Competent Authority shall be listed and labeled (third-party certified) by a listing agency (accredited conformity assessment body) or approved for the intended application. Devices or equipment used to treat on-site treated nonpotable water for use in the water closet and urinal flushing, surface irrigation, and similar applications shall comply with IAPMO/ANSI Z1324 or other relevant applicable standards approved by the Competent Authority.

5.6.9 On-site treated nonpotable water system color and marking information

On-site treated water systems shall have a colored background and marking information in accordance with relevant applicable standards.

5.6.10 Design and installation

The design and installation of on-site treated nonpotable systems shall be in accordance with Section 5.6.10.1 through Section 5.6.10.5.

5.6.10.1 Listing terms and installation instructions

On-site treated nonpotable water systems shall be installed in accordance with the terms of its listing and the manufacturer's installation instructions.

5.6.10.2 Minimum water quality

On-site treated nonpotable water supplied to toilets or urinals or for other uses in which it is sprayed or exposed shall be disinfected. Acceptable disinfection methods shall include chlorination, ultraviolet sterilization, ozone, or other methods as approved by the Competent Authority. The minimum water quality for on-site treated

nonpotable water systems shall meet the applicable water quality requirements for the intended applications as determined by the public health Competent Authority.

5.6.10.3 Deactivation and drainage

The on-site treated nonpotable water system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air/vacuum relief valves, etc.) to allow for deactivation or drainage as required for a cross-connection test in accordance with Section 5.2.3

5.6.10.4 Near underground potable water pipe

On-site treated nonpotable water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where piping materials do not meet this requirement, the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the on-site treated nonpotable water piping.

5.6.10.5 Required filters

A filter permitting the passage of particulates no larger than 100 microns (100 μm) shall be provided for on-site treated nonpotable water supplied to water closets, urinals, trap primers, and drip irrigation system.

5.6.11 Valves

Valves, except fixture supply control valves, shall be equipped with a locking feature.

5.6.12 Signs

Signs in buildings using on-site treated nonpotable water shall comply with Section 5.1.8.1 through Section 5.1.8.2.

5.6.13 Inspection and testing

On-site treated nonpotable water systems shall be inspected and tested in accordance with Section 5.2.1.

6 Nonpotable rainwater catchment systems

6.1 General

6.1.1 Allowable use of alternate water

Where approved or required by the Competent Authority, rainwater shall be permitted to be used instead of potable water for the applications identified in this standard.

6.1.2 System design

6.1.2.1 Rainwater catchment systems shall be designed in accordance with this chapter by a licensed plumbing contractor or registered design professional. Components, piping, and fittings used in a rainwater catchment system shall be listed.

6.1.2.2 Exceptions

- vii) A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems used for irrigation with a maximum storage capacity of 360 gallons (1363 L).
- i) A person registered or licensed to perform plumbing design work is not required to design rainwater catchment systems for single family dwellings where outlets, piping, and system components are located on the exterior of the building.

6.1.3 Permit

6.1.3.1 It shall be unlawful for a person to construct, install, alter, or cause to be constructed, installed, or altered a rainwater catchment system in a building or on a premise without first obtaining a permit to do such work from the Competent Authority.

6.1.3.2 Exceptions

- i) A permit is not required for exterior rainwater catchment systems used for outdoor drip and subsurface irrigation with a maximum storage capacity of 360 gallons (1363 L).
- ii) A plumbing permit is not required for rainwater catchment systems for single family dwellings where outlets, piping, and system components are located on the exterior of the building. This does not exempt the need for permits where required for electrical connections, tank supports, or enclosures.

6.1.4 Component Identification

System components shall be properly identified as to the manufacturer.

6.1.5 Maintenance and Inspection

6.1.5.1 Rainwater catchment systems and components shall be inspected and maintained in accordance with Section 6.1.5.2 through Section 6.1.5.4.

6.1.5.2 Frequency

Rainwater catchment systems and components shall be inspected and maintained in accordance with Table 6, unless more frequent inspection and maintenance are required by the manufacturer.

Table 6 — Minimum alternate water source testing, inspection, and maintenance frequency

Description	Minimum frequency
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Inspect and clean filters and screens, and replace (where necessary)	Every 3 months
Inspect and verify that disinfection, filters, and water quality treatment devices and systems are operational and maintaining minimum water quality requirements as determined by the Competent Authority	In accordance with manufacturer's instructions and the Competent Authority.
Inspect and clear debris from rainwater gutters, downspouts, and roof washers	Every 6 months
Inspect and clear debris from the roof or another above- ground rainwater collection surfaces	Every 6 months
Remove tree branches and vegetation overhanging a roof or other aboveground rainwater collection surfaces	As needed
Inspect pumps and verify operation	After initial installation and every 12 months thereafter
Inspect valves and verify operation	After initial installation and every 12 months thereafter
Inspect pressure tanks and verify operation	After initial installation and every 12 months thereafter
Clear debris from and inspect storage tanks, locking devices, and verify operation	After initial installation and every 12 months thereafter
Inspect caution labels and marking	After initial installation and every 12 months thereafter
Cross-connection inspection and test*	After initial installation and every 12 months thereafter
Test water quality of rainwater catchment systems required by this standard to maintain a minimum water quality	Every 12 months. After system renovation or repair.
The cross-connection test shall be performed in the presence of the Competent Authority in accordance with the requirements of this chapter.	

6.1.5.3 Maintenance log

A maintenance log for rainwater catchment systems is required to have a permit in accordance with Section 6.1.3 and shall be maintained by the property owner and be available for inspection. The property owner or designated appointee shall ensure that a record of testing, inspection, and maintenance in accordance with Table 6 is maintained in the log. The log will indicate the frequency of inspection and maintenance for each system.

6.1.5.4 Maintenance responsibility

The required maintenance and inspection of rainwater catchment systems shall be the responsibility of the property owner unless otherwise required by the Competent Authority.

6.1.6 Operation and Maintenance Manual

An operation and maintenance manual for rainwater catchment systems required to have a permit in accordance with relevant applicable standards, shall be supplied to the building owner by the system designer. The operating and maintenance manual shall include the following:

- i) Detailed diagram of the entire system and the location of system components
- ii) Instructions for operating and maintaining the system
- iii) Details on maintaining the required water quality as determined by the Competent Authority
- iv) Details on deactivating the system for maintenance, repair, or other purposes
- v) Applicable testing, inspection, and maintenance frequencies in accordance with Table 6.
- vi) A method of contacting the manufacturer(s).

6.1.7 Minimum water quality requirements

6.1.7.1 The minimum water quality for rainwater catchment systems shall comply with the applicable water quality requirements for the intended application as determined by the Competent Authority. Water quality for nonpotable rainwater catchment systems shall comply with Section 6.3.4.

Exceptions:

- (i) Water treatment is not required for rainwater catchment systems used for aboveground irrigation with a maximum storage capacity of 360 gallons (1363 L)
- (ii) Water treatment is not required for rainwater catchment systems used for subsurface or drip irrigation

6.1.8 Material compatibility

Rainwater catchment systems shall be constructed of materials that are compatible with the type of pipe and fitting materials, water treatment, and water conditions in the system.

6.1.9 System controls

Controls for pumps, valves, and other devices that contain mercury that come in contact with rainwater supply shall not be permitted.

6.1.10 Separation requirements

Underground rainwater catchment service piping shall be separated from the building sewer in accordance with relevant applicable standards. Treated nonpotable water pipes shall be permitted to be run or laid in the same trench as potable water pipes with a 12 inch (305 mm) minimum vertical and horizontal separation where both pipe materials are approved for use within a building. Where horizontal piping materials do not meet this

requirement, the minimum separation shall be increased to 60 inches (1524 mm). The potable water piping shall be installed at an elevation above the treated nonpotable water piping.

6.1.11 Abandonment

6.1.11.1 Rainwater catchment systems that are no longer in use, or fail to be maintained in accordance with Section 6.1.5.1 shall be abandoned. Abandonment shall comply with Section 6.1.11.2 and Section 6.1.11.3 The installation, construction, alteration, and repair of rainwater catchments systems intended to.

6.1.11.2 General

An abandoned system or part thereof covered under the scope of this standard shall be disconnected from remaining systems, drained, plugged, and capped in an approved manner.

6.1.11.3 Underground tank

An underground water storage tank that has been abandoned or otherwise discontinued from use in a system covered under the scope of this standard shall be completely drained and filled with earth, sand, gravel, concrete, or other approved material or removed in a manner satisfactory to the Competent Authority.

6.1.12 Sizing

Unless otherwise provided for in this chapter, rainwater catchment piping shall be sized in accordance with relevant applicable standards for sizing potable water piping.

6.2 Nonpotable rainwater catchment systems

6.2.1 General

The installation, construction, alteration, and repair of rainwater catchments systems intended to supply uses such as water closets, urinals, trap primers for floor drains and floor sinks, irrigation, industrial processes, water features, cooling tower makeup and other uses shall be approved by the Competent Authority. Rainwater catchment systems for collecting precipitation from rooftops shall comply with ARCSA/ASPE/ANSI 63 or other relevant applicable standards.

6.2.2 Plumbing plan submission

No permit for a rainwater catchment system shall be issued until complete plumbing plans, with data satisfactory to the Competent Authority, have been submitted and approved.

6.2.3 System changes

No changes or connections shall be made to either the rainwater catchment system or the potable water system within a site containing a rainwater catchment system requiring a permit without approval by the Competent Authority.

6.2.4 Connections to potable or reclaimed (recycled) water systems

Rainwater catchment systems shall have no direct connection to a potable water supply or alternate water source system. Potable or reclaimed (recycled) water is permitted to be used as makeup water for a rainwater catchment system provided the potable or reclaimed (recycled) water supply connection is protected by an air gap or reduced-pressure principle backflow preventer in accordance with this code.

6.2.5 Initial cross-connection test

Where a portion of a rainwater catchment system is installed within a building, a cross-connection test is required in accordance with Section 6.5.3.1. Before the building is occupied or the system is activated, the installer shall perform the initial cross-connection test in the presence of the Competent Authority and other authorities having jurisdiction. The test shall be ruled successful by the Competent Authority before final approval is granted.

6.2.6 Sizing

The design and size of rainwater drains, gutters, conductors, and leaders shall comply with relevant applicable standards.

6.2.7 Rainwater catchment system materials

6.2.7.1 Rainwater catchment system materials shall comply with Section 6.2.7.2 through Section 6.2.7.5.

6.2.7.2 Water supply and distribution materials

Rainwater catchment water supply and distribution materials shall comply with the requirements of this standard for potable water supply and distribution systems unless otherwise provided for in this standard.

6.2.7.3 Rainwater catchment system drainage materials

Materials used in rainwater catchment drainage systems, including gutters, downspouts, conductors, and leaders shall be in accordance with the requirements of this standard for storm drainage.

6.2.7.4 Storage tanks

Rainwater storage tanks shall comply with Section 6.3.5.

6.2.7.5 Collections surfaces

The collection surface shall be constructed of a hard, impervious material

6.2.8 Rainwater catchment system color and marking information

Rainwater catchment systems shall have a colored background in accordance with this standard. Rainwater catchment systems shall be marked, in lettering in accordance with relevant applicable standards with the words: "CAUTION: NONPOTABLE RAINWATER, DO NOT DRINK."

6.2.9 Deactivation and drainage for cross-connection test

The rainwater catchment system and the potable water system within the building shall be provided with the required appurtenances (e.g., valves, air or vacuum relief valves, etc.) to allow for deactivation or drainage as required for a cross-connection test in accordance with Section 6.5.3.1.

6.3 Design and installation

6.3.1 Rainwater catchment systems

The design and installation of nonpotable rainwater catchment systems shall be in accordance with Section 6.3.2 through Section 6.3.20.

6.3.2 Outside hose bibbs

Outside hose bibbs shall be allowed on rainwater piping systems. Hose bibbs supplying rainwater shall be marked with the words: "CAUTION: NONPOTABLE RAINWATER, DO NOT DRINK" and in Figure 2.



Figure 2 — Outside hose bibbs

6.3.3 Rainwater catchment collection surfaces

6.3.3.1 Rainwater shall be collected from roof surfaces or other manmade, aboveground collection surfaces

6.3.3.2 Other Surfaces

Natural precipitation collected from surface water runoff, vehicular parking surfaces, or manmade surfaces at or below grade shall be in accordance with the stormwater requirements for on-site treated nonpotable water systems in Section 5.6.1.

6.3.3.3 Prohibited discharges.

Overflows and bleed-off pipes from roof-mounted equipment and appliances shall not discharge onto roof surfaces that are intended to collect rainwater without prior approval from the Competent Authority.

6.3.4 Minimum water quality

The minimum water quality for harvested rainwater shall meet the applicable water quality requirements for the intended applications as determined by the Competent Authority. In the absence of water quality requirements determined by the Competent Authority, the minimum treatment and water quality shall be in accordance with IAPMO/ANSI Z1324 or other relevant applicable standards.

Exception: No treatment is required for rainwater used for subsurface or nonsprinkled surface irrigation where the maximum storage volume is less than 360 gallons (1363 L).

6.3.5 Rainwater storage tanks

Rainwater storage tanks shall comply with IAPMO/ANSI Z1002 or other relevant applicable standards and be installed in accordance with Section 6.3.6 through Section 6.3.12.

6.3.6 Location

Rainwater storage tanks shall be permitted to be installed above or below grade.

6.3.7 Above grade

Above grade, storage tanks shall be of an opaque material, approved for aboveground use in direct sunlight or shall be shielded from direct sunlight. Tanks shall be installed in an accessible location to allow for inspection and cleaning. The tank shall be installed on a foundation or platform that is constructed to accommodate loads in accordance with the relevant applicable standards.

6.3.8 Below grade

Rainwater storage tanks installed below grade shall be structurally designed to withstand anticipated earth or other loads. Holding tank covers shall be capable of supporting an earth load of not less than 300 pounds per square foot (lb/ft²) (1465 kg/m²) where the tank is designed for underground installation. Below grade rainwater tanks installed underground shall be provided with manholes. The manhole opening shall be not less than 20 inches (508 mm) in diameter and located not less than 4 inches (102 mm) above the surrounding grade. The surrounding grade shall be sloped away from the manhole. Underground tanks shall be ballasted, anchored, or otherwise secured, to prevent the tank from floating out of the ground where empty. The combined weight of the tank and hold down system shall meet or exceed the buoyancy force of the tank.

6.3.9 Drainage and overflow

6.3.9.1 Rainwater storage tanks shall be provided with a means of draining and cleaning. The overflow drain shall not be equipped with a shutoff valve. The overflow outlet shall discharge in accordance with this standard for storm drainage systems. Where discharging to the storm drainage system, the overflow drain shall be protected from backflow of the storm drainage system by a backwater valve or other approved method.

Table 7 — Minimum water quality

Application	Minimum Treatment	Minimum Water Quality
Car washing	Debris excluder or other approved means in accordance with this standard, and 100 microns in accordance with relevant applicable standards for drip irrigation.	N/A
Subsurface and drip irrigation	Debris excluder or other approved means in accordance with this standard, and 100 microns in accordance with relevant applicable standards drip irrigation.	N/A
Spray irrigation where the maximum storage volume is less than 360 gallons	Debris excluder or other approved means in accordance with this standard, and disinfection in accordance with relevant applicable standards.	N/A
Spray irrigation where the maximum storage volume is equal to or more than 360 gallons	Debris excluder or other approved means in accordance with this standard.	Escherichia coli: < 100 CFU/100 mL, and Turbidity: < 10 NTU
Urinal and water closet flushing, clothes washing, and trap priming	Debris excluder or other approved means in accordance with this standard, and 100 microns in accordance with relevant applicable standards.	Escherichia coli: < 100 CFU/100 mL, and Turbidity: < 10 NTU
Ornamental fountains and other water features	Debris excluder or other approved means in accordance with this standard.	Escherichia coli: < 100 CFU/100 mL, and Turbidity: < 10 NTU
Cooling tower make-up water	Debris excluder or other approved means in accordance with Section 1603.17, and 100 microns in accordance with Section 1603.18.	Escherichia coli: < 100 CFU/100 mL, and Turbidity: < 10 NTU
For SI units: 1 micron = 1 μ m, 1 gallon = 3.785 L		

6.3.9.2 Overflow outlet size

The overflow outlet shall be sized to accommodate the flow of the rainwater entering the tank and not less than the aggregate cross-sectional area of inflow pipes.

6.3.10 Opening and access protection

Rainwater tank openings shall be protected to prevent the entrance of insects, birds, or rodents into the tank.

Rainwater tank access openings exceeding 12 inches (305 mm) in diameter shall be secured to prevent tampering and unintended entry by either a lockable device or other approved method.

6.3.11 Marking

Rainwater tanks shall be permanently marked with the capacity and the language: "NONPOTABLE RAINWATER." Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following language: "DANGER-CONFINED SPACE."

6.3.12 Storage tank venting

Where venting using drainage or overflow piping is not provided or is considered insufficient, a vent shall be installed on each tank. The vent shall extend from the top of the tank and terminate not less than 6 inches (152 mm) above grade and shall be not less than 1½ inches (40 mm) in diameter. The vent terminal shall be directed downward and covered with a ⅜ of an inch (2.4 mm) mesh screen to prevent the entry of vermin and insects.

6.3.13 Pumps

Pumps serving rainwater catchment systems shall be listed. Pumps supplying water to water closets, urinals, and trap primers shall be capable of delivering not less than 15 pounds-force per square inch (psi) (103 kPa) residual pressure at the highest and most remote outlet served. Where the water pressure in the rainwater supply system within the building exceeds 80 psi (552 kPa), a pressure reducing valve reducing the pressure to 80 psi (552 kPa) or less to water outlets in the building shall be installed in accordance with this code.

6.3.14 Roof drains

Primary and secondary roof drains, conductors, leaders, and gutters shall be designed and installed in accordance with this code.

6.3.15 Water quality devices and equipment

Devices and equipment used to treat rainwater to maintain the minimum water quality requirements determined by the Competent Authority shall be listed or labeled (third-party certified) by a listing agency (accredited conformity assessment body) and approved for the intended application.

6.3.16 Freeze protection

Tanks and piping installed in locations subject to freezing shall be provided with an approved means of freeze protection.

6.3.17 Debris removal

The rainwater catchment conveyance system shall be equipped with a debris excluder or other approved means to prevent the accumulation of leaves, needles, other debris and sediment from entering the storage tank. Devices or methods used to remove debris or sediment shall be accessible and sized and installed in accordance with manufacturer's installation instructions.

6.3.18 Required filters

A filter permitting the passage of particulates not larger than 100 microns (100 µm) shall be provided for rainwater supplied to water closets, urinals, trap primers, and drip irrigation system.

6.3.19 Roof gutters

Gutters shall maintain a minimum slope and be sized in accordance with relevant applicable standards.

6.3.20 Rainwater diversion valves

Rainwater diversion valves ranging from 2 inches (50 mm) through 4 inches (100 mm) in diameter shall comply with IAPMO PS 59 or other relevant applicable standard. Rainwater diversion valves ranging from 6 inches (150 mm) to 12 inches (300 mm) in diameter shall comply with IAPMO IGC 352 or other relevant applicable standards. Valves shall be accessible and include a filter located upstream of the valve when required.

6.4 Signs

6.4.1 General

Signs in buildings using rainwater shall be in accordance with Section 6.4.2 and Section 6.4.3.

6.4.2 Commercial, industrial, and institutional restroom signs

A sign shall be installed in restrooms in commercial, industrial, and institutional occupancies using nonpotable rainwater for water closets, urinals, or both. Each sign shall contain $\frac{1}{2}$ of an inch (12.7 mm) letters of a highly visible color on a contrasting background. The location of the sign(s) shall be such that the sign(s) shall be visible to users. The number and location of the signs shall be approved by the Competent Authority and shall contain the following text: TO CONSERVE WATER, THIS BUILDING USES RAINWATER TO FLUSH TOILETS AND URINALS.

6.4.3 Equipment room signs

Each equipment room containing nonpotable rainwater equipment shall have a sign posted with the following wording in 1 inch (25.4 mm) letters: CAUTION NONPOTABLE RAINWATER, DO NOT DRINK. DO NOT CONNECT TO DRINKING WATER SYSTEM. NOTICE: CONTACT BUILDING MANAGEMENT BEFORE PERFORMING ANY WORK ON THIS WATER SYSTEM.

This sign shall be posted in a location that is visible to anyone working on or near rainwater equipment.

6.5 Inspection and testing

6.5.1 General

Rainwater catchment systems shall be inspected and tested in accordance with Section 6.5.3.2 and Section 6.5.3.5.

6.5.2 Supply system inspection and test

Rainwater catchment systems shall be inspected and tested in accordance with the applicable provisions of this standard for testing of potable water and storm drainage systems. Storage tanks shall be filled with water to the

overflow opening for a period of 24 hours, and during the inspection, or by other means as approved by the Competent Authority. Seams and joints shall be exposed during the inspection and checked for watertightness.

6.5.3 Annual cross-connection inspection and testing

6.5.3.1 An initial and subsequent annual inspection and test in accordance with this standard shall be performed on both the potable and rainwater catchment water systems. The potable and rainwater catchment water systems shall be isolated from each other and independently inspected and tested to ensure there is no cross-connection in accordance with **Section 6.5.3.2 through Section 6.5.3.5**.

6.5.3.2 Visual system inspection

Prior to commencing the cross-connection testing, a dual system inspection shall be conducted by the Competent Authority and other authorities having jurisdiction as follows:

- (i) Pumps, equipment, equipment room signs, and exposed piping in an equipment room shall be checked.

6.5.3.3 Cross-connection test

The procedure for determining cross-connection shall be followed by the applicant in the presence of the Competent Authority and other authorized authorities to determine whether a cross-connection has occurred as follows:

- i) The potable water system shall be activated and pressurized. The rainwater catchment water system shall be shut down and completely drained
- ii) The potable water system shall remain pressurized for a minimum period of time specified by the Competent Authority while the rainwater catchment water system is empty. The minimum period the rainwater catchment water system is to remain depressurized shall be determined on a case-by-case basis, taking into account the size and complexity of the potable and rainwater catchment water distribution systems, but in no case shall that period be less than 1 hour
- iii) Fixtures, potable, and rainwater shall be tested and inspected for flow. Flow from a rainwater catchment water system outlet shall indicate a cross-connection. No flow from a potable water outlet shall indicate that it is connected to the rainwater system
- iv) The drain on the rainwater catchment water system shall be checked for flow during the test and at the end of the period
- v) The potable water system shall then be completely drained
- vi) The rainwater catchment water system shall then be activated and pressurized
- vii) The rainwater catchment water system shall remain pressurized for a minimum period of time specified by the Competent Authority while the potable water system is empty. The minimum period the potable water system is to remain depressurized shall be determined on a case-by-case basis, but in no case shall that period be less than 1 hour

- viii) Fixtures, potable and rainwater catchment, shall be tested and inspected for flow. Flow from a potable water system outlet shall indicate a cross-connection. No flow from a rainwater catchment water outlet shall indicate that it is connected to the potable water system
- ix) The drain on the potable water system shall be checked for flow during the test and at the end of the period
- x) Where there is no flow detected in the fixtures which would indicate a cross-connection, the potable water system shall be repressurized.

6.5.3.4 Discovery of cross-connection

In the event that a cross-connection is discovered, the following procedure, in the presence of the Competent Authority, shall be activated immediately:

- i) Rainwater catchment piping to the building shall be shut down at the meter, and the rainwater riser shall be drained
- ii) Potable water piping to the building shall be shut down at the meter
- iii) The cross-connection shall be uncovered and disconnected
- viii) The building shall be retested following procedures listed in Section 6.5.3.2 and Section 6.5.3.3
- iv) The potable water system shall be chlorinated with 50 ppm chlorine for 24 hours
- v) The potable water system shall be flushed after 24 hours, and a standard bacteriological test shall be performed. Where test results are acceptable, the potable water system shall be permitted to be recharged.

6.5.3.5 Annual inspection

An annual inspection of the rainwater catchment water system, following the procedures listed in Section 6.5.3.2 shall be required. Annual cross-connection testing, following the procedures listed in Section 6.5.3.3 shall be required by the Competent Authority, unless site conditions do not require it. In no event shall the test occur less than once in 4 years.

Alternate testing requirements shall be permitted by the Competent Authority.

Bibliography

- [1] IAPMO/ANSI Z1324 *Alternate Water Source Systems for Multi-Family, Residential, and Commercial Use*
- [2] IAPMO PS 59 *Wastewater diverter/bypass valve and diversion system*

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