Preface

The International Code Council (ICC) develops model codes and standards to safeguard public health, safety, and general welfare in the built environment. ICC 825 establishes minimum requirements for the design, installation, alteration, repair, operation, and maintenance of onsite wastewater treatment systems (OWTS) serving one- and two-family dwellings not connected to centralized sanitary sewers. The standard focuses on residential-strength wastewater and excludes larger community, commercial, or industrial applications.

Globally, around 3.4 billion people lack access to safely managed sanitation services, often relying on onsite wastewater treatment systems or other decentralized approaches that may not consistently meet stringent public safety standards.

ICC 825's mission is to deliver affordable, risk-based minimum standards for OWTS that safeguard public health, enhance the climate resilience of sanitation infrastructure to extreme environmental hazards, and advance general welfare through contaminant control, water reuse, and worldwide accessibility, while remaining dynamically current and relevant.

Properly designed and managed OWTS fulfill this mission by:

- Containing pathogens to reduce waterborne diseases while safeguarding water resources from nutrients, pharmaceuticals, PFAS, and other emerging contaminants of concern.
- Enhancing resilience from climate and anthropogenic hazards by adapting systems to mitigate extreme weather impacts, such as heavier precipitation, prolonged droughts, and flooding, ensuring functionality amid variable economic and physical conditions for long-term public health and environmental stability.
- Enabling water reuse through options like graywater recycling, effluent irrigation, and nutrient recovery, conserving critical water resources and supporting sustained developmental progress.

The 20XX edition of ICC 825 introduces a risk-based, performance-oriented framework that matches treatment intensity to site-specific environmental sensitivity. The standard defines three/four treatment tiers: [Treatment Tiers Explainer]. This tiered approach ensures higher protection in sensitive areas while preserving the viability and affordability of onsite solutions. Future editions may expand on emerging contaminant mitigation, including advanced strategies for addressing PFAS. Major organizational changes include new chapters on _____.

To address challenges in improving system selection worldwide, this edition includes the Wastewater Infrastructure Simplified for Everyone (WISE) Toolkit. This toolkit offers non-binding guidance to assess local resources, skills, and environmental hazards like floods or droughts. Using simple checks and hazard tweaks, it promotes lower-failure setups for sustained public and environmental health gains. Informative

appendices provide design examples, technology evaluation protocols, and guidance for mitigating environmental hazards, including a table summarizing key strategies.

The WISE Toolkit can be found in the _____ section, with a digital web version linked in _____ for interactive use.

As a model standard for adoption by local, tribal, state, and international jurisdictions, ICC 825 supports broad implementation through flexible modifications permitted by authorities having jurisdiction to suit space constraints, regional hydrogeology, water-quality priorities, and administrative resources.

The ICC gratefully acknowledges the volunteers, regulators, engineers, scientists, manufacturers, and public-health professionals whose expertise enabled this update.

Table of Contents

Section 810 Plant Evapotranspiration Beds

Section 811 Biological Filtration Systems

Section 812 Vermifiltration

Section 813 Onsite Wastewater Secondary Treatment Systems (OWSTS)

Section 814 Source Separation

Section 815 Onsite Non-potable Water Systems (ONWS)

Chapter 9 Reference Publications

Appendix A Low Pressure Distribution (LPD) Design Guide

Appendix B Operations and Maintenance (O&M) Recommendations for Onsite Wastewater Treatment Systems

Appendix C Pit Latrines with Slabs

Appendix D Guiding Philosophy for Addressing Environmental Hazards in ICC 825

CHAPTER 1 ADMINISTRATION

SECTION 101 GENERAL

101.1 Purpose. The purpose of this standard is to protect public health and environmental quality under both normal and extreme conditions, ensuring that onsite wastewater systems remain safe, functional, and sustainable throughout their service life.

This standard is intended to:

1. Prevent the discharge of untreated or inadequately treated wastewater to the surface of the ground or to waters of the environment;
2. Protect groundwater and surface-water resources from contamination;
3. Promote the use of durable and sustainable materials; and
4. Provide a framework for resilient system design, construction, and maintenance practices adaptable to different climatic, soil, and site conditions.

101.2 Scope. This standard establishes minimum requirements for the design, construction, installation, operation, and maintenance of onsite wastewater systems serving one- and two-family dwellings.

This standard establishes minimum requirements for onsite wastewater treatment systems (OWTS) to provide a reasonable level of safety, health, property protection and general welfare by regulating the design, construction, installation, quality of materials, location, operation, and maintenance where connection to public utilities are not available or not required.

This standard promotes the resilience and continuity of onsite wastewater systems under varying environmental and climatic conditions, supporting long-term system function and protection of public health and environmental quality.

101.3 Exclusions. This standard does not include treatment systems discharging to public sewer systems or public waterways, onsite commercial and industrial sanitary systems, multifamily systems serving more than two dwellings.

SECTION 102 APPLICABILITY

102.1 Application. The provisions of this standard apply to the design, installation, alteration, repair, replacement, and inspection of onsite wastewater systems for one- and two-family dwellings.

Where conflicts occur between this standard and other referenced standards or codes, the provisions that most effectively protect public health and environmental quality shall apply.

102.2 Enforcement. This standard shall be administered and enforced by the authority having jurisdiction (AHJ) or other regulatory body legally empowered to issue permits, conduct inspections, and approve system installation, operation, and maintenance.

Nothing in this standard shall prevent an AHJ from adopting additional requirements consistent with local laws, climatic conditions, or public-health needs.

102.3 Severability. If any section, subsection, sentence, clause, or phrase of this standard is held to be invalid or unconstitutional, such decision shall not affect the validity of the remaining portions of this standard.

102.4 Referenced standards. The standards referenced in this standard shall be considered part of the requirements of this standard to the prescribed extent of each such reference and as further regulated in Sections 102.4.1 and 102.4.2.

102.4.1 Conflicts. Where conflicts occur between provisions of this standard and the referenced standards, the provisions of this standard shall apply.

102.4.2 Provisions in referenced codes and standards. Where the extent of the reference to a referenced code or standard includes subject matter that is within the scope of this standard, the provisions of this standard, as applicable, shall take precedence over the provisions in the referenced code or standard.

102.5 Clause notes. Notes accompanying clauses do not include requirements or alternative requirements; the purpose of a note accompanying a clause is to separate from the text explanatory or informative material.

102.6 Table/Figure notes. Notes to tables and figures are considered part of the table or figure and included as requirements.

102.7 Primary units. SI units are the primary units in this Standard. Inch/pound units are shown in parentheses.

102.8 Unit equivalency. The values stated in each measurement system are equivalent in application; however, each system is to be used independently. Combining values from the two measurement systems can result in non-conformance with this Standard.

102.9 Gallon reference. References to gallons are to U.S. gallons.

CHAPTER 2 CLIMATE RESILIENCE

SECTION 201 GENERAL

201.1 Site selection, system selection, and construction considerations. In locations where the impact of climate challenges, environmental hazards, or weather extremes on OWTS performance is a concern, users of this standard should consider the information in Appendix D. Appendix D provides guidance on selecting the type of OWTS and potential design mitigation strategies with respect to specific climate-hazard conditions.

Additionally, while most of the OWTS in this standard are intended for treatment and eventual dispersal of effluent into the environment, it should be noted that for jurisdictions concerned with drought or future water scarcity conditions, Section 815 provides requirements for the onsite treatment and non-potable reuse of wastewater.

CHAPTER 3 DEFINITIONS

SECTION 301 GENERAL

301.1 General. For the purposes of this standard, the terms listed in Section 302 shall have the indicated meaning.

301.2 Undefined terms. The terms not specifically defined in this standard or in standards referenced herein shall have the ordinarily accepted meanings such as the context implies.

301.3 Interchangeability. Words used in the present tense include the future; words stated in the masculine gender include the feminine and neuter; the singular number includes the plural and the plural, the singular.

301.4 Terms defined in other code. Where terms are not defined in Section 301 and are defined in applicable building, plumbing, or environmental codes, those definitions shall apply.

SECTION 302 DEFINITIONS

Absorption Area. The subsurface area designed to receive treated effluent from a soil absorption system for final treatment and dispersal into the soil. Also known as: drainfield, leach field, leaching bed, infiltration area, disposal area.

Aggregate. Graded hard rock that has been washed with water under pressure over a screen during or after grading to remove fine material and with a hardness value of 3 or greater on Mohs' Scale of Hardness. Aggregate that will scratch a copper penny without leaving any residual rock material on the coin has a hardness value of 3 or greater on Mohs' Scale of Hardness.

Air Break (Drainage System). A piping arrangement in which a drain from a fixture, appliance or device dis-charges indirectly into another fixture, receptacle or interceptor at a point below the flood level rim and above the trap seal.

Alternative System. An onsite wastewater treatment system that employs design, construction, or operational methods differing from onsite wastewater treatment systems covered in this standard and provides equivalent performance in the treatment and dispersal of wastewater.

Alluvium. Soil deposited by floodwaters.

As-Built (Record Drawing). A drawing prepared after construction that accurately shows the location, elevation, and dimensions of system components as installed, including any deviations from the approved design. Geospatial reference data or GPS coordinates is acceptable for documenting locations.

Authority Having Jurisdiction (AHJ). The organization, office, or individual responsible for enforcing the requirements of this standard, approving equipment, materials, installation, or procedures, and issuing permits or approvals. *Also referred to as:* competent authority, local council, regulatory agency, or approving officer.

Bedding layer. A habitat for composting worms within a vermifilter, typically composed of organic material such as wood chips, coir, compost, or coco chips.

Bedrock. The rock that underlies soil material or is located at the earth's surface. Bedrock is encountered where the weathered in-place consolidated material, larger than 2 mm (0.08 inch) in size, is more than 50 percent by volume.

Cesspool. A covered excavation in the ground receiving sewage or other organic wastes from a drainage system that is designed to retain the organic matter and solids, permitting the liquids to seep into the soil cavities.

Clear-water Wastes. Cooling water and condensate drainage from refrigeration compressors and air-conditioning equipment, water used for equipment chilling purposes, liquid that is free from impurities or where impurities have been reduced below a minimum concentration considered harmful, and cooled condensate from steam-heating systems or other equipment.

Climatic Variability. Variations in temperature, precipitation, and groundwater conditions that affect the performance or continuity of onsite wastewater systems.

Code Official. The officer or other designated authority charged with administration and enforcement of this code or a duly authorized representative.

Collovium. Soil transported under the influence of gravity.

Color. The moist color of the soil based on Munsell soil color charts.

Commode. A fixture without connection to a plumbing drainage system used for collecting, containing, or transporting excreta to a compost processor. (also dry toilet, urine diverting dry toilet [UDDT], vacuum flush toilet, foam flush toilet)

Compost Additives. Any material such as sawdust, wood shavings, coconut coir, sugarcane bagasse, or other compostable material added to maintain operational conditions within the composting toilet system.

Composting Toilet System. A system designed to safely collect and process excreta and compost additives into humus through aerobic decomposition.

Composting Worms. A type of epigeic earthworm that consumes decaying organic matter in or on the soil. Example worm species include: *Eisenia fetida, Eudrilus eugeniae* and *Perionyx excavatus*.

Compost Processor. The site of aerobic decomposition transforming excreta and compost additives into humus.

Construction Documents. The written, scaled drawings, graphic, and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of the project necessary for obtaining a building permit.

Conventional Soil Absorption System. A system employing gravity flow from the septic or other treatment tank and applying effluent to the soil through the use of a seepage trench, bed or pit.

Design Daily Flow. The volume of sewage or effluent a system is designed to receive and treat in a 24-hour period, based on occupancy, fixture count, or other design assumptions.

Design Flood Elevation. The elevation of the "design flood," including wave height, relative to the datum specified on the community's legally designated flood hazard map. In areas designated as Zone AO, the design flood elevation is the elevation of the highest existing grade of the building's perimeter plus the depth number (in feet) specified on the flood hazard map. In areas designated as Zone AO where a depth number is not specified on the map, the depth number shall be taken as being equal to 610 mm (2 feet).

Detailed Soil Map. A map prepared by or for a state or federal agency participating in the National Cooperative Soil Survey showing soil series, type and phases at a scale of not more than 24 m/mm (2,000 feet to the inch) and which includes related explanatory information.

Dispersal Area. The portion of an onsite wastewater system used to distribute effluent into the soil for absorption and final treatment. *Also known as:* disposal area, infiltration area, drainfield.

Diverted Urine. Urine that has been collected separately from fecal matter.

Dosing Soil Absorption System. A system employing a pump or automatic siphon to elevate or distribute effluent to the soil through the use of a seepage trench or bed.

Drainage Layer. Permeable material below the bedding layer, which provides support for the bedding layer and allows water to drain out of the bedding layer. Typically composed of inorganic material such as gravel, cinders, or crushed concrete.

Effluent. Treated liquid wastewater discharged from a septic tank, treatment unit, or other component for final dispersal to the soil absorption system.

Equivalent Performance. Performance that achieves the same level of treatment, protection, and reliability as a standard system where evaluated under comparable conditions.

Excreta. Includes and is not limited to urine, faeces, menses, and other human body emissions, as well as toilet paper and biodegradable cleaning products.

Flood Hazard Area. The greater of the following two areas:

1. The area within a flood plain subject to a 1-percent or greater chance of flooding in any given year.
2. The area designated as a flood hazard area on a community's flood hazard map or as otherwise legally designated.

Geospatial Reference Data. Coordinates or digital mapping information (such as GPS or equivalent systems) used to document the precise location of an onsite wastewater system and its components.

Headroom. The space between bottom of the vermifilter inlet pipe and the top of the bedding layer, which allows for the gradual accumulation of vermicompost and provides an air gap for aeration.

High Ground Water Area. Soil saturation zones, including perched water tables, shallow regional ground water tables or aquifers, or zones seasonally, periodically or permanently saturated.

Holding Tank. An approved water-tight receptacle for collecting and holding sewage.

Horizontal Reference Point. A stationary, easily identifiable point to which horizontal dimensions are related.

Humus. The biologically decomposed, soil-like output of the compost processor.

Influent. Toilet flush water mixed with excreta entering a vermifiltration toilet system.

Inspection Record. Documentation, including but not limited to written notes, photographs, videos, and GPS data, confirming that a system has been installed, tested, and approved in accordance with this standard.

Leachate. Liquid draining from a compost processor.

Legal Description. An accurate metes and bounds description, a lot and block number in a recorded subdivision, a recorded assessor's plat or a public land survey description to the nearest 16 hectares (40 acres).

Manhole. An opening of sufficient size to permit a person to gain access to a sewer or any portion of a private sewage disposal system.

Materials. Substances or manufactured products used in the construction, treatment, or dispersal components of an onsite wastewater system, conforming to recognized ASTM, CSA, EN, ISO, or AS/NZS standards, or equivalent.

Mobile Unit. A structure of vehicular, portable design, built on a chassis and designed to be moved from one site to another and to be used with or without a permanent foundation.

Mobile Unit Park. Any plot or plots of ground owned by a person, state or local government upon which two or more units, occupied for dwelling or sleeping purposes regardless of mobile unit ownership, are located and whether or not a charge is made for such accommodation.

Nuisance. Public nuisance as known in common law or equity jurisprudence; whatever is dangerous to human life or detrimental to health; whatever building, structure or premises is not sufficiently ventilated, sewered, drained, cleaned or lighted, in reference to its intended use; and whatever renders the air, human food, drink or water supply un-wholesome.

Nutrient Management Plan. A *nutrient management plan* outlines the quantity, timing, locations, methods and other aspects of applying plant nutrients and soil amendments to the land in order to prevent or minimize environmental impacts while maximizing horticultural benefits.

Onsite Wastewater Treatment System (OWTS). A system designed to treat and disperse domestic wastewater at or near the point of origin, including components for collection, treatment, storage, and

dispersal. *Commonly referred to as:* septic system, onsite sewage facility, decentralized wastewater system, or onsite sanitation system.

Operation and Maintenance Manual. A manual containing instructions for management of all aspects of a system.

Pan. A soil horizon cemented with any one of a number of cementing agents such as iron, organic matter, silica, calcium, carbonate, gypsum or a combination of chemicals. Pans will resist penetration from a knife blade and are slowly permeable horizons or are impermeable.

Percolation Test. The method of testing absorption qualities of the soil (see Section 501.2).

Permeability. The ease with which liquids move through the soil. One of the soil qualities listed in soil survey re-ports.

Pressure Distribution System. A soil absorption system using a pump or automatic siphon and smaller diameter distribution piping with small-diameter perforations to introduce effluent into the soil.

Privy. A structure, not connected to a plumbing system, that is used by persons for the deposition of human body waste.

Public Health Protection. The prevention of disease and safeguarding of human health through the design, installation, and operation of wastewater systems that prevent exposure to untreated or inadequately treated wastewater, whether managed by public authorities, community service providers, or private operators.

Registered Design Professional. An individual who is registered or licensed to practice their respective design profession, as defined by the statutory requirements of the professional registration laws of the state or jurisdiction in which the project is to be constructed.

Resilience. The ability of an onsite wastewater system to maintain safe and sanitary function during and after environmental stresses, including climatic variability, flooding, or power interruptions, and to recover normal performance following such events**.**

Secondary Composting. Additional retention and continued decomposition of humus removed from compost processors to meet the required retention time.

Secondary Treatment. Additional advanced treatment that yields effluent that meets the U.S. EPA secondary treatment standards under Title 40, Chapter I, Subchapter D, Part 133 of the U.S. Code of Federal Regulations.

Seepage Bed. An excavated area more than 1524 mm (5 feet) wide that contains a bedding of aggregate and has more than one distribution line.

Seepage Pit. An underground receptacle constructed to permit disposal of effluent or clear wastes by soil absorption through its floor and walls.

Seepage Trench. An area excavated 305 mm to 1524 mm (1 foot to 5 feet) wide containing a bedding of aggregate and a single distribution line.

Septage. Sludge, scum, liquid and any other material removed from a private sewage treatment and disposal system.

Septic Tank. A tank that receives and partially treats sewage through processes of sedimentation, flotation and bacterial action to separate solids from the liquid in the sewage, and which discharges the liquid to a soil absorption system.

Site Evaluation. The process of investigating and documenting soil, slope, groundwater, and other site characteristics to determine suitability for an onsite wastewater system. *Includes:* soil loading rate testing, groundwater separation, and classification of the site as suitable, conditionally suitable, or unsuitable.

Soil. The unconsolidated material over bedrock, 2 mm (0.08 inch) and smaller.

Soil Absorption Fields, Leach Fields, Drain Field. A system employing gravity flow or a pump or automatic siphon to elevate or distribute from the septic or other treatment tank and applying effluent to the soil through the use of a seepage trench, bed or pit.

Soil Boring. An observation pit dug by hand or backhoe, a hole dug by augering or a soil core taken intact and un-disturbed with a probe.

Soil Loading Rate. The rate at which treated effluent can be applied to the soil without causing ponding, surfacing, or groundwater contamination. *Also known internationally as:* infiltration capacity or hydraulic loading rate. *Determined through percolation, infiltration, or other recognized testing methods.*

Soil Mottles. Spots, streaks or contrasting soil colors usually caused by soil saturation for one period of a normal year, with a color value of 4 or more and a chroma of 2 or less. Gray-colored mottles are called low chroma; reddish-brown, red- and yellow-colored mottles are called high chroma.

Soil Saturation. The state in which pores in a soil are filled with water. Water will flow from saturated soil into a bore hole.

System Documentation File. The permanent collection of design, inspection, testing, and geospatial records for an onsite wastewater system, maintained by the owner or AHJ as evidence of compliance and for future maintenance or repair.

Treated Urine. *Diverted urine* that has been treated for beneficial use.

Urine Derived Product. A product that is derived from urine, such as an agricultural amendment, fertilizer, or diesel exhaust fluid.

Urine Diversion. Collection of diverted urine that occurs at the fixture.

Urine Diverting Commode. A commode that separates urine from other excreta and directs urine to a urine diversion system. (also urine diverting dry toilet)

Urine Diverting Water Closet. A fixture connected to a plumbing system that separates fecal matter and urine into separate piping. (also urine diverting flush toilet)

Vermicompost. The biologically decomposed, soil-like residue remaining on the surface of the bedding layer after the vermifiltration process.

Vermiculture. The practice of cultivating and multiplying composting earthworms. The primary aim is to produce composting worms.

Vermicomposting. The use of composting worms to decompose relatively dry organic matter, such as garden waste and food scraps. The primary aim is to convert unwanted solid waste material into usable compost.

Vermifiltration. The use of composting worms to treat a flow of wastewater. The primary aim is to reduce the organic pollution loading of the water. A secondary product is a small quantity of vermicompost.

Vermifiltration Toilet System. A system designed to safely collect and process excreta in wastewater through aerobic decomposition facilitated by earthworms.

Vent Cap. An approved appurtenance used for covering the vent terminal of an effluent disposal system to avoid closure by mischief or debris and still permit circulation of air within the system.

Vertical Elevation Reference Point. An easily identifiable stationary point or object of constant elevation for establishing the relative elevation of percolation tests, soil borings and other locations.

Watertight. Constructed to prevent the passage of water or effluent through joints, seams, or materials under operating and test conditions.

Wastewater. Human body waste and liquid waste generated by the occupants of an individual residence.

Watercourse. A stream usually flowing in a particular direction, though it need not flow continually and is some-times dry. A watercourse flows in a definite channel, with a bed, sides or banks, and usually discharges itself into some other stream or body of water. It must be something more than mere surface drainage over the entire face of a tract of land, occasioned by unusual freshets or other extraordinary cause. It does not include the water flowing in the hollows or ravines in land, which is the mere surface water from rains or melting snows, and is discharged through them from a higher to a lower level, and which at other times are destitute of water. Such hollows or ravines are not, in legal contemplation, watercourses.

Workmanship. Work of such character that will fully secure the results sought in the sections of this code as intended for the health, safety and welfare protection of all individuals.

302.2 Global Terminology Note. For clarity, this standard recognizes that equivalent terminology is used globally for certain onsite wastewater components. Where regional terms differ, the functional meaning of the component governs interpretation.

Examples:

- **Soil Absorption System** → *Drainfield, Leach Field, Leaching Bed, Soakaway, Infiltration Bed, Disposal Area*
- **Septic Tank** → *Primary Treatment Tank, Settling Chamber*
- **Distribution Box** → *Splitter Box, Manifold Chamber*
- **Effluent Pump Chamber** → *Dosing Tank, Pump Well*
- **Mound System** → *Raised Infiltration Bed, Sand Filter*

Chapter 4 GENERAL PERFORMANCE AND RESILIENCE REQUIREMENTS

SECTION 401 GENERAL

401.1 General. Onsite wastewater systems shall be designed, constructed, operated, and maintained to ensure the safe, sanitary, and reliable treatment and dispersal of wastewater. Systems shall prevent the discharge of untreated or inadequately treated effluent to the surface of the ground, to surface waters, or to groundwater.

Systems shall function as intended under normal operating conditions and within the range of environmental and climatic conditions reasonably expected for the location.

Wherever possible, system design shall promote efficiency, durability, and the use of sustainable or locally available materials consistent with public health protection and environmental quality objectives.

401.2 System resilience and environmental conditions. Onsite wastewater systems shall be designed and installed to perform under expected site and climatic conditions, including variations in precipitation, temperature, and groundwater levels.

Systems shall be protected from damage due to flooding, erosion, frost heave, soil movement, or other natural processes that could impair function or access.

Where power or mechanical equipment is required for operation, systems shall include simple or passive features that allow continued safe and sanitary operation during short-term power interruptions.

System resilience shall include the capacity to maintain treatment and dispersal performance under climatic variability, natural hazards, and other environmental stresses that affect operation or access.

401.3 Protection of water sources. Systems shall be located, designed, and installed to prevent the contamination of drinking-water wells, surface waters, and groundwater.

Minimum horizontal separation distances between system components and sensitive receptors shall comply with applicable regulations or recognized standards to ensure public health protection.

Where site conditions limit available separation distances, alternative designs or enhanced treatment systems are acceptable for use where demonstrated to achieve equivalent performance in protecting water sources.

401.4 Maintenance and serviceability. Systems shall be designed and installed to allow safe and convenient inspection, maintenance, and servicing.

Access points shall be provided to major components, including tanks, pumps, filters, and distribution devices. Access covers shall be secure, watertight, and constructed of durable materials resistant to corrosion and degradation.

Owners or operators shall maintain the system in accordance with manufacturer’s recommendations, operating permits, or maintenance plans approved by the authority having jurisdiction (AHJ).

401.5 Documentation and records. Designers and installers shall prepare and maintain accurate system documentation and as-built drawings identifying the locations, elevations, and specifications of system components.

Documentation shall be retained by the owner and made available for inspection or review by the AHJ. Documentation shall be prepared and retained for inspection in accordance with Chapter 6 (Inspections).

Where required by the AHJ, digital records such as geospatial reference data, photographs, and video documentation shall be submitted to verify system location and configuration.

CHAPTER 5 SITE EVALUATION AND REQUIREMENTS

SECTION 501 GENERAL

501.1 General. A site evaluation shall be conducted for every proposed onsite wastewater system to determine the suitability of the location for treatment and dispersal of wastewater.

The evaluation shall consider soil characteristics, slope, drainage, depth to groundwater or restrictive layers, flooding potential, and available area for installation and maintenance.

Site evaluations shall consider the potential effects of seasonal and climatic variability on soil moisture, groundwater elevation, and surface drainage to ensure long-term system resilience and protection of public health.

Site evaluations shall be documented in writing and include field data, test results, and a site plan showing the proposed system location, test-hole locations, structures, and relevant physical features. The site plan shall be drawn to scale. Building or floor plans need not be to scale and must show relevant dimensions.

501.2 Soil and percolation evaluation. At least two soil borings or test pits shall be excavated within the proposed dispersal area to determine soil texture, structure, color, mottling, and depth to limiting layers. Both borings shall be located within the proposed soil absorption system area.

Where required by the authority having jurisdiction (AHJ), soil loading rate testing—including percolation, infiltration, or other recognized methods—shall be performed to determine the rate at which treated effluent can be applied to the soil without causing ponding, surfacing, or groundwater contamination.
Soil loading rate testing shall be used to establish the design daily flow for sizing dispersal components.

The results of soil and percolation testing shall be recorded in writing and include:

1. Test locations and depths;
2. Measured infiltration or loading rates;
3. Elevation benchmark for the site; and
4. The name, qualifications, and signature of the person performing the evaluation.

501.3 Groundwater and bedrock separation. The minimum separation distance between the bottom of a soil absorption system and the seasonal high groundwater table or bedrock shall comply with local regulations or recognized standards.

Where high groundwater or shallow bedrock conditions are present, the use of alternative designs or mounded systems is acceptable to maintain the required vertical separation.

501.4 Site suitability and limitations. Sites shall be classified as suitable, conditionally suitable, or unsuitable based on the findings of the site evaluation.

Approval of sites that present limitations due to slope, flooding, soil stability, or restricted area is acceptable only if design modifications or alternative systems are proposed to provide equivalent performance in treatment and dispersal.

Where conditions cannot be corrected or mitigated, the site shall be deemed unsuitable for installation of an onsite wastewater system.

501.5 Fill material and altered slopes. Where fill or imported material is used to create the dispersal area, the fill shall be clean, stable, and of suitable texture and permeability to support treatment and infiltration.

Altered slopes shall be graded and stabilized to prevent erosion, ponding, or surface runoff that could affect system performance or accessibility.

Where systems are located on sloping terrain, measures shall be taken to prevent effluent breakout or downslope seepage.

501.6 Use or disposal of source separated products. If source-separated systems (see Section 814) are intended, the following criteria shall be evaluated:

1. Adequate space to access systems for product removal; or
2. If the outputs of source-separated systems are intended for on-site beneficial use or disposal (such as source-separated urine, or humus from composting toilets), the following site features shall be recorded:

    2.1 The beneficial use products produced and their expected quantity; and

    2.2 The locations of use and/or disposal and the locations' adequacy to receive the products, including:

        2.2.1 Nutrient demand, if product is intended as fertilizer; and
        2.2.2 Space for disposal and disposal method.

501.7 Completion of site evaluation. Upon completion of fieldwork and analysis, a written site evaluation report shall be prepared and submitted to the AHJ. The report shall include:

1. A summary of soil, slope, and groundwater findings;
2. Recommended system type and design daily flow;
3. Site plan and test-hole logs; and
4. Any design limitations or special conditions.

If any condition of this chapter cannot be met, the designer shall revise the system layout or propose an alternative system under the provisions of this standard.

Alternative systems shall comply with the requirements of Section 813 (Secondary Treatment) and the material provisions of Chapter 7 (Materials) to ensure equivalent protection of public health and the environment.

CHAPTER 6 INSPECTIONS

SECTION 601 GENERAL

601.1 General. Inspections shall be conducted to verify that the design, materials, and installation of an onsite wastewater system comply with this standard and the approved design documents.

Inspections shall be performed by the authority having jurisdiction (AHJ) or an authorized representative qualified to assess compliance.

Inspections shall be documented in writing and retained as part of the system documentation file.

601.2 Required inspections. Inspections shall be conducted at key stages of system construction and installation, including and not limited to:

1. Preconstruction – prior to system installation to verify site evaluation and layout.
2. Tank and Component Installation – to confirm correct placement, structural integrity, and watertightness.
3. Dispersal Area Construction – to verify dimensions, elevations, and materials.
4. Final Inspection – to confirm the completed system matches the approved design and that performance and safety provisions are met.

The AHJ retains the right to require additional inspections to verify corrective actions, repairs, or ongoing maintenance.

601.3 Testing and verification. Where testing is required, systems or components shall be tested for watertightness, hydraulic performance, or functional operation in accordance with recognized procedures or manufacturer's instructions.

Test results shall be recorded and included in the inspection record.
Failures identified during testing shall be corrected and retested prior to approval.

601.4 Recordkeeping and documentation. The inspection record shall include written observations, photographs, videos, and geospatial reference data (GPS) sufficient to verify the location, configuration, and compliance of the system.

Documentation shall be retained as part of the system documentation file required by Section 401.5. Records shall be stored in a secure, retrievable format and maintained by the AHJ or system owner in accordance with applicable retention policies.

Electronic records shall be accepted where they provide equal or improved reliability, traceability, and verification.

601.5 Nonconforming work. Where the AHJ determines that any portion of a system does not comply with this standard or the approved design, the installer or owner shall correct the deficiencies and request reinspection.

Work found to be nonconforming shall not be covered, concealed, or placed into service until approved.

601.6 Final approval and system commissioning. No system shall be placed into operation until the AHJ has verified compliance with this standard and issued formal approval.

601.6.1 Approval process. Final approval shall be based on satisfactory completion of required inspections, tests, and documentation.

601.6.2 Revocation of approval. The AHJ retains the right to revoke approval if it is determined that it was issued in error or that the system fails to comply with the provisions of this standard.

CHAPTER 7 MATERIALS

SECTION 701 GENERAL

701.1 General. Materials used in the construction, treatment, and dispersal components of an onsite wastewater system shall be durable, watertight where required, and capable of maintaining structural integrity and performance under expected service conditions.

Materials shall be free from defects and deterioration that would affect strength, corrosion resistance, watertightness, or functionality.

Materials shall be compatible with the type of wastewater, the surrounding soil, and the method of construction.

Materials shall be selected and installed to maintain performance under local environmental and climatic conditions, including temperature variation, soil movement, flooding, or other site-specific factors. Verification of material performance shall be confirmed through inspection and testing under Chapter 6 (Inspections).

701.2 Structural strength and integrity. Components subjected to earth or hydrostatic loads shall be capable of withstanding those loads without excessive deformation, cracking, or structural failure. Structural components such as tanks, vaults, or risers shall meet the design and test requirements of recognized standards.

701.3 Watertightness and corrosion resistance. Components required to be watertight shall be tested or certified to prevent the leakage of effluent or the intrusion of groundwater.
Materials and coatings shall resist corrosion, biological degradation, and chemical attack from wastewater, gases, or soils encountered under expected operating conditions.

701.4 Pipe, fittings, and joints. Pipes and fittings used for wastewater conveyance shall conform to recognized product standards and be suitable for the intended service.
Joints shall be watertight where required and resistant to infiltration and exfiltration.
Flexible joints shall be capable of accommodating minor settlement or soil movement without leakage.

701.5 Tanks and appurtenances. Septic tanks, pump chambers, and other watertight vessels shall be constructed of materials meeting recognized standards for structural strength, watertightness, and durability.
Tanks shall be designed to resist flotation, settlement, and uplift under site conditions.
Access openings shall be provided with secure, durable, and watertight covers to allow inspection, maintenance, and servicing.

701.6 Aggregate and filter media. Aggregate, sand, or other filter media used for treatment or dispersal shall be clean, durable, and of appropriate gradation and porosity to provide hydraulic capacity and aeration.

Media shall be free of fines, clay, or organic material that could reduce permeability.
Alternative media such as synthetic or recycled materials are acceptable where demonstrated to provide equivalent performance.

701.7 Liners, barriers, and geotextiles. Liners, barriers, and geotextiles shall be made of durable, stable materials that resist physical damage, ultraviolet degradation, and chemical attack.
Permeable fabrics used for filtration shall maintain porosity and prevent clogging under long-term loading conditions.

701.8 Material identification and certification. Products and components shall be identifiable by the manufacturer's name, trade designation, and applicable standard or certification mark.
Acceptance of alternative or proprietary materials shall be based on recognized testing protocols, third-party certification, or field performance data acceptable to the AHJ.

701.9 Reuse of materials. Previously used tanks, pipes, or fittings shall not be reused unless they meet applicable requirements of this standard and are verified by inspection to be structurally sound, watertight, and free from contamination.

Chapter 8 DESIGN AND CONSTRUCTION

SECTION 801 GENERAL REQUIREMENTS

801.1 Applicability. Onsite wastewater treatment systems covered under this Standard shall be designed, constructed, installed, modified, and repaired in accordance with the requirements set forth in this Chapter. These provisions apply to the system types, configurations, components, and associated site work described in this Chapter, unless otherwise specified.

801.2 Approval of deviations. The AHJ shall have the right to authorize deviations from specific prescriptive provisions of this Chapter where, in the judgment of the AHJ, such deviations are technically justified, provide an equivalent or greater level of public health and environmental protection, and do not compromise system performance, durability, or safety. Such approvals shall be documented and maintained in the system documentation record.

801.3 Use of alternative designs or methods. Where strict compliance with the requirements of this Chapter is impractical or impossible due to site constraints, soil conditions, or other substantiated factors, the AHJ shall have the authority to approve the use of alternative products, technologies, or design approaches.
Alternative solutions shall:

1. Demonstrate performance equivalent to or exceeding the intent of the applicable requirements of this Standard;
2. Be supported by acceptable engineering analysis, recognized testing, manufacturer documentation, or relevant performance data; and
3. Be installed in a manner consistent with manufacturer specifications and good engineering practice.

801.4 Professional competency. Design, installation, and construction activities governed by this Chapter shall be performed by individuals who are qualified, licensed, or otherwise authorized by the AHJ to perform such work. Where engineering design is required, it shall be completed by a licensed professional engineer competent in onsite wastewater treatment system design.

801.5 Coordination with manufacturers' instructions. Where this Chapter references or incorporates products with specific installation or performance requirements, such components shall be installed in accordance with the manufacturer's instructions unless otherwise approved by the AHJ. Manufacturer instructions shall not supersede the intent of this Chapter unless expressly authorized by the AHJ.

SECTION 802 SEPTIC AND HOLDING TANKS

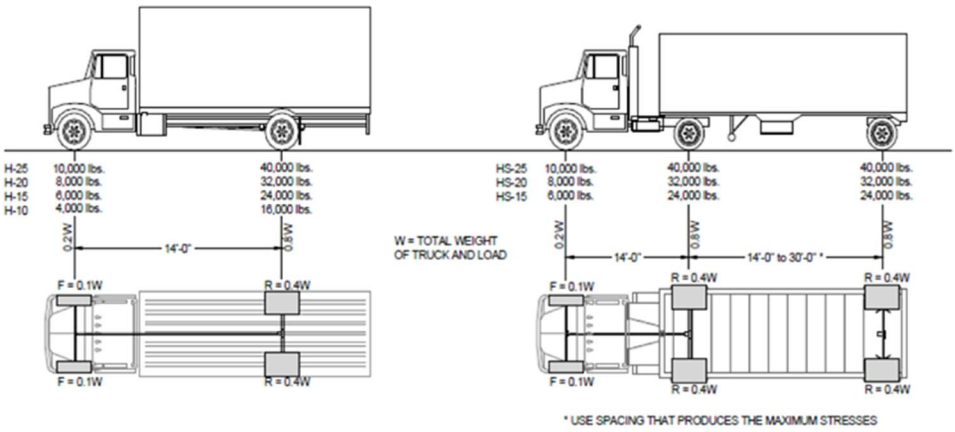
802.1 Scope. The provisions of this section shall govern the design, installation, repair, and maintenance of septic tanks, other treatment tanks, and holding tanks.

802.2 Overview. Septic tanks and other treatment tanks are key components of private sewage disposal systems as they must be properly sized to achieve the desired reduction of sewage to its basic

components of sludge and non-potable water. Section 802.4 covers design and installation of these tanks.

802.3 Design. The design of septic and holding tanks shall comply with the Sections 802.3.1 through 802.3.7.5.

802.3.1 Material. Septic tanks shall be fabricated or constructed of a coated welded steel, monolithic concrete, fiberglass, thermoplastic, or another material approved by the AHJ. Tanks shall be watertight and fabricated to constitute an individual structure and shall be designed and constructed to withstand the anticipated H10 or H20 loads as indicated in Figure 2 of AASHTO Standard Specifications for Highway Bridges.



Source: AASHTO Standard Specifications for Highway Bridges

Figure 2: AASHTO Highway Loads

Table 13: AASHTO Highway Loads Carried by Wheel Set

Load Type	H-10 lbs (kN)	H-15 or HS-15 lbs (kN)	H-20 or HS-20 lbs (kN)	H-25 or HS-25 lbs (kN)
W(1)	20,000 (89.0)	30,000 (133.4)	40,000 (178.0)	50,000 (222.4)
F(2)	2,000 (8.9)	3,000 (13.3)	4,000 (17.8)	5,000 (22.2)
R(2)	8,000 (35.6)	12,000 (53.4)	16,000 (71.2)	20,000 (89.0)
R_{axle}(3)	16,000 (71.1)	24,000 (106.7)	32,000 (142.3)	40,000 (177.9)

Notes:
1) W is defined as the total vehicle weight (see Figure 2)
2) F is defined as the front tire load and R is defined as the rear tire configuration load (see Figure 2)
3) R_{axle} represents the truck's rear axle load (see Figure 2)

802.3.2 Capacity and sizing. The capacity of a septic tank or other treatment tank shall be based on the number of persons using the building to be served or on the volume and type of waste, whichever is greater. The minimum liquid capacity shall be 3785 L (1000 gallons). Where the required capacity is to be provided by more than one tank, the minimum capacity of any tank shall be 3785 L (1000 gallons).

Table 802.3.2

MINIMUM SEPTIC TANK TOTAL CAPACITY FOR ONE- AND TWO-FAMILY DWELLINGS	
NUMBER OF BEDROOMS	MINIMUM TOTAL CAPACITY
1	3785 L (1000 GALLONS)

2	3785 L (1000 GALLONS)
3	3785 L (1000 GALLONS)
4	4731 L (1250 GALLONS)
5	5678 L (1500 GALLONS)
6	6624 L (1750 GALLONS)
7	7570 L (2000 GALLONS)
8	8517 L (2250 GALLONS)

802.3.3 Multiple tanks. The installation of more than four tanks in series is prohibited. Septic tanks shall have two compartments. The first compartment shall have not less than two-thirds or more than three-quarters of the total capacity of the tank, not less than 2521-2839 L (666-750 gallons) liquid capacity and not less than 914 mm (3 feet) wide and 1524 mm (5 feet) long. The secondary compartment of a septic tank shall not have less than a capacity of 946-1260 L (250-333 gallons) and not more than one-third or less than one-quarter of the total capacity. The secondary compartment of septic tanks having a total capacity of more than 5678 L (1,500 gallons) shall not be less than 1524 mm (5 feet) long. The liquid depth shall be not less than 762 mm (30 inches) and a maximum average of 1829 mm (6 feet). The total depth shall be not less than 203 mm (8 inches) greater than liquid depth. Rectangular tanks shall be constructed with the longest dimensions parallel to the direction of flow. Cylindrical tanks shall be not less than 1219mm (48 inches) in diameter.

802.3.4 Inlets and outlets. Inlets and outlets on septic and holding tanks shall comply with the Sections 802.3.4.1 through 802.3.4.3.

802.3.4.1 Open-end sanitary tees or baffle. The inlet and outlet on tanks or tank compartments shall be provided with open-end sanitary tees or baffle made of approved materials constructed to distribute flow and retain scum in the tank or compartments. The tees or baffles shall extend not less than 152 mm (6 inches) above the liquid level, not less than 229 mm (9 inches) below the liquid level, and not greater than one-third the liquid depth below the liquid level.

802.3.4.2 Clearances. There shall be not less than 51 mm (2 inches) of clear space provided above the top of the baffles or tees. The bottom of the outlet opening shall be not less than 51 mm (2 inches) below the bottom of the inlet.

802.3.4.3 Effluent filter. To enhance the quality of the effluent leaving the septic tank, an effluent filter certified and listed to NSF/ANSI 46 must be installed in the outlet tee of the furthest downstream septic tank.

802.3.5 Access openings. The access openings of septic and holding tanks shall comply with the Sections 802.3.5 through 802.3.5.3.

802.3.5.1 Sizing Each Compartment of a tank shall be provided with a minimum of one access opening located over the inlet or outlet opening and such opening shall be not less than 508 mm (20 inches) Square or 508 mm (20 inches) in diameter.

802.3.5.2 Inlet compartment. Where the inlet compartment of a septic tank exceeds 3658 mm (12 feet) in length, an additional access opening shall be provided over the baffle wall.

802.3.5.3 Access opening terminations. Access openings shall terminate not less than 305 mm (12 inches) below the ground surface. Access opening risers shall be used to bring the access termination point to ground level and shall be provided with a fitted, water-tight cover capable of withstanding anticipated loads. Access opening riser covers shall have an approved locking device with a secondary safety component (such as a star cover).

802.3.6 Installation. The installation of septic and holding tanks shall comply with the Sections 802.3.6 through 802.3.6.5.

802.3.6.1 Distance of location. Septic and other treatment tanks shall be located at a horizontal distance not less than specified in Table 802.3.6.1 between various elements.

TABLE 802.3.6.1

MINIMUM HORIZONTAL SEPARATION DISTANCES FOR TREATMENT TANKS

ELEMENT	DISTANCE m (feet)
Buildings, foundations, swimming pools, and other structures	3 m (10 ft)
Property or lot lines	1.5 m (5 ft)
Cisterns	7.5 m (25 ft)
Potable water service lines	1.5 m (5 ft)
Private potable water well or spring	15 m (50 ft)
Public water well	30 m (100 ft)
Surface water body (includes lakes, ponds, reservoirs, streams, and watercourses)	7.5 m (25 ft)
Swales and drainage ditches	4.5 m (15 ft)

802.3.6.2 Ground water install. Tanks installed in ground water shall be securely anchored in accordance with the tank manufacturer's recommendation and AHJ requirements.

802.3.6.3 Filter fabric. To prevent migration of in situ soils into the bedding and backfill material, a non-woven filter fabric must be installed to act as a barrier.

802.3.6.4 Bedding material. A 76mm (3 inch) compacted bedding shall be provided for septic and other treatment tank installations. The bedding material shall be sand, gravel,

granite, lime rock, crushed stone, or other noncorrosive materials of such size that the material passes through a 12.7 mm (0.5-inch) screen.

802.3.6.5 Backfill material specification. The backfill material for steel and fiberglass tanks shall be specified for bedding and shall be tamped into place without causing damage to the coating. The backfill for concrete tanks shall be soil material, which shall pass a screen and be tamped into place.

Typical backfill materials are crushed stone, gravel, and sand compacted to specified proctor density. Backfill should be specified regardless of what material the tank is made of and must be in accordance with the tank manufacturer recommendations and AHJ requirements.

802.3.7 Dosing or pumping chambers. The dosing or pumping chambers of septic and holding tanks shall comply with the Sections 802.3.7 through 802.3.7.5.

802.3.7.1 Design. Dosing or pumping chambers shall be fabricated or constructed of a coated welded steel, monolithic concrete, fiberglass, thermoplastic, or another material approved by Authority Having Jurisdiction (AHJ). Access opening riser terminations for dosing or pumping chambers shall terminate not less than 102mm (4 inches) above the ground surface. Dosing or pumping chambers shall be watertight, and materials and construction specifications shall meet the same criteria specified for septic tanks in this chapter.

802.3.7.2 Capacity and sizing. The working capacity of the dosing or pumping chamber shall be sized to permit automatic discharge of the total daily sewage flow with discharge occurring not more than four times per 24 hours.

802.3.7.3 Dosing chamber capacity. The minimum capacity of a dosing chamber shall be 1893 L (500 gallons) and a space shall be provided between the bottom of the pump and floor of the dosing or pumping chamber. A dosing chamber shall have a 1-day holding capacity located above the high-water alarm for one- and two-family dwellings based on 379 L (100 gallons) per day per bedroom. Minimum pump chamber sizes are indicated for one- and two-family in Table 802.3.7.3.

TABLE 802.3.7.3

PUMP CHAMBER SIZES

NUMBER OF BEDROOMS	MINIMUM PUMPING CHAMBER SIZE L (gallons)
1	1,893 (500)
2	1,893 (500)
3	2,839 (750)
4	2,839 (750)

5	3,785 (1,000)

802.3.7.4 Siphons and pumps. Where the total developed length of distribution exceeds 305 m (1,000 feet), the dosing or pumping chamber shall have two siphons or pumps dosing alternately and serving one-half of the soil absorption system.

802.3.7.5 Flow distribution valve. Alternatively, a flow distribution valve that splits the septic field into four zones is acceptable to be used thus providing more absorption time for each zone which enhances the septic field performance.

802.4 Other treatment tanks. The design of other treatment tanks shall be approved on an individual basis by the AHJ. The capacity, sizing, and installation of the tank shall be in accordance with this section except as otherwise approved by the AHJ. Where a treatment tank is preceded by a conventional septic tank, credit shall be given for the capacity of the septic tank.
Note: For Treatment tanks providing secondary treatment see Section 813. For treatment tanks treating wastewater for non-potable water reuse, see Section 815.

802.5 Holding Tanks. Holding tanks shall comply with the Sections 802.5.1 through 802.5.9.

802.5.1 Approval. The installation of a waste holding tank shall not be approved where the site can accommodate the installation of any other *private sewage disposal system* specified in this standard. A pumping and maintenance schedule for each holding tank installation shall be submitted to the AHJ. Pumping and maintenance logs shall be available for review by the AHJ.

802.5.2 Sizing. The minimum liquid capacity of a holding tank for one- and two-family dwellings shall be in accordance with Table 802.5.2. If more than one holding tank is required, they shall be installed in parallel.

Table 802.5.2
MINIMUM LIQUID CAPACITY OF HOLDING TANKS

NUMBER OF BEDROOMS	TANK CAPACITY L (gallons)
1	7,571 (2,000)
2	7,571 (2,000)
3	7,571 (2,000)
4	9,464 (2,500)
5	11,356 (3,000)
6	13,249 (3,500)
7	15,142 (4,000)
8	17,034 (4,500)

802.5.3 Design. Holding tanks shall comply with Section 802.4, unless otherwise stated in Section 802.5.

802.5.4 Construction. Holding tanks shall be constructed of a coated welded steel, coated monolithic concrete, glass-fiber-reinforced polyester, thermal plastic or other approved materials.

802.5.5 Installation. Tanks shall be located in accordance with Section, except the tanks shall be not less than 6096 mm (20 feet) from any part of a building. Holding tanks shall be located so the servicing access opening is located not less than 3048 mm (10 feet) from an all-weather access road or drive.

802.5.6 Warning device. A high-water warning device shall be installed to activate 305 mm (1 foot) below the inlet pipe. This device shall be either an audible or an approved illuminated alarm. The electrical junction box, including warning equipment junctions, shall be located outside the holding tank or housed in waterproof, explosionproof enclosures. Electrical relays or controls shall be located outside the holding tank.

802.5.7 Access openings. Each tank shall be provided with either an access opening not less than 508 mm (20 inches) square or with a manhole having a 508 mm (20 inch) inside diameter extending not less than 102 mm (4 inches) above ground. Finished grade shall be sloped away from the access opening cover to divert surface water from the access opening cover. Each access opening riser cover shall have an effective locking device and a secondary safety locking mechanism (safety star).

802.5.8 Septic tank. The outlet shall be sealed where an approved septic tank is installed to serve as a holding tank. Removal of the inlet and outlet tee shall not be prohibited.

802.5.9 Vent. Each tank shall be provided with a vent not less than 51 mm (2 inches) in diameter and shall extend not less than 305 mm (12 inches) above finished grade, terminating with a return bend fitting or approved vent cap.

SECTION 803 CONVENTIONAL SOIL ABSORPTION SYSTEM (ONE AND TWO FAMILY DWELLINGS)

803.1 General requirements. Effluent from septic tanks and other approved treatment tanks shall be disposed of by soil absorption or other methods described in this standard.

803.1.1 Applicability, volume limitations. Soil absorption fields shall have a daily effluent application of 18,925 L (5,000 gallons) or less.

803.1.2 Multiple soil absorption fields required. Multiple soil absorption fields of equal size shall be required for systems receiving wastewater flows exceeding 18,925 L (5,000 gallons) per day.

803.1.2.1 Equal distribution. A means of alternating wastewater application shall be provided that ensures equal distribution to each soil absorption field in a multi-field system. A distribution box, pump tank with indexing valve, or other approved means by AHJ are acceptable.

803.1.2.2 Classification. A multi-soil absorption field system shall be considered as one OWTS for the purposes of compliance with other Chapters and Sections of this Standard.

803.1.3 Engineer required. A professional engineer shall be consulted for system designs with effluent exceeding 37,855 L (10,000 gallons) per day.

803.2 Method of discharge. Flow from the septic or treatment tank to the soil absorption field shall be by gravity or pumping for facilities with a daily effluent application of 5,678 L (1,500 gallons) per day or less.

803.2.1 Pressure discharge required. Tank effluent exceeding 5,678 L (1,500 gallons) per day shall be discharged by pumping to a pressure distribution system. See Section 805 on pressure distribution systems for design guidance.

803.3 Soil absorption field sizing. The minimum size of the absorption system shall be calculated using the equation:

Soil Absorption Field Size (ft^2,m^2) = SDDF / SLR
SDDF = System Design Daily Flow (gpd,Lpd). See Section 803.3.1
SLR = Hydraulic Soil Loading Rate (gpd/ft^2, Lpd/m^2). See Section 803.3.2

803.3.1 System design daily flow (SDDF) criteria. The SDDF shall be calculated by using Table 803.3.1.1 This table provides methods to estimate daily sewage flow for one- or two-family residences based on home size, bedroom count, or number of occupants. All three daily flow estimates shall be calculated. To ensure system adequacy, the **most conservative (highest)** of the three estimates shall be selected as the SDDF.

803.3.1.1 SDDF reductions. For systems utilizing water reuse (wastewater or graywater), it is permissible to reduce the SDDF by the daily amount of reclaimed water. Consideration shall be given to whether the system will always be in operation, and whether a SDDF based on the dispersal of 100% of the wastewater generated is appropriate.

TABLE 803.3.1.1
System Design Daily Flow

Building (Square Ft.)	Estimated Flow (GPD)	Bedrooms	Estimated Flow (GPD)	Estimated Occupancy	Estimated Flow (GPD)
Less than or equal to 750	100	1	120	2	120
751 – 1200	200	2	240	4	240
1201-2250	300	3	360	6	360
2251 – 3,300	400	4	480	8	480
Each additional 750 sq ft	+100	Each additional bedroom	+120	Per occupant	+60

*Based upon US water use

Example: For a 3,000 sq ft, 5-bedroom home serving 9 people, calculate the flow for each method and choose the highest.

Method 1 (Using Sq Ft. of Building): 3,000 sq. ft = 400 GPD

Method 2 (Number of Bedrooms): 5 bedrooms = 600 GPD

Method 3 (Estimated Occupancy): 9 people = 540 GPD

Result: Use 600 GPD of SDDF (highest volume estimate)

803.3.2 Hydraulic soil loading rate (SLR) determination. For site evaluations using a soil analysis that includes soil texture and structure, the SLR in Table 803.3.2 corresponding to the soil texture and structure of the infiltrative soil layer shall be used.

For site evaluations using a percolation test, the SLR in Table 803.3.2 that corresponds to the soil texture and percolation rate of the infiltrative soil layer shall be used.

TABLE 803.3.2
Hydraulic Soil Loading Rate (SLR)

SOIL CHARACTERISTICS			PERCOLATION RATE (Min/inch)	HYDRAULIC SOIL LOADING RATE (gpd/ft^2)
TEXTURE	STRUCTURE			
	SHAPE	GRADE		BOD > 30 mg/L[1]
Coarse sand, Sand, Loamy coarse sand, Loamy sand	Single grain	Structureless	0-15	0.8
Fine sand, Very fine sand, Loamy fine sand, Loamy very fine sand	Single grain	Structureless	31-45	0.4
Coarse sandy loam, Sandy loam	Massive	Structureless	46-60	0.2
	Platy	Weak	46-60	0.2
		Moderate, Strong	> 60	U[2]
	Prismatic, Blocky, Granular	Weak	31-45	0.4
		Moderate, Strong	16-30	0.6
Fine sandy loam, Very fine sandy loam	Massive	Structureless	46-60	0.2
	Platy	Weak, Mod., Strong	> 60	U[2]
	Prismatic, Blocky, Granular	Weak	46-60	0.2
		Moderate Strong	31-45	0.4

Loam	Massive	Structureless	46-60	0.2
	Platy	Weak, Mod., Strong	> 60	U[2]
	Prismatic, Blocky, Granular	Weak	31-45	0.4
		Moderate, Strong	16-30	0.6
Silt Loam	Massive	Structureless	46-60	U[2]
	Platy	Weak, Mod., Strong	> 60	U[2]
	Prismatic, Blocky, Granular	Weak	31-45	0.4
		Moderate, Strong	16-30	0.6
Sandy clay loam, Clay loam, Silty clay loam	Massive	Structureless	> 60	U[2]
	Platy	Weak, Mod., Strong	> 60	U[2]
	Prismatic, Blocky, Granular	Weak	46-60	0.2
		Moderate, Strong	31-45	0.4
Sandy clay, Clay, Silty clay	Massive	Structureless	> 60	U[2]
	Platy	Weak, Mod., Strong	> 60	U[2]
	Prismatic, Blocky, Granular	Weak	> 60	U[2]
		Moderate, Strong	46-60	0.2

Table modified from source (Tyler, 2001)

1. Loading rate to be used for sizing disposal systems without validated secondary treatment. See Section 813 for sizing soil absorption fields with validated advanced treatment.
2. A "U" in the table represents soil conditions that are unsuitable for onsite disposal under this standard. Possible alternatives include consulting a licensed engineer for disposal system design or utilization of a holding tank.

Note: NRCS soil limitation ratings for "Septic Tank Absorption Fields" may be used as a screening reference when evaluating site suitability. In general, soils rated as *slightly limited* or *not limited* typically correspond to higher hydraulic soil loading rates shown in this table. Soils rated as *moderately limited* generally correspond to reduced loading rates or may require pressure distribution. Soils rated as *severely limited* typically require engineered systems such as mounds or other advanced designs. Final hydraulic soil loading rates shall be determined in accordance with the soil texture, structure, percolation rate, and design criteria specified in this section.

803.3.3 Maximum length. Soil absorption systems (field or trench) shall be designed to be as long as site conditions allow, while not exceeding 30.5 m (100 feet) in length.

803.4 Installation of conventional soil absorption field systems. Installations shall comply with this section.

803.4.1 Installation limitations. Environmental conditions shall limit installations according to the requirements of this section.

803.4.1.1 Precipitation prior to excavation. Soil absorption systems shall not be installed during periods of adverse weather conditions unless approved by the AHJ. *Seepage trench or bed* excavation shall not commence when the moisture content of the soil at the infiltrative surface exceeds the plastic limit when tested in accordance with ASTM D4318.
803.4.1.2 Precipitation after excavation. Where rain or snow falls on an open excavation, the soil shall be left until it is confirmed as not exceeding its plastic limit, in accordance with ASTM D4318.
803.4.1.2.1 Post-precipitation remediation. After the soil has been evaluated to be compliant with Section 803.4.1.2, the bottom area shall then be scarified and loose material removed.
803.4.1.3 Frozen Ground. A soil absorption system shall not be installed into a soil layer that is frozen.
803.4.1.4 Snow-covered ground. Snow cover shall be removed from the soil absorption area before excavation begins. Snow shall not be placed in a manner that will cause water to pond on the soil absorption system area during snow melt.
803.4.1.5 Backfill. Excavated soil to be used as backfill shall be protected from freezing. Excavated soil that freezes solid shall not be used as backfill. The first 305 mm (12 inches) of backfill shall be loose, unfrozen soil.
803.4.1.6 Compliance verification. Inspection of systems installed during winter conditions shall include inspection of the trench or bed excavation prior to the placement of gravel and inspection of backfill material at the time of placement.

803.4.2 Excavation, filling, and construction. Excavation, filling, and construction shall comply with this section.

803.4.2.1 Excavation depth. The seepage trench or bed area shall be excavated down to the infiltrative soil layer approved during the soil evaluation
803.4.2.2 Excavation surfaces. The bottom of a trench or bed excavation shall be level. Soil infiltrative surfaces in the sidewalls or bottom of *seepage trench* or seepage *bed* excavations shall be scarified or have the surface roughened.
803.4.2.3 Sand fill. In areas where the approved infiltrative soil layer is encountered deeper than 457 mm (1.5 feet) below natural existing grade, excavations shall be filled with material that conforms to the requirements of Section 804.5, up to a depth of not less than 457 mm (1.5 feet) below natural existing grade, while maintaining the required vertical separation from the seasonal high-water table. Where filling to an elevation above natural existing grade is required, a mound system design (Section 804) shall be considered.

803.4.2.4 Seepage trench excavations. Seepage trench excavations shall comply with this section.

803.4.2.4.1 Seepage trench absorption area. The soil absorption area of a *seepage trench* shall be calculated by using only the bottom of the trench area only. The bottom excavation

area of the distribution header and trench sidewall areas shall not be included in absorption area calculations.

803.4.2.4.2 Width, length, and spacing. *Seepage trench* excavations shall be 30.5 cm to 91.4 cm (1 foot to 3 feet) wide and spaced not less than 1.8 m (6 feet) apart on center. *Seepage trench* excavations shall be a maximum length of 30.5 m (100 feet).

803.4.2.4.3 Slope installations. Where installed in areas of sloping natural soil, seepage trenches shall be installed along land contours.

803.4.2.5 Seepage bed excavations. Seepage bed excavations shall comply with this section.

803.4.2.5.1 Seepage bed absorption area. The absorption area of a *seepage bed* shall be calculated by using the bottom of the excavated area only. Side wall surfaces shall not be included in absorption area calculations.

803.4.2.5.2 Width, length, and spacing. *Seepage bed* excavations shall be a minimum of 1.5 m (5 feet) wide, and a maximum of 30.5 m (100 ft) in length. Seepage beds shall have at least 3.1 m (10 ft) of horizontal separation between them when more than one is installed.

803.4.2.6 Aggregate. Aggregate shall range in size from 12.7 mm to 64 mm ($^{1}/_{2}$ inch to $2^{1}/_{2}$). Aggregate shall be washed and contain a maximum of 0.5% fines/silt. Not less than 152 mm (6 inches) of aggregate shall be laid into the trench or bed below the distribution pipe elevation. The aggregate shall be evenly distributed not less than 51 mm (2 inches) over the top of the distribution pipe.

803.4.2.6.1 Aggregate cover. The aggregate shall be covered with synthetic materials designed for use on OWTS and approved by the AHJ, or 229 mm (9 inches) of uncompacted marsh hay or straw.

803.4.2.7 Distribution piping. System piping shall conform to the requirements listed in this section.

803.4.2.7.1 Pipe to septic tank. Piping from the residence to the septic tank shall be at least 102 mm (3 inches) in diameter and shall be the same size as the building drain. Slope of the pipe to the septic tank shall be not less than .32 cm per 30.5 cm (1/8 inch per foot) of pipe (2%).

803.4.2.7.2 Pipe from septic tank to soil absorption field. Piping shall be connected from the septic tank to a distribution box or directly to a soil absorption field *manifold* at a point or points that promote even distribution of effluent. Distribution of effluent to *seepage trenches* on sloping sites shall be accomplished by using a drop box design or other approved methods.

803.4.2.7.3 Soil absorption field piping. Soil absorption field piping for gravity systems shall be not less than 102 mm (4 inches) in diameter.

803.4.2.7.3.1 Distribution manifold. Effluent shall be delivered to the absorption field distribution pipes by a distribution manifold. The distribution manifold (PVC) shall be solid-wall pipe. The distribution manifold (PVC) shall be level.

803.4.2.7.3.2 Soil absorption field distribution pipe. Soil absorption field distribution pipe shall have perforations at 120 degrees and 240 degrees of top dead center

803.4.2.7.3.3 Elevation and slope. The top of the absorption field distribution pipe shall be not less than 20.3 cm (8 inches) below the original surface in continuous straight or curved lines. The slope of the soil absorption field distribution pipes shall be a minimum

of 5.1 cm (2 inches) per 30.5 m (100 feet). The slope of the soil absorption field distribution pipes shall be a maximum of 10.2 cm (4 inches) per 30.5m (100 feet).

803.4.2.7.3.4 Number and Spacing. Seepage beds shall a minimum of 2 soil absorption field distribution pipes. Soil absorption field distribution pipe in a *seepage bed* shall be uniformly spaced at a minimum of 914 mm (3 feet) apart, and a maximum of 1524 mm (5 feet) apart. Soil absorption field distribution pipe in a seepage bed shall be placed a minimum of 305 mm (1 foot) and a maximum of 914 mm (3 feet) away from sidewalls or headwall. Soil absorption field distribution pipe in a *seepage trench* shall be centered in the trench.

803.4.2.8 Observation pipes. Observation pipes shall be provided to monitor all absorption field distribution pipes. For a seepage trench system, an observation pipe shall be installed for each distribution pipeline. For a seepage bed system, not more than four distribution pipelines that are connected by a common manifold pipe shall be served by one common observation pipe

803.4.2.8.1 Design. Observation pipes shall be not less than 102 mm (4 inches) in diameter. The bottom 305 mm (12 inches) of the observation pipe shall be perforated.

803.4.2.8.2 Installation. Observation pipes shall extend to the bottom of the soil absorption field aggregate layer and shall terminate at least 254 mm (10 inches) above final grade with a vented cap. Observation pipes shall be at least 7620 mm (25 feet) from any window, door or air intake of any building used for human occupancy.

Exception: Where approved and where the location of the observation pipe is permanently recorded, the observation pipe shall be allowed to be lower than 254 mm (10 inches) above final grade and not be deeper than 51 mm (2 inches) below the finished grade.

803.4.2.9 Backfill and final grading. Backfill and final grading shall comply with this section.

803.4.2.9.1 Cover layer thickness. A minimum of 254 mm (10 inches) and a maximum of 457 mm (18 inches) of backfill material shall be provided above the soil absorption field aggregate covering.

803.4.2.9.2 Grading and stabilization. Backfill shall be shaped to shed rainfall and shall be stabilized to prevent erosion through planting of vegetation or other suitable means.

803.4.2.9.3 Final cover materials. The materials used to cover a soil absorption system shall comply with this section.

803.4.2.9.3.1 Permeability. Soil absorption systems shall not be covered or paved over by material that inhibits air transfer or evaporation.

803.4.2.9.3.2Particle size. Particle size of backfill material shall be at least 250 µm in diameter

803.5 Seepage pits, use limitation. Due to the inferior treatment achieved by *seepage pits* resulting in increased risks to receiving soil, groundwater and potentially drinking water, seepage pits shall only be installed where other conventional systems or holding tanks described in this Standard are physically or economically unfeasible or impractical.

803.5.1 Design. Seepage pits shall consist of a chamber that is walled-up with material such as perforated precast concrete rings, concrete blocks, bricks or other approved materials, allowing effluent to percolate into the surrounding soil. The pit bottom shall be left open to the soil. A *seepage pit* shall have an inside diameter of not less than 1524 mm (5 feet)

803.5.2 Sizing. Minimum effective absorption area required shall be calculated using the criteria in Section 803.3, with the superseding requirement that a fixed soil loading rate of 0.6 gpd/ft^2 must be

used in the calculation. The effective area of a *seepage pit* shall be the total area of the walled-chamber, starting below the inlet and extending to the bottom of the chamber, that is in contact with soil strata that have soil loading rates of 0.6 gpd/ft^2 or higher. Table 803.5.2, or an approved method, shall be used for determining the effective sidewall area of circular *seepage pits*.

TABLE 803.5.2
EFFECTIVE ABSORPTION AREA FOR A SEEPAGE PIT

SEEPAGE PIT DIAMETER BELOW INLET ft (m)		CUMULATIVE DEPTH OF SOIL STRATA BELOW INLET THAT HAS SLR ≥ 0.6 gpd/ft^2 ft (m)					
		3	4	5	6	7	8
		EFFECTIVE ABSORPTION AREA FOR A SEEPAGE PIT ft^2 (m^2)					
Total[1]	Interior						
7	5	47	88	110	132	154	176
8	6	75	101	126	151	176	201
9	7	85	113	142	170	198	226
10	8	94	126	157	188	220	251
11	9	104	138	173	208	242	277
13	11	123	163	204	245	286	327

1. Total pit diameter includes interior, plus filled annular space and chamber wall.

803.5.3 Seepage pit excavation. Excavation and scarifying of soil infiltrative surfaces shall be in accordance with Section 803.4.2.2.
803.5.4 Seepage pit aggregate. Aggregate of 12.7 mm to 64 mm ($^1/_2$ inch to 2$^1/_2$ inches) in size shall be placed into a 152 mm (6-inch) minimum annular space separating the outside wall of the chamber and sidewall excavation.
803.5.4 Seepage pit access and venting. Each *seepage pit* shall be provided with a 610 mm (24-inch) manhole extending to the ground surface and comply with Section 802.4.5.3. A 102 mm (4-inch) diameter fresh air inlet with a screen shall also be provided.
803.5.6 Separation between pits. *Seepage pits* shall be located not less than 1524 mm (5 feet) apart.

SECTION 804 MOUND SYSTEMS.

804.1 General comments. Mound systems are soil treatment and dispersal systems constructed above natural grade to provide adequate vertical separation between the infiltrative surface and limiting site conditions such as groundwater, bedrock, or restrictive soil layers. Mound systems rely on both the treatment capacity of the native soil and the proper construction of the fill and interface layers to achieve effective wastewater treatment.

The performance of mound systems depends on appropriate site selection, conservative loading, uniform distribution, and strict construction controls. Poor construction practices, inadequate stabilization, or disturbance of the soil interface can significantly impair system function regardless of design calculations.

804.1.1 Purpose. The purpose of Section 804 is to establish minimum requirements for the design, construction, stabilization, inspection, and approval of mound systems serving residential wastewater. These provisions are intended to protect public health and water resources by ensuring that mound systems provide wastewater treatment and dispersal where conventional subsurface systems are not feasible.

804.1.2 General requirements. The provisions of Section 804 shall govern the design, construction, and installation of mound systems used for the treatment and dispersal of residential wastewater. Mound systems shall be used where site conditions do not allow installation of conventional subsurface soil treatment and dispersal systems while still providing effective wastewater treatment and protection of public health and water resources.

Mound systems shall be designed and constructed to prevent surface discharge, nuisance conditions, and direct exposure to untreated or partially treated wastewater.

Acceptable mound system designs include either lift-dosing to a gravity distribution network within the mound or pressure distribution within the mound using low-pressure distribution principles. Where pressure distribution is used, the design and installation of the distribution system shall comply with the applicable provisions of Chapter 7 (Materials).

804.2 Site suitability and limitations. Mound systems shall be installed only on sites where limiting conditions prevent the use of conventional subsurface soil treatment and dispersal systems, and where sufficient area exists to construct and protect a mound system in accordance with Section 804.

804.2.1 Limiting conditions. Mound systems shall be used where one or more of the following conditions are present: high groundwater, shallow bedrock, restrictive soil layers, slowly permeable soils, or other site conditions that do not provide the minimum vertical separation required for conventional subsurface systems. The limiting condition shall be identified through site and soil evaluation conducted in accordance with the applicable provisions of this standard.

804.2.2 Native soil suitability beneath the mound. The native soil beneath the mound basal area shall be suitable to receive and treat wastewater. Prior to placement of fill material, vegetation and surface organic debris shall be removed from the mound footprint. The soil surface shall be scarified or roughened to prevent formation of an impervious interface between the fill and native soil. Removal of topsoil shall be required where the surface horizon contains excessive organic material or is otherwise unsuitable for treatment.

The exposed native soil surface shall be scarified or roughened to prevent the formation of a restrictive or impervious interface between the fill material and the native soil. Smearing, compaction, or sealing of the native soil surface shall be prohibited.

The native soil beneath the mound basal area shall have sufficient permeability and structure to allow infiltration and treatment. Soils that are severely limiting due to permeability, structure, or

saturation and that cannot support treatment shall not be used as the receiving soil beneath the mound. The most restrictive soil condition within the basal area shall govern mound design.

804.2.3 Vertical separation. The vertical separation between the infiltrative surface at the base of the mound and the limiting condition shall meet or exceed the minimum separation required by this standard. The required separation shall be maintained after accounting for excavation, scarification, fill placement, and natural settling of the mound.

804.2.4 Slope limitations. Mound systems shall be constructed on sites with slopes that allow stable placement of fill material and protection of the soil treatment interface. Mound systems shall not be installed on slopes exceeding the maximum slope permitted by Section 804. Mounds shall be oriented parallel to site contours to the maximum extent practicable to minimize hydraulic loading downslope.

804.2.5 Flooding and surface water. Mound systems shall not be installed in areas subject to frequent flooding, ponding, or inundation unless adequate measures are provided to prevent saturation of the mound, erosion of side slopes, and exposure of wastewater. Surface drainage shall be directed away from the mound to prevent runoff from entering the system or flowing off-site.

804.2.6 Construction moisture limitations. Mound systems shall not be constructed where native soils beneath the basal area are excessively wet, frozen, or above the plastic limit. Construction shall not proceed under conditions that could cause smearing, compaction, or sealing of the native soil surface. Soil moisture conditions shall be evaluated prior to construction using an approved field method.

804.2.7 Area protection. The area designated for mound construction shall be protected from vehicular traffic, stockpiling of materials, and other disturbances prior to and during construction. Disturbance of the basal area outside the approved construction sequence shall be prohibited.

804.2.8 Setbacks. Mound systems shall comply with the setback requirements established by this standard. Setbacks shall be measured from the outer edge of the mound, including the shoulder and side slopes.

804.3 Design basis and loading rates. Mound systems shall be designed to provide effective soil treatment and dispersal by applying wastewater uniformly to the native soil beneath the mound at a rate that does not exceed the long-term treatment and hydraulic capacity of the receiving soil.

804.3.1 Design basis. The design of a mound system shall be based on the design wastewater flow, soil evaluation, and site characterization completed in accordance with the applicable provisions of this standard. Mound design shall assume that the native soil beneath the basal area provides the primary treatment function and shall be sized conservatively to account for variability in soil conditions and construction tolerances.

804.3.2 Governing soil condition. The most restrictive soil condition present within the mound basal area shall govern the selection of the design loading rate. Where soil conditions vary across the basal area, the lowest allowable loading rate shall be used for design.

804.3.3 Design loading rate. The design loading rate for a mound system shall be selected based on the treatment capacity of the native soil beneath the mound and shall not exceed the maximum loading rate permitted for mound systems by this standard. Loading rates used for mound systems shall be equal to or more conservative than those permitted for conventional subsurface soil treatment and dispersal systems receiving similar wastewater strength.

804.3.4 Basal area determination. The minimum required basal area shall be determined by dividing the design wastewater flow by the selected design loading rate. The basal area shall be measured at the interface between the fill material and the native soil and shall not include side slopes or shoulder areas.

804.3.5 Allowance for long-term performance. Mound systems shall be designed with consideration for long-term performance, including biomat development at the soil interface, seasonal water table fluctuation, and reduced infiltration capacity over time. Loading rates shall not be increased to compensate for reduced basal area or site constraints.

804.3.6 Use of fill material. Fill material above the native soil shall not be used to justify loading rates that exceed the long-term acceptance capacity of the receiving native soil. Where dual loading rate methodologies are used, both the loading rate to the fill material and the loading rate to the native soil shall be evaluated, and the more restrictive condition shall govern mound design.

804.3.7 Multiple mounds and phased loading. Where design wastewater flow exceeds the practical capacity of a single mound, it shall be acceptable to use multiple mound systems. Each mound shall be designed as an independent system meeting the requirements of Section 804. Alternating or phased loading shall not be used to increase allowable loading rates beyond those permitted for a single mound.

804.3.8 Replacement area. A designated replacement area shall be provided for each mound system. The replacement area shall be sized to accommodate a new mound system meeting the requirements of this chapter and shall meet the same site suitability, setback, and separation requirements as the initial mound system. The replacement area shall be protected from disturbance and shall be shown on the site plan.

Where a mound system is installed on a sloping site, a vegetated protection area shall be maintained downgradient of the mound to preserve infiltration capacity, prevent erosion, and protect the receiving soil from disturbance.

804.4 Basal area and mound geometry. Basal area and mound geometry shall comply with Sections 804.4.1 through 802.4.4.7.

804.4.1 Basal area configuration. The basal area of a mound system shall be configured to provide uniform application of wastewater to the native soil beneath the mound. The basal area shall be rectangular or elongated in shape and oriented parallel to site contours to the maximum extent practicable. The basal area shall be centered beneath the distribution network and shall extend beyond the outermost distribution pipes as required by Section 804.

804.4.2 Basal area width and length. The minimum basal area width shall be sufficient to accommodate the distribution network, aggregate, and required shoulder widths on both sides of the mound. The basal area length shall be determined based on the required absorption area and the selected basal area width. Narrow basal areas shall not be used where they would result in excessive mound height or unstable side slopes.

804.4.3 Shoulder requirements. A shoulder area shall be provided around the entire basal area to support mound stability and protect the soil treatment interface. The minimum horizontal separation between the edge of the basal area and the toe of the side slope shall be not less than 1.2 m (4 ft). Where site slopes exceed 2 percent, the shoulder width on the downslope side shall be increased by not less than 100 mm (4 in.) for each additional 1 percent of slope.

804.4.4 Mound height. The height of the mound shall be sufficient to provide the minimum required vertical separation between the infiltrative surface and the limiting soil condition identified during site evaluation. Required separation shall be measured after scarification, fill placement, and allowance for natural settling of the mound.

The total vertical distance from the bottom of the distribution system to the finished ground surface shall not exceed 760 mm (30 in.) after accounting for natural settling of fill material, unless otherwise approved based on site-specific stability analysis.

804.4.5 Side slope geometry. Side slopes shall be designed to maintain long-term stability and resist erosion.

1. Where mound height does not exceed 915 mm (36 in.), side slopes shall not be steeper than 4 horizontal to 1 vertical (4:1).
2. Where mound height exceeds 915 mm (36 in.), side slopes shall not be steeper than 3 horizontal to 1 vertical (3:1).

Steeper slopes shall not be permitted unless a retaining structure designed by a qualified professional is provided.

804.4.6 Interface protection. The basal interface between the fill material and the native soil shall remain undisturbed during mound construction. Equipment shall not traverse the basal area after scarification. Fill placement shall proceed in a manner that preserves the integrity and permeability of the native soil surface.

804.4.7 Relationship to distribution method. Basal area dimensions and mound geometry shall be compatible with the selected distribution method. Where pressure distribution is used, the mound geometry shall allow uniform pressurization of the distribution network. Where lift-dosing to gravity distribution is used, the mound geometry shall promote even distribution across the basal area without preferential flow paths.

804.5 Fill materials and interface layers. Fill materials and interface layers shall comply with Sections 804.5.1 through 802.4.5.7.

804.5.1 General. Fill materials used in mound construction shall be selected and placed to support soil treatment, structural stability, and long-term performance of the mound system. Fill materials shall be compatible with the native soil beneath the mound and shall not create restrictive layers that impede vertical or lateral movement of wastewater.

804.5.2 Fill material suitability. Fill materials shall be classified based on their suitability for use in mound construction.

1. Fill materials that are suitable or moderately limiting shall be acceptable for use where consistent with their intended function within the mound.
2. Severely limiting materials shall not be used in mound construction.

Fill material placed beneath the distribution system and within the treatment zone shall be clean, free of organic matter and deleterious materials, and shall possess particle size distribution and permeability characteristics suitable for unsaturated flow and aerobic treatment. The fill shall be of uniform gradation and compatible with the design loading rate established for the mound system.

The authority having jurisdiction retains the right to require laboratory or field verification of fill material characteristics prior to placement.

804.5.3 Fill material inspection and approval. Fill materials proposed for use in mound construction shall be made available for inspection and approval by the authority having jurisdiction prior to placement. Fill material shall be inspected on site or at the source to verify suitability, cleanliness, and consistency with the approved design. Fill material that has not been inspected and approved shall not be used in mound construction prior to placement.

804.5.4 Native soil–fill transition. The native soil surface beneath the mound shall be scarified to promote hydraulic continuity between the native soil and the overlying fill material. Fill material shall be placed in a manner that prevents the formation of a distinct or restrictive boundary between soil types. Construction methods shall ensure intimate contact between the scarified native soil and the fill material to facilitate unsaturated flow and treatment.

804.5.5 Sand and fill placement. Sand or fill material placed above the interface layer shall be clean, uniform, and free of organic matter, debris, or frozen material. Fill shall be placed in a manner that prevents compaction of the native soil and interface layer. Mechanical compaction of fill material within the treatment zone shall be prohibited.

804.5.6 Soil cap. A soil cap shall be placed over the distribution system, shoulder, and side slopes of the mound. The soil cap shall consist of suitable or moderately limiting soil material capable of supporting vegetation, resisting erosion, and allowing adequate aeration and gas exchange. The soil cap shall not be used to increase allowable loading rates.

The completed mound shall be stabilized with vegetation or other approved erosion control measures. Where seasonal or climatic conditions prevent immediate vegetative establishment, temporary erosion and freeze protection measures shall be provided until permanent stabilization is achieved.

804.5.7 Prohibited materials. The following materials shall not be used within the mound basal area, interface layer, or treatment zone:

1. Topsoil containing significant organic matter
2. Peat, muck, or other highly organic soils
3. Severely limiting soils
4. Construction debris or recycled materials not approved for use in soil treatment systems

804.6 Distribution system requirements. The distribution system shall comply with the Sections 804.6.1 through 804.6.7.

804.6.1 General. Mound systems shall be provided with a distribution system designed to apply wastewater uniformly across the basal area. The distribution system shall be compatible with the mound geometry, loading rate, and selected dosing method.

804.6.2 Distribution methods. Mound systems shall use one of the following distribution methods:

1. Lift-dosing to a gravity distribution network within the mound; or
2. Pressure distribution within the mound using low-pressure distribution principles.

Where pressure distribution is used, the design and installation of the distribution system shall comply with the applicable provisions of Chapter 7.

804.6.3 Uniform application. The distribution system shall be designed and installed to achieve uniform application of wastewater over the basal area. Uneven distribution, short-circuiting, or preferential flow paths shall be prohibited.

804.6.4 Distribution pipe layout. Distribution pipes shall be laid level and spaced to provide even coverage of the basal area. Pipe spacing shall be consistent throughout the mound and shall be selected to match the treatment capacity of the receiving soil and the selected distribution method.

804.6.5 Aggregate and bedding. Where aggregate is used, distribution pipes shall be installed within clean, durable aggregate that promotes drainage and prevents clogging of distribution openings. Aggregate shall extend beneath and above the distribution pipes as required to maintain pipe alignment and protect openings.

804.6.6 Compatibility with mound geometry. The distribution system shall be located within the mound such that required separation distances, cover, and interface protection are maintained. Distribution pipes shall not be placed in a manner that compromises mound stability, side slope integrity, or erosion control.

804.6.7 Terminal ends and flushing. Distribution pipes shall be configured to allow inspection, flushing, and maintenance. Where pressure distribution is used, distribution pipes ends shall be capped and provisions for flushing shall be provided. Where gravity distribution is used, distribution pipes shall be configured to prevent short-circuiting and allow cleaning where required by the authority having jurisdiction.

804.7 Construction requirements and sequencing. The construction requirements and sequencing shall comply with the Sections 804.7.1 through 804.7.7.

804.7.1 General. Mound systems shall be constructed in accordance with the approved design and in a manner that protects the soil treatment interface, preserves native soil structure, and ensures long-term system performance. Construction practices that damage the native soil, interface layer, or mound geometry shall be prohibited.

804.7.2 Site preparation. Prior to mound construction, the construction area shall be clearly delineated and protected from disturbance. Vegetation and surface organic debris shall be removed from the mound footprint in accordance with Section 804.2.2. Where the surface horizon contains excessive organic material or is otherwise unsuitable for treatment, it shall be removed. The exposed native soil surface shall be scarified or roughened immediately prior to placement of fill material.

804.7.3 Protection of native soil and interface. Construction equipment shall not traverse the prepared basal area after scarification. Equipment traffic shall be limited to areas outside the mound footprint. Smearing, compaction, or sealing of the native soil surface shall be prohibited.

804.7.4 Construction timing and moisture conditions. Mound systems shall not be constructed where native soils or fill materials are excessively wet, frozen, above the plastic limit, or otherwise unsuitable for proper placement. Construction shall be suspended under conditions that could compromise soil structure, hydraulic continuity, or mound stability.

804.7.5 Fill placement sequence. Fill material shall be placed in a manner that maintains the integrity of the native soil and interface layer. Fill shall be placed from outside the mound footprint or from previously placed fill. Mechanical compaction of fill material within the treatment zone shall be prohibited.

804.7.6 Distribution system installation. Distribution pipes shall be installed after placement of the required fill and interface layers and prior to placement of the soil cap. Distribution pipes shall be laid level and secured to prevent displacement during subsequent fill placement.

804.7.7 Inspection during construction. Construction of mound systems shall be subject to inspection at the following stages. Construction shall not proceed beyond each stage until approval is granted by the

authority having jurisdiction. Construction of mound systems shall be subject to inspection at the following stages. Construction shall not proceed beyond each stage until approval is granted by the authority having jurisdiction.

1. Basal area and fill material inspection.
   An inspection shall be conducted after vegetation and unsuitable surface materials have been removed and the native soil surface has been scarified or roughened, and prior to placement of fill material. Soil moisture conditions shall be evaluated at this stage to confirm that native soils are not excessively wet or above the plastic limit. Proposed fill material shall be present on site and available for inspection and approval.

2. Distribution system and structural components inspection.
   An inspection shall be conducted after the mound has been constructed to the required elevation and geometry, septic tank(s) and pump tank(s), where applicable, have been installed, and the distribution system (including header or manifold and distribution pipes) has been installed and bedded, and prior to placement of the soil cap or final cover. The distribution network shall be flushed and pressurized to verify uniform discharge. Residual head at the terminal end of the distribution piping shall be measured and confirmed to meet design specifications. Orifice diameter, residual head measurement, dose volume, and pump operation shall be verified and recorded.

3. Final cover and stabilization inspection.
   A final inspection shall be conducted after placement of the soil cap, completion of side slopes and shoulders, installation of drainage features, and completion of required stabilization. Final approval shall not be granted until stabilization of the mound has been completed.

804.8 Stabilization, drainage, and protection. Stabilization, drainage and protection shall comply with this section.

804.8.1 General. Mound systems shall be stabilized and protected to prevent erosion, maintain structural integrity, and ensure long-term performance. Stabilization and drainage measures shall be completed promptly following construction and prior to final approval.

804.8.2 Vegetative stabilization. The entire mound, including the basal area cover, shoulders, and side slopes, shall be stabilized with vegetation. Vegetation shall be selected and established to provide effective erosion control and long-term slope stability.

804.8.3 Slope stabilization requirements. Side slopes with a gradient steeper than 5 horizontal to 1 vertical (5:1) shall be stabilized using sod, hydroseeding, or an equivalent method capable of providing immediate erosion control. Slopes with a gradient of 5:1 or flatter shall be stabilized by either the methods for steeper slopes previously described in this section, or by seeding and mulching, provided adequate erosion control is achieved.

804.8.4 Temporary erosion control. Where permanent vegetation has not yet been established, temporary erosion control measures shall be provided. Such measures include straw or hay mulch, erosion control blankets, or other approved materials. Temporary measures shall be maintained until permanent stabilization is achieved.

804.8.5 Surface drainage. Surface drainage features, including swales, berms, or diversions, shall be provided as necessary to prevent surface water from flowing onto the mound or discharging from the mound onto adjacent properties. Drainage features shall be designed to prevent ponding, erosion, and saturation of the mound.

804.8.6 Protection from disturbance. The mound system shall be protected from vehicular traffic, heavy equipment, livestock, and other activities that could damage the mound, distribution system, or soil treatment interface. Protective barriers or markings shall be installed where necessary to prevent disturbance.

804.8.7 Final approval. Final installation approval shall not be granted until stabilization of the mound has been completed and verified. Stabilization, drainage, and protection measures shall be maintained for the life of the system.

Prior to final approval, an operation and maintenance manual specific to the installed system shall be provided to the owner.

SECTION 805 LOW PRESSURE DISTRIBUTION (LPD) SYSTEMS.

805.1 General comments. Low-pressure distribution (LPD) systems are pressure-dosed subsurface soil treatment and dispersal systems designed to apply effluent uniformly to trenches, beds, or mounds through pressurized distribution piping and orifices. Uniform application helps use the full infiltrative surface, reduces localized overloading, and supports consistent long-term performance.

Because LPD systems rely on hydraulic design and mechanical components (including pumps, controls, manifolds, valves, and orifices), system performance depends on proper sizing, installation, and verification. Key considerations include selection of an appropriate design loading rate, distribution network configuration, control of head loss and residual head, and dosing volume and frequency sufficient to pressurize the network and discharge from orifices as intended.

Construction requirements remain foundational. Excavation quality, media placement, and protection of infiltrative surfaces are critical to performance regardless of distribution method.

805.1.1 Purpose. The purpose of Section 805 is to establish minimum requirements for the design, construction, and dosing of conventional low-pressure distribution (LPD) systems serving subsurface trenches, beds, and mounds. LPD systems are typically designed and installed by qualified designers, including professional engineers and experienced onsite wastewater practitioners, and require hydraulic design to achieve uniform subsurface effluent application. These requirements address design loading rate selection, hydraulic design of manifolds and laterals, bed and trench construction, pump and control requirements, and dosing criteria to support reliable long-term performance.

805.1.2 General requirements. The provisions of Section 805 shall govern the design and installation of low pressure distribution systems. Section 805 does not apply to drip irrigation dispersal systems.

805.2 Design loading rate. Design loading rate shall comply with this section.

805.2.1 General. A pressure distribution system shall be permitted for use on any site meeting the conventional private sewage disposal system criteria.

The elevation of the distribution pipe shall be established such that the minimum required vertical separation between the infiltrative surface and the limiting soil condition, as determined in accordance with this standard, is maintained.

There shall be not less than 152 mm (6 inches) of suitable cover material from original grade to the top of the distribution piping. Where required for frost protection or to prevent physical damage, additional cover shall be provided.

The installation of a pressure distribution system shall not be used to reduce the minimum required vertical separation established for the soil treatment and dispersal system.

805.2.2 Absorption area. The total absorption area required shall be computed from the estimated daily wastewater flow and the design loading rate based on the percolation rate for the site. The required absorption area equals wastewater flow divided by the design loading rate from Table 805.2.2.

Table 805.2.2 Design loading rate.

Percolation rate s/mm (min/in.)	Design loading factor L/m²/day (gal/ft²/day)
0 to <24 (0 to <10)	48.8 (1.2)
24 to <72 (10 to <30)	32.6 (0.8)
72 to <108 (30 to <45)	29.3 (0.72)
108 to 144 (45 to 60)	16.3 (0.4)

805.2.3 Estimated wastewater flow. The estimated wastewater flow from a residence shall be 568 L (150 gallons) per bedroom per day.

805.3 System design. System design rate shall comply with this section.

805.3.1 General. Pressure distribution systems shall discharge effluent into trenches or beds. Each pipe connected to an outlet of a manifold shall be counted as a separate distribution pipe. The horizontal spacing of distribution pipes shall be 762 mm to 1829 mm (24”30 in. to 72 in.). The system shall be sized in accordance with the formulas listed in this section. Systems using Schedule 40 plastic pipe shall be sized in accordance with the formulas listed in this section or in accordance with the tables listed in Appendix B. Distribution piping shall be installed at the same elevation, unless an approved system provides for a design ensuring equal flow through each of the perforations and the effluent is uniformly applied to the soil infiltrative surface.

805.3.2 Symbols. The following symbols and notations shall apply:

Ch = Hazen-Williams friction factor
D = distribution pipe diameter, mm (in.)
d = perforation diameter, mm (in.)
Dd = delivery pipe diameter, mm (in.)
Dm = manifold pipe diameter, mm (in.)
f = fraction of total head loss in the manifold segment
FD = friction loss in the delivery pipe, m of head (ft of head)
Fi = friction factor for ith manifold segment
FN = friction loss in the network pipe, m of head (ft of head)
h = pressure in distribution pipe, m of head (ft of head)
hd = in-line pressure at distal end of lateral, m of head (ft of head)
LD = length of delivery pipe, m (ft)
Li = length of ith manifold segment, m (ft)
N = number of perforations in the lateral
q = perforation discharge rate, L/min (gpm)
Qi = flow rate in ith manifold segment, L/min (gpm)
Qm = flow rate at manifold inlet, L/min (gpm)

805.3.3 Hazen-Williams friction factor. Hazen–Williams friction factor (Ch) shall be determined in accordance with Table 805.3.3.

Table 805.3.3 Hazen-Williams friction factor (Ch).

Pipe material	Ch
Smooth-wall plastic pipe (PVC, ABS, PE/HDPE, PP)	150
Copper or copper-alloy tubing	150
Concrete pipe	110
Cast-iron pipe	100
Vitrified clay pipe	100

Note 1. Where the pipe material is not listed in Table 805.3.3, Ch shall be permitted to be established using the pipe manufacturer's published hydraulic data or an approved engineering reference accepted by the authority having jurisdiction.

Note 2. For evaluation, repair, or modification of existing systems using legacy materials, the following Ch values shall be used: asbestos-cement pipe (Ch = 140) and bituminized fiber pipe (Ch = 120).

805.3.4 Manifolds. Manifold pipe diameter shall be determined in accordance with Equation 7-1. The fraction of the total head loss allocated to the manifold segment, f, shall be ≤ 0.10, and the in-line distal head pressure, hd, shall be ≥ 0.76 m (2.5 ft) of head. Distribution pipes shall be connected to the manifold with tees or 90-degree (1.57 rad) ells, and distribution pipe ends shall be capped.

Equation 8-1

Dm (mm) = 25.4 [Σ(Li Fi) / (f hd)]^0.21

Where: Dm = manifold diameter, mm (in.); Li = length of the ith manifold segment, m (ft); Fi = friction factor for the ith manifold segment (dimensionless); Qi = flow in the ith manifold segment, L/min (gpm); f = fraction of total head loss in the manifold segment; hd = in-line pressure at distal end of lateral, m (ft) of head.

Fi = 8.35 × 10^-5 Qi^1.85

Q = Nq

805.3.5 Friction loss. The delivery pipe shall include pipe between the pump and the supply end of the distribution pipe. Friction loss in the delivery pipe, FD, shall be determined in accordance with Equation 7-2. Friction loss in the network pipe, FN, shall be determined in accordance with Equation 7-3. Pipe in the system shall be increased in size where friction loss is excessive.

Equation 8-2 (delivery pipe friction loss)
FD (m) = LD (m) [4643 Qm (L/min) / (Ch Dd^2.63 (mm))]^1.85
FD (ft) = LD (ft) [3.55 Qm (gpm) / (Ch Dd^2.63 (in.))]^1.85

Equation 8-3 (network pipe friction loss)
FN = 1.31 hd
(units consistent, m (ft) of head)

805.3.6 Force main. Force main size shall be based on friction loss and effluent velocity. Effluent velocity in a force main shall not exceed 1.52 m/s (5 ft/s). Force mains shall be designed to achieve a minimum scouring velocity of 0.61 m/s (2 ft/s) during pump operation to prevent solids deposition.

805.4 Bed and trench construction. The excavation and construction for pressure distribution system trenches and beds shall be in accordance with Section 804.4.2. Aggregate shall be not less than 152 mm (6 inches) beneath the distribution pipe with 51 mm (2 inches) spread evenly above the pipe. The aggregate shall be clean, nondeteriorating 12.7 mm to 64 mm (0.5 inch to 2.5 inches) stone.

805.5 Pumps. Pumps rate shall comply with this section.
805.5.1 General. Pump selection shall be based on the discharge rate and total dynamic head (TDH) determined from the pump performance curve. The TDH shall be equal to the difference in elevation between the pump and the distribution pipe invert plus friction loss and the residual head required to achieve the designed orifice discharge rate in the distribution network.

Where low-pressure distribution is used, residual head shall be sufficient to deliver the required discharge through the orifice openings based on hydraulic calculations in accordance with Section 805.

805.5.2 Pump and alarm controls. The control system for the pumping chamber shall consist of controls for operating the pump and an alarm system to detect high liquid level or pump failure. Pump start and stop depth controls shall be adjustable.

Pump operation shall be controlled by either demand dosing or timed dosing. Where timed dosing is used, the control system shall regulate dose frequency and duration in accordance with the dosing requirements of Section 805.6.

Pump and alarm controls shall be of an approved type. Switches and control components shall be resistant to sewage corrosion and suitable for the intended environment.

805.5.3 Alarm system. Alarm systems shall consist of an audible and/or visual signal mounted within the structure and located to be easily seen or heard. The high-water sensing device shall be installed above the pump "on" control elevation and below the invert of the inlet to the pumping chamber.

Pumping chamber capacity shall comply with the minimum tank sizing requirements of this standard and shall provide sufficient working and emergency storage volume for the selected dosing method.

Alarm systems shall be installed on a separate electrical circuit from the pump circuit.

805.5.4 Electrical connections. Electrical connections shall be located outside the pumping chamber. Electrical work for pumps, controls, alarms, and associated circuits shall be installed in accordance with the applicable electrical code and shall be permitted and inspected where required by the authority having jurisdiction.

805.6 Dosing. Dosing frequency and volume shall be selected to promote uniform distribution and unsaturated flow within the soil treatment and dispersal system.

Dosing shall be controlled by either demand dosing or timed dosing. Where timed dosing is used, dose frequency shall be sufficient to distribute the daily design flow evenly over the design period and support unsaturated soil conditions.

Dose volume shall be sufficient to fully pressurize the distribution network and achieve uniform discharge through orifices. As a default design basis, dose volume shall be not less than two times the calculated internal volume of the distribution piping network unless hydraulic calculations demonstrate that adequate pressurization and uniform discharge can be achieved with a smaller volume.

Dose volume shall not exceed that necessary to maintain unsaturated conditions in the receiving soil and uniform distribution across the basal area.

The internal volume of the distribution piping shall be calculated in accordance with Table 805.6.

Table 805.6 Estimated pipe volume.

Distribution pipe mm (in.)	Volume L/m (gal/ft)

25 (1)	0.51 (0.041)
32 (1¼)	0.80 (0.064)
38 (1½)	1.14 (0.092)
51 (2)	2.03 (0.164)
76 (3)	4.56 (0.368)
102 (4)	8.13 (0.655)
152 (6)	18.26 1.47)

SECTION 806 DRIP-DISPERSAL SYSTEMS.

806.1 General requirements. Drip-dispersal systems shall comply with this section.

806.1.1 Site suitability. A *drip dispersal system* shall be permitted for use on any site meeting the conventional *private sewage disposal system* criteria. A *drip dispersal system* shall be permitted for use on sites deemed unsuitable for a conventional *private sewage disposal system* when approved by the regulatory authority having jurisdiction.

NOTE: It is recommended that additional secondary treatment be provided, including possibly disinfection, on drip-dispersal systems on sites deemed unsuitable for a conventional disposal system.

806.1.2 Conventional system alignment. Drip-Dispersal systems shall comply with the applicable requirements of Section 803.1.

806.2 Method of discharge. Septic tank effluent shall be discharged into a dosing tank. Delivery of effluent into a drip-dispersal system shall be by pressurized dosing only.

806.3 Drip-dispersal system design. Drip-dispersal system design shall comply with this section.

806.3.1 Sizing. Drip-dispersal system area shall be calculated in accordance with Section 803.3, and the soil loading rates listed in Table 803.3.2 used in sizing calculations shall be reduced by 50 percent.

806.3.2 Spacing. The drip tubing shall be placed on a minimum of 61 cm (2 foot) centers in a drip field.

806.3.3 Drip tubing length. The linear footage of drip tubing shall be determined by dividing the required absorption field area by the spacing of the drip tubing. Drip tubing shall be placed along land contours and the length of tubing required shall be adjusted upward as needed, depending on topography.

EXAMPLE: 1000 qt ft field using 2 foot spacing of drip tubing: 1000/2 = 500 linear feet of drip tubing required.

806.3.4 Mechanical dosing tanks and pumps. A dosing tank is required and shall meet the requirements of Section 802.4.7. Mechanical pumps are required and shall be rated for use with septic tank effluent, shall have a capacity to deliver both field dose and flush dose volumes, and shall be capable of maintaining minimum emitter pressure and achieving a minimum 61 cm/s (2 ft/s) flush velocity in flush lines.

806.3.5 Field dosing volume. The system dosing volume required for the field is determined by the emitter dose rate and the number of emitters in a field and shall be developed in accordance with any manufacturer specifications.

806.3.6 Field dosing events. Drip-dispersal systems shall be dosed based on timed cycles only. The number of dosing events shall be equivalent to the system design flow divided by the system dose volume and be equally spaced throughout a 24 hour period. A minimum of three dosing events/day shall be achieved. Effluent filters must be flushed prior to field dosing.

806.3.7 System flushing. Flush dose volume is determined by the diameter of the flush line and the dosing volume shall achieve a minimum velocity in the flush line of 61 cm/s (2 feet/s). Both the effluent filters and the drip tubing shall be capable of being flushed.

806.3.8 Control panels. Control panels shall be installed for measuring the volume of water in a dose tank, signaling the system to field dose, or signaling the system to field dose and flush. Controls shall include:

1. Float switches or pressure transducers for controlling and detecting where tank capacity is sufficient for dosing and flush cycle,
2. Time-dose programming capability,
3. Float switches or pressure transducers for detecting where the water level in the tank is too high, indicating that there is either excess water entering the system or the pump has failed,
4. Audible and visual high-level alarms, and
5. Manual override capability for flushing and testing.

806.3.9 Additional or supplementary treatment. Where additional treatment is required by the authority having jurisdiction, such as to address site or soil limitations, the additional treatment component shall be placed immediately preceding the pump or dose tank.

806.3.9.1 Disinfection. If disinfection treatment is required, it shall be permissible to be installed prior to or following the dose tank. Disinfection devices, if installed, shall comply with NSF/ANSI 385.

806.3.10 Field supply line. The field supply line must be sized to accommodate both the field dosing requirements and the field line flushing requirements.

806.3.11 Flush line. Flush line must be sized to accommodate a dose with sufficient volume to achieve a minimum flushing velocity in the line of 61 cm/s (2 feet/sec).

806.3.12 Drip tubing design. Drip tubing shall be pressure-compensating and rated for use in subsurface wastewater dispersal systems. Drip tubing shall be certified to operate at a 70-480 kPa (10–70 psi) pressure range. Drip tubing shall be made from UV-resistant polyethylene or equivalently corrosion-resistant material. Drip tubing shall be resistant to clogging and biological fouling. Drip tubing shall have a minimum diameter of 1.3 cm (0.5 inches)

806.3.13 Drip tubing installation. Drip tubing shall be installed a minimum of 152 mm (6 inches) and a maximum of 30.5 cm (12 inches) below grade. Drip tubing shall be configured to follow the natural land contours to prevent surface flow. Drip tubing shall be placed, to the extent possible, on land with uniform slope and shall not be placed in gullies or unstable areas.

806.3.14 Air vacuum release valves. Air vacuum release valves are required and shall be installed at the points of highest elevation within the drip system layout.

806.3.15 Emitters, design. Emitters installed in drip systems shall be pressure-compensating to assure uniform effluent distribution through a field. Emitter shall be resistant to clogging and capable of delivering a consistent flow rate as specified by the manufacturer.

806.3.16 Emitters, installation. Drip emitters shall be integrated within the drip tubing and spaced a minimum of 30.5 cm (12 inches), and maximum of 61 cm (24 inches) apart.

NOTE: Standard drip tubing utilizes a 61 cm (24 inch) emitter separation, special order tubing can achieve any desired emitter spacing.

806.3.17 Emitters, flow rate. The flow rate per emitter shall be a minimum of 1.9 LPH (0.5 GPH), and a maximum of 7.5 LPH (2.0 GPH) at 70-480 kPa (10–70 psi).

806.3.18 Filtration requirement. Effluent filters shall be incorporated into the drip design and the effluent filter must remove particles 20 percent of the size of the emitter flow path.

806.4 Construction and installation of drip-dispersal systems.

806.4.1 Limitations. The installation limitations of Section 803.4.1 shall apply to drip-dispersal systems.

806.4.2 Drip tube trenches. Drip tube trenches shall be a maximum of 1.9 cm (0.75 inches) wide. Trenches shall be a minimum of 15.2 cm (6 inches) and a maximum of 45.7 cm (18 inches) deep. The bottom and side walls of trenches shall not be compacted or smeared when digging.

806.4.3 Drip tubing installation. Drip tubing shall be placed on the soil surface at bottom of the trench. Drip tubing shall not have any sharp bends

806.4.4 Emitter installation. Emitters shall be oriented to discharge effluent downwards or sideways.

806.4.5 Leak testing. Systems shall be pressure tested for leaks after installation is complete. Pressure testing shall include at least one complete dosing cycle and one complete flushing cycle. Pipe connections shall be examined for leaks. Emitters shall be examined to verify flow is occurring as designed.

If leaks are found at any connection point or if emitters are not achieving the designed flow, repairs to the system shall be made. A new pressure test cycle must be completed after all repairs are completed and shall demonstrate the system is free of leaks and that emitters are operating correctly.

806.5 Final backfill cover. The final backfill cover of the system shall be native soil removed during trench construction or meet the requirements of Section 803.4.3.

807 Surface dispersal. Surface dispersal rate shall comply with this section.

807.1 Scope. The provisions of this section shall govern the design and installation of surface dispersal mechanisms for the management of onsite wastewater systems servicing individual domestic dwellings.

807.2 Application. Surface dispersal shall only be permitted where specifically authorised by the Authority Having Jurisdiction (AHJ). The requirements in this section shall be in addition to the requirements of the applicable local codes and standards. Such systems shall be designed, constructed, and operated to protect public health, prevent nuisance conditions, and avoid degradation of surface water or groundwater.

807.3 Exclusions and limitations. This surface dispersal section only includes systems that receive domestic human excreta. However, if surface dispersal systems receive waste from food waste disposal units then the system shall be designed by a suitably qualified and experienced person that takes into account the additional flows and loads generated.

807.4 Design principles. Design principles shall comply with this section.

807.4.1 Surface dispersal systems shall maximise the evapotranspiration potential of soil and vegetation and are suited to moderate to slow draining soils.

807.4.2 Topsoil depth. Surface dispersal systems shall have adequate topsoil depth (at least 250 mm (9.84 inches)) to facilitate infiltration of the effluent.

807.4.3 Surface dispersal systems shall be limited by the most restrictive soil horizon and depth to groundwater.

807.5 Effluent quality. Effluent quality shall comply with the following.

1. Effluent used for **drip irrigation** or **covered surface application** shall be treated to a **secondary treatment standard**, achieving:
    a. $BOD_5 \leq 20$ mg/L (90% of samples, without a single sample > 30 mg/L).
    b. TSS ≤ 30 mg/L (90% of samples, without a single sample > 45 mg/L).
2. Effluent used for **spray irrigation** shall be treated to a **disinfected secondary standard**, achieving:
    a. BOD_5 and TSS limits as above.
    b. *E. coli* ≤ 10 cfu/100 mL average, with not more than 20% of samples > 20 cfu/100 mL.
    c. Continuous disinfection required.
3. Effluent used for **low pressure effluent distribution (LPED)** shall be at least equivalent to well-maintained septic tank effluent with outlet filtration of solids ≥ 3 mm (0.11 inches).
4. Where effluent does not meet the above microbiological standards, only **covered or subsurface dispersal methods** shall be permitted.

807.6 Distribution and application. Distribution and application shall comply with the following.

1. Systems shall be designed to provide **uniform application** without runoff, ponding, or overspray.
2. Spray application shall be prohibited during wind speeds or climatic conditions that cause aerosol drift beyond the designated boundary.
3. Distribution equipment shall be designed to operate reliably under anticipated climatic and site conditions.

807.7 Setback distances. The minimum horizontal separation distances for surface disposal areas shall be:

1. 30 m (100 ft) from potable water supply wells.
2. 15 m (50 ft) from surface waters including lakes, rivers, and streams.
3. 7.5 m (25 ft) from property lines and public rights-of-way.
4. 7.5 m (25 ft) from dwellings and occupied buildings.
5. 3 m (10 ft) from swimming pools or similar water features.

807.8 Vertical separation. A minimum vertical separation of 600 mm (24 inches) shall be maintained between the ground surface and the seasonal high groundwater table.

807.9 Hydraulic loading and vegetation. Hydraulic loading and vegetation shall comply with the following.

1. Hydraulic loading rates shall not exceed the infiltration and evapotranspiration capacity of the site soils and vegetation.
2. Application areas shall be designed with alternating or resting zones to allow soil and vegetative recovery.
3. Vegetative cover shall be maintained in a healthy condition to maximize nutrient uptake and evapotranspiration.

807.10 Operation and maintenance. Operation and maintenance shall comply with the following.

1. Operators shall maintain a documented schedule of inspection, monitoring, and maintenance for pumps, controls, and distribution systems.
2. To keep the system running at its design capacity and increase the life expectancy of the system distribution lines and filters are to be flushed and or cleaned in accordance with the manufacturer's recommendations.
3. Disinfection systems shall be monitored to ensure continuous performance in accordance with the manufacturer's recommendations.
4. Vegetation must be managed to ensure that root intrusion does not result in the clogging of emitters.
5. Effluent sampling and system performance records shall be retained and provided to the AHJ upon request.

807.11 Operation and maintenance manual. An operation and maintenance manual shall be supplied in hardcopy with all systems. The manual shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

2.2.2.1 Schedule for all regular maintenance tasks.
2.2.2.2 Instructions for all regular maintenance tasks.
2.2.2.3 Instructions on unacceptable materials that should not be flushed down the toilet.

807.12 Health and safety. Secure fencing shall be erected to eliminate unauthorised people, especially children and animals from entering the surface dispersal area.

807.13 Prohibited Practices. The following practices are prohibited.

1. Direct discharge of effluent to bare ground, roadways, or drainageways is prohibited.
2. Application during soil saturation, frozen ground, or precipitation events causing runoff is prohibited.
3. Surface disposal of industrial, hazardous, or non-domestic wastewater is prohibited.

808 Ponds, lagoons and basins. Ponds, lagoons and basins shall comply with this section.

808.1 Scope. The provisions of this section shall govern the design and installation of ponds, lagoons and basins for the management of onsite wastewater systems servicing individual domestic dwellings.

808.2 Application. Ponds, lagoons and basins shall only be permitted where specifically authorised by the Authority Having Jurisdiction (AHJ). The requirements in this section shall be in addition to the requirements of the applicable local codes and standards. Such systems shall be designed, constructed, and operated to protect public health, prevent nuisance conditions, and avoid degradation of surface water or groundwater.

808.3 Exclusions and limitations. This pond, lagoon and basin section only includes systems that receive domestic human excreta. However, if any pond, lagoon or basin systems receive waste from food waste disposal units then the system shall be designed by a suitably qualified and experienced person that takes into account the additional flows and loads generated.

808.4 Design principles. Design principles shall comply with this section.

808.4.1 Function. The function of a pond, lagoon or basin is to provide a stand-alone open water onsite wastewater treatment system (OWTS) or as a pretreatment stage before an additional OWTS to remove solids and reduce organic loading with both requiring different retention times.

808.4.2 Pre-treatment. Ponds, lagoons and basins used as a pre-treatment stage used to protect subsequent onsite wastewater treatment stages include (but are not limited to):

1. Sand filters and basins
2. Media filters or basins
3. Nets or other semi permeable barriers
4. Pressurized filter vessels using pressure sensor threshold based back flushing
5. Timer based or manual back flushing of filter systems
6. Other collection media that can be excavated if used in pre-treatment basins

808.4.3 Design limiting factor. Minimum surface water area of $15m^2$ ($161.46ft^2$) regardless of the number of people within the domestic dwelling is requirement to achieve effectual effluent treatment.

808.5 Sizing. Minimum size requirements shall include:

1) The top surface of the treatment area shall be at least $3m^2$ ($32.29ft^2$) per person equivalent.

2) The minimum total area shall be $15m^2$ ($161.46ft^2$) regardless of the number of people within the domestic dwelling.

808.6 Influent quality and delivery. Influent quality and delivery shall comply with this section.

808.6.1 Quality. A range of influent quality shall be suitable for ponds, lagoons and basin systems ranging from a minimum treatment provided by a septic tank fitted with an effluent outlet filter to tertiary treated onsite wastewater.

808.6.2 Delivery. The pond, lagoon or basin shall receive influent by way of gravity or a pumped dosed influent delivery line.

808.7 Effluent discharge. Effluent discharge shall comply with this section.

808.7.1 Retention time. As required by the AHJ minimum wastewater retention times and wastewater quality shall be meet within the pond, lagoon or basin before discharge to the environment.

808.7.2 Wastewater reuse. If further wastewater reuse is desired, the next treatment stages shall proceed after the pond, lagoon or basin treatment process.

808.8 Setback distances. The minimum horizontal separation distances from a pond, lagoon or basin shall be:

1) 30 m (100 ft) from potable water supply wells.

2) 15 m (50 ft) from surface waters including lakes, rivers, and streams.

3) 7.5 m (25 ft) from property lines and public rights-of-way.

4) 7.5 m (25 ft) from dwellings and occupied buildings.

808.9 Vertical separation. A minimum vertical separation of 600 mm (24 in) shall be maintained between the base of the pond, lagoon or basin and seasonable high groundwater table.

808.10 Operation and maintenance. Operation and maintenance shall comply with this section.

808.10.1 Quality checks. Periodic water quality checks and sludge excavation shall be required.

808.10.2 Disposal. Appropriate disposal of excavated sludge shall comply with AJH.

808.10.3 Sampling and records. Effluent sampling and system performance records shall be retained and provided to the AHJ upon request.

808.10.4 Upgradient infrastructure features. Upgradient infrastructure features from the pond, lagoon or basin shall be maintained such as the pump chamber and septic tank which shall be routinely emptied in accordance with the AHJ (Such as, every 1 – 3 years).

808.11 Operation and maintenance manual. An operation and maintenance manual shall be supplied in hardcopy with all systems. The manual shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

- Schedule for all regular maintenance tasks.
- Instructions for all regular maintenance tasks.
- Instructions on unacceptable materials that should not be flushed down the toilet.
- Expected schedule for removing sludge from the pond, lagoon or basin.

808.12 Health and safety. Health and safety shall comply with this section.

808.12.1 Fencing. Secure fencing shall be erected surrounding the pond, lagoon or basin to eliminate unauthorized people, especially children and animals.

808.12.2 Disease vector controls. The use of disease vector control measures, such as aquaculture to reduce the impact of mosquitos where appropriate are acceptable.

808.13 Prohibited practices. Prohibited practices shall comply with this section.

808.13.1 Influent loading. Influent loading which causes uncontrolled pond, lagoon or basin overflow onto the ground surface is prohibited.

808.13.2 Prohibited wastewater disposal. Disposal of industrial, hazardous, or non-domestic wastewater into ponds, lagoons and basins is prohibited.

SECTION 809 CONSTRUCTED WETLANDS.

809.1 Scope. The provisions of this section shall govern the design and installation of constructed wetlands for the management of onsite wastewater systems servicing individual domestic dwellings.

809.2 Application. Constructed wetlands shall only be permitted where specifically authorised by the Authority Having Jurisdiction (AHJ). The requirements in this section shall be in addition to the requirements of the applicable local codes and standards. Such systems shall be designed, constructed, and operated to protect public health, prevent nuisance conditions, and avoid degradation of surface water or groundwater.

809.3 Exclusions and limitations. This constructed wetland section only includes systems that receive domestic human excreta. However, if constructed wetland system receives waste from food waste disposal units then the constructed wetland shall be designed by a suitably qualified and experienced person that takes into account the additional flows and loads generated.

809.4 Design principles. Design principles shall comply with this section.

809.4.1 Wetland function. Constructed wetlands shall be designed to treat domestic onsite wastewater by passing through a wetland system (horizontally or vertically), utilising plant species with a subsequent discharge to the environment or reuse.

809.4.2 Treatment purpose. A constructed wetland system shall provide secondary treatment and to assist in the removal of sediment, nutrients and microorganisms through physical, chemical and biological processes and includes:

1. Horizontal and vertical flow beds
2. Hybrid plant bed systems (including floating plant bed)

809.5 Critical design features. Critical design features shall comply with this section.

809.5.1 Qualified personnel. A suitably qualified and experience person (SQEP) with relevant knowledge and experience shall carry out the design and installation.

809.5.2 Influent sources. A domestic constructed wetland can receive influent from a range of onsite wastewater sources from septic tank influent to tertiary treated onsite wastewater.

809.5.3 Grit screening. A grit removal screen shall be fitted prior to onsite wastewater entering a constructed wetland.

809.5.4 Wetland lining. The wetland sides and base shall be lined with suitably protected waterproof membrane (Such as puncture-resistant synthetic membrane) or constructed in natural ground conditions using locally available soils that have the ability to be compacted.

809.5.5 Pre-Treatment. Prior to entry into the constructed wetland, domestic onsite wastewater shall settle in at least a septic tank treatment system that is designed to receive and treat the loads and type of influent it receives.

809.5.6 Base drainage. The constructed wetland should be drained from the base using base drainage pipes connected to a single pipe discharge of at least 70 mm (2.76 inches) in diameter. This discharge pipe should be encased within at least 150 mm (5.91 inches) thick 20 – 40 diameter washed gravel/stone (or equivalent material) and be allowed to drain under gravity conditions.

809.5.7 Transition layer. Above the drainage layer there shall be a transition layer consisting of at least 50 mm (1.97 inches) thick washed stone (or equivalent material) of between 6 – 10 mm (0.24-0.39 inches) in diameter.

809.5.8 Media layer. Above the transition layer there shall be a treatment medium layer of non-degradable aggregate media of at least 600 mm (23.62 inches) in thickness.

809.5.9 Dosing method. The domestic onsite wastewater influent is to be discharged on the top of the constructed wetland in evenly distributed dose batches of between 5 – 12 litres/m^2 (1.32 – 3.17 gallons/ft^2) with adequate rest periods between dose batches.

809.5.10 Media requirements. The treatment medium within the constructed wetland needs to be sufficiently free draining that completely empties between dose batches and must provide some resistance to prevent rapid drainage. The treatment medium shall be at least 600 mm in depth and consist of gritty sand with very low fines content with a consistent density over the entire constructed wetland.

809.5.11 Bund design. If earthen bunds surround the constructed wetland they shall be formed into a shape that is stable, resistant to erosion and designed so that runoff from the surrounding land does not enter the constructed wetland.

809.5.12 Effluent disposal. Effluent after treatment within the constructed wetland shall then enter a land application system, be reused, or if the AHJ allows enter a surface water body.

809.6 Sizing. Minimum size requirements shall include:

1) The top surface of the treatment area shall be at least $3m^2$($32.29ft^2$) per person equivalent.

2) The minimum total area shall be $15m^2$($161.46ft^2$) regardless of the number of people within the domestic dwelling.

3) The minimum width or length of the top surface of the constructed wetland shall be at least 2 meters (6.56 feet) to ensure that edge effects are not significant.

4) The complete constructed wetland bed should be undivided, or else divided into two equal beds to facilitate maintenance.

809.7 Plants. Plants shall comply with this section.

809.7.1 Plant density. Plants used within the constructed wetland shall be planted at a density of at least 4 plants per m^2.

809.7.2 Plant selection. Where possible native non-invasive plant species suitable for wetland environments shall be used.

809.7.3 Vegetative health. Vegetative cover shall be maintained in a healthy condition to maximise nutrient uptake and evapotranspiration.

809.7.4 Moisture management. The wetland shall be kept moist during periods of dry weather, especially during the first year to ensure that establishment of young plants in areas of high plant evapotranspiration rates and low summer onsite wastewater use.

809.8 Hydraulic loading. Hydraulic loading shall comply with this section.

809.8.1 Loading limits. Hydraulic loading rates shall not exceed the infiltration and evapotranspiration capacity of the constructed wetland treatment medium and vegetation.

809.8.2 Resting zones. Application areas shall be designed with alternating or resting zones to allow treatment medium and vegetation recovery.

809.9 Influent delivery. Influent delivery shall comply with this section.

809.9.1 Pre-Treatment. As a minimum requirement prior to the constructed wetland receiving domestic onsite wastewater the influent shall settle within at least a septic tank treatment system.

809.9.2 Flow control. Influent shall enter the constructed wetland system through an adjustable device used to manage the water and, through dose batch events maintain a consistent moisture within the constructed wetland and to avoid surface ponding.

809.10 Effluent discharge. Effluent discharge shall comply with this section.

809.10.1 Retention requirements. As required by the AHJ minimum wastewater retention times and wastewater quality shall be meet within the constructed wetland before discharge to the environment.

809.10.2 Effluent control. Effluent shall exit the constructed wetland system through an adjustable device used to manage the water and maintain consistent moisture within the constructed wetland and to avoid surface ponding.

809.10.3 Further treatment. If further wastewater reuse is desired, the next treatment stages shall proceed after the constructed wetland treatment process.

809.11 Setback distances. The minimum horizontal separation distances from a constructed wetland shall be:

1) 30 m (100 ft) from potable water supply wells.

2) 15 m (50 ft) from surface waters including lakes, rivers, and streams.

3) 7.5 m (25 ft) from property lines and public rights-of-way.

4) 7.5 m (25 ft) from dwellings and occupied buildings.

809.12 Vertical separation. A minimum vertical separation of 600 mm (24 in) shall be maintained between the base of the constructed wetland and seasonable high groundwater table.

809.13 Ventilation. Ventiliation shall comply with this section.

809.13.1 Base ventilation. The base of the constructed wetland shall be ventilated by ventilation pipes.

809.13.2 Vent pipe design. The ventilation pipes shall be constructed from perforated pipes positioned within the base drainage layer and connected to non-perforated pipes which rise above the surface of the constructed wetland by at least 100 mm (3.94 inches).

809.13.3 Aerobic conditions. Ventilation shall be maintained in order to ensure an aerobic environment within the treatment medium.

809.14 Operation and maintenance. Operation and maintenance shall comply with this section.

809.14.1 Water quality. Periodic water quality checks and sludge excavation are required.

809.14.2 Sludge disposal. Appropriate disposal of excavated sludge shall comply with AJH.

809.14.3 Record keeping. Effluent sampling and system performance records shall be retained and provided to the AHJ upon request.

809.14.4 Access requirements. Reasonable pedestrian access for tasks such as planting, maintenance and operation of the bed treatment surface is acceptable.

809.14.5 Surface maintenance. Weeds shall be removed and excessive build-up of organic debris (Such as decaying leaves) removed from the surface of the constructed wetland to maintain permeability and hydraulic performance of the treatment layer.

809.14.6 Upgradient maintenance. Upgradient infrastructure features from the constructed wetland shall be maintained such as the pump chamber and septic tank which shall be routinely emptied in accordance with the AHJ (such as, every 1 – 3 years).

809.15 Operation and maintenance manual. An operation and maintenance manual shall be supplied in hardcopy with all systems. The manual shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

1. Schedule for all regular maintenance tasks.
2. Instructions for all regular maintenance tasks.
3. Instructions on unacceptable materials that should not be flushed down the toilet.
4. Expected schedule for removing sludge from the constructed wetland.

809.16 Health and safety. Health and safety shall comply with this section.

809.16.1 Secure fencing. Secure fencing shall be erected surrounding the constructed wetland to eliminate unauthorized people, especially children and animals.

809.16.2 Vector control. The use of disease vector control measures, such as aquaculture to reduce the impact of mosquitos where appropriate are acceptable.

809.17 Prohibited practices. The following are prohibited practices.

809.17.1 Overflow prohibition. Influent loading which causes uncontrolled constructed wetland overflow onto the ground surface is prohibited.

809.17.2 Waste restrictions. Disposal of industrial, hazardous, or non-domestic wastewater into a constructed wetland is prohibited.

809.17.3 Vehicle exclusion. Vehicles or machinery are not permitted to track onto the treatment area of the constructed wetland.

SECTION 810 PLANT EVAPOTRANSPIRATION BEDS.

810.1 Scope. The provisions of this section shall govern the design and installation of plant evapotranspiration beds for the management of onsite wastewater systems servicing individual domestic dwellings. Plant evapotranspiration beds include domestic onsite wastewater that is dispersed into beds planted with shallow-rooted, high evapotranspiration assisting plantings.

810.2 Application. Plant evapotranspiration beds shall only be permitted where specifically authorised by the Authority Having Jurisdiction (AHJ). The requirements in this section shall be in addition to the requirements of the applicable local codes and standards. Such systems shall be designed, constructed, and operated to protect public health, prevent nuisance conditions, and avoid degradation of surface water or groundwater.

810.3 Exclusions and limitations. This plant evapotranspiration bed section only includes systems that receive domestic human excreta. However, if a plant evapotranspiration bed receives waste from food waste disposal units then the plant evapotranspiration bed shall be designed by a suitably qualified and experienced person that takes into account the additional flows and loads generated.

810.4 Design principles. Design principles shall comply with this section.

810.4.1 Evapotranspiration process. Plant evapotranspiration beds are designed to treat domestic wastewater by plants absorbing water and nutrients through the roots and releasing water through leaves into the atmosphere through transpiration, and sun and wind induced evapotranspiration.

810.4.2 Soil infiltration. The effluent not taken up by plants is absorbed and infiltrates through the natural soil or substrate through natural gravity seepage at the base, below the plant evapotranspiration bed, at a rate determined by the soil structure and texture (soil type).

810.4.3 Sealed containment. Plant evapotranspiration beds are designed to prevent discharge to surface or groundwater by use of sealed beds and vegetation layers that facilitate water loss through natural processes.

810.4.4 Site suitability. Plant evapotranspiration beds are considered suitable for semi-arid environments, high groundwater locations, or sites with poor soil permeability.

810.4.5 Capillary action. The sand layer that overlies the treatment medium of a plant evapotranspiration bed draws liquid upward by capillary action to feed both water and nutrients to stimulate plant growth and evapotranspiration.

810.4.6 Surface diversion. During periods of wet weather, surface flows shall be diverted around the edges of the plant evapotranspiration bed.

810.5 Critical design features. Critical design features shall comply with this section.

810.5.1 Qualified personnel. A suitable qualified and experienced person (SQEP) with relevant knowledge and experience shall carry out the design and installation.

810.5.2 Bed quantity. A minimum of two beds shall be installed at any site with a maximum bed length of 20 m (65.62 feet) to ensure even distribution over the entire infiltration area.

810.5.3 Bed dimensions. A maximum bed width of 4 meters (13.12 feet) with a minimum separation distance between bed edges of 1.5 meters (4.92 feet).

810.5.4 Media depth. The minimum treatment medium depth should be 200 mm (7.87 inches) of sand (0.5 – 1 mm (0.02- 0.04 inches) diameter) overlying 200 mm (7.87 inches) of gravel (20 mm (0.79 inches) minimum diameter) and 50 mm (1.97 inches) of cushion sand. Therefore, the minimum excavated depth of a plant evapotranspiration system shall be 450 mm (17.72 inches) below ground level.

810.5.5 Topsoil mounding. A minimum mounded topsoil thickness of at least 150 mm (5.91 inches) is required to manage sidewall seepage under winter conditions.

810.5.6 Dose loading. The onsite wastewater shall be dose loaded into the plant evapotranspiration bed by pump or siphon to ensure even loading within the distribution pipe.

810.5.7 Bed mounding. The plant evapotranspiration system shall be mounded to shed rainwater and avoid ponding.

810.5.8 Runoff diversion. Surface runoff shall be diverted away from the plant evapotranspiration system by contour trenches.

810.5.9 Pipe venting. The influent distribution pipe shall be vented at both ends.

810.5.10 Reserve area. A 100% reserve area shall be available for either future extensions or for replacement of the original system in the event that due to unforeseen circumstances the system does not match the design expectations.

810.6 Influent quality. A range of influent quality shall be suitable for a plant evapotranspiration system ranging from a minimum treatment provided by a septic tank fitted with an effluent outlet filter to tertiary treated onsite wastewater.

810.6.1 Grit screening. A grit removal screen shall be fitted prior to effluent entering a plant evapotranspiration system.

810.7 Sizing. Minimum size requirements shall include:

1. The top surface of the treatment area shall be at least $3m^2$ ($32.29ft^2$) per person equivalent.
2. The minimum total area shall be $15m^2$ ($161.46ft^2$) regardless of the number of people within the domestic dwelling.
3. The minimum width of the plant evapotranspiration system shall be at least 2 meters to ensure that edge effects are not significant.

810.8 Plants. Plants shall comply with this section.

810.8.1 Vegetation cover. Plants used within the plant evapotranspiration system shall provide healthy and dense vegetation cover to maximise plant evapotranspiration and nutrient uptake. The plant roots however shall not impact the function of the onsite wastewater system.

810.8.2 Plant selection. Where possible native non-invasive plant species suitable for wetland environments shall be used.

810.8.3 Moisture management. The wetland shall be kept moist during periods of dry weather, especially during the first year to ensure that establishment of young plants in areas of high plant evapotranspiration rates and low summer onsite wastewater use.

810.9 Hydraulic loading and vegetation. Hydraulic loading and vegetation shall comply with this section.

810.9.1 Loading limits. Hydraulic loading rates shall not exceed the infiltration and evapotranspiration capacity of the site soils and vegetation.

810.9.2 Soil based rates. Depending on the soil category in accordance with the AHJ loading rates shall vary. This ranges from a highly structured soil with an indicative permeability of between 1.5 – 3 (Ksat) m/day resulting in a loading rate of up to 15 mm (0.59 inches)/day to a massive structured soil with an indicative permeability of between 0.06 – 0.12 (Ksat) m/day resulting in a loading rate of up to 5 mm/day.

810.9.3 Resting zones. Application areas shall be designed with alternating or resting zones to allow soil and vegetation recovery.

810.10 Setback distances. The minimum horizontal separation distances from a plant evapotranspiration system shall be:

1) 30 m (100 ft) from potable water supply wells.

2) 15 m (50 ft) from surface waters including lakes, rivers, and streams.

3) 7.5 m (25 ft) from property lines and public rights-of-way.

4) 7.5 m (25 ft) from dwellings and occupied buildings.

810.11 Vertical separation. A minimum vertical separation of 600 mm (24 in) shall be maintained between the base of the plant evapotranspiration system and seasonable high groundwater table.

810.12 Ventilation. The base of the plant evapotranspiration system shall be ventilated by ventilation pipes that rise above the system by at least 100 mm (3.94 inches).

810.13 Operation and maintenance. Operation and maintenance shall comply with this section.

810.13.1 Plant maintenance. Plant cover over the evapotranspiration system shall be regularly maintained to avoid plant overgrowth and vegetation collapse onto the bed surface.

810.13.2 Growth checks. Regular vegetation checks shall be undertaken to ensure optimum growth conditions for maximising evapotranspiration.

810.13.3 Record keeping. Effluent sampling and system performance records shall be retained and provided to the AHJ upon request.

810.14 Operation and maintenance manual. An operation and maintenance manual shall be supplied in hardcopy with all systems. The manual shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

1) Schedule for all regular maintenance tasks.
2) Instructions for all regular maintenance tasks.
3) Instructions on unacceptable materials that should not be flushed down the toilet.

810.15 Health and safety. Edible crops (such as, vegetables or fruits) shall not be planted within a plant evapotranspiration system.

810.16 Prohibited practices. Prohibited practices shall comply with this section.

810.16.1 Overflow prohibition. Effluent loading which causes uncontrolled overflow onto the surrounding ground surface is prohibited.

810.16.2 Waste restrictions. Disposal of industrial, hazardous, or non-domestic wastewater into constructed wetlands is prohibited.

811 Biological filtration systems. Biological filtration systems shall comply with this section.

811.1 Scope. The provisions of this section shall govern the design and installation of biological filtration systems for the management of onsite wastewater systems servicing individual domestic dwellings. Biological filtration systems (sometimes referred to as package media filters) are modular units that utilise natural materials to provide mechanical filtration, chemical adsorption or a substrate for microbial growth for onsite wastewater treatment.

811.2 Application. Biological filtration systems shall only be permitted where specifically authorised by the Authority Having Jurisdiction (AHJ). The requirements in this section shall be in addition to the requirements of the applicable local codes and standards. Such systems shall be designed, constructed, and operated to protect public health, prevent nuisance conditions, and avoid degradation of surface water or groundwater.

811.3 Exclusions and limitations. This biological filtration systems section only includes systems that receive domestic human excreta. However, if a biological filtration system receives waste from food waste disposal units then the system shall be designed by a suitably qualified and experienced person that takes into account the additional flows and loads generated.

811.4 Design principles. Design principles shall comply with this section.

811.4.1 Filtration systems. Biological filtration systems includes both physical natural filtration media and biological filtration systems.

811.4.2 Physical filtration. Physical filtration systems utilise inert natural materials to act as a sieve to remove solids and smaller contaminants by creating a physical barrier for the contaminants, preventing their passage. Examples include: crushed glass, natural textiles/fabric or volcanic scoria or pumice sand.

811.4.3 Biological filtration. Biological filtration systems include natural materials that actively participate by feeding the biology to create a biofilm or chemically binding contaminants. There are two specific options:

1) Organic media: Peat, coconut coir, maize/corn cobs, rice/coffee husks which provide a carbon source for denitrifying bacteria.

2) Mineral and buffering media: crushed oyster or snail shells and crushed limestone which act as natural pH buffers.

Examples of biological filtration media and their primary mechanism, maintenance level and best use are given below in Table 811.4.3.

Table 811.4.3 Examples of biological filtration media and their primary mechanism, maintenance level and best use

Biological filtration Media Type	**Primary mechanism**	**Maintenance level**	**Best used for**
Crushed Glass	Mechanical Sieve	High (Backwashing)	Fine solid removal
Plastic Biomedia	Biological Oxidation	Low (Self-cleaning)	Ammonia & BOD reduction
Coconut/Peat	Adsorption/Carbon	Medium (Replacement)	Odor & Heavy metal removal

Oyster Shells	pH Buffering	Low	Acidic effluent stabilization
Biochar	Adsorption/Physical	Medium (Replacement)	Final polishing & odors
Volcanic Scoria	Biological/Physical	Low	Fixed-bed biofilms

811.5 Influent quality. Influent quality shall comply with this section.

811.5.1 Influent quality. A range of influent quality shall be suitable for a biological filtration systems ranging from a minimum treatment provided by a septic tank fitted with an effluent outlet filter to tertiary treated onsite wastewater.

811.5.2 Grit screening. A grit removal screen shall be fitted prior to effluent entering the biological filtration system

811.6 Hydraulic loading. Hydraulic loading shall comply with this section.

811.6.1 Loading limits. Hydraulic loading rates shall not exceed the infiltration capacity of the biological filtration media.

811.6.2 Resting zones. Application areas shall be designed with alternating or resting zones to allow for biofilm recovery.

811.7 Effluent discharge. Effluent discharge shall comply with this section.

811.7.1 Retention requirements. As required by the AHJ minimum wastewater retention times and wastewater quality shall be meet within the biological filtration system before discharge to the environment.

811.7.2 Further treatment. If further wastewater reuse is desired, the next treatment stages shall proceed after the biological filtration system process.

811.8 Setback distances. The minimum horizontal separation distances from the discharge of a biological filtration system shall be:

1) 30 m (100 ft) from potable water supply wells.

2) 15 m (50 ft) from surface waters including lakes, rivers, and streams.

3) 7.5 m (25 ft) from property lines and public rights-of-way.

4) 7.5 m (25 ft) from dwellings and occupied buildings.

811.9 Vertical separation. A minimum vertical separation of 600 mm (24 in) shall be maintained between the discharge point of a biological filtration system and seasonable high groundwater table.

811.10 Ventilation. The base of the biological filtration system shall be ventilated by ventilation pipes.

811.11 Operation and maintenance. Operation and maintenance shall comply with this section.

811.11.1 Record keeping. Effluent sampling and system performance records shall be retained and provided to the AHJ upon request.

811.11.2 Maintenance tasks. The maintenance tasks and their frequency will be determined by the various biological filtration media as shown in Table 811.11.2.

Table 811.11.2

Maintenance frequency	Maintenance task	Target media
Daily/Weekly	Pressure Differential Check	Physical (Glass/Sand/Textile)
Monthly	Visual Inspection	Organic (Peat/Coconut/Maize)
Quarterly	Sludge Depth Check	Settlement Ponds
Bi-Annually	Media Top-up	Buffer (Shells/Limestone)
Annually	Biofilm Health Check	Biomedia (Plastic/Scoria)

811.12 Operation and maintenance manual. An operation and maintenance manual shall be supplied in hardcopy with all systems. The manual shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

1. Schedule for all regular maintenance tasks.
2. Instructions for all regular maintenance tasks.
3. Instructions on unacceptable materials that should not be flushed down the toilet.

811.13 Health and safety. A physical barrier shall be erected surrounding the biological filtration system to eliminate unauthorised people, especially children and animals.

811.14 Prohibited practices. Prohibited practices shall comply with this section.

811.14.1 Overflow prohibition. Effluent loading which causes uncontrolled overflow onto the ground surface is prohibited.

811.14.2 Wate restrictions. Disposal of industrial, hazardous, or non-domestic wastewater into a biological filtration system is prohibited.

812 Vermifiltration systems. Vermifiltration systems shall comply with this section.

812.1 Scope. The provisions of this section shall govern the design and installation of vermifiltration systems for the management of onsite wastewater systems servicing individual domestic dwellings.

812.2 Application. Vermifiltration systems shall only be permitted where specifically authorised by the Authority Having Jurisdiction (AHJ). The requirements in this section shall be in addition to the requirements of the applicable local codes and standards. Vermifiltration systems shall be designed, constructed, and operated to protect public health, prevent nuisance conditions, and avoid environmental degradation (such as surface water or groundwater).

812.3 Exclusions and limitations. Exclusions and limitations shall comply with this section.

812.3.1 System scope. Vermifiltration systems, more broadly, can be used to treat wastewater on a larger scale (Such as municipal wastewater treatment plant) and non-sewage wastewaters (such as household greywater, agricultural processing wastewater) and these uses are not considered in this Standard.

812.3.2 Design requirements. This vermifiltration system section only includes systems that receive domestic human excreta. However, if vermifiltration systems are to receive waste from food waste disposal units then the onsite wastewater treatment plant and land application system shall be designed by a suitably qualified and experienced person that takes into account the additional flows and loads generated.

812.4 Effluent quality. Domestic vermifiltration systems can receive effluent from a range of onsite wastewater sources from septic tank effluent to tertiary treated onsite wastewater.

812.5 Design principles. Design principles shall comply with this section.

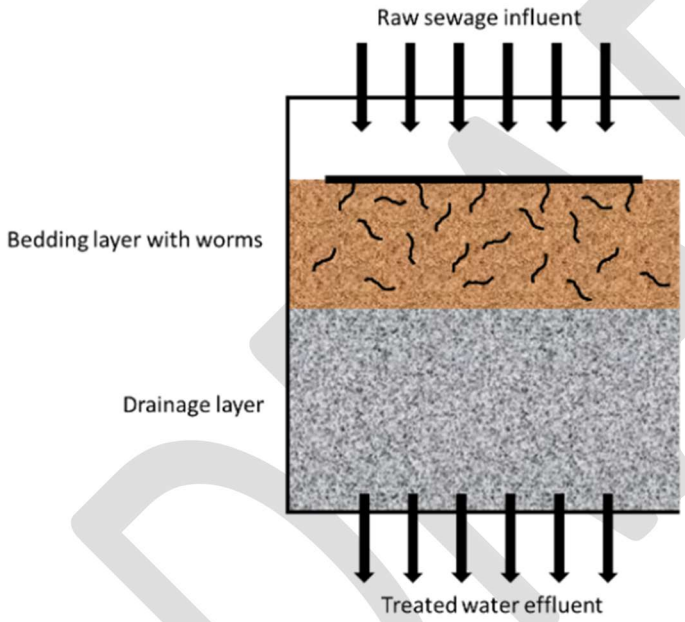
812.5.1 System function. The function of a vermifiltration system is to remove organic contaminants from toilet wastewater from a domestic dwelling.

812.5.2 Biological action. Within a vermifilter, the activity of composting earthworms and various microorganisms enable the biological filtration of wastewater.

812.5.3 Organic decomposition. Solid organic waste is trapped in the bedding layer and aerobically decomposed into carbon dioxide gas and a small amount of vermicompost. Vermicompost is a stable and inoffensive product that can be used as a soil conditioner or removed for disposal in an authorised manner by the AHJ. The aerobic decomposition process does not generate climate-damaging methane gas. A schematic diagram of a basic vermifilter with vertical flow is shown in Figure 812.5.3.

Figure 812.5.3.

Schematic diagram of a basic vermifilter.



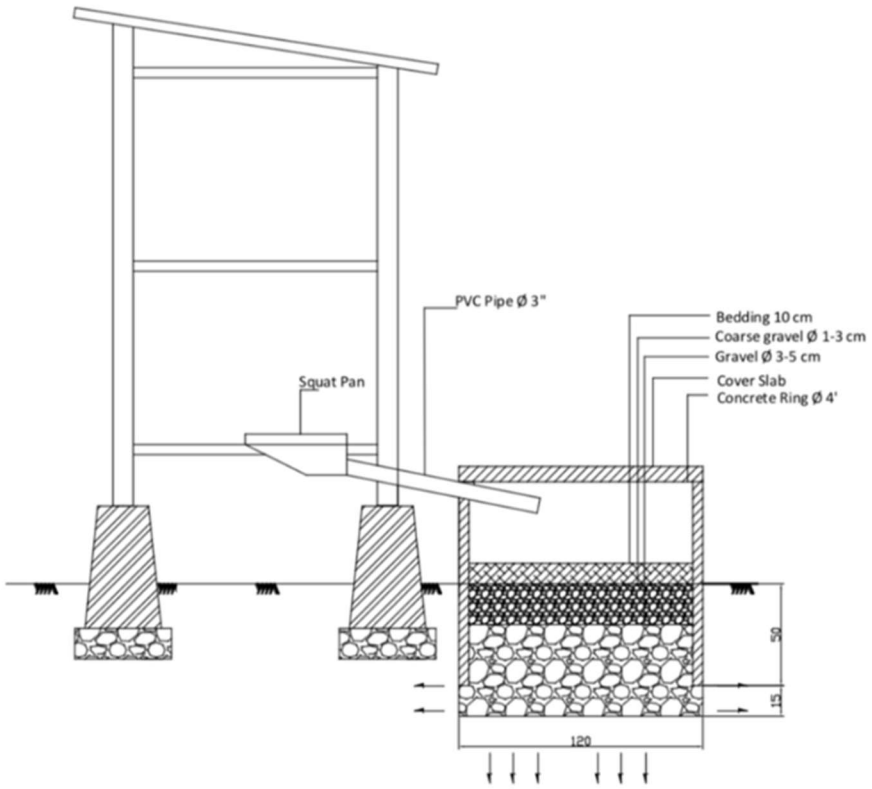
812.5.4 System categories. There are two main categories of vermifilters:

1. Open-system vermifilters
2. Closed-system vermifilters

Open-system vermifilters are set into the ground and have perforated sides and/or bottom, allowing the treated liquid effluent to infiltrate directly into the surrounding soil. An example is the Tiger Toilet shown in Figure 812.5.4-1 (Source: *Oxfam Tiger Worm Toilet Manual*, 2020). Tiger Toilet vermifilters are considered an appropriate excreta disposal solution for rural low-resource settings. The Tiger Toilet is low cost, uses mainly locally available materials, and does not require any specialized skills for construction and maintenance. Due to the high efficacy of the vermifiltration decomposition process, most of the solid waste is converted to carbon dioxide gas,

leaving a small amount of vermicompost that must be removed every six to eight years for a typical household size. The toilet (typically a squatting pan) is enclosed in a simple outhouse super-structure, and uses a pour-flush mechanism with a water seal to separate the users from the vermifilter. This results in minimal odors or flies.

Figure 812.5.4-1: A typical Tiger Toilet design, with treated effluent infiltrating into the soil surrounding the vermifilter (Source: Oxfam Tiger Worm Toilet Manual, 2020).



Closed-system vermifilters are enclosed in sealed tanks that contain the treated liquid effluent and direct it to further treatment or disposal elsewhere. Figure 812.5.4-2 shows an example of a vermifilter constructed in Hawaii that provides primary treatment of household wastewater and then drains the effluent to a planted gravel bed for secondary treatment (Source: *Tiger BioFilter Solutions*, 2022). Compared to a conventional septic tank, a vermifilter system like this is easier and less expensive

to install. It requires less maintenance, because vermicompost builds up more slowly than the accumulation of sludge in septic tanks, as solids are digested by the composting worms and converted largely into carbon dioxide which dissipates into the air.

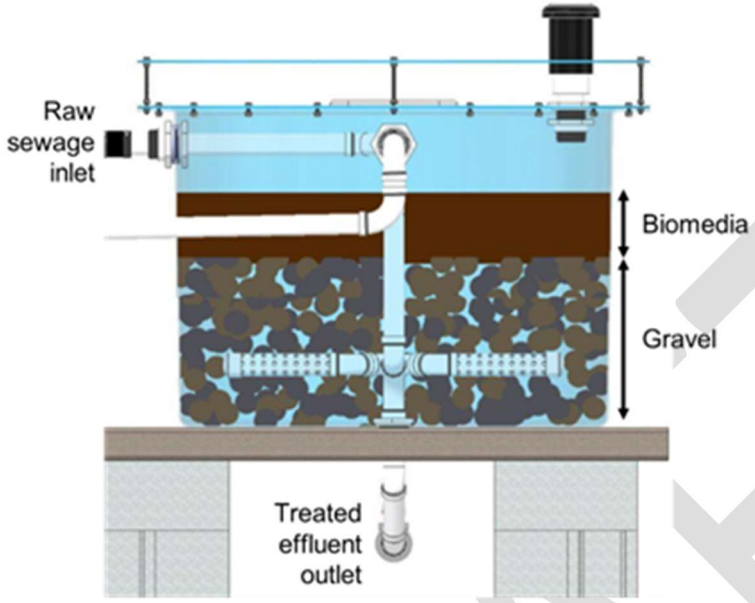


Figure 812.5.4-2: A closed-system vermifilter in a sealed tank, which provides primary treatment and then directs wastewater elsewhere for disposal or additional treatment (Source: Tiger BioFilter Solutions, 2022).

812.6 Critical design factors. Critical design factors shall comply with this section.

812.6.1 Worms. Vermifiltration system composting worms are only to be used (Such as *Eisenia fetida* known commonly as redworms or tiger worms).

812.6.2 Habitat. In order for a vermifiltration system to function properly an appropriate habitat for composting worms shall be maintained and include:

1. A bedding layer of organic material (Such as wood chips) to act as a primary tiler to trap excreta and allow for aeration and water drainage.
2. Composting worms primarily feed at the surface so a minimum surface area of one square meter per a family (five people) shall be provided within a domestic vermifiltration system.
3. Adequate food supply (Such as human excreta) shall be provided to the worms and extended non-use of the toilet system (for periods longer than several weeks) shall be avoided.
4. Materials and substances (Such as large quantities of high-strength bleach) that are toxic to worms or beneficial microorganisms or non-degradable products (Such as plastics) shall not enter the toilet system.

5. A suitable moisture content (specify %) with an adequate influent flow rate shall be maintained within the system at all times to protect against periods of excessive drying or flooding.
6. Beneath the bedding layer, a drainage layer of inorganic material (Such as gravel) shall be present to provide further treatment and filtration of the wastewater. This drainage layer shall consist of finer grade materials at the top and coarser materials at the bottom.
7. The vermifiltration system shall facilitate the development of bacterial biofilms on the surface of the drainage media inorganic material to further assist wastewater treatment processes.
8. For closed vermifiltration systems, that are contained within an enclosed tank an appropriately sized outlet pipe must be included with adequate effluent flow rates maintained to avoid back-up of wastewater into the bedding layer and negatively impacting worm health.
9. For open vermifiltration systems, lining materials must contain perforations or openings on the sides and/or base to maintain adequate effluent flow rate to avoid back-up of wastewater into the bedding layer and negatively impacting worm health.
10. Regardless of vermifiltration system type, the system must be sized to accommodate the domestic dwelling's typical influent volumes.
11. For open vermifiltration systems, the infiltration rate and surface area of the receiving land/soil must be adequately designed/calculated to ensure timely infiltration/disposal of the influent volumes.
12. At least 40cm (16 inches) of headroom should be designed between the bottom of the inlet pipe and the top of the bedding layer to ensure aeration and space or vermicompost accumulation.

812.6.3 Construction. Vermifiltration toilet systems shall be constructed with the following design features:

1. Protect users from contact with untreated excreta;
2. Adequate capacity for the treatment of wastewater (in accordance with the design capacity of the system);
3. Ensure adequate flow-through of wastewater and avoidance of blockage;
4. Provision for disposal or further treatment of effluent;
5. Access for inspection and for removal of accumulated vermicompost;
6. Reduce the likelihood of unauthorised access to untreated excreta;
7. Built from materials that are resistant or impervious to the excreta and effluent for the serviceable life of the system;

8. Prevent likelihood of damage from any superimposed loads or normal ground movement;
9. Remain integral for their serviceable life;
10. Perform adequately with only normal maintenance over their serviceable life;
11. Prevent odours from exfiltrating the vermifiltration toilet system;
12. Prevent unwanted entry of insects or vermin into any part of the vermifiltration toilet system;
13. Appropriate system siting to reduce the likelihood of floodwaters entering; the system;
14. Ensure adequate passive aeration and suitable habitat for worms.

812.7 System materials and components. Components expected to contact excreta or effluent shall be constructed of corrosion-resistant material such as stainless steel or durable polymers. Concrete in contact with excreta or effluent shall meet requirements of Section 813.3.9.

812.8 Pipe and fixtures. Pipe, pipe fittings, traps, fixtures, material, and devices used in vermifiltration toilet systems that are expected to contact effluent shall be listed by an approved agency or a third-party certification agency, unless otherwise approved by the code official. Products and materials shall be identified.

812.9 Concrete and masonry construction. Concrete and masonry construction shall be reinforced, watertight, and, if used to support a structure or user, able to withstand the expected structural loading. Where drainage is required, the vermifilter floor shall be sloped not less than 20mm per meter (¼-inch per foot), or 2 percent. The flange of each sub-drain shall be set level.

812.10 Toilets. Toilets used in vermifiltration toilet systems may shall designed for either sitting or squatting, and in all cases shall have a water seal (S-trap or P-trap) to separate the user from the vermifilter.

812.11 Vermifilter. Vermifilters shall maintain unsaturated aerobic composting conditions within the bedding layer, ensured by adequate drainage of effluent through the drainage layer.

812.12 Openings. Openings to the vermifilter shall be covered and secured to prevent tampering. Openings shall be screened or covered to prevent insect and vermin infiltration and be protected against unauthorized human entry.

812.13 Watertightness. Vermifilters shall be constructed of watertight material in accordance with Section 813.3.7. An exception is made for open-system vermifiltration toilet systems (such as the Tiger Toilet) that allow effluent to infiltrate directly into the soil surrounding the vermifilter.

812.14 Vermifilter sizing. Vermifilters shall be sized to accommodate the maximum daily adult usage as specified by the manufacturer's or designer's published ratings. A typical vermifilter size for a 5-person family contains a bedding layer with a surface area of at least 1 m^2 (10.76 ft^2).

812.15 Grade level. Vermifilter walls installed below grade shall be structurally designed to withstand anticipated earth or other loads. The upper edge of the vermifilter shall extend at least 100 mm (4

inches) above the surrounding grade to avoid flooding by rainwater. The surrounding grade shall be sloped away from the vermifilter.

812.16 Cover. Vermifilter covers that are slightly above grade (see 813.3.15) shall be made of reinforced concrete or other rigid material, and capable of supporting the weight of people and livestock that walk on it. The vermifilter cover shall be removable, or shall include a manhole opening of sufficient size, to enable periodic removal of accumulated vermicompost.

812.17 Headroom. Vermifilters shall be sized such that the headroom between the bottom of the inlet pipe and the top of the bedding layer is not less than 40 cm (16 inches), prior to any accumulation of vermicompost. This headroom is intended to allow several years of operation of the vermifiltration toilet system before vermicompost removal is required.

812.18 Ventilation. Vermifilters shall be constructed to allow adequate ventilation of gases, enabling aerobic decomposition of excreta. Ventilation shall be accomplished by an air gap between the vermifilter cover and tank, a screened ventilation pipe, or other methods approved by he AHJ. Ventilation openings shall comply with 812.12 and 812.19.

812.19 Insects and vermin. Vermifilters shall be protected to prevent the unintentional entry of insects and vermin. Unsecured openings, other than drainage, shall not exceed 6 mm (1/4 inch) in the least dimension.

812.20 Effluent. Effluent shall be disposed of in accordance with local regulations. In open-system vermifiltration toilet systems (such as the Tiger Toilet) the effluent shall infiltrate directly into the soil surrounding the vermifilter. In closed-system vermifiltration toilet systems, the effluent shall be collected, further treated as needed by secondary treatment processes, and drained to an approved sanitary drainage system or other location approved by the code official.

812.21 Secondary treatment. In jurisdictions mandating effluent treatment to a specified quality (Such as in conformance with NSF-40 or NSF-245 standards), effluent from the vermifilter shall be directed to secondary treatment processes such as trickling filters or planted gravel beds. The final effluent from the secondary treatment shall to tested to ensure compliance with locally-applicable standards.

812.22 Effluent reuse. In jurisdictions allowing reuse of treated water, effluent shall be treated to a specified quality (Such as in conformance with NSF-350 standards) using secondary treatment methods and reused in accordance with local regulations.

812.23 Unacceptable materials. Users of the vermifiltration toilet system shall be instructed to not flush unacceptable items down the toilet, such as plastics, metals, non-biodegradable materials, pharmaceuticals, feminine hygiene products, kitchen greases and oil, acid-based or other harsh chemical toilet cleaners, oil, petroleum products, chemical waste, paint and paint thinners.

812.24 Temperature. Vermifiltration toilet systems shall account for the reduced metabolism and reproduction of composting worms in regions subject to cold conditions. Temperature within the bedding layer shall not remain below 10 °C (50 °F) for extended periods. In addition to local ambient temperature, factors affecting the temperature within the bedding layer includes placement of the vermifilter below grade, insulation placed around the vermifilter, heat generated by the metabolism

of worms and microorganisms, and the temperature of flush water and excreta introduced into the vermifilter.

812.25 Worm supply. The installer of vermifiltration toilet systems shall maintain a source of composting worms, so that replacement worms are available for addition to a vermifilter in case of die-off of the worm population (due to the user flushing toxic material down the toilet). Prior to replacing the worm population, the installer shall ascertain the reason for the die-off, and take steps to avoid its reoccurrence.

812.26 Vermicompost removal. Vermicompost shall be removed from the vermifilter in accordance with the operation and maintenance manual. Vermicompost shall be permitted to be used around ornamental shrubs, flowers, trees, or fruit trees and shall be mixed with soil or mulch and covered with at least 76 mm (3 inches) of cover material. Depositing vermicompost from any vermifiltration toilet system around any edible vegetable or vegetation shall be prohibited.

812.27 System records. The property owner is responsible for retaining maintenance records (such as vermicompost emptying, any problems arising such as waste accumulation, smells or liquid backing-up) and making such records available to the authority having jurisdiction upon request. Upon transfer of property or tenancy, all maintenance records shall be transferred to the owner or tenant.

812.28 Maintenance responsibility. The required maintenance and inspection of vermifiltration toilet systems shall be the responsibility of the property owner, unless otherwise required by the authority having jurisdiction.

812.29 Operation. Vermifiltration systems shall be operated and maintained in a safe and sanitary condition.

812.30 Operation and maintenance manual. An operation and maintenance manual shall be supplied in hardcopy with all systems. The manual shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

- Schedule for all regular maintenance tasks.
- Instructions for all regular maintenance tasks.
- Instructions on unacceptable materials that should not be flushed down the toilet.
- Expected schedule for removing vermicompost from the vermifilter.
- Plan for safe handling and on-site disposal of vermicompost or professional removal.

812.31 Health and safety. Site appropriate barriers or fencing shall be erected surrounding the vermifiltration system to eliminate unauthorised people, especially children and animals from accessing the system.

813 Onsite wastewater secondary treatment systems (OWSTS). Onsite wastewater secondary treatment systems shall comply with this section.

813.1 Scope. This chapter applies to the design, construction, performance, installation, and operation of OWSTS. These systems are intended to provide enhanced treatment beyond conventional septic systems. The requirements of this chapter cover both mechanical OWSTS used in conjunction with soil absorption fields and systems that provide secondary treatment in the same footprint, hereafter referred to as "combined treatment and dispersal (CTD) systems". Unless otherwise approved by the AHJ or expressly permitted by Section 813, components of an OWSTS shall comply with all other applicable Chapters of this Standard.

813.2 System requirements. Systems shall comply with this section.

813.2.1 Treatment standards, evaluation, and conformance. Treatment standards, evaluation, and conformance shall comply with this section.

813.2.1.1 Standards. OWSTS shall be evaluated and certified as compliant with at least one of the following standards: NSF/ANSI 40, EN 12566-3, BNQ 3680-600 series, or AS 1546.3.

813.2.1.2 Accredited evaluation program. Compliance evaluations, including performance testing, shall be performed by an independent third-party organization accredited to ISO/IEC 17065 or ISO/IEC 17025, as applicable to the certification and test scope, and as acceptable to the Authority Having Jurisdiction (AHJ). Organizations or agencies that do not hold accreditation as described in this section are permitted to evaluate OWSTS if approved to do so by the regulatory AHJ.

813.2.1.4 Certification. OWSTS shall hold a current certification to NSF/ANSI 40, EN 12566-3, BNQ 3680 series, or AS 1546.3, for the design loading and performance class applicable to the intended use.

813.2.2 Sampling and observation. The system shall be designed and installed with the capability to be sampled for monitoring of effluent quality.

813.2.2.1 . Port, required. Systems shall include a dedicated sampling and/or observation port located downstream of the last point of treatment and upstream of any soil dispersal for PTP systems, at the natural soil dispersal interface for CTD systems, and shall be approved by the AHJ.

813.2.2.2 Port location. The sampling port shall provide direct and safe withdrawal of representative effluent samples, shall be accessible from finished grade without excavation or with a traffic-rated access cover where needed, and shall include provisions to prevent inflow/infiltration and ensure operator safety. The system design shall ensure effluent conditions, such as flow, or mixing, at the sampling point are representative of system treatment performance.

813.2.3 Failure sensing and alarms. Each system shall be equipped with failure-sensing devices and associated alarms to alert users or service providers of the failure of critical system components.

813.2.3.1 Failure detection. Systems shall include sensors and controls capable of detecting abnormal operating conditions, including high water level within each treatment or dosing tank, aeration pump failure, recirculation or dosing pump failure, disinfection system failure (if disinfection is installed), and electrical power failure to any electrically powered component.

813.2.3.2 Audio and visual alarms. Failure conditions shall activate both audio and visual alarms. The visual alarm shall be located where it is easily observable by the system owner or maintenance provider. The audio alarm must be distinctively recognizable and capable of being muted while the visual indicator remains active until the failure condition is resolved.

813.2.3.3 Remote signaling. Where required by the AHJ or specified by the manufacturer, alarms shall be capable of remote notification and data logging.

813.2.3.4 Weather resistance. Control and alarm panels shall be weather-resistant and installed in accordance with the manufacturer's instructions and AHJ requirements.

813.2.3.5 Exemption. Systems without mechanical devices included in system design are exempt from requirements of Section 813.2.3.

813.3 Installation. Installation shall comply with this section.

813.3.1 Conformance to approved design. Systems shall be installed in accordance with the tested and certified system design used during the compliance evaluation required under section 813.2.1, including tank sizing, process train configuration, media types, aeration or dosing equipment, disinfection equipment, and control settings. The manufacturer's approved instructions and any other requirements of the AHJ shall be followed.

813.3.2 System initiation. Where applicable, startup shall include verification of sensor calibration, alarm function, process setpoints, watertightness, and successful completion of manufacturer-prescribed commissioning procedures.

813.3.3 System protection. Access risers, covers, electrical enclosures, sampling ports, and appurtenances shall be protected from traffic, flooding, frost heave, and vandalism as applicable to site conditions.

813.3.4 Enhancements and alterations. System enhancements that improve system performance are permissible, provided they are approved by the designer and the AHJ. Any alteration, modification, or substitution of components that negatively impact system performance, affect treatment processes, or modify certified flow paths or operating parameters shall not be permitted.

813.4 Soil absorption fields. Soil absorption fields shall comply with this section.

813.4.1. General requirements. Soil absorption fields (SAF) used in conjunction with a mechanical OWSTS or as a CTD system design shall meet applicable requirements of this standard, except as modified under Section 813.4.2 for SAF sizing or for isolation from restrictive layers. Modification using both 813.4.2.1 and 813.4.2.2 is prohibited unless approved by the AHJ. For OWSTS use in unsuitable soil, see Section 813.4.3 of this Chapter.

813.4.2 Permissible modifications to SAF for OWSTS used in suitable soils. Permissible modifications shall comply with this section.

813.4.2.1 Size reduction. A 25 percent increase in the applicable soil loading rate as determined by Table 803.3.2 (resulting in a decrease in the required SAF footprint) shall be permissible where the preceding secondary treatment system is certified and installed per this section and where allowed by the AHJ.

813.4.2.2 Vertical isolation reduction. The minimum required vertical isolation distance between the bottom of the trench or absorption bed and a restrictive layer, such as impermeable soil or a seasonal high water table, shall be permissible to be reduced to not less than 610 mm (24 inches) where the preceding OWSTS is certified and operated per this section and where allowed by the AHJ.

813.4.3 Permissible Modifications To SAF For OWSTS Used In Unsuitable Soils (Conditional). If expressly permitted by the Authority Having Jurisdiction (AHJ) on a case-by-case basis, an OSWTS system shall be allowed in soils that are otherwise determined to be unsuitable per the standard's soil loading rate table (Table 803.3.2), provided the system's certified performance and dispersal design mitigate limiting factors such that public health and environmental protection are maintained.

813.5 Operation and Maintenance (O&M). Operation and maintenance shall comply with this section.

813.5.1 Responsibility. The system owner shall be responsible for ensuring the system is maintained and serviced on a regular schedule.

813.5.2 Frequency. Systems shall be inspected, monitored, and serviced at a frequency determined by the AHJ, and not less than the minimum service interval recommended by the manufacturer or specified in the certification.

813.5.3 Provider qualifications. Maintenance shall be performed by individuals qualified in the servicing of the OWSTS as required by the AHJ.

813.5.4 Evaluation and documentation. At each service event, the following shall be verified and documented: treatment process operation, condition and functionality of sensors and alarms, sludge and scum accumulation, effluent clarity and odor, electrical integrity, condition of sampling ports and access covers, and CTD or soil absorption field distribution checks where accessible.

813.5.5 Record retention. Service records shall be retained by the system owner and made available to the AHJ upon request, including dates of service, findings, corrective actions, parts replaced, and laboratory results where applicable.

813.6 Performance Retention. Systems shall maintain performance equal to or greater than the certified performance class where operated and maintained in accordance with Section 813. Any change in influent characteristics or loading beyond certified limits shall be evaluated and approved by the AHJ.

813.7 System Manuals, Identification, and Marking. System manuals, identification and markings shall comply with this section.

813.7.1 Provision. The manufacturer or system designer shall provide a comprehensive manual to both the AHJ and the system owner prior to installation and operation.

813.7.2 Required information. The manual shall include, and not be limited to, the following information:

1. Detailed instructions for system installation.
2. System component specifications (including model numbers, electrical requirements, and performance characteristics).
3. Recommended operation and maintenance (O&M) procedures and schedules.
4. Detailed troubleshooting guide for common fault conditions and alarm responses.
5. Limitations and restrictions for use that are essential to maintain certified performance.
6. Current contact information for the manufacturer, the system designer, and the installer.

813.7.3 Identifying markers. Treatment units, control panels, and alarm devices shall be permanently labeled with the manufacturer name, model, serial number, electrical ratings, and applicable certification standards.

SECTION 814 SOURCE SEPARATION.

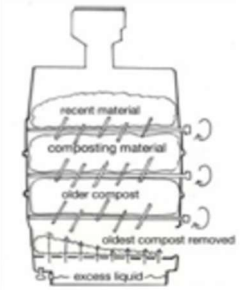
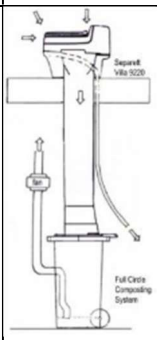
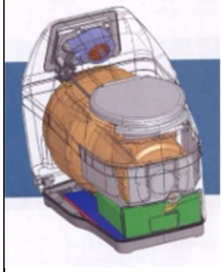
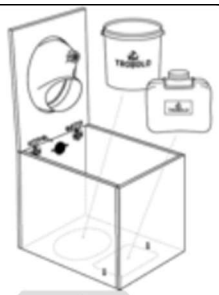
814.1 Composting Toilet Systems. Composting toilet systems shall comply with this section.

814.1.1 General. The function of a composting toilet system is to collect and treat human excreta and any other added organic material and bulking agents from a domestic dwelling.

The conditions within the compost processor provide the conditions necessary for biological decomposition of human excreta to humus, a safer, more stable and less offensive product that can be used as a soil conditioner or removed for disposal in a manner approved by local regulatory authorities. The five types of systems typically referred to as “composting toilets” are listed below in Table 814.1.1 Composting toilets shall be one of the types listed in Table 814.1.1.

Table 814.1.1

Continuous Composter	Batch Composter	Desiccating Toilet	Container-Based Toilet	Thermophilic Composter
Fresh excrement is added to one side and decomposed material is removed from the other. This is the design of the first modern composting toilet, the Clivus Multrum.	Multiple containers isolate fresh excrement from decomposing material. This is the most common site-built design.	Heating and ventilation are used to dry excrement without any, or possibly minimal, biological decomposition. Most self-contained “cottage” composting toilets are of this design, as are many	Excrement is contained and odor controlled by adding organic matter (such as sawdust or coconut coir). The container is intended to be emptied and is not a processor. Common in vehicles and trailers.	Excrement is added in batches to a carefully managed compost with high internal temperatures (greater than 35C/95F and up to 80C/175F) for rapid decomposition and pathogen destruction. Also known as the “Humanure” process.

		systems designed for dry environments.		
				
Ex: Phoenix Composting Toilet	Ex: Full Circle Composting System	Ex: Sun-Mar Excel	Ex: Trobolo Corpus Compact	Illustration: Molly Danielsson

814.1.2 Attributes. The five types of systems in Table 814.1.1 are common combinations of a variety of technologies and strategies. These technologies and strategies vary among six attributes of composting toilet system design. Composting toilets shall utilize at least one of the following attributes:

814.1.2.1 Compost processor containment.

1. Partially contained. Compost processor is open to the soil. Soil organisms have access to decomposing material and/or leachate infiltrates to soil.

   Examples: Green Mountain Club Moldering Privy, vermifilter systems

   NOTE: This chapter does not include partially-contained systems; please see Chapter 812, Vermifiltration

2. Fully contained. Compost processor is watertight without direct contact to soils. Organism access is limited by barriers, screens, and traps, and leachate is drained in a controlled manner.

   Examples: most commercial and site-built composting toilet systems.

814.1.2.2 Compost processing method.

1. Thermophilic (hot) composting for pathogen destruction (Such as the Humanure system)
2. Moldering (cold) composting of excreta (Such as most continuous or batch composters)
3. Desiccating (drying) of excreta (most “cottage” composting toilets)

814.1.2.3 Compost processor design.

1. Continuous composting of excreta in a single chamber. *Verifying the proper function of new continuous composter designs can require extensive testing. Continuous composter designs are recommended to have function verified by independent research or a 3rd party testing program. Please see testing programs detailed in NSF/ANSI 41 and appendices to AS/NZS 1546.2.*
2. Decomposing excreta is exposed to fresh excreta
3. Chamber design limits exposure of decomposing excreta to fresh excreta
4. Batch composting of excreta in multiple chambers, whereby decomposing excreta is isolated from fresh excreta. *The requirements of Section XX4 are sufficient to inspect and verify batch composting systems.*

814.1.2.4 Liquid containment.

1. Liquid absorbed, recirculated, or evaporated
2. Liquid drained to treatment system
3. Liquid drained to soil

814.1.2.5 Toilet fixture.

1. Container-based toilets where organic matter is used for odor control and which are designed to be emptied.
2. Direct-drop toilets that discharge to a composting chamber
3. Vacuum toilets that discharge to a composting chamber
4. Microflush toilets that use 1L (0.26 gallons) or less to flush
5. Various means of separating solids from a flushing system (Such as Aquatron centrifugal separator)

814.1.2.6 Material transport from fixture to processor.

1. Dry collection with direct connection to processor
2. Container transfer
3. Vacuum flush
4. Microflush
5. Solids separation

814.1.3 Critical Design Factors for a Composter. Although there are a large number of factors governing composting, the problem of managing nutrient-rich human excreta can be reduced to three essential factors: moisture, airflow, and insulation.

814.1.3.1 Insulation. Ideally, a composting toilet will maintain continuous biological activity. If cold or freezing conditions are common, the composting chamber should be insulated or inside an insulated building to allow biologically active temperatures year-round. Alternatively, the composting chamber should be sized to allow composting to go dormant during cold weather and still achieve the desired treatment period.

814.1.3.2 Moisture. Moisture management shall be climate-specific. In dry climates, leachate shall be recirculated to maintain decomposition, while in wet climates, leachate shall be drained away from compost and handled independently.

814.1.3.3 Airflow. Airflow can be actively maintained with fans or passively through compost processor design. Composting generates heat, and this heat can create a natural draft of air if the compost processor allows air to flow underneath the compost mass. Additionally, the compost mass must not be so compacted as to prevent airflow. A bulking agent, such as wood chips, should be added to the compost. Heights of compost above 1m should be avoided to prevent compaction.

814.1.4 Composting toilet system design features. Composting toilet systems shall be constructed with the following features:

1. Protect users from contact with untreated excreta
2. Adequate capacity for the treatment of excreta;
3. Allow for the retention of excreta for composting / treatment time period;
4. Provision for storage, processing, or transferring leachate for further treatment;
5. Avoid the likelihood of blockage;
6. Access for removal of the contents of the compost processor or for maintenance;
7. Reduce the likelihood of unauthorized access;
8. Built from materials that are resistant or impervious both to the excreta contained in the compost processor and the operating environment for the serviceable life of the toilet;
9. Prevent likelihood of damage from any superimposed loads or normal ground movement;
10. Resist hydrostatic uplift pressures;
11. Remain integral for their serviceable life;
12. Perform adequately with only normal maintenance over their serviceable life.
13. Prevent odors from exfiltrating the composting toilet system.
14. Prevent unwanted entry of insects or vermin into any part of the composting toilet system.

15. Remove unwanted insects though traps

814.1.5 International composting toilet standards. Depending on the context, various composting toilets evaluated for conformance to the following standards are acceptable for use:

1. AS/NZS 1546.2:2008 – On-site Domestic Wastewater Treatment Units Part 2: Waterless composting toilets. Australian/New Zealand Standard.
2. IAPMO/ANSI WE Stand – 2023 Water Efficiency Standard. International Association of Plumbing and Mechanical Officials / American National Standard.
3. ISO 30500 – Non-sewered sanitation systems – Prefabricated Integrated Treatment Units – General Safety and Performance Requirements for Design and Testing.
4. NSF/ANSI 41 – 2023 Non-Liquid Saturated Treatment Systems. NSF International Standard / American National Standard.

814.1.6 Scope. The provisions of this section shall govern *composting toilet systems*.

814.1.6.1 Maintenance responsibility. The required maintenance and inspection of composting toilet systems shall be the responsibility of the property owner, unless otherwise required by the code official.

814.1.6.2 Operation. *Composting toilet systems* shall be operated and maintained in a safe and sanitary condition in accordance with Section 814.1.6.3.

814.1.6.3 Operation and maintenance manual. An operation and maintenance manual shall be supplied in hardcopy with all systems. The manual shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

1. Operating conditions including minimum air inlet temperatures, and ambient temperature and humidity range for normal operation.
2. Schedule for addition of necessary compost additives.
3. Source or provider of necessary compost additives.
4. Schedule for all regular maintenance tasks.
5. Instructions for all regular maintenance tasks.
6. Expected input of and capacity for excreta and compost additives to composting toilet system specifying loading of commode(s) and compost processor(s).
7. Plan for container transfer and cleaning where transfer is used.
8. Treatment period and expected schedule for removing humus from composting processors and secondary composting, where used.
9. Plan for on-site disposal of humus or professional removal.
10. Plan for managing leachate.

11. For composting toilet systems not approved in accordance with Section 814.1.5.4, and if an accredited lab is available and accessible, a plan for microbial testing of the first batch of humus in accordance with Section 814.1.6.5.3.

12. A system-specific risk management plan that provides actions and advice for the following situations, as relevant:

    12.1 A new owner/occupant is not told what to do;

    12.2 A new owner/occupant does not conduct regular maintenance as described in operation and maintenance manual;

    12.3 Compost additives not added to system;

    12.4 Processors/bins or other receptacles are not alternated;

    12.5 The compost is too hot;

    12.6 The compost is too cold;

    12.7 The compost is too wet;

    12.8 The compost is too dry;

    12.9 The compost is removed too early;

    12.10 There is poor drainage of leachate; and

    12.11 Decommissioning.

814.1.6.4 Approved systems Composting toilet systems shall comply with NSF 41, AS/NZS 1546.2, ISO 30500, IAPMO WE Stand, or shall be in accordance with 814.1.6.

814.1.7 Composting Toilet System Design. Composting toilet system design shall comply with this section.

814.1.7.1 Approval. Composting toilet systems complying with this section shall be permitted for residential, commercial, and institutional applications.

814.1.7.2 System records. The property owner is responsible for retaining test result records in accordance with Section 814.1.7.3 and making such records available to the *code official* upon request. Upon transfer of property or tenancy, test records shall be transferred to the owner or tenant, and humus shall be re-tested after its first treatment period and a record retained by the property owner.

814.1.7.3 System materials and components. Components expected to contact excreta or leachate shall be constructed of corrosion-resistant material such as stainless steel or durable polymers. Concrete in contact with *excreta* or *leachate* shall meet requirements of Section 814.1.7.3.3.

814.1.7.3.1 Pipe and fixtures. Pipe, pipe fittings, traps, fixtures, material, and devices used in composting toilet systems that are expected to contact leachate or diverted urine shall be listed by an

approved agency or a third-party certification agency, unless otherwise approved by the code official. Products and materials shall be identified.

814.1.7.3.2 Screening. Where screening is required to prevent the unintentional entry of insects and vermin, screening shall have openings with a maximum size of 2.4 mm (3/32 inches). Screening shall be made of materials compatible with the system components in contact with screen materials. Screen materials shall not generate galvanic corrosion of system components.

814.1.7.3.3 Concrete construction. Concrete construction shall be reinforced, watertight, and, if used to support a structure or user, able to withstand the
expected structural loading. Where drainage is required, the compost processor floor shall be sloped not less than 20mm per meter (¼-inch per foot), or 2 percent. The flange of each sub-drain shall be set level.

814.1.7.3.4 Commodes. Commodes shall be designed to support a weight not less than *2.2kN* (*500lb*) applied to front edge of the fixture. Commodes shall transport excreta into the *compost processor* or contain *excreta* for transfer as designed and in accordance with the operation and maintenance manual.

814.1.7.3.4.1 Urine diversion. Urine diversion piping shall be connected to a urine diversion system in accordance with Section 814.2.

814.1.7.3.4.2 Commode opening. Where commodes are directly connected to compost processors, the maximum dimension of the commode connection shall not exceed 190 mm (7.5 inches).

814.1.7.4 Compost processors. Compost processors shall maintain unsaturated aerobic composting conditions within the compost mass through the drainage, absorption or desiccation of leachate; and aeration of the compost processor.

814.1.7.4.1 Openings. Openings shall be covered and secured to prevent tampering. Openings shall be screened or covered to prevent insect and vermin infiltration and be protected against unauthorized human entry.

814.1.7.4.2 Transfer. Where unfinished excreta or diverted urine is transferred between compost processors or from commode to compost processor, transfer and cleaning of containers and provisions for limiting user exposure shall be in accordance with the operation and maintenance manual.

814.1.7.4.3 Watertightness. Compost processors shall be constructed of watertight material in accordance with Section 814.1.6.3.

814.1.7.4.4 Insects and vermin. Compost processors shall be protected to prevent the unintentional entry of insects and vermin. All unsecured openings, other than vents, drainage, or commode shall not exceed 12.7 mm (0.5 inches) in the least dimension.

814.1.7.4.5 Sizing. Compost processors shall be sized to accommodate the maximum daily adult usage as specified by the manufacturer's or designer's published ratings.

814.1.7.4.6 Treatment period. The compost processor or processors shall be sized to compost excreta for a treatment period with a minimum of one year of biologically active conditions. Biologically active conditions shall be maintained at or above a daily average of 6°C (42°F).

Exception: Systems with shorter treatment periods shall be permitted where either:

1. Humus from the compost processor has been tested in accordance with Section 814.1.6.5.3 and transferred to secondary composting in accordance with Section 814.1.6.4.7.
2. Humus is removed off site for processing or disposal at an approved facility.

814.1.7.4.7 Secondary composting. *Humus* transferred to *secondary composting* shall first be tested in accordance with Section 814.1.6.5.3. *Secondary composting* shall be labeled and protected from human contact in a well maintained compost bin or other facility designated for the exclusive purpose of containing *humus* removed from the *compost processor*. Contact with precipitation and surface waters shall be prohibited.

814.1.7.4.8 Venting. Negative pressure between the *commode* and *compost processor* shall be provided where the *compost processor* is connected directly to the *commode* without a trap.

814.1.7.4.9 Vent terminals. Vent stacks shall terminate to the exterior of the building in compliance with the requirements of the International Plumbing Code or other code used by AHJ.

814.1.7.4.10 Leachate. *Leachate* shall be collected for removal or recirculation within the *compost processor*, evaporated or drained to an approved sanitary drainage system or other location approved by the *code official*.

814.1.7.4.11 Leachate storage tanks. *Leachate* storage tanks shall be constructed of corrosion resistant materials.

814.1.7.4.11.1 Venting. *Leachate* storage tanks shall be vented as required for pressure equalization. Where required, vents shall be installed on *leachate* storage tanks and shall extend from the top of the tank. Storage tank vents shall be permitted to connect to the plumbing venting system at least 152 mm (6 inches) above the flood level rim of the highest fixture. Vents extending to the outdoors shall terminate not less than 305mm (12 inches) above grade. The vent terminal shall be directed downward and covered screening to prevent the unintentional entry of insects and vermin.

814.1.7.4.11.2 Vent size. Pressure equalization vents that prevent nitrogen loss by the use of restrictions, or of piping or tubing that is less than the minimum pipe diameter required by the International Plumbing Code or other code used by AHJ, shall be approved by the *code official*.

814.1.7.4.11.3 Overflow. Where storage tank overflows are installed, they shall be connected to the sanitary drainage system.

814.1.7.4.11.4 Backwater prevention. Storage tank overflows shall be provided with a backwater valve or check valve at any point of connection to a sanitary drainage system or *private sewage disposal system* subject to backflow. The backwater valve shall be accessible for inspections and maintenance.

814.1.7.4.11.5 Above grade. Where subject to freezing conditions, storage tanks shall be provided with an adequate means of freeze protection. Above grade leachate storage tank shall be provided with a high-water sensing device and alarm system. The alarm shall report where 80 percent volume is reached.

814.1.7.4.11.6 Below grade. *Leachate storage tanks* installed below grade shall be structurally designed to withstand anticipated earth or other loads. Tank covers shall be capable of supporting an earth load of not less than 1464 kg/m^2 (300 pounds per square foot [lb/ft^2]) where the tank is designed for underground installation. Below grade *leachate* tanks installed underground shall be provided with manholes. The manhole opening shall be at least 510 mm (20 inches) in diameter and located at least 102 mm (4 inches) 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 hold-down capacity of the thank and hold down system shall meet or exceed the buoyancy force of the tank. Below grade *leachate* storage tanks shall be provided with a high-water sensing device and alarm system.

814.1.7.4.11.7 Marking. Where openings are provided to allow a person to enter the tank, the opening shall be marked with the following words: "DANGER—CONFINED SPACE." The letters shall be not less than 12.7 mm (½ inches) in height and shall be of a color in contrast with the background on which they are applied.

814.1.7.5 Testing and verification. System shall be tested for watertightness in accordance with Section 814.1.6.5.1. *Humus* from the first treatment period shall be tested after the first treatment period in accordance with Section 814.1.6.5.3**.**

814.1.7.5.1 Compost processors. *Compost processors* shall be tested for watertightness by filling the system to the maximum designed liquid storage capacity of the unit for a duration of 24 hours. Where leaks are detected, repairs shall be made at the owner's expense and the test shall be repeated.

814.1.7.5.2 Environmental Conditions. Minimum air inlet temperatures for the compost processor and ambient temperature and humidity range for normal operation of the system, as listed in the operation and maintenance manual per Section 814.1.7.3**,** shall be met by either building mechanical systems or environmental conditions of the 5-year maximum weather events.

814.1.7.5.3 Humus, testing. The owner or owner's agent of the composting toilet system shall verify compliance with the operation and maintenance manual after the first treatment period and before removal of humus from the compost processor. A sample of the humus from the first treatment period shall be submitted to a certified laboratory. Where multiple compost processors are used, the humus sample shall be removed from the last compost processor. Humus shall not have a moisture content exceeding 75 percent by weight, and the most probable number (MPN) fecal coliform assay shall not exceed 200 MPN per gram (dry weight basis). The sample shall be tested in accordance with EPA/625/R-92/013, Appendix F, Section 1.2; or ASTM D4959 and APHA 9221F or APHA 9223B.

814.1.7.5.4 Testing Following repairs and alterations. Following repairs of the compost processor or alterations to the compost processor or commode, tests shall be conducted at the owner's expense and in accordance with Section 814.1.7.5.3.

814.1.7.6 Humus removal. *Humus* shall be removed in accordance with the operation and maintenance manual. *Humus* from the *compost processor* shall be permitted to be used around ornamental shrubs, flowers, trees, or fruit trees and shall be mixed with soil or mulch and covered with at least 76 mm (3 inches) of cover material. Depositing *humus* from any *composting toilet system* around any edible vegetable or vegetation shall be prohibited.

8.14.2 Urine Diversion Systems. Urine diversion systems shall comply with this section.

8.14.2.1 Background. Urine diversion and collection systems can be used to prevent nutrient pollution of ground and surface waters and enable beneficial use of urine constituents. This chapter provides requirements for collecting, transporting, storing and disposing of urine or treating and outputting urine derived products.

814.2.2 Scope. This appendix shall govern the materials, design, installation, maintenance and inspection of urine diversion systems, and shall govern the disposal or treatment of diverted urine and the output of urine derived products.

814.2.3 Tests. Tests shall comply with this section.

814.2.3.1 Test Gauge. Tests shall utilize a test gauge having increments of 0.69 kPa (0.10 psi) or less.

814.2.3.2 Drainage and Vent Water Test. A water test shall be applied to the urine drainage system either in its entirety or in sections. If applied to the entire system, openings in the piping shall be tightly closed, except the highest opening, and the system shall be filled with water to the point of overflow. If the system is tested in sections, each opening shall be tightly plugged except the highest openings of the section under test, and each section shall be filled with water, and sections shall not be tested with less than 3000 mm (10-foot) head of water. In testing successive sections, not less than the upper 3000 mm (10 feet) of the next preceding section shall be tested so that only joints or pipes in the building in the uppermost 3000 mm (10 feet) of the system, shall have been submitted to a test of less than 3000 mm (10-foot) head of water. This pressure shall be held for not less than 15 minutes. The system shall then be tight at all points.

814.2.3.3 Drainage and Vent Air Test. Plastic piping shall not be tested using air. An air test shall be made by forcing air into the system until there is a uniform gauge pressure of 35.5 kPa (5 psi) or sufficient to balance a 250 mm (10-inch) column of mercury. This pressure shall be held for a test period of not less than 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperatures or the seating of gaskets shall be made prior to the beginning of the test period.

814.2.3.4 Drainage and Vent Vacuum Test. The portion of the drainage and vent system under test shall be evacuated of air by a vacuum-type pump to achieve a uniform gauge pressure of negative 34 kPa (-5 psi). This pressure shall be held without removal of additional air for a period of 15 minutes. Any adjustments to the test pressure required because of changes in ambient temperatures or the seating of gaskets shall be made prior to the beginning of the test period.

814.2.4 Maintenance Responsibility. The required maintenance and inspection of urine diversion systems shall be the responsibility of the property owner, unless otherwise required by the code official.

814.2.5 Operation. Urine diversion systems shall be operated and maintained in a safe and sanitary condition in accordance with the Section 813.2.6.

814.2.6 Operation and Maintenance Manual. An operation and maintenance manual shall be provided in hardcopy form and shall be transferred to the new owner or tenant upon transfer of property or tenancy. The manual shall include the following items:

1. Storage capacity for urine, flush water and additives.
2. Design loading of the system and expected inputs.
3. Expected schedule of additives.
4. Sources or provider of necessary additives.
5. Comprehensive maintenance schedule, including a pipe cleaning schedule and schedule for replacing and/or servicing fixture traps, if traps are not integral liquid traps meeting the requirements of Section 814.2.10.3.
6. Cleaning agents and instructions for each.
7. Instructions for all maintenance tasks.
8. If container transfer is used, container transfer plan and container cleaning instructions.
9. Disposal or beneficial use plan containing all of the following, as applicable:

1. Removal schedule and service provider.
2. Instructions for diversion to sewer or private sewage disposal system.
3. Treatment plan and treatment system operations.
4. Plan for licensing, certification, or labeling of urine derived products.
5. Land application following a nutrient management plan.

814.2.7 Materials Material used for *urine diversion* shall be corrosion resistant, such as stainless steel or durable polymers. Concrete piping is prohibited.

814.2.8 Identification. *Urine diversion* piping shall be identified.

814.2.9 Screening. Where screening is required to prevent the unintentional entry of insects and vermin, screening shall have openings with a maximum size of 2.4 mm (3/32 inches). Screening shall be made of materials compatible with the system components in contact with screen materials. Screen materials shall not generate galvanic corrosion of system components.

814.2.10 Urine Diversion System Design. Urine diversion system design shall comply with this section.

814.2.10.1 Pipe sizing. Urine drainage pipe shall be a minimum of 32 mm (1 ¼ inches) or shall be *approved*.

814.2.10.2 Change of direction. Changes in direction of *urine diversion* piping shall be made by a long-sweep 90-degree fitting or other approved fittings of equivalent sweep.

814.2.10.3 Traps. Fixtures discharging into *urine diversion* piping shall be trapped.

814.2.10.3.1 Size of fixture traps. Fixture trap size shall be sufficient to drain the fixture rapidly and not larger than the drainage pipe into which the trap discharges.

814.2.10.3.2 Liquid Traps. Liquid traps shall be self-scouring. Fixture traps shall not have interior partitions, except where such traps are integral with the fixture or where traps are constructed of an approved material that is resistant to corrosion and degradation. Slip joints shall be made of an approved elastomeric gasket and shall be installed only on the trap inlet, trap outlet, and within the trap seal.

814.2.10.3.2.1 Liquid Trap Seals. Each fixture trap shall have a liquid seal of not less than 51 mm (2 inches) and not more than 102 mm (4 inches).

814.2.10.3.3 Other Traps. Other traps shall be user serviceable from the exterior of the fixture and shall be listed by a third-party certification agency or approved by the authority having jurisdiction. The schedule of maintenance and service life of such traps shall be listed in the operation and maintenance manual.

814.2.10.3.4 Prohibited Traps. The following types of traps are prohibited.

1. Traps that depend on moving parts to maintain the seal.
2. Bell traps.
3. Crown-vented traps.
4. Traps not integral with a fixture and that depend on interior partitions for the seal, except those traps constructed of an approved material that is resistant to corrosion and degradation.
5. “S” traps.
6. Drum traps.

a. Exception: Drum traps used as solid interceptors.

814.2.10.4 Slope of horizontal piping. *Urine diversion* piping shall be installed at a slope conforming to the manufacturer’s installation instructions and of not less than 20 mm per meter (¼-inch per foot), or 2 percent toward the point of storage or disposal.

814.2.10.5 Cleanouts. A cleanout shall be provided at the upper terminal of each drain line, every 15 m (50 feet), and at any aggregate horizontal change of direction exceeding 135 degrees.

814.2.10.6 Venting. *Urine diverting water closets* shall be vented as specified in Chapter 9 of the International Plumbing Code or other local plumbing code. *Urine diverting* commodes shall be vented to a composting toilet system vent in compliance with Section 814.1.6.

Exception: Where the code official determines urine storage tank venting or air admittance valves are sufficient to vent fixtures, venting of fixtures shall not be required.

814.2.10.6.1 Tests. The vent system shall be tested in accordance with Section 814.2.3.

814.2.10.6.2 Materials. The materials and methods for the construction of venting systems shall comply with Section 814.2.7.

814.2.10.7 Discharge. A urine diversion system shall be directed to a storage tank or discharged to an approved sanitary drainage system.

814.2.11 Urine Diversion System Design.

814.2.11.1 Volume. Total urine tank storage volume shall be in accordance with Equation 814.2.11.1-1. Where treatment by retention in accordance with Section 814.2.12.2 is specified, days in use for collection (D) shall be at least 365.

$V = (C + (N \times (U + F) \times O)) \times D$ (Equation 814.2.11.1-1)

where:

V = total tank volume

C= water used per fixture per day for cleaning

$C = (c + w + t)/7$

c = water used per cleaning

w = cleanings per week

t = total urine diversion fixtures

N = number of users

U = urine per person per day (0.4 gallons, 1.5L)

F = flush water per day

$F = f \times e$

f = water volume per flush

e = visits to toilet per day (5.9)

O = occupant fraction

D = Days in use for collection

814.2.11.2 Venting. Urine storage tanks shall be vented as required for pressure equalization. Where required, vents shall be installed on urine storage tanks and shall extend from the top of the tank. Dedicated urine storage tank vents extending to the outdoors shall terminate not less than 305 mm (12 inches) above grade. The vent terminal shall be directed downward and screened to prevent entry of

insects and vermin. Storage tank vents shall be permitted to connect to the plumbing venting system at least 152 mm (12 inches) above the flood level rim of the highest fixture.

814.2.11.2.1 Vent size. Pressure equalization vents that prevent nitrogen loss through the use of restrictions, or of piping or tubing that is less than the minimum pipe diameter required in the plumbing code, shall be *approved*.

814.2.11.3 Traps. Urine storage tanks shall prevent odors and nitrogen loss from the tank inlet by means of a P-trap, mechanical trap, submerged inlet piping, or other *approved* means. Submerged inlet piping shall remain submerged during use and after pumpout.

Exception: Tanks of 20 L (5.3 gallons) or less with connection to a fixture with active venting.

814.2.11.4 Overflow. Where urine storage tank overflows are installed, they shall be connected to the sanitary drainage system.

814.2.11.5 Backwater valve. Where connected to a public sewer system or private sewage disposal system and where subject to backflow, storage tank overflows shall be provided with a backwater valve or check valve at the point of connection to the sanitary drainage system. The backwater valve shall be accessible for inspections and maintenance.

814.2.11.6 Water level monitoring and warning. Urine storage tanks shall be provided with a water level monitoring device connected to an alarm system. The alarm system shall provide a visual and auditory warning signal when 80 percent volume is reached.

Exception: Tanks meeting one of the following requirements:

1. Where tank volume does not exceed 20 L (5.3 gallons) and the tank is located within the toilet room, a visible indicator of tank volume shall be provided.
2. Where the tank is not directly connected to urine diversion piping, is filled manually, and has a visible indicator of tank volume.

814.2.11.7 Construction. Urine storage tanks shall be constructed of corrosion resistant materials such as stainless steel or durable polymers.

814.2.11.8 Above Grade. Where subject to freezing conditions, above grade storage tanks and associated piping shall be provided with an *approved* means of freeze protection, or fitted with high level alarms that are suitable for detecting a high level condition in the presence of ice.

814.2.11.9 Below Grade. Urine storage tanks installed below grade shall be structurally designed to withstand anticipated earth or other loads. Tank covers shall be capable of supporting an earth load of not less than 1465 kg/m^2 (300 lb/ft^2) where the tank is designed for underground installation. Below grade urine tanks installed underground shall be provided with manholes. The manhole opening shall have a diameter of at least 504 mm (20 inches) and located at least 102 mm (4 inches) 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 hold-down capacity of the tank and hold down system shall meet or exceed the buoyancy force of the tank.

814.2.11.10 Marking. Where openings are provided to allow a person to enter the tank, the openings shall be marked with the following words: "DANGER—CONFINED SPACE." The letters shall be not less than 12.7 mm (0.5 inches) in height and shall be of a color in contrast with the background on which they are applied.

814.2.11.11 Openings. Openings shall be covered and secured to prevent tampering. Openings shall be screened or covered to prevent insect and vermin entry and be protected against unauthorized human entry.

Exception: Where tanks have a volume not exceeding 20 L (5.3 gallons) and comply with one of the following:

1. Are connected to a fixture(s) with active ventilation.
2. Have an integrated seal.

814.2.11.12 Transfer. Where urine is transferred between tanks, cleaning of tanks and provisions for limiting user exposure shall be in accordance with the operation and maintenance manual.

814.2.12 Treatment, use and disposal. Treatment, use and disposal shall comply with this section.

814.2.12.1 Disposal and beneficial use. *Urine diversion* systems shall have a plan for disposal or shall have a plan for beneficial use with one of the following methods. The plan shall be recorded in the operation and maintenance manual.

1. **Disposal**. Urine shall be removed by one of the following methods:

a. An approved service provider.

b. Discharge to a public sewer system or private sewage disposal system.

c. Discharge to the compost processor of a composting toilet system in compliance with Section 814.1.

2. **Urine derived products.** Urine shall be processed into urine derived products for commercial product licensing, certification, and labeling as required by the authority having jurisdiction.

3. **Land application**. Treated urine complying with Section 814.2.12.2shall be land applied following an *approved nutrient management plan* if required by the authority having jurisdiction.

814.2.12.2 Approved treatment methods. Retention of diverted urine without addition for six months before usage. Two or more holding tanks shall be required for retention.

2. Heat sanitization with one of the following methods:

a. Heat treatment for not less than 15 seconds and not greater than 30 minutes at a temperature calculated using Equation XXX-2.

b. Heat treatment for not less than 30 minutes at a temperature of at least 50°C (122°F) for a period calculated using Equation XXX-3.

$$D = \frac{131{,}700{,}000}{10^{0.14T}}$$

(Equation XXX-2)

$$D = \frac{50{,}070{,}000}{10^{0.14T}}$$

(Equation XXX-3)

D = treatment duration (days)

T = temperature (degrees Celsius)

3. Other approved method.

SECTION 815 Onsite Non-potable Water Systems (ONWS).

815.1 Scope and General Requirements. Onsite non-potable water systems shall comply with this section.

815.1.1 Applicability. This Chapter applies to the design, construction, performance, installation, and operation of ONWS intended to treat, store, and distribute non-potable water. These systems are intended to provide enhanced onsite treatment for combined wastewater or graywater for reuse in residential dwellings covered by this standard. Unless otherwise approved by the AHJ or expressly permitted by this Chapter, components of an ONWS shall comply with all other applicable Chapters of this Standard. ONWS shall comply with applicable laws, rules and ordinances of the jurisdiction.

815.1.2 Source water and end use. This Chapter applies to systems treating combined wastewater and graywater. Permitted end uses include unrestricted and restricted surface and subsurface irrigation, indoor toilet and urinal flushing, decorative fountains and dust control. Water treated to this standard shall not be used for bidets, irrigation of edible portion of food crops (including root crops), or any other use that results in intentional direct contact or consumption of the treated reuse water.

815.1.3 Graywater sources. Onsite nonpotable graywater reuse systems shall collect waste discharge from only the following sources: bathtubs, showers, lavatories, clothes washers, laundry trays, condensate, and other domestic wastewaters that are not expected to contain urine, fecal matter, grease, or food wastes.

815.1.4 Treated water quality. Treated non-potable reuse water quality shall meet the minimum requirements as specified in 815.2.1, and as established for the intended application by applicable laws, rules, and ordinances of the jurisdiction. Where water from multiple sources is combined for treatment, the system shall comply with the most stringent of the requirements of this standard that are applicable to such sources.

815.2 System Requirements. Systems shall comply with this section.

815.2.1 Treatment Standards, Evaluation, and Conformance. Treatments, evaluations and conformance shall comply with this section.

815.2.1.1 Standards conformity. ONWS shall be evaluated and certified as compliant with at least one of the following standards or guidelines: NSF/ANSI 350, Auckland Council guideline document GD2021/006.

815.2.1.2 Accreditation of testing organization. Compliance evaluations, including performance testing, shall be performed by an independent third-party organization accredited to ISO/IEC 17065 or ISO/IEC 17025, as applicable to the certification and test scope, and as acceptable to the Authority Having Jurisdiction (AHJ). Organizations or agencies that do not hold accreditation as described in this section are permitted to design and evaluate ONWS if approved to do so by the regulatory AHJ.

815.2.1.3 Valid certification. ONWS shall hold a current certification to NSF/ANSI 350 or meet the Auckland Council guideline document GD2021/006 – Section D1.8, for the design loading and performance class applicable to the intended use.

815.2.1.4 Exemption conditions. ONWS that reuse graywater for subsurface irrigation only, such as laundry-to landscape systems) shall be exempt from the requirements of 815.2.1.1 through 815.2.1.4 only if expressly permitted by local regulations, rules, or ordinances.

815.2.2 Signage and marking. Signage and markings shall comply with this section.

815.2.2.1 Outlets. Where non-potable water is supplied to outlets such as hose connections, hydrants, open-ended pipes, and faucets, each outlet shall be identified at the point of use with signage that reads as follows: "CAUTION: NONPOTABLE WATER - DO NOT DRINK." The words shall be legibly and indelibly printed on a tag or sign constructed of corrosion-resistant waterproof material or shall be indelibly printed on the fixture. The letters of the words shall be not less than 12.7 mm (0.5 inch) in height and in colors in contrast to the background on which they are applied. In addition to the required text, one of the pictographs shown in Figure 814.2.2.1 shall appear on the signage required by this section.

FIGURE 815.2.2.1—PICTOGRAPH—DO NOT DRINK

815.2.2.2 Piping. Treated non-potable water supply piping shall be clearly marked and distinguishable from potable water supply piping in accordance with the plumbing code of the jurisdiction. Where plumbing code requirements are absent, the treated non-potable water supply line shall be a color

distinct from that of potable water supply piping and labeled as follows: "CAUTION: NONPOTABLE WATER". A permanent label or marking shall be placed at a minimum of every 305 cm (10 feet) of pipe, and every non-potable water supply pipe shall have at least one label or marking.

815.2.3 Outdoor outlet access, marking. Sill cocks, hose bibbs, wall hydrants, yard hydrants and other outdoor outlets supplied by non-potable water shall be located in a locked vault or shall be operable only by means of a removable key and marked in accordance with Section 815.2.2.

815.2.4 Freeze protection. Where sustained freezing temperatures occur, provisions shall be made to keep storage tanks, process tanks, equipment, and the related piping from damage due to freezing.

815.2.5 Tanks. Nonpotable water storage and process tanks shall comply with the requirements of this Section.

815.2.5.1 Protection from sunlight. Any storage tank, process tank and equipment or portion thereof that is above grade shall be protected from direct exposure to sunlight by one of the following methods:

(1) Tank construction using opaque, UV-resistant materials such as heavily tinted plastic, fiberglass, lined metal, concrete, or painted to prevent algae growth.

(2) Specially constructed sun barriers.

(3) Installation in garages, crawl spaces or sheds.

815.2.5.2 Overflow protection. Tanks shall be equipped with an overflow pipe that discharges to a sanitary sewer or an approved OWTS. The overflow drain shall not be equipped with a shutoff valve.

815.2.5.3 Means of emptying. Tanks shall be provided with a means of emptying the contents for the purpose of service or cleaning. Tanks shall be drained by using a pump or by a drain located at the lowest point in the tank. The tank drain pipe shall discharge to a sanitary sewer or an approved OWTS. Not less than one cleanout shall be provided on each drain pipe. Tank drain pipe size and cleanouts shall conform to the plumbing code of the jurisdiction having authority, where applicable.

815.2.6 Shutoff and diversion valves. Treatment equipment shall be installed with shutoff or diversion valves immediately upstream and downstream to allow for isolation during maintenance. Diversion valves shall discharge to a sanitary sewer, an approved OWTS, or a receiving tank approved by the AHJ.

815.2.7 Makeup water. Where an uninterrupted supply is required for the intended application, an additional source of makeup water shall be provided for the storage tank. Makeup water supplies shall be protected against backflow. Flow into the storage tank shall be controlled by fill valves or other automatic supply valves installed to prevent the tank from overflowing and to prevent the water level from dropping below a predetermined point. The water level shall not be permitted to drop below the intake of any pump supplying makeup water.

815.2.8 Sampling and Observation. The system shall be designed and installed with the capability to be sampled for monitoring of effluent quality.

815.2.8.1 Sampling point(s). The quality of the water for the intended application(s) shall be verified at the point of use in accordance with aII applicable laws, rules, ordinances of the jurisdiction, and in accordance with the operation and maintenance manual, and where required, the operating permit.

815.2.8.2 Safe access. The sampling port shall provide direct and safe withdrawal of representative effluent samples, shall be accessible from finished grade without excavation or with a traffic-rated access cover, and shall include provisions to prevent inflow/infiltration and ensure operator safety.

815.2.9 Failure Sensing and Alarms. Each system shall be equipped with failure-sensing devices and associated alarms to alert users or service providers of the failure of critical system components.

815.2.9.1 Abnormal operating condition detection. Systems shall include sensors and controls capable of detecting abnormal operating conditions, including high water level within each treatment or dosing tank, aeration pump failure, recirculation or dosing pump failure, disinfection system failure, and electrical power failure to any electrically powered component.

815.2.9.2 Audio and visual alarms. Failure conditions shall activate both audio and visual alarms. The visual alarm shall be located where it is easily observable by the system owner or maintenance provider. The audio alarm must be distinctively recognizable and capable of being muted while the visual indicator remains active until the failure condition is resolved.

815.2.9.3 Diversion to waste. Upon any alarm event, the system shall immediately and automatically initiate diversion of influent and effluent that would otherwise enter the reuse distribution system to a sanitary sewer or an AHJ-approved OWTS. Diversion shall not discharge to storm drains, surface waters, or to grade. Only a sanitary sewer or AHJ-approved soil absorption system is acceptable.

815.2.9.4 Power loss. Upon loss of power, loss of control, or instrumentation failure, the diversion assembly shall default to the diversion position, preventing any discharge to reuse distribution. Diversion shall include any bypasses, overflows, equalization tanks, or reuse water lines that could deliver untreated or non-treated water to reuse outlets.

815.2.9.5 Manual reset. Following diversion, the reuse system shall remain locked out of service until a manual reset is performed by a qualified operator after the cause of the alarm is corrected.

815.2.9.5.1 Verification prior to reset. Before returning the system to service, the system operator shall verify that treatment performance criteria as required under Section 815.2.1 are met for a defined verification period as determined by the AHJ, and not less than 15 continuous minutes. Automatic resumption of reuse service shall not be permitted.

815.2.9.6 Weather resistance. Control and alarm panels shall be weather-resistant and installed in accordance with the manufacturer’s instructions and AHJ requirements.

815.2.9.7 Remote monitoring and notification. Where required by the AHJ or specified by the manufacturer, alarms shall be capable of remote notification and data logging.

815.3 Installation. Systems shall be installed in accordance with the tested and certified system design used during the compliance evaluation required under section 815.2.1, including tank sizing, process train configuration, media types, aeration or dosing equipment, and control settings. The manufacturer's

approved instructions and any other requirements of the AHJ, including local plumbing codes, shall be followed.

815.3.1 Startup conditions. Startup shall include verification of sensor calibration, alarm function, process setpoints, watertightness, and successful completion of manufacturer-prescribed commissioning procedures.

815.3.2 Component protection. Access risers, covers, electrical enclosures, sampling ports, and appurtenances shall be protected from traffic, flooding, frost heave, and vandalism as applicable to site conditions.

815.3.3 Separation from sewer lines. Treated non-potable water distribution piping shall be separated from the buried building sewer and potable water piping by 152.4 cm (5 feet) of undisturbed or compacted earth. Non-potable water distribution piping shall not be located in, under, or above cesspools, septic tanks, or any OWTS disposal area.

815.3.4 System alterations. System enhancements that improve system performance are permissible, provided they are approved by the designer and the AHJ. Any alteration, modification, or substitution of components that negatively impact system performance, affect treatment processes, or modify certified flow paths or operating parameters shall not be permitted.

815.4 OWTS and Sewer Connection. ONWS shall be connected to a sanitary sewer system or an AHJ-approved OWTS for the collection and disposal of combined wastewater or graywater during alarm conditions, servicing, or system overflow.

815.4.1 OWTS requirements. OWTS used in conjunction with an ONWS system shall meet all applicable requirements of this standard, except as modified under Section 815.4.2.

815.4.2 OWTS modification. Where approved by the AHJ, a reduction in system design flow (GPD) shall be permissible. In adjusting the daily design flow for the OWTS, consideration shall be given to the anticipated daily volume of water diverted to the ONWS for reuse, potential impacts to the wastewater characteristics discharged to the OWTS if greywater is being removed, and the potential for extended bypass or discontinued use of the ONWS.

815.5 Operation and Maintenance (O&M) Operation and maintenance shall comply with this section.

815.5.1 Owner responsibility. The system owner shall be responsible for ensuring the system is maintained and serviced on a regular schedule.

815.5.2 Frequency determination. Systems shall be inspected, monitored, and serviced at a frequency determined by the AHJ, and not less than the minimum service interval recommended by the manufacturer or specified in the certification.

815.5.3 Service provider requirements. Maintenance shall be performed by individuals qualified in the servicing of the ONWS as required by the AHJ.

815.5.4 Service provision. At each service event, the following shall be verified and documented: treatment process operation, condition and functionality of sensors and alarms, sludge and scum

accumulation, effluent clarity and odor, electrical integrity, condition of sampling ports and access covers. Sampling of treated water shall be performed as required by the AHJ.

815.5.5 Record retention. Service records shall be retained by the system owner and made available to the AHJ upon request, including dates of service, findings, corrective actions, parts replaced, and laboratory results where applicable.

815.6 Performance Retention. Systems shall maintain performance equal to or greater than the certified performance class where operated and maintained in accordance with Section 815. Any change in influent characteristics or loading beyond certified limits shall be evaluated and approved by the AHJ.

815.7 System Manuals, Identification, and Marking. The manufacturer or system designer shall provide a comprehensive manual to both the AHJ and the system owner prior to installation and operation.

815.7.1 Manual requirements. The manual shall include, and not be limited to, the following information:

1. Detailed instructions for system installation.
2. System component specifications (including model numbers, electrical requirements, and performance characteristics).
3. Recommended operation and maintenance (O&M) procedures and schedules.
4. Detailed troubleshooting guide for common fault conditions and alarm responses, including diversion pathways, valves, interlocks, and fail-safe states.
5. Limitations and restrictions for use that are essential to maintain certified performance.
6. Current contact information for the manufacturer, the system designer, and the installer.

815.7.2 Labels required. Treatment units, control panels, and alarm devices shall be permanently labeled with the manufacturer name, model, serial number, electrical ratings, and applicable certification standards.

815.8 System abandonment. If the owner of an on-site non-potable water system, or components thereof, elects to cease use, or fails to maintain them, it shall be abandoned and shall comply with Sections 815.8.1 through 815.8.3.

815.8.1 Water system disconnection. Source water piping supplying the ONWS shall be disconnected and rerouted to the municipal sewer or approved OWTS. Any potable water lines utilized by the ONWS shall be removed or disabled.

815.8.2 Distribution piping replacement. The distribution piping system shall be removed or replaced with an approved potable water supply piping system. Where an existing potable pipe system is already in place, the fixtures shall be connected to the existing system.

815.8.3 Tank decommissioning. Tanks shall be removed, or secured from accidental access by sealing or locking tank inlets and access points, or filling with sand or equivalent.

Chapter 9 Reference Publications

This chapter lists the standards that are referenced in various sections of this document. The standards are listed herein by the promulgating agency of the standard, the standard identification, the effective date and title. The application of the referenced standards shall be as specified in Section 102.4.

ASHRAE 90.1: Energy Standard for Buildings Except Low-Rise Residential Buildings
International Residential Code - P2603.5 Freezing
International Plumbing Code – P3009.8.1 Percolation Test Methods
International Wildland-Urban Interface Code
CALGreen California Green Building Standards Code
FEMA Floodplain Management Requirements
Florida Administrative Code 62-600.705 – Domestic Wastewater Collection/Transmission System Permitting
US EPA Onsite Wastewater Treatment Manual
ISO 5667-10:1992 Guidance on Sampling of Wastewaters
ISO 31000 Risk Management
ISO 24511 Management of Wastewater Utilities
NSF 350 2019 Onsite Residential and Commercial Water Reuse Treatment Systems. NSF International Standard / American National Standard.
NSF 40 2019 Residential Wastewater Treatment Systems. NSF International Standard / American National Standard.
ASCE 24 Flood Resistant Design
NFPA 1144 Standard for Reducing Structure Ignition Hazards from Wildland Fire

ISO 30500 – Non-sewered sanitation systems – Prefabricated Integrated Treatment Units – General Safety and Performance Requirements for Design and Testing.

IAPMO/ANSI WE Stand – 2023 Water Efficiency Standard. International Association of Plumbing and Mechanical Officials / American National Standard.

AS/NZS 1547:2012 – On-site Domestic Wastewater Management (Appendix M – Irrigation Systems, Appendix R – Setback Distances).

U.S. Environmental Protection Agency. Onsite Wastewater Treatment Systems Manual. EPA/625/R-00/008 (2002).

Regulation (EU) 2020/741 – Minimum Requirements for Water Reuse (applicable to irrigation with treated wastewater, adopted June 2020).

ASTM D4318:18 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils

Appendices

Appendix A Low Pressure Distribution (LPD) Design Guide.

(Informative in support of section 805 (low pressure))

A.1 Purpose and use.

This appendix provides a step-by-step design workflow for conventional low-pressure distribution (LPD) systems serving subsurface trenches, beds, and mounds. It is intended to support consistent plans and calculations using the same methods, symbols, equations, and tables provided in Section 805.

A.2 Design workflow.

A.2.1 Step 1 Establish design inputs.

1. Determine design wastewater flow based on Section 803.3.1.
2. Confirm soil evaluation results, including percolation rate or soil absorption/loading rate, and confirm the site meets the conventional system criteria referenced in 803.3.2
3. Confirm the selected soil treatment and dispersal system type (trench, bed, or mound) and the planned system geometry.

A.2.2 Step 2 Determine loading rate and required absorption area.

1. Select the design loading factor from Table 803.3.2 based on the site percolation rate or soil absorption/loading rate.
2. Compute the required soil absorption field size using the Section 803 approach described in 803.3.1
   Soil Absorption Field Size = SDDF / SLR
   Where:
   SDDF = System Design Daily Flow (L/day or GPD)
   SLR = Soil Loading Rate (L/m²/day or GPD/square foot)
3. Lay out trenches/beds/mounds to meet minimum soil absorption field size in accordance with the applicable construction provisions referenced by Section 803.

A.2.3 Step 3 Confirm minimum soil depth and cover.

1. Confirm minimum required suitable soil depth from original grade.
2. Confirm minimum cover to the top of distribution piping is not less than 152 mm (6 inches).

A.2.4 Step 4 Establish distribution layout and perforation plan.

1. Determine the number of distribution pipes (laterals) and lateral lengths based on the selected trench/bed layout and the spacing requirement in Section 805.3.
2. Select perforation diameter, d, and perforation spacing such that each lateral provides uniform application over the infiltrative surface.
3. Select a design distal head, hd, that meets the minimum in Section 805 (hd ≥ 0.76 m (2.5 ft) of head as used in Section 805.3.4.

A.2.5 Step 5 Determine perforation discharge and total lateral flow.

Perforation discharge shall be determined using an orifice discharge relationship accepted by the authority having jurisdiction.

1. Determine discharge per perforation, q, using the Section perforation discharge relationship used with the chapter symbols (q, d, hd).
2. Determine the number of perforations per lateral, N, based on lateral length and perforation spacing.
3. Determine total lateral flow, Q, using the Section 805 relationship:
   Q = Nq
   Where:
   Q = total lateral flow (L/min (gpm))
   N = number of perforations
   q = perforation discharge (L/min (gpm))

A.2.6 Step 6 Manifold sizing (Equation 8-1 method).

1. Define manifold segments consistent with the actual manifold layout and lateral connections.
2. Confirm the fraction of total head loss allocated to the manifold segment, f, is not greater than 0.10 (Section 805.3.4).
3. Determine flow in each manifold segment, Qi, consistent with the number of laterals served and whether laterals operate simultaneously or by zones.
4. Determine Fi for each segment using the Section 805 relationship:
   Fi = 8.35 × 10^-5 Qi^1.85
   Where:
   Qi = flow in the ith segment (L/min (gpm))
5. Determine manifold diameter using the Section 805 equation in metric-first form:
   Dm (mm) = 25.4 [Σ(Li Fi) / (f hd)]^0.21
   Where:
   Dm = manifold diameter (mm (in.))
   Li = length of the ith manifold segment (m (ft))
   Fi = friction factor for the ith manifold segment

f = fraction of total head loss in the manifold segment
hd = distal head (m (ft) of head)

6. Show manifold connection details consistent with Section 805.3.4 (tees or 90-degree (1.57 rad) ells; capped ends).

A.2.7 Step 7 Pipe material selection and friction factor.

1. Identify pipe materials used for the delivery pipe, manifold, and laterals.
2. Select Hazen–Williams friction factor, Ch, using Table 805.5.3 (or manufacturer/approved reference where materials are not listed).

A.2.8 Step 8 Delivery pipe and network friction losses (Equations 8-2 and 8-3).

1. Define delivery pipe length, LD, as the pipe length between the pump and the supply end of the distribution pipe as described in Section 805.3.5.
2. Determine delivery pipe friction loss, FD, using Equation 8-2 (metric-first form shown in Section 805.3.5):
   FD (m) = LD (m) [4643 Qm (L/min) / (Ch Dd^2.63 (mm))]^1.85
   (US form is permitted for calculation where used: FD (ft) = LD (ft) [3.55 Qm (gpm) / (Ch Dd^2.63 (in.))]^1.85)
3. Determine network pipe friction loss, FN, using Equation 8-3:
   FN = 1.31 hd
   (units consistent, m (ft) of head)

A.2.9 Step 9 Force main sizing and velocity limit.

1. Size the force main based on friction loss and effluent velocity.
2. Confirm effluent velocity in the force main achieves a minimum scouring velocity of 0.61 m/s (2 ft/s) during pump operation and does not exceed 1.52 m/s (5 ft/s), as required by Section 703.6.

A.2.10 Step 10 Total dynamic head (TDH) and pump selection.

1. Determine TDH as required by Section 805.5.1: elevation difference between pump and distribution pipe invert plus friction loss.
2. Confirm that residual head is sufficient to achieve the designed orifice discharge rate in the distribution network in accordance with the hydraulic requirements of Section 805.
3. Select a pump using the pump performance curve that delivers the required discharge at the calculated TDH.

A.2.11 Step 11 Controls, alarms, and electrical.

1. Provide pump and alarm controls consistent with Sections 805.5.2 and 805.5.3 (adjustable on/off controls, corrosion-resistant switches, separate alarm circuit).

2. Locate electrical connections outside the pumping chamber consistent with Section 805.5.4.
3. Electrical work for pumps, controls, alarms, and associated circuits should be coordinated with the AHJ for permitting and inspection as required by the applicable electrical code.

A.2.12 Step 12 Dosing volume and frequency (Section 805 method).

1. Select dosing frequency to promote uniform distribution and unsaturated flow within the soil treatment and dispersal system. Where timed dosing is used, confirm that daily design flow is distributed evenly over the design period.
2. Determine distribution piping network volume using Table 805.6.1 and the actual pipe diameters and lengths used in the design.
3. Select dose volume sufficient to fully pressurize the distribution network and achieve uniform orifice discharge. As a default design basis, dose volume shall be not less than two times the calculated internal volume of the distribution piping network unless hydraulic calculations demonstrate adequate pressurization with a smaller volume.
4. Confirm that selected dose volume does not exceed that necessary to maintain unsaturated conditions in the receiving soil.

A.3 Design submittal checklist (recommended).

A complete LPD design package should include:

1. Site plan showing soil treatment and dispersal system geometry and distribution layout (laterals, manifold, caps/flush points where used), and elevations.
2. Cross-sections showing trench/bed/mound construction and cover.
3. Hydraulic calculations documenting: perforation discharge, Q = Nq, manifold sizing (Equation 8-1), friction losses (Equations 8-2 and 8-3), and force main velocity check.
4. Pump selection documentation showing the design operating point on the pump curve and calculated TDH.
5. Control/alarm schematic and settings (on/off, alarm elevation, and any alternation logic).
6. Electrical notes consistent with Section 805.5.4 and applicable electrical code requirements.

Appendix B Operation & Maintenance (O&M) Recommendations for Onsite Wastewater Treatment Systems.

(Informative)

B.1 Purpose and Use. This appendix is for informational use only, unless formally adopted by a jurisdiction as a rule or policy. This appendix provides recommended operation, inspection, maintenance, and user-practice guidance for onsite wastewater treatment systems (OWTS). These guidelines identify critical maintenance tasks and the recommended frequency at which they should be performed to ensure long-term performance, public health protection, and environmental protection.

It is intended to support this standard by reducing the likelihood of hydraulic overload, clogging, treatment failure, and nuisance conditions; and providing minimum O&M elements that can be adapted to local conditions, product requirements, and regulatory programs.

Applicability note: Manufacturer O&M instructions, permits, and local codes should take precedence where applicable, even if they are more stringent.

B.2 Recommended General O&M Principles (Applies to All OWTS).

B.2.1 Protecting the System from Overload.

B.2.1.1 Hydraulic loading protection guidance.

1. Fix leaks promptly (such as toilets or faucets).
2. Spread laundry across the week; avoid multiple large loads in one day.
3. Divert foundation drains, sump pumps, roof drains away from the system area (never into tanks/soil treatment).
4. Avoid discharging high-sodium water softener brine and reverse osmosis reject water to the OWTS where possible (follow AHJ guidance)
5. Do not discharge hot tubs/spas backwash or drains to OWTS

B.2.1.2 Organic/solids loading guidance.

1. Avoid or limit the use of garbage disposals. If used routinely, increased inspection and pumping frequency of tanks should be considered (See Section B.3.2).
2. Avoid releasing fats, oils, and grease (FOG) such as cooking oil, bacon grease, or heavy cream, down the drain.

B.2.2 Keep Inappropriate Materials Out of the System. Do not discharge the following into the system:

1. Inert Solids: Wet wipes ("flushable" or otherwise), diapers, feminine hygiene products, paper towels, condoms, dental floss, coffee grounds, cat litter, cigarette butts, plastics, rubber, or anything non-biodegradable
2. Chemicals: Paints, solvents, pesticides, herbicides, antifreeze, fuels, high amounts of bleach or other disinfectants/sanitizers, drain cleaners, acids/alkalis, or unused medications.

B.2.3 Protecting the Treatment and Dispersal Area.

1. Keep heavy vehicles/equipment off tanks, pipes, and soil treatment areas (including mounds).
2. Maintain vegetative cover; avoid deep-rooted trees/shrubs near or over components.
3. Mark and protect component locations (risers, lids, inspection ports, control panels).

B.2.4 Safety.

1. Tanks are confined spaces with toxic gases and oxygen deficiency hazards. **Do not enter** unless you are a trained professional with proper personal protective equipment.
2. Lids must be maintained secure and child-resistant.
3. Electrical work should only be performed by qualified persons.

B.2.5 Signs of Trouble (Call for Service).

1. Sewage odors indoors or outdoors
2. Slow drains or gurgling plumbing
3. Alarm beeping or pump running continuously
4. Wet spots, lush green strips, surfacing effluent
5. Backups into fixtures

B.3 Septic/Trash Tank Pumping Recommendations.

B.3.1 Measurement-based pumping. Using measurement-based pumping (sludge judge/core sampling) is preferred over calendar-only schedules. Pump septic/trash tanks where combined sludge + scum occupies approximately 30–35% of the tank's liquid depth, or when the bottom of the scum layer is within 75 mm (3 inches) of the outlet baffle/filter, or when the top of the sludge layer is within 300 mm (12 inches) of the outlet baffle/filter.

B.3.2 Time-Based Pumping Guidance (If Measurements Not Available). A common baseline for typical residences is to pump tanks every 3–5 years for conventional septic tanks. Adjusted shorter to 1–3 years where occupancy is high relative to tank size, or there is known high solids or additional organic loading is routinely occurring

B.3.3 Pumping Best Practices.

1. Pump the tank completely; inspect baffles/tees, tank integrity, and risers.
2. Clean/replace effluent filters/screens as needed.
3. Confirm outlet invert and watertightness; check for infiltration or effluent flow back into the tank.
4. Document sludge/scum levels, condition, and any repairs.

NOTE: Pumping alone is unlikely to "fix" a failing soil dispersal area without diagnosing root causes (such as hydraulic overload, biomat clogging, broken pipes, or compaction).

B.4 Component-Level O&M Elements (Common Across Systems).

B.4.1 Effluent Screens/Filters (If Equipped).

1. Inspect/clean every 6–12 months initially, then adjust.
2. Pull the filter cartridge and hose off debris into the inlet side of the tank to avoid washing solids into the outlet.

B.4.2 Pumps, Floats, and Controls.

1. Test alarm function and floats at least annually
2. Verify dose volume, run time, and cycle counts (where monitored)
3. Ensure check valves function and do not stick
4. Confirm pump vault is free of excessive solids/grease

B.4.3 Distribution Boxes/Manifolds.

1. Check for levelness and equal distribution (as accessible)
2. Flush distribution lines if sediment accumulation is suspected

B.5 Soil Absorption & Dispersal Systems.

B.5.1 Conventional Soil Absorption Fields (Trench/Bed). Recommended Frequency: Annually

1. Walk the drainfield area to check for "breakout" (surfacing effluent), wet spots, settling/sunken areas, or odors.
2. Maintain shallow root vegetation cover and remove any saplings or deep-rooted plants intruding on the area.
3. Verify storm gutters and surface drainage are diverted away from the soil absorption field.
4. Keep heavy traffic off the dispersal area at all times and check at least annually for any deep depressions or other physical damage to the soil absorption field area.

B.5.2 Mound Systems. Recommended Frequency: Annually (Inspection) / Every 3 Years (Flushing)

B.5.2.1 Annual inspection points.

1. Where the system is pressure dosing to mound, verify the pump cycles correctly (dosing volumes and rest periods). Inspect the pump chamber and test the high-water alarm.
2. Inspect the surface for erosion, seepage, settling/sunken areas, and animal burrows. Check the perimeter base of the mound for any leakage.
3. Check observation ports (if provided) for ponding in the mound.
4. Maintain grass cover; do not plant trees/shrubs on or near the mound.
5. Keep runoff diverted; maintain upslope diversions/swales if present.

B.5.2.2 Flushing. Open the ends of the lateral lines and flush them to scour accumulated biomass.

B.5.3 Pressure Dosed Systems (Pressurized Trenches/Beds). Recommended Frequency: Professional inspection recommended. Annually (Inspection) / Every 3 Years (Flushing).

B.5.3.1 Annual inspection points.

1. Check the distal head pressure (squirt height) at the cleanouts to ensure equal distribution. If squirt height is uneven, clean or jet the laterals to clear clogged orifices.
2. Test pump operation (dose volume and dosing frequency) and alarm float functionality. Monitor for short-cycling or excessive run time.
3. Inspect and clean upstream filtration (screens, filters).

B.5.3.2 Flushing. Open the ends of the lateral lines and flush them to scour accumulated biomass.

B.5.4 Drip Dispersal Systems. Recommended Frequency: Every 6 Months (or per AHJ requirements and Manufacturer recommendations).

1. It is critical to inspect disc or screen filters. Clean or replace if the pressure differential indicates clogging.
2. Perform a field flush of drip zones to clear debris from drip tubing and a flush of the supply/return manifolds.
3. Inspect air/vacuum release valves for leaks and check soil moisture levels for signs of emitter failure. Repair or replace as needed.
4. Verify proper pressure regulation, flow rates, and zone valves functionality.

B.6 Alternative Biological and Secondary Treatment Systems.

B.6.1 Pond/Lagoon Systems. Recommended Frequency: Quarterly (Inspection) / Every 3–5 Years (Sludge Check).

B.6.1.1 Quarterly inspection points.

1. Ensure water color is green (healthy algae) rather than gray/black (anaerobic).
2. Check for short-circuiting between the inlet and outlet.
3. Inspect embankments for erosion, animal burrows, seepage, or settling.
4. Maintain fencing/signage for safety.
5. Mow embankments and prevent woody growth root intrusion that compromises integrity and inhibits visual inspection.
6. Confirm freeboard above lagoon effluent is at design level.

B.6.1.2 Sludge check.

1. Measure sludge accumulation. Plan for removal at intervals appropriate to loading and design.
2. Dredging is typically required only every 10–20 years.

B.6.2 Constructed Wetlands (Subsurface or Surface Flow). Recommended Frequency: Quarterly (Inspection) / Annually (Harvest)

B.6.2.1 Quarterly inspection points.

1. Inspect pretreatment (septic/trash tank) frequently; solids carryover is a primary cause of failure.
2. Clear debris from inlet/outlet structures to maintain design water levels.
3. Check for burrowing animals (muskrats/nutria).
4. Check water levels and hydraulic distribution across the wetland. Monitor for short-circuiting, odors, mosquito breeding (surface flow), and clogging of inlet zones.

B.6.2.2 Harvest.

1. Harvest dead vegetation (cattails/reeds) to prevent nutrient release back into the water.
2. Maintain designed plant community and remove any invasive plant species.

B.6.3 Plant Evapotranspiration (ET) / Evaporation Bed Systems. Recommended Frequency: Seasonally.

1. Maintain healthy vegetation and uniform cover. Monitor plant health closely as the system fails if the plants die.
2. Replant dead plant areas immediately. In arid climates, monitor soil for salt crusting. If negatively impacting the system function, remove accumulated salts from the soil by applying fresh water to wash (leach) them below the root zone. Note, this requires adequate soil drainage capability and shall comply with any requirements for AHJ approval.
3. Prevent stormwater from entering the bed by maintaining berms/liners as designed.
4. Monitor for surface ponding and seepage at edges (indicates hydraulic overload).

5. These systems are highly dependent on climate and loading; adjust use during wet seasons if required by design/permit.

B.6.4 Biological Filtration Systems (Such as Sand/Peat/Textile/Trickling Media Filters). Recommended Frequency: Every 6 Months.

1. Inspect dosing equipment and distribution. Verify effluent is distributed evenly across the media surface. Check recirculation timers or splitter valves.
2. If ponding is observed on filter surface, clean distribution plates/pipes as needed.
3. Rake the surface of sand filters to break up biomats and remove weeds.
4. Replace or rehabilitate media at end of service life (varies by media type and loading).
5. Maintain upstream septic tank pumping/filtering diligently to prevent clogging.

B.6.5 Vermifiltration Systems. Recommended Frequency: Monthly.

1. Visually inspect the worm population (Such as *Eisenia fetida*) for health and activity. Maintain optimal moisture (moist and not waterlogged), temperature, and ventilation for worm health.
2. In winter, verify insulation is maintaining temps above freezing.
3. Preventing toxic inputs (bleach dumps, solvents, pesticides, high fats/oils/greases) is essential to maintain the worm and microbial habitat.
4. Inspect for ponding, clogging, or anaerobic odors.
5. Harvest castings/solids as specified; maintain pre-screening if required.

B.6.6 Secondary Treatment Units/Systems (OWSTS). These systems usually require a maintenance contract with a certified provider. Maintain service contract where required/recommended. Maintenance should be performed by individuals qualified in the servicing of the OWSTS or as required by the AHJ.

Recommended Frequency: Every 6 Months (or per AHJ requirements and Manufacturer recommendations).

1. Examine septic tank for solids accumulation. Follow manufacturer guidance on observed solids accumulation and/or Section X.3 as appropriate. Some OWSTS require more frequent sludge pumping than conventional septic systems.
2. Inspect aeration units (blowers/compressors) for noise and air output.
3. Clean air intake filters and replace diaphragms or vanes in compressors as needed (typically every 1–2 years).
4. Inspect pumps, recirculation, and sludge return mechanisms.
5. Inspect electrical system components for hazards and functionality

6. Inspect the condition and functionality of sensors and alarms, and alarm history.
7. Inspect the condition of sampling ports and access covers
8. Inspect effluent for clarity and odor. Recommend sampling and testing for BOD, TSS, and any other parameters that are indicative of performance per the manufacturer or AHJ permit conditions.
9. Inspect soil absorption field (per applicable system-specific recommendations under Section B.5 or B.6)
10. Service records should be retained by the system owner and made available to the AHJ upon request if required. These records should include dates of service, findings, corrective actions, parts replaced, and laboratory results where applicable.

B.7 Toilet and Source Separation Systems.

B.7.1 Composting Toilets. Recommended Frequency: Per Use (Bulking) / Weekly (Turning) / Annually (Emptying)

B.7.1.1 Bulking. Maintain correct carbon-to-nitrogen balance with bulking agent (sawdust/coir, or as specified).

B.7.1.2 Turning.

1. Rotate the drum or mix the pile to aerate.
2. Keep moisture and ventilation within design range to prevent odors and flies.

B.7.1.3 Emptying.

1. Remove finished compost per manufacturer guidance; cure/store as required. Ensure it has cured for the recommended time (often 6+ months) before disposal.
2. Use gloves and safe handling; follow local rules for final disposal/use of compost.
3. Keep leachate/urine management systems functional (if applicable).

B.7.2 Urine Diversion Systems (UDDT/UD Toilets).

Recommended Frequency: Monthly

1. Flush urine piping with a mild acid (vinegar or citric acid) to dissolve struvite (urine salt) crystals and prevent blockages.
2. Inspect the odor seal (trap or silicone curtain) for functionality.
3. Ensure adequate ventilation for odor control.
4. Manage collection, storage, and end-use/disposal per local requirements.

B.7.3 Incinerating Toilets.

Recommended Frequency: Weekly (Ash Removal) / Annually (Vent Check)

B.7.3.1 Ash removal.

1. Empty the sterile ash pan (frequency depends on usage, typically after 50–70 cycles).
2. Clean bowl liners/catalysts/combustion chamber components per manual.

B.7.3.2 Vent check.

1. Inspect the exhaust flue/chimney for soot buildup, bird nests, or other blockages.
2. Verify safety interlocks and temperature controls.

B.8 Onsite Nonpotable Water Systems (ONWS) - Combined Wastewater or Graywater Reuse

These systems usually require a maintenance contract with a certified provider. Maintain service contract where required/recommended. Maintenance should be performed by individuals qualified in the servicing of the ONWS or as required by the AHJ.

Recommended Frequency: Every 6 Months (or per AHJ requirements and Manufacturer recommendations)

1. Examine tank(s) for solids accumulation, as applicable. Follow manufacturer guidance on observed solids accumulation and/or Section X.3 as appropriate.

    1.1 If applicable to the ONWS:

    1.2 Inspect aeration units (blowers/compressors) for noise and air output.

    1.3 Clean air intake filters and replace diaphragms or vanes in compressors as needed (typically every 1–2 years).

2. Inspect pumps, recirculation, and sludge return mechanisms.
3. Disinfection Check:

    3.1 Chlorine*:* Maintain tablet/liquid levels and replenish as needed. Check chlorine feeder system functionality, dose concentration, and disinfectant residual in storage tanks.

4. UV: Check that the light is operational. Clean quartz sleeves. Replace UV bulbs as needed.
5. Filtration: Inspect any filtration media or membranes, clean and replace as needed.
6. Safety Check:

    6.1 Verify color-coding (purple pipes) and labels remain visible.

    6.2 Perform a cross-connection test if plumbing changes have occurred.

    6.3 Inspect electrical system components for hazards and functionality

7. Inspect the condition and functionality of all sensors and alarms and alarm histories.
8. Inspect storage tanks:

8.1 clean as needed,

8.2 prevent stagnation and biofilm growth by maintaining disinfectant residual,

8.3 ensure screened vents and mosquito control

9. Maintain clear labeling and cross-connection control:

    9.1 Conduct backflow prevention device testing,

    9.2 Ensure purple pipe and/or markings are in place,

    9.3 Ensure signage at fixtures/irrigation points is in good repair and legible.

10. Inspect effluent for clarity and odor. Recommend sampling and testing for BOD, TSS, and any other parameters, including microbiological constituents, that are indicative of performance per the manufacturer or AHJ permit conditions.

11. Service records should be retained by the system owner and made available to the AHJ upon request if required. These records should include dates of service, findings, corrective actions, parts replaced, and laboratory results where applicable.

12. Winterize irrigation lines as needed per geography

B.9 Pit Latrines. Recommended Frequency: Monthly

1. Keep area dry and clean (daily to weekly)
2. Maintain slab/platform integrity and a tight-fitting lid to reduce vectors/odors.
3. Check that vent pipe screens are intact.
4. Monitor the fill level.
5. Where solids reach within 0.5 meters (1.5 feet) of the surface, the pit must be closed/filled with soil and a new pit dug, or mechanically emptied.
6. Have a plan for pit filling:

    6.1 safe closure and relocation, or

    6.2 emptying by trained personnel with appropriate PPE and AHJ approved disposal pathway that maintains surface and groundwater protection.

B.10 Troubleshooting Guide (Quick Reference).

B.10.1 Alarm sounds / high water.

1. Conserve water immediately.
2. Check breaker/GFCI (do not reset repeatedly if it trips).
3. Call service provider; possible pump/float failure or downstream blockage.

B.10.2 Odors present.

1. Verify venting, tank lids, and cleanouts.
2. Check for overloading, clogged filters, or treatment malfunction.

B.10.3 Surfacing effluent / soggy area.

1. Stop/discontinue high water uses.
2. Keep people/pets away.
3. Call professional for diagnosis (hydraulic failure, broken pipe, saturated soil, dosing issue).

B.10.4 Frequent filter clogs.

1. Indicates excess solids/FOG, tank baffle problems, or hydraulic surges.
2. Increase pumping/inspection; adjust user practices.

B.11 Recommended O&M Schedules (Summary Framework).

B.11.1 Owner Checks (Monthly/Quarterly).

1. Confirm alarms have not activated; check control panel lights.
2. Walk-over inspection: no wet spots, sewage odor, surfacing.
3. Verify downspouts/sumps are diverted away.
4. Observe plumbing: no slow drains/backups.

B.11.2 Professional Annual Visit (Typical for Most Engineered Systems).

1. Tanks: baffles/tees, watertightness, sludge/scum estimate, filter condition
2. Pumps: floats, alarms, run time, dose volume, check valves
3. Dispersal: manifolds/valves, flushing points, inspection ports
4. Treatment units: blower/aerator, media condition, sampling ports (if required)
5. Reuse: disinfection verification, cross-connection controls, labeling

B.11.3 Multi-Year.

1. Septic/trash tank pumping per B.3
2. Media replacement/rehabilitation per manufacturer and observed headloss
3. Lagoon sludge survey/management as needed
4. Dripline periodic integrity checks and emitter performance checks

B.12 Recommended O&M Program Structure.

B.12.1 Roles and Responsibilities.

B.12.1.1 Owner/operator.

1. Use system properly; keep records; arrange inspections/pumping/service.
2. Maintain access to components and protect system area.

B.12.1.2 Service provider.

1. Perform inspections, tests, and maintenance; provide written findings and recommendations.
2. Verify alarms and controls; document parts replaced and settings.

B.12.1.3 Regulator/management entity (if applicable).

Maintain inventory of permitted systems; manage reporting; enforce service contracts for advanced units.

B.12.2 Minimum Documentation (Recordkeeping).

Maintain an O&M file with:

1. "As-built" plans (component locations, elevations, model numbers)
2. Permits and approvals
3. Manufacturer manuals and warranties
4. Service reports, pumping receipts, sampling results (if any)
5. Alarm events and corrective actions
6. Any modifications/repairs (date, contractor, parts)

B.12.3 Inspection and Maintenance Frequency (Baseline).

Frequencies below are general starting points; adjust based on flow, occupancy, system age, and observed sludge/scum accumulation.

1. Owner monthly/quarterly: visual checks (alarms, wet spots/odors, vegetation, surface discharge)
2. Professional annual (typical): comprehensive inspection for systems with pumps/controls, secondary treatment, reuse, drip, or complex dispersal
3. Professional every 1–3 years (typical): conventional gravity systems depending on risk and usage
4. After unusual events: flood, earthquake, extended vacancy, power outages, alarm activations

Appendix C Pit Latrine With Slab.

(Normative)

C.1 Use Limitation. Pit Latrines constructed to the requirements of this Section are the minimum standard for an OWTS. Other OWTS options for the collection and treatment of wastewater provided in this Standard are more likely to result in improved health outcomes and shall be considered prior to the installation of pit latrines.

Due to the inferior treatment achieved by pit latrines resulting in increased risks to receiving soil, groundwater, and potentially drinking water, pit latrines shall only be installed where other OWTS options described in this Standard are physically or economically unfeasible or impractical.

C.2 Location.

C.2.1. Isolation from dwelling. Pit latrines shall be separated from dwellings by a minimum of 10 m. Pit latrines shall have a maximum of 50 m separation from a family dwelling.

C.2.2. Isolation from drinking water. Pit latrines shall be located downhill from drinking water sources and must conform to Section C.2.4. Pit latrines shall be isolated from drinking water sources as much as possible. A minimum of 30 m horizontal distance separation from drinking water sources is required.

C.2.3. Isolation from surface water bodies. Pit latrines shall have at least 30 m horizontal distance separation from surface water bodies.

C.2.4. Protection from surface water intrusion.

1. Pit latrines shall be constructed in an area not subject to flooding.
2. Pit latrines, including superstructures, shall be constructed on a slight mound that is a natural landscape feature or constructed with mounded soil, divert surface water away from the pit.
3. Constructed diversion channels or trenches shall be permissible to use to achieve prevention of surface water intrusion.

C.3 Design and Construction.

C.3.1. Pit size.

C.3.1.1 Diameter. Latrine pits shall be a minimum of 1 m wide. If soil stability allows, pits shall be 1.2 m wide. Pits of greater than 1.5m depth shall not exceed 1.5m in diameter or width due to risk of soil wall collapse.

C.3.1.2 Depth. Latrine Pits shall be a minimum of 3 m deep. Where necessary to conform with Section C.3.2, pit depth is permitted to be reduced to 1.5 m.

NOTE – pits of lesser depth will require larger diameter or width and/or require more frequent emptying.

C.3.2 Isolation from groundwater. The bottom of latrine pits shall be at least 2 m above the ground water level (water table). If groundwater is within 5 m of the ground surface, one of the following options shall be used:

1. A more shallow pit shall be constructed in accordance with Section C.3.1.2, or
2. The pit shall be constructed to extend above grade to the desired height using an elevated platform with water tight walls where the pit extends above grade, or
3. Relocation of the pit to an area with depth to groundwater compliant with this section, or
4. Construct a Sealed Vault in accordance with Section C.3.4, or
5. Alternative options for wastewater collection found in Section 803 shall be utilized.

C.3.3 Lining, Requirement. Pit latrine pits shall be lined as required by this section

C.3.3.1 Materials. Pits shall be lined with brick, rot-resistant timber, concrete, stone or mortar plastered onto the soil.

C.3.3.2 Depth. Pit lining must extend the entire depth of the pit. The bottom of the pit is not required to be lined or unsealed. Installation of a "pit collar" where the pit lining extends to only 1 m below the slab shall be permissible where the soil wall of the entire pit is stable. If the pit latrine is expected to be emptied mechanically, then the pit shall be lined to the entire depth of the pit.

C.3.4 Sealed vault (Pit Vault). Pits shall be entirely sealed and water-tight (sides and bottom) where required by local authorities.

C.3.4.1 Materials. See Section 802.6 for required design criteria for a sealed pit vault.

C.3.5 Slab. Pit latrines shall have a slab above the pit that is constructed in accordance with the requirements of Section 803.

C.3.5.1 Materials. Slabs shall be constructed from materials that are durable, with a smooth finish and easily cleanable. Acceptable materials include concrete, brick, stone, plastic, fiberglass, metal or pest and rot-resistant wood planks. The use of wooden planks must include a smooth covering layer of mortar.

C.3.5.2 Slab size/dimensions. Slabs must be a minimum of 10 cm thick. Strengthening slabs with reinforcing materials such as rebar is permissible. Slabs must extend at least 30 cm beyond the pit opening on all sides.

C.3.5.3 Drop hole size. Drop hole opening through the slab shall be a maximum of .25 m in diameter.

C.3.5.4 Cover/lid. Pit latrines shall be equipped with a removable drop hole cover or lid that has a handle.

C.3.5.5 Access for emptying. If intended for periodic emptying, a pit latrine slab shall incorporate an external access point such as a removable lid or panel. The access point must be large enough to accommodate emptying mechanically or manually.

C.3.6 Pour Through Water Seal Feature. If installed, a pour-through water seal device shall be made of smooth materials such as plastic of ceramic. Pour-through devices and attached drain line shall be sloped to effectively transfer excreta to the pit. Pour-through water seal devices shall be constructed with a plumbing trap of adequate size to prevent gases from entering the pit superstructure. Commercially available pre-fabricated pour-through devices, such as a SaTo pan, shall be permissible and installed in accordance with the manufacturer's instructions.

C.3.7 Toilet/Seating feature. Toilet/seating features are permissible and shall be constructed of durable and easily cleanable materials.

C.3.8 Ventilation. Pit Latrines must include provisions for ventilation as required by the section.

C.3.8.1 Ventilated Improved Pit-Latrines (VIP).

C.3.8.1.1 Fresh air inlets. One gap at either the door or in the upper 1/3 of a wall shall be required for pit latrines utilizing a ventilation pipe. The area of the gap in a VIP shall be at least 3 times larger than the cross-sectional area of vent pipe. The gap requirement does not apply if a spiral wall design is utilized.

C.3.8.1.2 Ventilation pipe height. Ventilation pipe shall extend from inside the pit to .3 m above the highest point of the superstructure roof.

C.3.8.1.3 Ventilation pipe screen. Ventilation pipe must be provided with a screened cover that is secured to the vent pipe and has a maximum 1.5 mm mesh pore size.

C.3.8.1.4 Ventilation pipe size. Ventilation pipe shall be a minimum of 10 cm in diameter. NOTE – larger ventilation pipes result in greater air transfer

C.3.8.1.5 Ventilation pipe affixed. Ventilation pipe shall be secured to the superstructure at a minimum of 2 points or be constructed as a permanent integral component of the superstructure.

C.3.8.1.6 Ventilation pipe materials. Ventilation pipes or system shall be constructed of precast plastic of metal pipe, brick, cement, or locally sourced suitable materials such as bamboo reeds.

C.3.8.2 Non-VIP system. A gap above the door and in at least one wall of the superstructure shall be provided. A gap of equal size shall be located in the bottom 1/3 of the wall opposite the door. The gap requirement does not apply if a spiral wall design is utilized.

C.9 Superstructure. Pit latrines shall include a superstructure atop the pit that is constructed to the requirements of this Section.

C.9.1 Walls. Walls shall be constructed of cement block, brick, stone with cement or timber, or other locally sourced material adequate for wall construction.

C.9.2 Roof. The roof shall be constructed of durable materials, affixed to the walls of the superstructure and extend beyond the walls at least .2 m.

C.9.3 Doors. Doors shall be constructed of solid locally sourced material. Doors shall be placed facing the direction of prevailing winds. Doors shall be sized to minimize gaps other than as required under Section 3.8.1.1. Where utilizing a spiral design, a door shall not be required.

C.9.4 Lighting. For VIPs, light shall be minimized to reduce the incidence of flies

C.9.5 Drop hole lid. Each drop hole within a superstructure shall be equipped with a lid with a handle attached that completely covers the drop hole. VIP systems are not required to have a drop-hole lid.

C.9.6 Seating. Superstructures are permitted to incorporate a seat, bench, squatting pan, or raised foot rest, provided they are durable with a smooth finish and are easily cleanable.

Appendix D Guiding Philosophy for Addressing Environmental Hazards in ICC 825

(Informative)

D.1 Intent. The provisions of this appendix provide guidance for mitigating environmental hazards in OWTS. These measures address vulnerabilities such as component failure and treatment disruption, which can impair structural integrity, efficiency, and contaminant containment. Impairments elevate public health risks from pathogen exposure and ecological impacts. The standard establishes minimum risk-based engineering controls to address these concerns, providing for reliable operation and cost-effectiveness in various installations.

D.2 System Resilience. System resilience shall be the engineered capacity to withstand environmental stressors without critical failure and to restore function promptly, minimizing downtime and contamination. Core functions include:

1. Protecting components from damage.
2. Maintaining hydraulic and biological processes.
3. Limiting contaminant transport.

Designs shall emphasize durability against erosion, pollutant containment, effluent compliance, and groundwater protection to support public health through effective waste treatment.

D.3 Common Vulnerabilities. As identified in the EPA Onsite Wastewater Treatment Systems Manual, common vulnerabilities include:

1. Saturated drainfields, impairing soil treatment and risking pathogen-laden surface effluent.
2. Diminished treatment capacity due to overloading or disruptions, resulting in incomplete contaminant removal.
3. Infrastructure damage, such as cracks from erosion or compaction, leading to groundwater leaks.

D.4 Hazards Covered. This appendix addresses immediate extreme weather events and environmental stressors, including:

1. Wildfires
2. Drought
3. Flooding
4. Heavy precipitation
5. Temperature extremes

D.5 Application and Authority. An engineering and scientific methodology is applied, as detailed in the hazard mitigation tables for each OWTS type. Affordable options tailored to systems and hazards are

provided to enhance mitigation and extend system lifespans through maintenance. AHJ's shall be permitted to adopt, modify, or exceed these minimum requirements based on local site evaluations and event frequencies. ICC 825 references standards such as IPSDC 2024 for site protection and NSF/ANSI 40-2025 for treatment enhancements to reduce failures and ensure operational consistency.

Resources

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