

## Indiana Standards for Subsurface Constructed Wetland Treatment Technology

These standards apply to the design and construction of subsurface constructed wetland (SCW) treatment technology for on-site sewage systems with design daily flow of 750 gallons per day or less. The design and construction of subsurface constructed wetland (SCW) treatment technology for on-site sewage systems with design daily flow of greater than 750 gallons per day are reviewed and approved on a project-by-project basis by the Indiana State Department of Health (department).

### I. Approval and On-site Sewage System Construction Permit

- A. The department reviews and approves treatment technology when a design has been demonstrated to meet or exceed the requirements contained in the department's standards for approving new methods, processes and equipment.
- B. The department approves the SCW treatment technology described in this document. [Only the design described in this document is approved. If a design is included in the plan submittal for an on-site system that does not comply with these standards, it may not be approved for use without department review and approval.]
- C. Before the department or a LHD may issue a construction permit for an on-site sewage system incorporating SCW technology that complies with these standards, the design and specifications must be included in the plan submittal.
- D. Any changes, modifications, or substitutions of materials to an approved design must be submitted by the designer and approved by the department or local health department (LHD), whichever has authority, prior to the change, modification, or substitution.

### II. Application Standards

- A. A SCW must be designed and constructed according to the designer's requirements, in a manner that complies with *410 IAC 6-8.3, Residential On-Site Sewage Systems*, or *410 IAC 6-10.1, Commercial On-Site Sewage Systems*, whichever is applicable, these standards, and local ordinances, requirements and procedures.
- B. A soil absorption field (SAF) for a new on-site system may be reduced in size up to 1/3 provided the design is for a SAF that is as long and narrow as the site will allow.
- C. SCW treatment technology that comply with these standards may not be used in an on-site sewage system having a subsurface drip SAF without additional treatment that results in sewage effluent that has been demonstrated to meet or exceed Indiana performance criteria for secondary treatment units (STUs).

### III. Requirements, Designers and Installers

- A. Each designer must include design drawings to scale, specifications, and construction instructions with the plan submittal.
  - 1. The plan submittal must be consistent with the requirements of *410 IAC 6-8.3, 410 IAC 6-10.1*, and these standards.
  - 2. The designer must train the installer of the SCW on construction in accordance with the approved plans.

3. The designer must provide the installer ongoing consultation during construction of the SCW, as needed.
- B. Each Installer must:
1. Be trained by the designer before constructing an on-site sewage system containing a SCW; and
  2. Construct the SCW in compliance with the approved plan.

#### IV. Requirements for Design and Construction

- A. Requirements for design and components of a SCW.
1. Requirements for designing a SCW.
    - a. These design requirements apply to a single cell SCW only.
    - b. The total area of the SCW bottom must be at least one (1) square foot (ft<sup>2</sup>) per gallon per day (gpd) of design daily flow (DDF) of the on-site sewage system.  
$$\text{Total area of SCW} \geq 1 \text{ ft}^2/\text{gpd} \times \text{DDF (gpd)}$$
    - c. The length-to-width ratio of a SCW cell must be two-to-one (2:1).
    - d. The SCW must be located to receive full sunlight.
  2. If a dose tank is located between the septic tank and the SCW, the dose must be timed to deliver ten (10) equal doses per day. Dose tanks must meet the minimum requirements of *410 IAC 6-8.3* and *410 IAC 6-10.1*
    - a. If the effluent force main and manifold do not drain to the dose tank, the timer must be set to deliver one-tenth (1/10) of the design daily flow (Dose = 1/10 DDF).
    - b. If the effluent force main and manifold drain to the dose tank, the timer must be set to deliver one-tenth (1/10) of the design daily flow (DDF) plus the volume contained in the effluent force main and manifold that drains back to the dosing tank (Dose = 1/10 DDF + Vol<sub>FM</sub>).
    - c. The dose pump must meet the minimum requirements for total dynamic head (TDH) and total discharge rate (TDR) for the on-site sewage system (see *410 IAC 6-8.3* and *410 IAC 6-10.1*).
- B. Requirements for outlet sumps.
1. A level-adjusting outlet sump must be installed at the outlet end of the SCW.
    - a. The outlet sump must be a watertight device.
    - b. The SCW outlet effluent sewer into the outlet sump must:
      - 1) Have an adjustable vertical extension set to maintain the level of effluent in the SCW at two (2) to three (3) inches below the finished grade of the aggregate within the SCW; and
      - 2) Have a threaded cap with a one-half (1/2) to one and one-half (1 1/2) inch drilled hole.
    - c. The effluent sewer from the sump must outlet to a distribution box or a dose tank.
  2. Outlet sumps must have securely fastened insulated lids.
- C. Site preparation for the flexible liner subgrade.
1. One of the following methods must be used to prepare the site for the flexible liner subgrade.
    - a. Preparation of the subgrade using sand.
      - 1) The soil must be:

- a) Excavated to a minimum of four (4) inches below the final grade of the placement of the bottom of the flexible liner; and
      - b) Leveled throughout its length and width.
    - 2) The following must be placed over the bottom of the excavation:
      - a) A layer of fine to coarse sand at least four (4) inches thick, free from rock, fractured stone, debris, and roots; and
      - b) Leveled throughout its length and width and compacted.
    - b. Preparation of the subgrade using manufacturer's protective blanket.
      - 1) The soil must be excavated to the final grade of the placement of the bottom of the flexible liner.
      - 2) The soil must be leveled throughout its length and width and compacted.
      - 3) A protective blanket, recommended by the manufacturer, must be placed over the bottom of the excavation.
  - 2. The perimeter sidewall berm must:
    - a. Be formed from debris-free soil material; and
    - b. Have the following dimensions:
      - 1) A height of three (3) feet or greater above the finished elevation of the subgrade;
      - 2) A bottom width of seven (7) feet or greater; and
      - 3) Side slopes of one-to-one (1:1).
- D. Requirements for flexible liners in SCW.
- 1. General requirements for flexible liners.
    - a. Material for flexible liners must be polyvinyl chloride (PVC), ultraviolet (UV) light resistant polyethylene, or ethylene propylene diene monomer (EPDM) rubber.
    - b. Flexible liners must be:
      - 1) Thirty (30) mil in thickness or greater for polyvinyl chloride (PVC) and ultraviolet (UV) light resistant polyethylene;
      - 2) Forty-five (45) mil in thickness or greater for EPDM rubber.
    - c. The physical properties of patches, repairs and seams in a flexible liner must be equal to or exceed the physical properties of the flexible liner.
  - 2. Requirements for the installation of flexible liners in SCW.
    - a. The flexible liner must be:
      - 1) Transported, handled and stored to prevent damage;
      - 2) Protected from weathering and sunlight; and
      - 3) Dry for seaming, patching and connecting "boots".
    - b. The flexible liner must be installed in the following climatic conditions:
      - 1) The temperature must be between 42° F to 90° F; and
      - 2) Gustly winds must be avoided to prevent interference with flexible liner placement; alignment of seams; and contamination of seams, patches, and boot connections.
    - c. The subgrade must be maintained in a smooth, uniform and compacted condition during installation of the lining.
    - d. The final cut size of the flexible liner must generously fit the subgrade and sidewall geometry without straining of the flexible liner material. The flexible liner must:
      - 1) Be installed along the sidewalls to a height of two (2) – six (6) inches or greater above the finished elevation of the subgrade.

- 2) Be installed to minimize elongation and strain; and
  - 3) Have no surfaces exposed to sunlight or weathering.
- e. Flexible liner placement and watertight installation.
- 1) Flexible liner panels must be positioned to minimize handling.
    - a) The flexible liner must not be stressed during installation.
    - b) The flexible liner must not bridge any portion of the subgrade or sidewalls.
    - c) The flexible liner must be secured to prevent movement during installation of influent and effluent manifolds and media.
  - 2) Factory seams in the flexible liner must be inspected after installation according to manufacturer's recommended procedures.
  - 3) Where pipe penetrations of the flexible liner are necessary, connections to the flexible liner and pipes must be watertight and installed according to manufacturer's recommended procedures.
  - 4) Field seaming (if unavoidable) and field repairs (if necessary) must be:
    - a) Watertight;
    - b) Performed only when contact surfaces of the materials are free of dirt, dust, moisture, and all other foreign materials; and
    - c) Made according to manufacturer's recommended procedures.
  - 5) The flexible liner must be visually inspected after installation for punctures and tears, and tested by one of the following two methods to insure a watertight membrane at seams, patches, penetrations and connections:
    - a) Inlets and outlets must be plugged and the flexible liner flooded by at least one (1) foot of water above the highest boot connection. After a twenty-four (24) hour period there must be no loss of water except for evaporation; or
    - b) An air lance test must be performed at all seams, patches, penetrations and connections. This test must be performed using a minimum fifty (50) pounds per square inch (psi) air supply directed through a three-sixteenths (3/16) inch nozzle held not more than two inches from the edge being tested. Riffles must not occur at any seam.
  - 6) Requirements for inspection and repair of the flexible liner.
    - a) The flexible liner must be visually inspected for punctures and tears after each stage of the construction of SCW, including, but not limited to, the installation of influent and effluent manifolds, and media.
    - b) Punctures and tears, resulting from the construction of SCW, must be repaired according to manufacturer's recommended procedures.

E. Requirements for SCW components installed after the flexible liner.

1. The following must be placed on the inlet end of the SCW:
  - a. A two (2) to four (4) inch layer of INDOT Spec. 1 aggregate must be placed on the liner and extend four (4) feet or more from the inlet end of the SCW. Consideration must be given to the permeability and hydraulic conductivity of the central aggregate in determining the appropriate length of this layer of aggregate into the wetland.
  - b. The influent manifold must be installed on this layer of aggregate six (6) to eighteen (18) inches from the inlet end of the SCW.
  - c. An additional twenty (20) to twenty-two (22) inch layer of INDOT Spec. 1 aggregate must be placed on the two (2) to four (4) inch layer of INDOT Spec.

- 1 aggregate, resulting in a total of twenty-four (24) inches of INDOT Spec. 1 aggregate over the liner.
    - d. The side slope of the INDOT Spec. 1 aggregate at the central aggregate interface must be one-to-one (1:1).
  2. The following must be placed on the outlet end of the SCW.
    - a. A two (2) to four (4) inch layer of INDOT Spec. 1 aggregate must be placed on the liner and extend three (3) feet from the outlet end of the SCW.
    - b. The effluent manifold must be installed on this layer of INDOT Spec. 1 aggregate six (6) to twelve (12) inches from the outlet end of the SCW.
    - c. An additional twenty (20) to twenty-two (22) inch layer of INDOT Spec. 1 aggregate must be placed on the two (2) to four (4) inch layer of INDOT Spec. 1 aggregate, resulting in a total of twenty-four (24) inches of INDOT Spec. 1 aggregate.
    - d. The side slope of the INDOT Spec. 1 aggregate at the central aggregate interface must be one-to-one (1:1).
  3. The influent and effluent manifolds must be fitted with a four (4) inch cleanout at both ends that extend above the finished grade of the SCW aggregate.
  4. The central aggregate must be eighteen (18) inches of INDOT Spec. 8 aggregate with a six (6) inch top layer of INDOT Spec 11 pea gravel.
  5. Barrier material must not be installed between any media within the constructed wetland.
- F. Requirements for plants and planting.
  1. The SCW must be insulated as follows:
    - a. Place a two (2) – six (6) inch layer of mulch, free of undesirable weed species and seeds, over the aggregate; and
    - b. Cover the mulch with a woven biodegradable netting or jute.
  2. The SCW must be planted at least ten (10) weeks before the first hard frost. If planting cannot take place at least ten (10) weeks before the first hard frost, then planting must be postponed until spring.
  3. Air temperature at the time of planting must be forty (40) degrees Fahrenheit or greater.
  4. A variety of at least two (2) species of wetland perennials with deep, dense fibrous root systems and winter tolerance must be planted in the SCW. [Examples of plants indigenous to Indiana include cattails (typha), bulrushes (scirpus), rushes (juncus), and sedges (carex)].
  5. Plants of the same species must be grouped within the SCW.
  6. Plant rows must be perpendicular to the direction of flow.
  7. Plant rows must be separated by eighteen (18) inches, and plants must be staggered by nine (9) inches.
  8. Shallower root plants must be located near the inlet to the SCW, with the deeper root plants located near the outlet of the SCW.
  9. Plants must be inserted three (3) to four (4) inches into the pea gravel with the shoots slightly exposed and the roots placed in water.
    - a. Plant roots must be kept wet at all times by:
      - 1) The immediate application of effluent; or
      - 2) Filling the SCW with water to within two (2) to three (3) inches of final grade.
    - b. The water level must be maintained.

- c. Water-soluble plant food must be applied, at the manufacturer's lowest recommended rate for lawns, to the SCW once every three weeks until effluent is available.

10. If plants do not take hold and show visible signs of growth within ten (10) weeks, replanting must be done in-between the original plants.

G. Requirements after installation of the SCW.

- 1. The final grade around the outer berm must divert surface water away from the SCW.
- 2. A fence with a minimum height of four (4) feet must restrict access onto the SCW.

**V. Requirements for Operation and Maintenance (O&M)**

A. The department requires that service personnel obtain training specific to the operation of the SCW. Training needs specific the SCW include, but are not limited to:

- 1. Plant (i.e., vegetation) maintenance requirements;
- 2. Hydraulics control;
- 3. Cleaning techniques; and
- 4. Troubleshooting of system problems and malfunctions.

B. Requirements for maintenance.

- 1. The SCW must be inspected and maintained every 6 months. Maintenance activities include, but are not limited to:
  - a. Pulling out undesirable plant species, such as sunflowers, prickly lettuce, tamarisk, thistle, and cottonwood and willow tree saplings;
  - b. Removing dead vegetation (not dormant vegetation);
  - c. In spring, removal of dead tops of dormant plants.
  - d. Filling low spots with gravel to bring low spots up to design finish level;
  - e. Replanting and fertilizing;
  - f. Cleaning/brushing screens and pipes;
  - g. Adjusting SCW sump level control;
  - h. Installation of barriers to exclude wildlife and deer; and
  - i. Control of turtles and burrowing animals.
- 2. If there are no sewage flows for more than 6 days, or if sewage flows are significantly below average, service personnel must add water to the SCW every 2 to 3 days to maintain the water level 2 inches below the SCW gravel surface to prevent plant die-off.

**VI. Requirements for the Remainder of the On-site Sewage System**

A. For residential on-site sewage systems, a plan submittal with a proposal to replace a SAF and utilize existing on-site sewage system components must include a report, with test procedures and results, demonstrating that any existing on-site sewage system component to be utilized is watertight and in good condition.

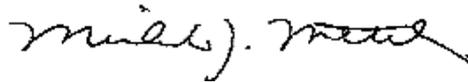
B. A SAF must be designed and installed according to the designer's requirements, in a manner that complies with *410 IAC 6-8.3, Residential On-Site Sewage Systems*, or *410 IAC 6-10.1, Commercial On-site Sewage Systems*, whichever is applicable (including site evaluation, system selection and system size), and local ordinances, requirements and procedures.

C. An on-site sewage system SAF must not be constructed during periods when the soil is sufficiently wet to exceed its plastic limit. **Before installation of the SAF, the installer must perform, and the soils must pass, soil plasticity tests.** Soil

plasticity tests include the evaluation of soil samples throughout the SAF site, both at the surface and at the depth of installation, to assure that the plastic limit of the soil is not exceeded. The plastic limit of a soil is exceeded when the soil can be rolled between the palms of the hands to produce threads one-eighth (1/8) inch in diameter that do not easily break apart or crumble.

Approved: August 6, 2018

Effective: August 6, 2018

A handwritten signature in black ink, appearing to read "Michael Mettler, Rehs". The signature is written in a cursive style with a large initial "M".

MICHAEL METTLER, REHS, DIRECTOR  
ENVIRONMENTAL PUBLIC HEALTH DIVISION