New Hampshire Department of Environmental Services

Land Treatment and Disposal of Reclaimed Wastewater: Guidance for Groundwater Discharge Permitting

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1.0 INTRODUCTION

The New Hampshire Department of Environmental Services (NHDES) has developed this guidance document to describe how certain uses of reclaimed water from wastewater treatment plants are regulated in New Hampshire. For this document, the use of reclaimed wastewater has been limited to discharges to the land surface to: 1) Recharge aquifers; 2) Irrigate crops and/or turf at golf courses; or 3) make snow. Specifically, this document provides guidance for obtaining permits to develop new groundwater discharges associated with the following forms of wastewater land treatment and/or disposal methods:

1) Rapid Infiltration (RI) systems.

2) Slow Rate infiltration (SR) systems.

3) Spray irrigation of turf at golf courses.

4) Snow making.

Rapid infiltration achieves treatment and disposal by rapid infiltration of primary or secondary effluent into alternately dosed shallow basins over highly permeable soil. (Primary effluent quality is attainable by primary treatment or simple settling. Secondary effluent quality is attainable by secondary treatment, which follows primary treatment and contains a biological treatment component). Slow rate infiltration systems achieve treatment and disposal by slow rate application of primary or secondary effluent (i.e., typically spray irrigation or drip irrigation) onto moderately permeable cultivated or forested land. Similarly, **spray irrigation** at golf courses achieves treatment and disposal by applying treated wastewater as spray irrigation to turf where the wastewater is evaporated, transpired, or recharged into aquifers. **Snow making** offers a cold season disposal option for either secondary or tertiary treated effluent dependent on the final use of the manufactured snow.

A groundwater discharge permit issued by NHDES is the primary mechanism regulating wastewater reclamation activities in New Hampshire. It is NHDES' intent that this guidance be used to achieve compliance with the requirements contained in Env-Wq 402 to obtain a groundwater discharge permit, although the applicant should be aware that additional laws and regulations apply. In addition to this guidance document, other documents can be used as resources for developing a wastewater reclamation project. These documents include:

TR-16: Guides for the Design of Wastewater Treatment Works – 2011 Edition. New England Interstate Water Pollution Control Commission.

Process Design Manual: Land Treatment of Municipal Wastewater. United States Environmental Protection Agency (EPA 625/1-81-013).

Process Design Manual: Land Treatment of Municipal Wastewater – Supplement on Rapid Infiltration and Overland Flow. United States Environmental Protection Agency (EPA 625/1-81-013a).

2012 Guidelines for Water Reuse – September 2012. United States Environmental Protection Agency (EPA Publication EPA/600R-12/618) National Service Center for Environmental Publications (NSCEP).

2.0 LAWS AND REGULATIONS

There are several laws and regulations implemented by federal, state and local governmental agencies that pertain to developing sites to receive reclaimed wastewater. This section summarizes the major regulatory programs with jurisdiction over the types of wastewater reclamation projects described in this document. Copies of the laws and regulations referenced below may be obtained as follows:

(1) State Laws and Regulations - Visit the New Hampshire Department of Environmental Services website or telephone (603) 271-2975 or 8876;

(2) Local Bylaws, Ordinances and Regulations - Contact the Town Clerk at the town offices for the municipality in which the facility is to be located; and

(3) Federal Laws and Regulations - Visit the Federal Bookstore website or telephone (866) 512-1800.

2.1 State

The primary statutory authority for regulation of wastewater treatment and disposal facilities is contained in the New Hampshire statute RSA 485-A: Water Pollution and Waste Disposal. This law requires NHDES to develop regulations pertaining to the siting and operation of wastewater treatment and disposal facilities. This law also requires NHDES to maintain regulations for discharging wastewater to the groundwater to ensure that any disposal activity does not make groundwater beyond a designated “groundwater discharge zone” undrinkable. (A groundwater discharge zone is defined as the subsurface volume in which groundwater contamination associated with the discharge of domestic wastewater is contained).

NHDES has adopted regulations to implement the requirements of RSA 485-A. The regulations and their purpose are described below.

Env-Wq 700 - Standards of Design and Construction for Sewerage and Wastewater Treatment Facilities

NHDES’ Wastewater Engineering Bureau (WWEB), Design Review Section, has the responsibility of reviewing plans and specifications for all public and private wastewater collection systems and domestic sewage treatment systems. The WWEB also reviews and issues permits for major new users of municipal treatment plants, assists small communities with wastewater treatment needs and prepares environmental assessments for projects that are funded by the Clean Water State Revolving Loan Fund. Additional functions of the Design Review Section include reviewing wastewater planning studies, municipal sewer use ordinances, user charge systems and inter-municipal agreements. In accordance with State statute, the WWEB has developed regulations (Env-Wq 700) that pertain to the location, design, construction, and maintenance of new wastewater facilities.

Env-Wq 304 - Certification of Wastewater Treatment Plant Operators

The WWEB maintains a certification program for wastewater treatment plant operators. Operators of wastewater treatment plants must have the proper level of certification for a given type of treatment process. The WWEB has developed regulations (Env-Wq 304) that specify the certification requirements for operating wastewater treatment plants.

Env-Wq 402 - Groundwater Discharge Permits and Registrations

NHDES' Drinking Water & Groundwater Bureau (DWGB) maintains a groundwater discharge permit program (Program) that specifies procedures applicable to the management and disposal of pollutants. NHDES has adopted regulations (Env-Wq 402) that identify requirements for obtaining a groundwater discharge permit including: 1) Minimum water quality applicable to the various waters of the state; 2) Mechanisms to establish and manage discharges within designated groundwater discharge zones; and 3) Requirements for dischargers to establish groundwater and surface water monitoring, sampling, record keeping and reporting procedures.

Each groundwater discharge permit also contains monitoring and reporting requirements to verify compliance with permit limitations and conditions. Detailed plans for a groundwater monitoring well network must be submitted to NHDES as part of a complete permit application. The plans must specify the types of wells, their locations, depths, screen selection and method of construction, development and sampling. The applicant must also submit, for review and approval by the Program, detailed plans and specifications for all new collection, treatment and disposal facilities.

An applicant must submit sufficient engineering and hydrogeologic information to explain the potential public health and environmental impacts of the proposed project to NHDES. The information must demonstrate that all groundwater contamination associated with a groundwater discharge is contained within a "groundwater discharge zone" that is owned or legally controlled by the applicant. After receiving sufficient information, NHDES will either: 1) Issue a groundwater discharge permit with conditions; 2) Deny the discharge permit application; or 3) Request additional information.

Env-Wq 2012 - Water Use Registration and Reporting

NHDES' Drinking Water & Groundwater Bureau (DWGB) maintains a water use registration and reporting program which gathers water use data from facilities using in excess of 20,000 gallons of water per day averaged over any 7-day period, or more than 600,000 gallons of water over any 30-day period. The goal of the program is to maintain accurate water use data to help understand how water resources are being used in New Hampshire.

NHDES adopted administrative rules for water use registration and reporting under the authority of RSA 488 Water Management legislation. The rules implement statutory requirements by describing the information required for registration, outlining accuracy requirements relative to water use measurement, and defining the frequency that water use data must be submitted to NHDES. The rules associated with this program can be found at the Department's web page.

2.2 Local

NHDES has primary regulatory authority for approving new wastewater treatment and disposal facilities. However, local ordinances and zoning may restrict the types of activities allowed at a private wastewater treatment and disposal facility.

The applicant must notify the municipality when a complete application for a groundwater discharge permit has been submitted to NHDES. The applicant can meet this requirement by providing a copy of a completed permit application to the town/city clerk of the municipality in which the facility is to be located.

2.3 Federal

The Underground Injection Control (UIC) Program is a federal program designed to protect underground sources of drinking water from pollution. The US Environmental Protection Agency (EPA) pursuant to the Federal Safe Drinking Water Act, 42 U.S.C.A §§300f to 300j-26, administers this program. The EPA divides injection practices into five classes. Class I includes deep disposal wells for industrial and municipal waste. Class II covers all injection wells related to oil and gas production including wells used to store hydrocarbons that are liquid at standard temperature and pressure. Class III includes wells that inject liquids for the *in situ* extraction of minerals or energy. Class IV includes the injection of hazardous and high level radioactive wastes into and above usable groundwater (currently prohibited under 40 CFR 144.13(a)). Class V covers shallow wells used to dispose of wastes or water into or above underground sources of drinking water including wells used to discharge treated sewage, nondomestic wastewater, heating and cooling water and stormwater. Class VI covers wells used for injection of carbon dioxide (CO_2) into underground subsurface rock formations for long-term storage, or geologic sequestration.

In New Hampshire, the EPA has delegated the UIC Program to NHDES. NHDES has developed regulations (Env-Wq 404) to implement the State's UIC Program in accordance with federal requirements. For purposes of the UIC Program, a well is defined as a "bored, drilled, or driven shaft, a dug hole, or seepage pit whose depth is greater than the largest surface dimension; or, an improved sinkhole; or, a soil absorption system as defined in 40 CFR 144.3."

3.0 FILING FOR A GROUNDWATER DISCHARGE PERMIT

Any wastewater facility that discharges 20,000 gallons per day or greater to groundwater and/or the ground surface must possess a valid groundwater discharge permit issued by NHDES in accordance with Env-Wq 402. Once issued, permits are valid for a period of up to five years, unless modified or revoked by NHDES. An application for a permit renewal must be submitted no sooner than 90 days prior to the expiration date of the permit. Additionally, new or modified wastewater treatment facilities must obtain separate approval from NHDES and comply with the requirements of Env-Wq 700 (wastewater treatment facilities).

Groundwater discharge permit applications must include hydrogeologic studies of the proposed disposal site, its surroundings, and a surface water and groundwater monitoring plan. Applications are reviewed by NHDES to verify compliance with the requirements of Env-Wq 402. NHDES' review consists of two parts. First, an administrative review will be completed to insure proper rules have been followed and the permit fee paid (when applicable). Then technical reviews will be completed to evaluate the technical submittals (plans and specifications, hydrogeologic studies, surface water and groundwater water monitoring plans, ownership documentation, if required). If, during either review, deficiencies are noted in the application, NHDES will send written notice to the applicant identifying the deficiencies. If compliance with Env-Wq 402 is demonstrated, a permit will be issued within 90 days. Issued discharge permits will contain effluent discharge limitations, surface water and groundwater monitoring requirements and operational conditions. Permits also contain requirements for the regular monitoring of groundwater quality up-gradient and down-gradient of the proposed discharge in approved monitoring wells.

Applicants proposing to apply reclaimed wastewater to the land surface to recharge aquifers or to golf course turf must submit the basic information described below as part of the groundwater discharge permit application. In addition to the information required below, the applicant must demonstrate compliance with the criteria stated in Section 4.0 for the specific discharge method.

Although NHDES only requires that an application for a groundwater discharge permit be submitted in accordance with the requirements of Sections 3.0 and 4.0 of this document and Env-Wq 402, it strongly recommends that applicants submit a proposed scope of work for review and approval prior to initiating work on the application and completing field testing. This will allow all parties to more clearly identify data needs on a site-by-site basis upfront, before work initiates, which may make the permitting process more time and cost-efficient.

3.1 Basic Information

Each groundwater discharge permit application for discharging reclaimed wastewater must contain the following basic information:

(1) The facility name, address, property deed reference by county, book and page, property tax map and lot number;

(2) The facility owner's name, mailing address, and telephone number;

(3) The property owner's name, if different then facility owner, mailing address, and telephone number;

(4) The facility operator's name, if different then facility owner, mailing address, and telephone number;

(5) The contact person's name, mailing address, and telephone number;

(6) An original or color photocopy of a United States Geological Survey (USGS) topographic map, 7-1/2 minute series, which clearly identifies the facility location;

(7) Written verification from NHDES of Resources and Economic Development that threatened or endangered species do not exist on the site;

(8) A copy of the permit, or application if permit not yet issued, for NHDES's approval of an Alteration of Terrain permit under RSA 485-A:17 if applicable, for drainage and erosion control measures;

(9) A copy of the permit, or application if a permit has not yet been issued, for the septage or sludge management permit pursuant to Env-Wq 800 or Env-Wq 1600, if applicable;

(10) A copy or status of NHDES's dam permit pursuant to Env-Wr 100-700, if applicable, for bermed or dammed structures;

(11) A copy or status of NHDES's wastewater treatment plant operator permit, as required under Env-Wq 304, if applicable;

(12) An estimate of the construction time and the projected start-up date;

(13) A statement certifying that other relevant local, state and federal permits or approvals have been sought; and

(14) A list of reports on land use history, activities, water quality, and hydrogeology associated with the property on which the facility is located.

3.2 Inventory of Abutters and Potential Receptors

Each groundwater discharge permit application utilizing reclaimed wastewater must describe the abutters and potential receptors in the vicinity of the proposed facility. This information should be provided both on maps with an appropriate scale and in a written and/or tabular format. Specifically, the following information must be provided:

(1) Any streets within 1,000 feet of the proposed groundwater discharge zone;

(2) Any properties, including tax map and lot number, ownership and land use information, within 1,000 feet of the proposed groundwater discharge zone;

(3) Any surface waters or flood zones within 1,000 feet of the proposed groundwater discharge zone including their designated river classification, in accordance with RSA 483, New Hampshire Rivers Management and Protection Program, if applicable;

(4) Any private or public water supply sources, including type of use, within 1,000 feet of the proposed groundwater discharge zone;

(5) Any wastewater disposal systems or regulated discharges, which are within 1,000 feet of the proposed groundwater discharge zone;

(6) Any public utilities which are within 1,000 feet of the proposed groundwater discharge zone;

(7) Any source water protection areas (or wellhead protection areas) for any community, transient, or noncommunity, non-transient public water supply as defined by RSA 485:1-a, within 1,000 feet of the groundwater discharge zone;

(8) Residences or developed areas within 1,000 feet of wastewater storage and disposal areas; and

(9) Land uses and vegetative coverages within 1,000 feet of the wastewater storage and disposal areas.

3.3 Hydrologic Study

Each groundwater discharge permit application must contain the following information based on a hydrologic study:

(1) A description and map of existing and proposed site topography, existing and proposed site drainage, and proposed retention/recapture zones;

(2) A geologic site description including a description of surficial geologic materials, estimates of hydraulic conductivity, hydraulic gradients, and seepage velocity using published surficial geology maps, published soil survey maps, or maps prepared by a Certified Soil Scientist or Professional Geologist;

(3) The location of bedrock known to be at or near the ground surface within 1000 feet of the groundwater discharge zone;

(4) Boring log data including:

a. Soil sample descriptions according to either "Standard Classification of Soils for Engineering Purposes, Unified Soil Classification System," American Society for Testing and Materials, Designation: D2487, approved June 29, 1990, and published August 1990, updated 1993; or "Standard Practice for Description and Identification of Soils, Visual Manual Procedure," American Society for Testing and Materials Designation: D2488, approved June 29, 1990, and published August 1990, updated 1993;

b. Drilling methods; and

c. "N-values" according to "Penetration Test and Split Barrel Sampling of Soil," American Society for Testing and Materials Designation: D1586, approved October 15, 1992;

(5) Well construction details of existing and proposed groundwater monitoring wells including the elevations of the tops of well casings, soil boring information, Standard Penetration Test results and measured depths to the water table from the tops of casings. Monitoring wells must be installed and maintained in accordance with the New Hampshire Water Well Board Administrative Rules We 602.13. It is recommended that monitoring wells be constructed with 15-foot screens installed approximately 5 feet above and 10 feet below the adjusted high groundwater level. Well construction may be modified based upon specific site conditions such as suspected seasonal high water level fluctuations. Wells must be able to be secured and constructed so as not to allow infiltration of surface water.

(6) Soil horizon and soil profile data obtained by test pits excavated throughout the proposed disposal area. One test pit must be excavated per each 500 square feet of disposal area, with a minimum of two per proposed contiguous disposal area. Test pits shall be excavated at the furthest boundaries of the proposed disposal area. If the soil profile is consistent across the proposed disposal area, then the number of test pits may be reduced to one per 1000 square feet, with a minimum of four test pits. The following test pit data must be provided:

a. Verify depth, type, and texture of soil based on field observations recorded in test pit logs. If bedrock is encountered, field personnel shall describe observations to characterize the bedrock surface such as but not limited to the degree of weathering, fracturing, and type of rock. Field personnel shall note if redoxymorphic features (evidence of seasonal water table or seasonal saturation) or water appear to be at or near this surface at the time of observation;

b. Identify distinct soil layers;

c. Identify grain size;

d. Determine field-based soil permeability results;

e. Determine chemical soil properties such as pH, nutrient levels, and cation exchange capacity; and

f. Determine root zone storage capacity.

(7) A groundwater conditions evaluation, which must include the following:

a. Depth to groundwater confirmed by field investigations (i.e., piezometers or backhoe test pits) for various seasons, including data from the period of March through May;

b. Locations of perched water tables;

c. Groundwater contours;

d. Direction of groundwater movement and flow; and

e. Location of groundwater seeps or discharges;

(8) An estimation of hydraulic conductivity and infiltration rate for the site. Basin loading tests, double ring infiltrometer tests, and permeameter tests may be conducted, as applicable, in accordance with certified testing methods. Basin loading tests shall be required where rapid infiltration is the proposed disposal method.

(9) An estimation of the seasonal high groundwater table utilizing redoxymorphic features when applicable, or published observation or monitoring well data according to the methodology set forth in the following publications: Frimpter, M.H. 1981, *Probable High Ground-Water Levels in Massachusetts*: U.S. Geological Survey Water Resources Investigations Open File Report 80-1205; and Frimpter, M.H. and Fisher, M.N, 1983, *Estimating Highest Ground-Water Levels for Construction and Land Use Planning – A Cape Cod Massachusetts Example*: U.S. Geological Survey Water Resources Investigation Report 83-4112.

(10) A table summarizing all groundwater and surface water monitoring results to date;

(11) Nitrate, phosphorous or contaminant movement study (if applicable). No discharge may cause nitrate in a public water supply well to exceed 5 mg/L, or result in a surface water quality violation in accordance with Env-Wq 1700;

(12) Bench scale and soil column study(s) for quantifying both soil treatment capacity for nutrients and inorganics removals, and determining the potential for the discharged effluent to mobilize constituents in the subsurface resulting in exceedances in the AGQS (see Section 4.3).

(13) Ambient water quality of the site (groundwater and if present, nearby surface water). Sampling points for monitoring ambient water quality must be provided;

(14) A consideration of the added effects of natural precipitation as it relates to soil saturation, and seasonal changes affecting both soil and groundwater characteristics. This analysis must include, at a minimum:

a. Evaluate yearly rainfall, seasonal rainfall variations, and total precipitation for each month (use the wettest year in the past ten);

b. Determine the mean number of days per year with temperatures less than or equal to 32°F (O°C);

c. Determine mean wind velocities and prevailing direction;

d. Determine potential water loss through evapotranspiration; and

e. Evaluate plant growing seasons and periods of highest nutrient/water uptake;

(15) An analysis of the ability of the site to accept and disperse flow at the proposed maximum monthly flow rate for 90 days;

(16) An evaluation of the potential for groundwater mounding, the presence of confining layers, and unsaturated receiving material thickness and estimated areal extent. Mounding calculations or modeling must be evaluated for maximum monthly flow for a period of 90 days. The evaluation must include (if applicable) the effect of impermeable or semi-permeable barriers within the potential groundwater mound. These would include but not be limited to foundations and retaining walls. Characterization of difference between the mounding material and the native material must be done to account for difference in infiltration rate and preferential flow direction;

(17) A proposal for an appropriate groundwater monitoring well network based upon known or inferred groundwater flow direction under various seasonal conditions and geology (must include both up-gradient, cross-gradient, and down-gradient locations). The exact number of monitoring points should be based upon site complexity, proximity to sensitive areas, or design of the system.

(18) A proposal for a water level and water quality monitoring program. The program must include a sampling plan for both wastewater and monitoring wells installed within the groundwater discharge zone. The sampling plan must also include any nearby surface water bodies. The purpose of the sampling plan is to ensure that the discharge of wastewater will not cause water quality standards to be violated outside of the groundwater discharge zone immediately, or over time. A water level monitoring plan must be maintained to: 1) Ensure the land application of wastewater does not exceed design standards specified in Section 4.0; and 2) Verify the extent of mounding and the direction of seasonal groundwater flow and velocity under discharging conditions.

(19) An evaluation of likely impacts on current and potential down-gradient and cross-gradient receptors as identified in Section 3.2;

(20) If the discharge is within a source water protection area (or wellhead protection area), an evaluation of the time of travel from discharge to the source of supply. **Recharged wastewater must have a travel time of two years or more to any public water supply well or intake, unless enhanced treatment process or controls combined with other natural hydrologic influences justify an allowance of a shorter travel time;**

(21) Delineation of a groundwater discharge zone in which all contamination associated with the discharge will be contained;

(22) Demonstration that the facility meets the design and siting parameters described in Section 4.0.

a. For rapid infiltration, the design parameters specified in Section 4.1.

b. For slow rate application, the design parameters specified in Section 4.2.

c. For spray irrigation of golf course turf, the design parameters specified in Section 4.3.

d. For snow making, the design parameters specified in Section 4.4.

(23) Demonstration that the facility is designed to meet the treatment level and effluent quality criteria of Table 4.5.

3.4 Final Hydrologic Design and Operational Parameters

Each groundwater discharge permit application utilizing reclaimed wastewater must contain the following information describing operational parameters of the proposed facility:

(1) A complete description of the facility, its intended capacity, and type of wastewater that will be discharged. Supporting information describing the process involved in the pretreatment, treatment, storage, and disposal of wastes should be included in the description.

(2) A detailed description of the wastewater to be discharged, including:

a. Discharge characteristics, including calculations and analytical results if available;

b. Volume of discharge;

c. Hydraulic loading rates (including seasonal, peak, and monthly averages);

(3) Proposed discharge schedule;

(4) Location and number of discharge points;

(5) A detailed proposal for a groundwater and surface water quality monitoring program, including proposed monitoring schedule, parameters to be analyzed, and monitoring locations with supporting information justifying the locations, frequency, and parameters selected; and

(6) Status of Department approval of design plans and operations and maintenance manuals for the wastewater treatment system in accordance with Env-Wq 700.

3.5 Standard Site Control Measures

Each groundwater discharge permit application utilizing reclaimed wastewater must contain the following information demonstrating that adequate site control measures are in place:

(1) A groundwater discharge zone map, using a tax map as a base, which identifies and locates, to the extent ascertainable, the following:

a. A groundwater discharge zone boundary; and

b. Any deeded easements, which restrict the use of the groundwater within the zone.

(2) Proof of ownership of the groundwater discharge zone including documentation filed in the registry of deeds, which acknowledges that easement ownership rights have been obtained to restrict the use of water wells within the groundwater discharge zone.

3.6 Facility Plan

Each groundwater discharge permit application utilizing reclaimed wastewater must contain a facility plan prepared in accordance with the following:

(1) The plan shall include a title, a legend, and a true north arrow;

(2) The plan shall be drawn to scale and the scale shall be noted on the plan and include a graphic scale bar;

(3) The base plan sources from which the facility plan was derived shall be noted on the plan;

(4) The location, elevation, and datum of a bench mark shall be included, but if a bench mark referenced to National Geodetic Vertical Datum (NGVD) or North American Vertical Datum (NAVD) is within 1,000 feet of the facility, elevation shall be recorded using NGVD and the source of the NGVD bench mark information shall be noted on the plan;

(5) The plan shall identify and locate, to the extent ascertainable, the following:

   a. Existing and proposed groundwater monitoring wells that will be monitored;

   b. Surface water sampling points;

   c. Groundwater contours which show groundwater flow direction within 100 feet of the groundwater discharge zone;

   d. Surface waters within 1000 feet of the groundwater discharge zone;

   e. Areas where deeded easements restrict the use of groundwater;

   f. A groundwater discharge zone boundary;

   g. Land surface contours within 100 feet of the groundwater discharge zone;

   h. Piezometers used to develop groundwater contours and/or monitor groundwater mounding;

   i. Table of water level measurements and elevations found in piezometers and monitoring wells used to develop the groundwater contours;

   j. Soil borings and test pits within 1000 feet of the groundwater discharge zone;

   k. Physical structures and buildings associated with facility;

   l. Surface and underground storage tanks associated with the facility;

   m. Underground utilities at the facility; and

   n. Subsurface drains at the facility.

4.0 DESIGN CRITERIA FOR WASTEWATER LAND TREATMENT AND/OR DISPOSAL METHODS

Final effluent disposal to the land or subsurface must be by means of properly designed facilities. This section provides general guidelines for developing land treatment facilities that use the following disposal methods for treated wastewater:

1) Rapid Infiltration (RI) systems;

2) Slow Rate infiltration (SR) systems;

3) Spray irrigation of turf at golf courses; and

4) Snowmaking.

Other methods of discharge may be allowed on a case-by-case basis provided adequate documentation is presented to NHDES, which evaluates the estimated impact on the environment and hazard to public health resulting from such alternate system. This documentation shall include either results of a properly monitored pilot test performed with Departmental approval at the proposed discharge site or the results of tests and/or actual experience at other similar locations. It may be necessary to develop a reserve area to dispose of wastewater via a more conventional technology in the event the facility's main disposal area cannot be operated or the alternative technology does not function as projected.

Below, some basic facility siting and design guidelines are provided for various wastewater land treatment and disposal methods. Note that these guidelines supplement the standard information required for all new groundwater discharge permit applications associated with wastewater land treatment and disposal that are listed in Section 3.0 of this document.

4.1. Rapid Infiltration (RI) Systems

RI systems achieve treatment and disposal by rapid infiltration of primary or secondary effluent into alternately dosed shallow basins over highly permeable soil. RI systems provide treatment as wastewater percolates through the soil. RI systems require a minimum of primary treatment although secondary treatment has often been provided at existing facilities. When RI basins follow aerated lagoons, filtration for algae control is sometimes necessary to prevent surface clogging. Soil permeability is most often the factor limiting the application rate but a particular constituent in the wastewater may also limit the application rate. Very little of the applied wastewater will be lost to evaporation. RI systems typically achieve a high level of treatment.

Hydraulic Loading Rate

The design average annual hydraulic loading rate for rapid infiltration should be calculated as follows:

$L_w = I \times (24 \text{ hr/day}) \times N \times f$

Where:

- L_w = annual design loading rate, in inches per year

- I = measured infiltration rate, in inches per hour
- N = number of operating days per year, in days per year
- f = design application factor expressed as a decimal that ranges from 2 to 15 percent of the measured infiltration rate depending on type of infiltration test conducted

Drying periods are required for RI systems to allow the soil to aerate and recover between application periods. Because wastewater application is not continuous, the actual wastewater application rate is greater than the annual design loading rate. The actual application rate is calculated according to the following formula:

$$RA = \frac{\text{Lw x operating cycle in days}}{\text{365 x application period in days}}$$

Where:

- RA = actual application rate in inches per day
- Lw = average annual design loading rate, in inches per year

Typical RI system design loading rates vary from 50 to 400 feet per year. Basin bottom area requirements for rapid infiltration are calculated from the following formula:

$$A = \frac{\text{Q (gal/day) x 365 day/yr}}{\text{(0.083 ft/in.) x Lw (in./yr) x 7.48 gal/ft}^3\text{) x 43,560 ft}^2\text{/acre}}$$

Where:

- A = basin bottom area in acres
- Q = wastewater flow in gallons per day
- Lw = average annual design loading rate in inches per year

This formula is applicable if flow equalization or storage is available. When equalization is not available, the daily wastewater flow should be adjusted to provide for the highest flow rate anticipated on a weekly, monthly, or seasonal basis. Additional basins may be provided to accommodate periods of high flow. Commonly, having multiple smaller basins is preferred over a fewer number of larger basins. This provides an operational advantage for maintenance and offers additional time for individual basin rest and recovery between dosing cycles. RI basins can operate on a year-round basis; therefore, storage may not be necessary. However, it has been found useful to dose the basins with a large flow from storage, particularly when daily flows are small. Small continuous flows are more susceptible to freezing than a large dose of warmer wastewater. For winter operation, the formation of an ice cover is encouraged, as each dose of wastewater should float the ice to allow infiltration to occur under the ice surface. Storage may also be needed if soil permeability is relatively low and the water drains so slowly that freezing occurs.

Site Investigation

Special emphasis should be placed on site geology and field verification of soil characteristics when developing RI basins. RI basins generally require deep, permeable soils with percolation rates of one inch per hour or more. A complete hydrogeologic evaluation must be completed to predict the range of the effluent plume and the point of breakout. Site investigations must include depth of soil to groundwater or bedrock, topography, and groundwater movement. Depth to groundwater and bedrock at several locations during the field investigation must be determined. Test pits and permeability tests must determine the location and infiltration rate of the most restrictive soil layer(s) in the basin. Adequate test pits and monitoring wells must be constructed to define the movement of groundwater. Soil conditions beyond the RI basin site must be verified to ensure that percolate will flow away from the site. Continuous sampling of soil borings is required within the proposed basin area(s) and strongly recommended during investigations.

Measurements of infiltration rates using flooding basin tests should be conducted whenever possible, and must be conducted when rapid infiltration is the only method for disposing of wastewater. Alternative methods of measuring can overestimate the infiltration rate. Depending on the soil type, application rates may vary from 4 to 120 inches per week. The minimum distance from the application surface to groundwater or an impervious layer should be 10 feet prior to application. A groundwater mounding analysis should be performed to estimate the extent of the effluent plume. After application, mounding should be no closer than 4 feet to the basin bottom. The design should include multiple dosing basins to avoid overdosing individual basins and allow for sufficient drying time between doses such that the surface of the basin is dry prior to the next dosing. Chemical analysis of the soil is recommended to determine whether the accumulation of phosphorus or nitrogen in the soil may limit design and complete background sampling and analysis of groundwater is also required prior to system approval. Site management should ensure long-term treatment by controlling the hydraulic and nitrogen loading rates.

Treatment Performance

RI systems can remove relatively high levels of BOD (Biochemical Oxygen Demand) and TSS (Total Suspended Solids) through filtration, soil adsorption, and bacterial decomposition. Nitrogen removal does not always occur, but removals from 40 to 90 percent have been reported at some sites. Nitrogen removal is a function of biological denitrification and occurs through modified operating procedures that ensure an anoxic period. Denitrification is affected by the BOD-to-nitrogen ratio (optimally 3:1), hydraulic loading rate, and the ratio of flooding time to resting time (basin rest periods may range from 5 to 20 days). Phosphorus removal occurs from soil adsorption and chemical precipitation in unsaturated conditions. Detention time in the percolate zone in relation to the proximity of monitoring wells must be estimated. Short-circuits may occur, yielding false high phosphorus content in the groundwater. Nitrogen and phosphorus may be limiting factors at a given RI site, particularly if the existing groundwater aquifer approaches or exceeds state drinking water limits or exceeds surface water compliance standards.

Maintenance Requirements

Periodic cutting should be conducted to control vegetation on basin slopes and bottom areas. Cuttings should be removed. Exterior basin slopes and surrounding grounds should be cut regularly to discourage burrowing animals and tree roots from penetrating the basin embankments and to encourage air circulation.

4.2 Slow Rate (SR) Systems

SR systems achieve treatment and disposal by slow rate application (i.e., typically spray irrigation) of primary or secondary effluent onto moderately permeable cultivated or forested land. Special emphasis should be placed on field verification of soil characteristics when designing SR systems. A Certified Soil Scientist should conduct a high-intensity soil survey when a detailed soil survey is not available. Even when published data are available, field confirmation and refinement of soil properties in the areas to be used is necessary. A hydrogeologic evaluation must be performed to quantify site hydrogeologic capacity based on the soil and groundwater information required by Section 3.0 of this document.

Hydraulic Loading Rate

Soil permeability should be mid-range for spray irrigation. When soils are rapidly permeable, rapid infiltration basins are generally a better treatment choice. Typical soil permeabilities for spray irrigation as a means of effluent disposal are in the range of 0.2 to 2.0 inches per hour and are normally associated with loamy soils. Soil permeability is typically a limiting factor in the design of SR systems. Depending on the soil type, slope, depth to groundwater, and depth to an impermeable layer, application rates may vary from 0.5 to 4.0 inches per week (including precipitation). Vegetation selection directly affects the level of pre-application treatment, type of distribution system, and hydraulic loading rate. The type of vegetative cover will determine the period of expected transpiration and the duration of the application season. Wastewater should not be disposed of using the SR method when:

- More than 0.5 inch of rain fell in previous 8-hour period;
- Frost is in the ground;
- More than one inch of snow is on the ground;
- The ground is frozen and a hard crust is on the snow;
- High groundwater limits infiltration of effluent;

Surface runoff from spray sites is not allowed; and wastewater application at spray sites must cease during storm conditions. The wastewater field application area can be calculated using the formula below:

$$A = \frac{Q\,(ft^3/7.48\,gal)\ \text{x}\ 365\,day/yr + dV}{Lw\ \text{x}\ N\ \text{x}\ (ft./12\,in.)\ \text{x}\ (43{,}560\,ft^2/acre)}$$

Where:

- A = field area, in acres
- Q = wastewater flow, in gallons per day
- dV = net loss or gain in stored water volume because of precipitation and/or evaporation, in cubic feet per day
- Lw = design hydraulic loading rate, in inches per day

- N = number of days of operation, in days per yr

Hydraulic loading rate must be calculated on a site-specific basis using the water balance equation:

$$Lw = ET - P + Wp$$

Where:

- Lw = wastewater hydraulic loading rate based on soil permeability, in depth per time
- ET = design evapotranspiration rate based on the estimated average evapotranspiration of the crop, in depth per time
- P = design precipitation rate based on total precipitation for the wettest year in the previous 10-year period, in depth per time
- Wp = design percolation rate as measured in the field, in depth per time

In this formula, the precipitation rate should be the wettest year in the past 10 years. The percolation rate should be based on field measurements. If permeability varies across the site, determine the average minimum based on different soil types. The design percolation rate should not exceed 4 to 10 percent of the minimum soil permeability. Use the lower percentage for poorly defined soil conditions. A water balance should be calculated using the equation above for each of the 12 months of the year to determine the annual loading rate. Consideration must be given to the agronomic rate for the selected vegetative cover at the application site. Typical spray irrigation systems in New England use sprinklers for wastewater application and apply 3.5 to 6.5 feet per year.

Nitrogen may be a limiting factor at a given SR site. If this is the case, percolate nitrogen should be limited to a maximum of 10 mg/L total nitrogen.

Site Investigation

Chemical analysis of the soil is recommended to determine whether the accumulation of nitrogen may limit system design. Minimum depth to an impervious layer prior to application ranges from 1.0 to 5.0 feet. The minimum vertical separation from the ground surface to the actual water table during the period of application ranges from 1.0 to 3.0 feet.

Treatment Performance

SR systems can achieve greater than 90 percent BOD^5 (5-day biochemical oxygen demand test) removal from primary effluent, up to 90 percent BOD^5 removal from secondary effluent, nearly complete pathogen reduction, and significant nitrogen and phosphorus reduction. BOD^5 removal is achieved by filtration, soil adsorption, and bacterial oxidation. Phosphorus is removed by soil adsorption and chemical precipitation. Nitrogen is removed through plant uptake, nitrification/denitrification, and storage in the soil. Pathogens are similarly removed in addition to other reductions by radiation and exposure to adverse environmental conditions. Effluent disinfection immediately prior to SR application will ensure pathogen reduction and is required when the potential for human contact exists. Pathogens, particularly viruses, are adsorbed to soil particles in the first 20 inches (0.5 m) under the infiltrative surface. In cool, moist conditions they can remain viable for more than a year, and may desorb under saturated conditions. Therefore seasonal high groundwater cannot inundate the treatment zone even if effluent application is not occurring at the time. High groundwater may not be an issue if the effluent to be applied is pretreated to at least secondary levels and is disinfected immediately prior to application.

Another method of slow rate irrigation is Drip Irrigation or Drip Dispersal. This method is operable throughout the year and is useful where slopes or soils may not support any other conventional method of wastewater disposal. The discharge rates for drip irrigation for treated wastewater are based on the same criteria as SR systems (soil characteristics, rainfall, evaporation, evapotranspiration rates, and nutrient balances).

These subsurface slow rate disposal systems require pretreatment and filtration and are operated under pressure. The treated wastewater is applied to soil slowly and uniformly using a network of narrow tubing (usually plastic or polyethylene) placed below ground at shallow depth.

Drip irrigation in some settings may be less disruptive to construct than other subsurface disposal methods, and the system sizing and configuration are dependant upon hydraulic loading and the manufacturer's design and installation requirements and guidelines. The use of this type of system for a given discharge facility is approved on a case-by-case basis.

4.3 Water Reuse as Irrigation for Golf Courses or Other Landscaping Applications

Proposals to use reclaimed wastewater on golf courses or other landscaping applications are based on a SR system design, however, these proposals must satisfactorily address public health related issues and demonstrate that the permitted treatment plant can successfully achieve and maintain the water quality described in the ambient groundwater quality standards (AGQS). (AGQS as defined in RSA 485-C:2, I, namely "maximum concentration levels for regulated contaminants in groundwater which result from human operations or activities, as delineated in RSA 485-C:6."). A Best Management Practices (BMP) plan must be submitted that demonstrates how operation of the treatment and disposal systems and the facility or land use itself will be managed to minimize exposure to humans and prevent direct contact with reclaimed water. The applicant must also submit a plan to monitor the impacts that the project has on ground and surface water quality and the performance of the land use components that are considered part of the treatment system. For example, if turf on a golf course is meant to remove nitrogen from treated wastewater, the performance of the turf must be demonstrated through sample acquisition below the root layer.

Best Management Practices (BMP)

The implementation of golf course management protocols is an integral part of the goal of minimizing health risks through minimizing exposure to humans. There are a multitude of construction, and operation and maintenance practices that can be employed at golf courses to minimize human exposure. BMPs are considered a "working" part of the overall system approval, as important to minimizing risk through exposures as generating an acceptable effluent and insuring proper treatment train performance. As part of the groundwater discharge permit application process, NHDES must review and approve a facility management plan that describes in detail the types of BMPs that will be employed at the spray irrigation facility. Depending upon the type of land use, the geologic setting, the sensitivity of local water resource areas and the risk of human exposure, many or all of the following practices/protocols must be employed where spray irrigating reclaimed wastewater:

- Spray irrigating during non-use hours utilizing low trajectory sprayers;

- Public awareness signs indicating use of reclaimed water;
- Nutrient management plan reflecting fertilizer application and nutrients in sprayed wastewater;
- Storage ponds designed for maximizing water quality;
- Installation and maintenance of appropriate cross-connection/backflow preventing devices and use of proper color coding of potable vs. non-potable piping and fixtures;
- Emergency contingency plans and contracts with a spray irrigating system vendor;
- Procedure for immediate switch-over to a non-growing season disposal system;
- No ponding of sprayed water may result;
- Outside plumbing fixtures must have locking caps and be labeled as non-potable water;
- Correlation of spraying times and practices with wind speed or directions to reduce the drift of spray aerosols or mists outside of the disposal area;
- Appropriate buffers to spray irrigated water must be imposed;
- Education of facility personnel responsible for irrigation practices.

Buffers and Barriers

To reduce the risk of human exposure, the establishment of natural barriers and buffers to eliminate aerosol drift must be undertaken by facilities spray irrigating reclaimed wastewater:

- Areas of the facility receiving sprayed treated effluent must be a minimum of 400 feet from buildings, drinking water wells, Class A surface water bodies and surface water intakes;
- Areas of the facility being sprayed with potable water need not employ barriers or setbacks;
- To further reduce the risk of human exposure, spray irrigation of treated effluent must take place during nonoperational hours;
- There can be no spray irrigation of reclaimed water within 100 feet of any property line, wetland or surface water body;
- Irrigation systems must be designed to avoid any surface ponding, the spraying of paved or impermeable areas, or the creation of any surface runoff; and
- Irrigation systems should be designed to avoid spraying building and dwellings, decks, garages, driveways and roads.

In some instances, hedges or trees may be used to create barriers and reduce setback requirements. This will be considered on a case-by-case basis.

Treatment

Wastewater reused for irrigation at golf courses must meet more stringent reclaimed water quality standards and more frequent water quality sampling and analysis of wastewater effluent will be required because of the potential of human contact with the disposal areas. Effluent used at golf courses must receive secondary treatment, be disinfected and, optimally, be filtered. Except for certain nutrients discussed below, effluent sprayed onto golf courses must meet ambient groundwater quality standards. Permits that do not impose a drinking water standard for nitrogen, nitrate, or phosphorous may be issued to enhance fertilization practices. In order for permits to reflect the allowance of a different nutrient limit for reclaimed water, golf course fertilization practices must include a reduction in artificially applied fertilizer. For example, a golf course that receives reclaimed water with a nitrogen concentration of 30 mg/L from a nearby treatment plant must demonstrate that the number of pounds of nitrogen dissolved in the reclaimed water is taken into account when fertilization plans for the course are considered. There should effectively be a weight-for-weight reduction in artificially applied fertilizers. This issue must be addressed in the BMP plan.

Storage Ponds

Man-made irrigation ponds designed to store reclaimed water must be designed to minimize physical and biological influences that would adversely affect the quality of the stored water. These design factors include, but are not limited to:

- Lining the pond;
- Pond aeration;
- Placing the location so that they do not present a physical hazard to the public;
- Promoting pond circulation by properly locating inlet and outlet structures;
- The pond should be sized to allow for frequent recycling of pond water. One pond volume equivalent should be pumped frequently allowing for the addition of fresh reclaimed water and the evacuation of old water;
- Runoff from fertilized areas must be directed away from ponds;
- The perimeter of each storage pond should be landscaped to impede direct access to the water by exploratory children and youth;
- Signs should be placed at the perimeter indicating that direct contact with the water and/or sediment could pose a health hazard.

4.4 Wastewater Reuse as Snow

Snowmaking is an alternative method to manage wastewater either for recharging aquifers via wintertime ‘stockpile’ storage and infiltration [melting], or by use as artificial snow for ski slopes and recreational areas. The use of wastewater for snowmaking (a.k.a. Effluent Snow or E-Snow) offers a unique opportunity for wastewater storage and disposal in colder climates and has been successfully implemented in New England and Canada for many years.

4.4.1 Effluent Snow (E-Snow) for Storage and Aquifer Recharge

This method of disposal requires storage of effluent to accommodate the flows received outside of the typical discharge season. Snowmaking with the intent to store for disposal should be designed to keep accumulation areas isolated where human contact is restricted. E-snow is made out of treated effluent throughout the winter and is spread out over a cleared, prepared site. Melting and infiltration of the E-snow into the ground takes place over the spring and early summer. Although the E-snow process is intended as a disposal method, the effluent receives additional treatment by means of the process of forming snow.

When this approach is used in combination with slow rate spray irrigation it can be operated year round and can significantly reduce the storage capacity needed for a single limited seasonal discharge. In all cases a groundwater and surface water monitoring program is developed to verify the activity is in compliance with groundwater and surface water quality regulations. This application is permitted on a case-by-case basis.

Buffers and Barriers

To reduce the risk of human exposure, the facility should utilize the natural barriers and buffers of local terrain and forested areas. Particular attention should be given to prevailing wind speed and direction to minimize aerosol drift. With any facility proposing wastewater disposal via snowmaking, the facility shall develop a target E-snow “drop zone,” and E-snow production should be reduced or cease at times when wind velocities are carrying the E-snow substantially beyond the zone boundary. The following criteria apply to E-Snow drop zones;

- Areas of the facility receiving this snow accumulation must be a minimum of 400 feet from buildings, drinking water wells, frequented areas of human activity such as parking, recreational areas;
- There can be no E-snow spray of reclaimed water within 100 feet of any property line, wetland or surface water body;
- The storage areas must be designed to avoid any long term surface ponding, and any runoff from the accumulated snow piles shall be controlled to encourage infiltration and prevent direct flow to drainage ways and tributaries to surface water or the creation of any surface runoff; and
- The systems should be designed to avoid spraying were buildings and dwellings, decks, garages, driveways, and roads will be impacted.

In all instances, methods to manage E-snow spray and storage will be reviewed on a case-by-case basis.

Treatment Performance

The treatment benefits after snow is deposited are minimal. Soils and vegetation do have the capacity to uptake and utilize the nutrients from the snow melt water; however, the timing of melt does not always match the spring growth period. Control of runoff is essential to manage potentially nutrient rich water from entering surface waters. In some instances, residual precipitates that form on ground surface at the base of the E-snow pile may need to be managed as waste after full pile melt-out.

4.4.2 E-Snow Application to Ski Slopes and Recreational Areas

In recent years interest has been growing for the innovative use of highly treated disinfected wastewater as an alternative source (or supplement) to water used for recreation-related snowmaking.

The benefits of this alternative use are the decreased volume of effluent released directly to the environment and a decreased demand on surface and groundwater resources. Additionally, the treated disinfected water may also be eligible for nonpotable domestic use in new developments or facilities or for irrigating open spaces.

Due to the potential for human contact, before wastewater is considered for recreation-related snowmaking it must first receive tertiary treatment (nutrient removal). Tertiary treatment is commonly achieved using a variety of biological nutrient removal technologies. The processed wastewater is then filtered using advanced (ultra) filtration to achieve adequate removals for viral pathogens [4-log reduction]. Disinfection is also included in the treatment process at a location appropriate for the facility's design.

Best Management Practices

- Signage should be posted around any treated wastewater storage pond and direct access to the pond should be restricted.
- Awareness training of the health and safety risks associated with wastewater should be part of the safety instruction for employees tasked with system operation and maintenance.
- The delivery system should be monitored at all times E-snow is being produced or transferred from the treatment works to ensure that the effluent maintains a safe and consistent quality. The infrastructure should include a notification protocol and fail-safe devices to stop use or transfer of the effluent if treatment and/or disinfection is interrupted or malfunctions. This is necessary to eliminate the possibility of untreated wastewater being transferred into the snowmaking ponds or used for E-snow.

Because this is a seasonal use, the facility must have either adequate storage capacity for off-season flows or an alternative method of disposal. This method can be used in conjunction with conventional groundwater disposal systems or with a NPDES permit for off-season discharges. A NPDES permit may also be required if the treated wastewater is stored in ponds that outlet to surface water and/or tributaries.

4.5 Reclaimed Wastewater Treatment Requirements and Target Effluent Criteria

The following table represents minimum treatment and disinfection limits required for reuse or recharge of treated wastewater. On a case-by-case basis NHDES shall consider alternative treatment technologies that are demonstrated to meet effluent quality standards.

Table 4.5: Reclaimed Wastewater Treatment Requirements and Target Effluent Standards

Disposal Methods (1)	Minimum Treatment Required	Biological Oxygen Demand (BOD_5)	Total Suspended Solids (TSS)	Nitrate (NO_3) (2)	Disinfection (3) (Fecal Coliform)	Turbidity
Rapid Infiltration Basing (RIB)	Secondary	≤30 mg/L	≤ 30 mg/L	Site Specific	Not Required	No Limit Set
Slow Rate Spray Irrigation (SR)	Secondary	≤30 mg/L	≤ 30 mg/L	Site Specific	Not Required	No Limit Set
Drip Irrigation (SR)	Primary with Filtration (4)	≤ 30 mg/L	≤ 30 mg/L	Site Specific	Not Required (5)	No Limit Set
Golf Course &	Secondary	≤ 10 mg/L	≤ 10 mg/L	Site Specific	No detect - 7 day	5 NTU

Landscape Application (SR)	with Settling or Filtration				median (1 day max 14 cts/100)	(or meet TSS Limit of 10 mg/L)
E-Snow for storage and disposal (SR)	Secondary	≤ 30 mg/L	≤ 30 mg/L	Site specific	Not required	No limit Set
E-Snow for Ski Slopes and Recreational Areas (SR)	Tertiary with Filtration	≤ 10 mg/L	≤ 5 mg/L	Surface Water Quality Dependant **(6)**	No detect -7 day median (1 day max 14 cts/100) 4 log viral removal	2 NTU (or meet TSS Limit of 5 mg/L)

(1) Treatment level and effluent quality are generally established by: the requirement of meeting ambient groundwater quality standards at the limit of the groundwater discharge zone; access restrictions to the discharge site both during operation and after discharge; the inferred degree of direct human exposure posed by the given disposal method; or any combination thereof.

(2) For most facilities, nitrate limits are established during the hydrogeological study /contaminant migration evaluation for the discharge site.

(3) Disinfected wastewater in which the pathogenic organisms have been destroyed by chemical, physical, or biological means. Generally, the criterion for adequate disinfection with chlorine requires 1 part per million (mg/L) free chlorine residual after 30 minutes contact time

(4) Filtered wastewater: an oxidized, coagulated, clarified wastewater which has been passed through natural undisturbed soils, filter media, or synthetic membrane(s) to achieve the disinfection limits.

(5) Disinfection required if access is not restricted.

(6) Effluent limits for nitrate (and phosphorous) will be established for E-snow discharges for ski areas and other recreational use on a case-by-case basis relative to the requirement to remain in compliance with state surface water quality standards and criteria.

4.6 Emerging Issues

Although NHDES encourages expanded reuse of properly treated wastewater and recognizes the environmental benefits these water reclamation practices offer, NHDES also acknowledges that there are many chemicals potentially present in recycled wastewater that may not be well characterized. These emerging chemicals of concern include such classes of compounds as industrial solvents, pharmaceuticals, pesticides, various personal care products, surfactants and their associated degradation compounds. NHDES continues to track the science associated with emerging contaminants of concern. If new water quality standards are developed for certain constituents, discharge permits may need to be modified.