New Septic Technologies for Nitrogen Management

Permeable Reactive Barriers (PRBs)

What are permeable reactive barriers?

PRBs are narrow trenches installed below the ground filled with media that treats groundwater as it flows through the trench materials. They depend on chemical and microbial activity to effect groundwater treatment.

What are the benefits?

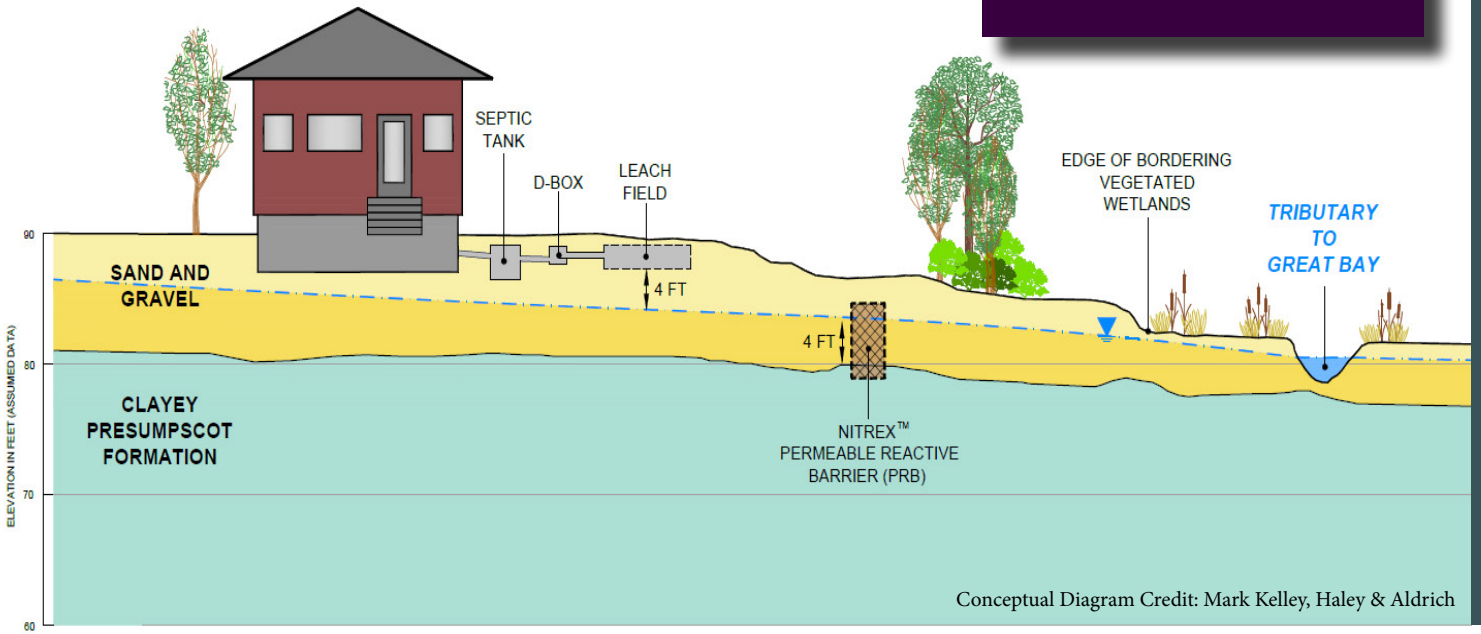
According to the Interstate Technology & Regulatory Council (PRB: Technology Team 2011), PRBs have been shown to remove substantial amounts of nitrate in groundwater. This provides a potential cost effective solution to the problem of excessive nitrogen in the waters of the region. It is a sustainable technology that requires little or no maintenance. It may take up to 6–12 months or more for the system to achieve optimal microbial growth and nitrate removal rates.

What makes for a good location for a PRB?

The ideal hydrologic setting for cost effective installation of a PRB includes an area of predictable shallow groundwater flow downgradient from a nitrate source area like a domestic or commercial leach field. If this groundwater zone is underlain by a low permeability layer the treatment zone can be easily defined and managed. This setting is common to many on-site septic systems in the Great Bay region (see figure below).

How do they work?

PRBs for nitrate treatment are narrow, shallow trenches filled with a site-specific mix of organic materials (such as hardwood chips) down gradient from the source of contamination. The trench is designed to capture all shallow groundwater down gradient of the source and change the oxidation state to a reducing condition. This allows naturally occurring bacteria to transform dissolved nitrogen compounds to nitrogen gas which is then slowly released to the atmosphere.



Conceptual Diagram Credit: Mark Kelley, Haley & Aldrich

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NEW HAMPSHIRE DEPARTMENT OF Environmental Services

Strafford REGIONAL PLANNING COMMISSION

Local Planning

Town of Brentwood

Located in Brentwood, NH off of North Road, this site is a community septic system that services a condominium development. The system was originally installed in 1998. Two of the three effluent disposal fields failed and were replaced in 2010. The system is upgradient of a wetland that drains to Dudley Brook, a tributary of the Exeter River. The Exeter River becomes the Squamscott River below the Great Dam in Exeter where it becomes tidally influenced.

The PRB was installed in October, 2015. Also included in this project was the planning and implementation of a shallow groundwater and surface water monitoring program to evaluate the pre- and post- PRB installation water quality and gage the effectiveness of PRBs to reduce nitrogen concentrations in shallow groundwater, down gradient from on-site septic systems. Finally, outreach was implemented to inform residents and town boards of the project as well as professionals and active watershed stakeholders of the technology and project results.

* Photos courtesy of RCCD/SCCD

Nitrate-Nitrogen Concentration at Monitoring Wells Brentwood Permeable Reactive Barrier Pilot Site

Upgradient Wells

Downgradient and PRB Wells

Graph Credit: Danna Truslow

PRB Installation – October 2015

Project Overview

Evaluate, implement, and demonstrate the use of PRB technology at a condominium development off North Road

Project Goal

The goal of this project was to site, design, and install a PRB to reduce the loading of nitrogen to the Great Bay Watershed.

"Our lakes, estuaries, and rivers are susceptible to water quality impacts due to nutrient input from septic systems. By exploring alternative technologies for nutrient removal, such as permeable reactive barriers, we hope to gain a better understanding of simple, cost effective methods for controlling nutrient output from septic systems."

-Sally Soule, NHDES