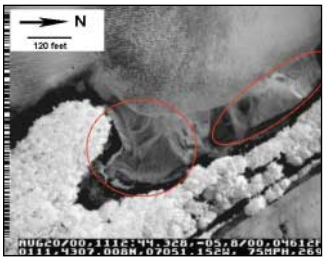
Project Bulletin

CICEET

Assessing Groundwater Inflow and Loadings to Estuaries

Challenge

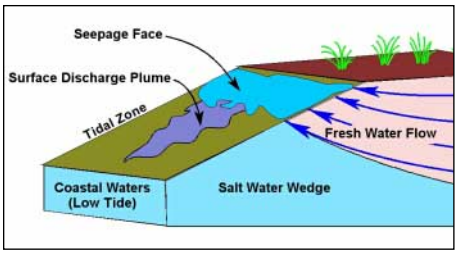


Several recent studies have indicated that groundwater flow into bays and estuaries can be equal in magnitude to river flow. Since groundwater is frequently contaminated by land based human activities, it can potentially represent a significant source of pollution to coastal waters. This project is using innovative thermal (heat sensitive) technologies and GIS-based analyses to identify the location, quantity and quality of groundwater flowing into the Great Bay Estuary in New Hampshire. The results of this project will provide important information on pollution sources in coastal waters.

Science

Project Approach

The conventional approach to detecting and quantifying submarine groundwater discharge (SGD) is based on extensive groundwater mapping. Here, researchers used aerial Thermal Infrared (TIR) surveys to quickly detect discharge zones (see circled areas, top right figure) within the intertidal zone of the Great Bay Estuary. Using GIS, researchers then ascertained the seepage face surface area (see adjacent figure). Together with field estimates of flow rates, this enabled scientists to quantify total discharge and assess the levels of nitrogen loadings from groundwater. This method was also verified by conventional assessments using groundwater mapping to estimate discharge to coastal waters.



Results

- The aerial TIR survey method for assessing SGD was verified by groundwater mapping methods.
- TIR proved to be a fast, effective, affordable alternative to conventional groundwater mapping. (In total, the TIR approach took one year and groundwater mapping took two.) Additionally, it has the capability to identify specific locations of discharge.
- Total groundwater discharge was calculated as 24.2 cubic feet per second; nutrient loading was calculated to be 19.3±21.2 tons of nitrogen per year for the total Great Bay Estuary, which accounts for approximately 5% of the total non-point source load to the estuary.

Application

Seasonal Variation

This project culminated in a snapshot of groundwater discharge quantity and quality. A subsequent CICEET project has been funded to analyze seasonal variation.

Automating the GIS Analysis

The process of using GIS to quantify seepage face surface area is very intricate. A related project will develop a software tool that will simplify this process and allow a wider range of users to effectively estimate contaminant loading from groundwater.

Nutrient Management

This project focuses on intertidal groundwater discharge zones; a separate CICEET project concentrates on detecting subtidal discharge sites. These projects are potential tools for resource managers striving to comply with Total Maximum Daily Load (TMDL) regulations, which set limits on the amount of pollutants a waterbody can receive and still meet water quality standards.

Project Essentials

Title: Inflow and Loadings from Groundwater to the Great Bay Estuary, New Hanpshire

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Start - End Date: 09/01/1998 - 09/01/2001

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