Project: Watershed Assessment of New Boston Air Force Base

Problem: New Boston Air Force Station (NBFAS) has a history of land use that may have contributed to contamination of the on-site water resources. In WWII, the land was purchased by the U.S. government and used as a target site for bomb training operations. Throughout the 1940s, thousands of bombs, both live and dummy ordnance, were dropped throughout the base, with the primary target being Joe English Pond. Extensive clean-up (identification and removal) of unexploded ordnance is on-going at the base. Contamination from ordnance, as well as from other point sources (i.e. an on-site landfill) has been detected in the groundwater and surface water on the base. An understanding of the hydrology on the NBFAS is needed to assess potential for off-site contamination.

Objectives:

1). Inventory the inputs (precipitation) and outputs (evapotranspiration and streamflow) for NBFAS (for one calendar year).

2). Evaluate surface water flow and develop a delineated watershed profile showing surface water movement.

3). Identify groundwater flow paths throughout the year.

Methods:

1). An understanding of the annual hydrologic cycle for the NBFAS is necessary in assessing the amount of water, potentially contaminated by past land use activities, that is leaving the base through the outlet at Joe English Brook. As the location of the base does not allow daily access by the Research Assistant, the BROOK90 hydrologic model is being employed to model the hydrologic cycle. This model was developed for use at the Hubbard Brook Experimental Forest, in the White Mountain National Forest in New Hampshire. Though many of the parameters are similar, localized parameters for NBAFS were obtained from existing reports (from Shaw Environmental, Inc.) and New Hampshire GRANIT.

This model requires inputs of precipitation, wind speed, and maximum and minimum temperatures at a daily time interval. A weather station was previously installed on NBFAS. The station was calibrated for the correct latitude, longitude, and elevation and a heating element was installed to allow for winter precipitation data to be collected. Monthly readings are obtained and checked against weather data from the nearby Manchester, NH airport. Weather data has been collected since 11/07. At least one full year of data is desired.

BROOK90 allows for input of measured streamflow and compares this to streamflow predicted by the model. As it was not possible to obtain daily streamflow, the modeled streamflow value will be used to approximate discharge leaving the base.

2). An understanding of the surface water flow paths is necessary to determine the direction of water movement on the base. Direction of surface water flow can be determined by delineating the NBFAS watershed (using GIS) and overlaying a topographic map. Surface water flow direction follows contour intervals.

3). Groundwater contamination has been detected on the base. It is necessary to identify the direction of groundwater flow to determine if this contaminated groundwater is leaving the base, or is contained within the watershed boundaries. Approximately 15 groundwater wells were installed throughout the NBFAS during past studies. The depth to water table is being measured monthly to allow a potentiometric map of groundwater flow paths to be drawn and to allow for seasonal fluctuations in flow direction to be identified. For these maps to be created, it is necessary to know the relative elevation of these wells. This information was provided by Shaw Environmental, Inc. Spot-checking of their values with surveying equipment has shown that they have a margin of error between five and ten feet. As this error is too large to allow for an accurate assessment of groundwater flow direction, the wells will be re-surveyed within the next two months.

Major findings and significance: An understanding of the hydrology of NBAFS is necessary to assess the contribution of the base to off-site water contamination. By estimating discharge from the watershed and by identifying groundwater and surface water flow paths, it is possible to identify "at risk" areas. As this study aims to provide a one-year hydrologic budget for NBFAS, there are currently no major findings of note.

Publications, presentations, awards: N/A

Publications from WRRC supported work completed in previous years and not reported previously (if applicable): N/A

Outreach or Information Transferred: N/A

Number of students supported (and degree level, undergrad, Master, PhD):
1 Master's Candidate