

MONITORING LAND DEVELOPMENT IMPACTS ON THE DELAWARE NATIONAL ESTUARINE RESEARCH RESERVE

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BACKGROUND

The Blackbird Creek component of the Delaware National Estuarine Research Reserve (DNERR), which was established in one of the most pristine watersheds in Delaware, is under increasing development pressure. Historically the watershed along with most of southern New Castle County was dominated by farmland, forests, and marshland. Currently due to infrastructure improvements over the last 5 years the area has become desirable for numerous bedroom communities. To evaluate the effects of these land use changes on estuarine health, the DNERR along with partners from the University of Delaware and Delaware State University have undertaken various monitoring projects. While some monitoring has been ongoing since 1997, most of the projects have been recently implemented in an effort to collect baseline data before the effects of the landuse change permanently impact the estuary.

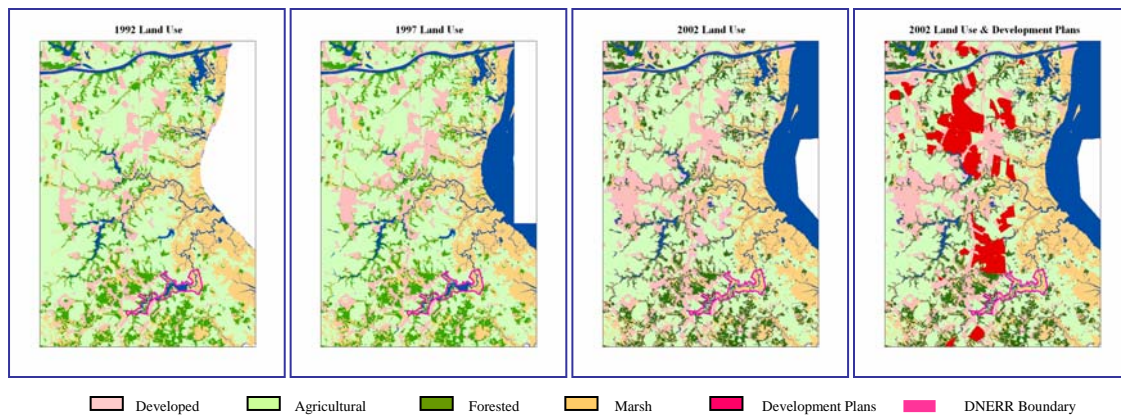


Figure 1. Historic and proposed development in southern New Castle County, Delaware.

MONITORING PROJECT DESCRIPTIONS

Water Quality Monitoring: Continuous monitoring of water quality in the Upper Blackbird Creek through the deployment of YSI datasondes. The project is a part of the National Estuarine Research Reserve's (NERR) System-Wide Monitoring Program (SWMP). The specific goal of the System-wide Monitoring Program is to "to identify and track short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purpose of contributing to effective national, regional, and site specific coastal zone management." Two datasondes are deployed in the Blackbird watershed. One sonde, located in Blackbird Creek, has recorded data since 1995, while the other sonde, deployed in Beaver Branch, has operated since 2002. The data collected every 30 minutes includes water temperature, dissolved oxygen concentration and percent saturation, salinity, specific conductivity, turbidity, and water depth. This long-term data base will be able to show trends in water quality from pre-development through the period of land-use change and finally to stabilized conditions.

Nutrient Monitoring: The National Estuarine Research Reserve's SWMP program includes the investigation of nutrients in the estuary. The nutrient program, launched in 2002, provides a baseline nutrient data set for use in ongoing storm water related and other projects in the Blackbird watershed. Monthly grab samples, taken at the Blackbird Creek and Beaver Branch continuous water quality monitoring stations, include results on various nitrogen and phosphorus compounds, silica, and the plant pigments chlorophyll-a and phaeophytin. This information will characterize nutrient input changes into the estuary as land use changes from agriculture to suburban lands.

Meteorological Monitoring: A weather station, on a neighboring open field, provides meteorological data on a 15 minute basis to support local research and provide valuable information on natural events in the area. Recorded parameters include: air temperature, relative humidity, photosynthetically active radiation (PAR), barometric pressure, wind speed, wind direction, and precipitation. In 2003 the Blackbird station was added to the University of Delaware's and the Delaware Emergency Management Agency's Delaware Environmental Observing System (DEOS) project. By incorporating the station within DEOS, the dissemination of data via the internet was made possible. The public may check meteorological conditions at the Blackbird station, as well as other stations throughout the region, by visiting the DEOS homepage at:
<http://www.deos.udel.edu/html>

Storm Water Runoff and Non-point Source Monitoring: A NERRS funded Graduate Research Fellow (GRF) is monitoring bi-weekly baseline conditions and 2-3 storm events a season to capture information on surface runoff of nitrogen and phosphorus compounds along with sediment transport from disturbed lands into the Blackbird Creek. In conjunction with the SWMP monitoring this database will be used to evaluate the impacts of development of adjacent lands to the estuary. The data will also be statistically

analyzed and compiled to provide inputs for watershed models that can be used by local and state officials for land-use planning.

Sediment-Elevation Table (SET): Deforestation and the conversion of farmland to residential uses increases the impervious surfaces surrounding the estuary, along with the thinning of the natural riparian vegetation, large quantities of sediment could be shed into the estuary. The rate of anthropogenic sedimentation can be measured through the use of a Sediment-Elevation Table (SET), which can measure both the influence of a single meteorological event and long-term trends (i.e. decades) in elevation changes. The SET measurements allow the magnitude of increased runoff of particulate matter from the areas of development and disturbance, as well as the natural subsurface and surface processes, to be fully assessed and quantified. After understanding the dominant factors that influence sediment elevation changes in the estuary can we then understand the impact that increased anthropogenic sedimentation is having upon the system and how the system will respond through time to global sea-level change.

Hyper-Spectral Imaging of the DNERR Sites: In cooperation with Delaware State University and the NOAA sponsored Environmental Cooperative Science Center, a hyper-spectral imaging flyover has recently taken place over the Blackbird watershed from the Delaware Bay west to State Route 1. The 31 spectral bands recorded will be processed and the data used on three separate projects. These will include evaluating the use of multi-spectral imaging to identify and discriminate species of phragmites, collection of spectral images of various vegetative species to be use in quantifying abundance and locations, and to determine if multi-spectral data can be used as an indicator of nutrients and organic matter in local water bodies. During this flyover numerous samples of water quality and ground-truthing of vegetation were done to calibrate the multi-spectral data to the actual conditions. With calibrated baseline images future periodic hyper-spectral images will provide a wealth of spatial data covering the watershed to characterize any changes in the estuary.

The Evaluation of Various Methods of Remote Sensing Technologies: The DNERR Blackbird Creek Component combined with the St. Jones River component are one of 4 locations across the country that are being used to evaluate various methods of remote sensing technology that can be used for coastal management applications. The project will evaluate various images types and techniques (satellite, aerial photography, multi-spectral, and unmanned remote aircraft) for their applicability, ease of use, and cost effectiveness. A side-product of this project will be a high quality image set of the Blackbird Watershed, which will provide even more baseline data that can be periodically repeated to evaluate the effects of land use change to the Blackbird Creek.

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