LESSON PLAN: GEOGRAPHY OF THE HARBOR - Where is NY/NJ Harbor Estuary?

Overview: During this lesson, students learn about the boundaries of the Estuary and gain experience using several types of maps of the area.

Objective:
Following completion of this lesson, students will be able to:

- Locate the NY/NJ Harbor Estuary on a map.
- Know the difference between a road map, a topographic map and a nautical chart
- Gain experience using topographic maps and nautical charts.

Grade level: 5^{th} – 12^{th}

Materials:
A road map of the metropolitan area, several topographic quadrangle maps from the area, nautical chart #12327 (New York Harbor) or 312326 (Approaches to New York, Fire Island to Sea Girt).

Procedure:
1. Allow students to examine the different types of maps of the area. Have students brainstorm the situations in which each type of map would be useful.

2. Using the nautical charts have students plot a course as if they were the captain of an oil tanker sailing from the Atlantic Ocean into an area refinery. The ship drafts 25 feet.

3. Have students create a "ship's log" of the voyage. They should note dangers and how they were avoided, plus note any points of interest along the route.

Background:
The NY/NJ Harbor Estuary, also referred to as the Hudson-Raritan Estuary, the New York Bight or New York Harbor extends from the tidal waters of the Piermont Marsh in New York State to an imaginary line (the Sandy Hook-Rockaway Point Transect) connecting Sandy Hook, New Jersey, and Rockaway Point, New York, at the mouth of the Harbor. This core area includes the bi-state waters of the Hudson River, Upper and Lower Bays, Arthur Kill, Kill van Kull, and Raritan Bay. In New York, it includes the East and Harlem Rivers and Jamaica Bay, and in New Jersey it includes the Hackensack, Passaic, Raritan, Shrewsbury, Navesink, and Rahway Rivers, and Newark and Sandy Hook Bays.

It is one of the most prominent features of the metropolitan area, is one of the greatest natural harbors in the world and one of the busiest ports in the nation. It plays a crucial role in the regional economy and is also the site of thriving natural habitats.

The land boundaries of the Estuary are the meeting place of three geologic formations; the rock-based New England Terrain represented by Manhattan, Bronx, Westchester, and Northern New Jersey, the glacial Till/Oak Pinelands represented by Long Island including Brooklyn and Staten Island and the coastal plain/Pine Barrens vegetation represented by southern New Jersey. The shoreline of the area is categorized by two distinct configurations; rocky shores to the north and sand and gravel beaches to the south. The region outside of New York Harbor is classified as a coastal plain.

The drainage basin or watershed of the Harbor Estuary covers over 16,000 square miles, including parts of eastern New York, northern New Jersey, and small parts of western Connecticut, Massachusetts, and Vermont. The quality of the Estuary's waters is affected not only by activities occurring directly in the Harbor but also by industrial, agricultural, land use, and other individual practices throughout this larger watershed. As rainwater moves over the land in the watershed, it carries with it many potential pollutants that eventually end up in the Estuary – oil dumped down storm drains, pesticides from farms, lawn fertilizers, oil and gasoline from highway runoff, sewage from failed septic tanks, and sediment from construction projects.

Topograhic maps and nautical charts are two good ways to study the geography of the Estuary.

TOPOGRAPHIC MAPS:
Just as a globe is a model of the earth, maps are models of the places they represent. A topographic map is a line and symbol representation of natural and manufactured features on the Earth's surface plotted to a definite scale.

The National Mapping Program of the United States Department of Interior Geological Survey produces the standard topographic map series. Each map in the U.S. Geological Survey series conforms to established specifications for size, scale, content, and symbolization. The unit of survey for standard topographic maps is the quadrangle. Each quadrangle is defined by parallels of latitude and meridians of longitude. Quadrangles are named after a city, town, or prominent natural feature within the area mapped.

Topographic maps give as complete a picture of the terrain as can be legibly produced in mapped form. Topographic maps show the location and shape of mountains, valleys, and plains, the networks of streams and rivers and the principal manufactured features of the area depicted. A distinguishing characteristic of a topographic map is the portrayal of the shape and elevation of the terrain by contours. Contours are imaginary lines which follow the land surface or the ocean bottom at a constant elevation above or below sea level. The contour interval is the elevation difference between adjacent contour lines. The contour interval is chosen on the basis of the map scale and the local relief. Contour intervals differ with the scale of the map and the relief of the area mapped. For example, a small contour interval is used for flat areas whereas larger intervals are used for mountainous terrain. Manufactured features are printed in black, water features are

printed in blue, road classifications, urban areas, and U.S. land lines are red, woodlands and other vegetated areas are shown in green, and contour lines are printed in brown.

Topographic maps have many uses. They are an essential part of terrestrial ecological studies, geologic research and water quantity and quality studies. They may also be used in flood control, soil conservation, and reforestation projects. Topographic maps are extremely useful for studying marine environments. They depict details about shorelines including the extent of wetlands or shoreline development and the approximate mean high water line. They also provide the types and locations of prominent coastal features like seawalls, breakwaters, jetties, piers, or wharves. In addition, topographic maps reflect local bathymetry including water depth depicted by depth curves based on soundings and other bathymetric features like areas exposed at low tide, the locations of channels, sunken rocks, rocks awash and exposed wrecks.

NAUTICAL CHARTS

A nautical chart can be viewed as a roadmap for the marine environment. They are designed to provide information needed by mariners to make proper piloting decisions. The general shape and nature of the sea floor are important to mariners and a good chart will have a high density of sounding and bottom information. They also include information about tides, currents, depth, navigation channels, obstructions and other hazards to navigation, the location and description of local aids to navigation, and other information of interest. Most nautical charts are of the Mercator type, meaning that they are a graphic representation on a flat, two dimensional surface of a navigable portion of the surface of the earth on which latitude and longitude lines are at right angles to one another. Distances are measured on charts either from printed scales or from bordering meridians and are scaled in minutes of latitude or nautical miles.

Nautical charts are also extremely useful for studying the features of waterways and the relation of waterways to adjacent land areas. In addition to portraying the physical characteristics of a water body, nautical charts portray land areas in detail including shoreline configuration, topographic landmarks, harbor facilities and prominent natural and manufactured features of interest. Charts of the United States waters are prepared and published by the National Oceanic Service (NOS) of the National Oceanic and Atmospheric Administration (NOAA). The scale of a chart is represented by a ratio of a given distance on the chart to the actual distance it represents on Earth. Not unlike topographic maps, a scale of 1:200,000, on a nautical chart indicates that 1 inch on the chart represents 200,000 inches, or about 2.74 nautical miles on earth. One nautical mile equals 6,080.20 ft.