1. Introduction
In coastal aquifers, the mixing of fresh groundwater with seawater occurs in a nearshore area termed the subterranean estuary (STE) (Moore, 1999). In the STE, rapid changes in porewater dissolved oxygen and salinity at the saltwater/freshwater boundary generates a unique set of redox conditions that can control the speciation of trace metals and in turn, the overall flux to the overlying surface waters. GIS is an interactive medium that can incorporate datasets from water quality measurements, landuse descriptions, and hydrologic properties all into one functioning geodatabase (Diluzio et al., 2004). The goal of this project is to exhaust multiple applications in ArcMap in order to display areas within a local embayment of the Long Island Sound, NY that are more prone to receiving nonpoint source pollution as well as evaluate the water quality being discharged at these select areas.

2. Methods
Study Site and Motivation
- Stony Brook Harbor, which connects to the Long Island Sound, NY via a narrow inlet (Fig. 1)
- Submarine groundwater is discharged (SGD) through the Upper Glacial Aquifer
- Stony Brook Harbor has been subjected to harmful algal blooms during the summer months

Tracking Trace Metal Cycling in Stony Brook Harbor, NY by using GIS Applications
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3. Results

Figure 2. Geochemical Tracers
- Trident probe collected pore water samples at depth of 60 cm along various locations of the harbor (Fig. 2)
- Trident probe samples measured for temperature, salinity, and conductivity
- Piezometer wells were drilled to a maximum depth of 10 m and were screened at various depths along the well
- Piezometer wells were sampled for trace metal concentration

Figure 3. Arc Hydro Groundwater
- Screenplot of what the toolset looks like
- Borehole/Well Editor main toolset employed

GIS Analysis
- Collection of all necessary data sets
  - 1m resolution digital elevation model (DEM)
  - 1m resolution orthophotographs
  - Projected using the NAD 1983 State Plane New York Long Island FIPS 3104 coordinate system

4. Conclusions
- By using the easily obtained physical variables of temperature, salinity, and conductivity an environmental assessment can be conducted in a cost efficient manner
- This can then translate into examining the influence that that anthropogenic actions have on the groundwater discharging into coastal waters
- Vanadium is of particular interest as previous investigations suggest it may be sourced from the freshwater end-member (Beck et al., 2010)
- The results of this project can be used in future coastal zone protection projects aimed at water quality control and environmental feedback from nonpoint source pollution

5. Recommendations
- Future recommendations would be to consider a larger study area and see if the same principals are consistent
- This type of GIS work highlights the capability of the Arc Hydro groundwater toolset by displaying the valuable information that can be translated from a surface to subsurface interface
- The next step in carrying out this project would be to obtain the full subsurface analyst extension in order to create a 3D outcrop view of the piezometer well transect

6. Conductivity Interpolation
- This figure uses an inverse distance weight interpolation for porewater conductivity
- The premise for using porewater conductivity is that terrestrial derived groundwater is more “fresh” and therefore will react less with the material it is permeating through

Figure 6 Conductivity Interpolation
- Top elevation for ID #1 represents surface water

Figure 7. Piezometer Well Location
- Determined from interpolations where most SGD would be expected to occur
- See Fig 4 for spatial reference

Figure 8a. Borehole Toolset
- Result of the Borehole tool set after inputting x, y, and z coordinates along with concentration
- HGUD is the ID code for concentration (mg/L)

Figure 8b. Salinity Profiles
- Results of Salinity measurements taken from Piezometer wells
- Well numbers coincide with placement on Fig 7
- Blue represents freshwater endmember
- Red signifies salinity plume

8. References