Coastal Manager's Toolbox
Training Workshop

Presented by
Marcia R. Berman
Comprehensive Coastal Inventory Program
Center for Coastal Resources Management
Virginia Institute of Marine Science

October 13, 2006

Comprehensive Coastal Inventory
Center for Coastal Resources Management
Virginia Institute of Marine Science

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Center for Coastal Resources Management
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Chapter 1. Introduction

Welcome to the Coastal Managers' Toolbox Workshop. The term "Toolbox" has become a catch-all phrase that refers to a collection of products which when packaged together provide valuable assistance in making our jobs easier.   This workshop has combined a unique set of tools designed to enhance the capabilities of individuals who manage coastal environments.

The Comprehensive Coastal Inventory Program at the Virginia Institute of Marine Science has been developing tools for coastal managers for several years. Our target audience ranges from regulators of wetlands to local government planners. These tools utilize the Geographic Information System (GIS) technology along with the power of the Internet.   With only Internet access necessary, these tools are accessible from your office desktop computer. You are not required to have GIS software.

The organizers of this workshop understand how difficult it is to implement new concepts within a program. Finding time to learn new applications is a luxury. The purpose of this laboratory workshop is to provide you the forum and the time to become familiar with the collection of Internet based resources we have developed for you. This afternoon has been set aside to provide some basic training and instruction for using these tools.   We believe this will begin to engage you in the use of these tools on a daily basis.

Laboratory Format

In the general session you received some basic introduction to the toolbox. The format of the afternoon session is hands-on computer training. In the computer lab you will independently work through a series of exercises for each tool. Staff will be circulating to provide you with assistance, as necessary. Periodic breaks will occur where you can share questions and comments with the group.   You may work as long as you like. Your take home workbook will allow you to try these from your home or office as well.

Acknowledgements

The principal investigator wishes to acknowledge the efforts of a number of staff and graduate students within the Center for Coastal Resources Management at VIMS. Special thanks goes to Lindy Dingerson, a former graduate student within the Center, for all her contributions, both creative and technical. Dan Schatt, GIS Programmer/Analyst, and Dave Weiss, systems and database administrator, were responsible for the development of the ArcIMS applications and the challenge of insuring public access through the Internet. Additional assistance developing modules were provided by Karen Duhring. Dawn Fleming provided administrative assistance and Ruth Hershner of the VIMS publication center provided publication support. Lastly, the tools in this workshop represent years of effort among a large and diverse staff of dedicated scientists and graduate students within the Center for Coastal Resources Management. These efforts represent a long-standing commitment to providing advisory service to the Commonwealth of Virginia.

The Technology

The Comprehensive Coastal Inventory Program (CCI) is a GIS and remote sensing research unit within the Center for Coastal Resources Management at the Virginia Institute of Marine Science. CCI has developed coastal data sets to serve managers of the Chesapeake Bay region. The Program primarily uses computer software developed by two companies, ESRI and Leica. Over the years, ESRI has enhanced the ability to reach clients through specialized Internet map service software known as ArcIMS. CCI is using ArcIMS in conjunction with the web to bring dynamic maps and GIS data to the desktop. The Internet is the vehicle to get the data products to you. ArcIMS is the technology that allows you to access and manipulate GIS from other servers. Two of the three tools introduced during this workshop utilize the ArcIMS software. These are the Shoreline Manager's Assessment Kit (SMAK) and the Wetlands Mitigation Targeting Tool.

The basic interface of any ArcIMS application includes a suite of instruments that allow a user to pan, zoom in or out, make measurements, make maps, and query attribute tables. Interfaces can be customized to allow for simple or complex queries of the databases from the host server. The applications presented in this workshop differ with respect to the customized query tools offered.

The Toolbox

The Toolbox we will present at the Wetlands Workshop includes three (3) different applications. A brief description of each is given below. Details on each come later following Chapter 2; an introduction to ArcIMS. Chapters 3-5 are dedicated to the tools. Chapter 6 gives a brief description of other tools available.

Shoreline Managers Assessment Kit (SMAK):

Website: http://ccrm.vims.edu/SMAK_intro.html

The Shoreline Managers Assessment Kit (SMAK) was originally developed in 2001. The project includes 22 different data layers which are viewed within an ArcIMS interface. SMAK was originally developed to support the concept of holistic, watershed-based management. To that end, SMAK allows users to view site-specific data, as well as information developed at the scale of tributaries or localities. SMAK pulls data from the same database used in the current GIS-based permit review reports, which are familiar to many of you.

SMAK includes data layers that are both current and historic. As information becomes available SMAK is updated. The project has tried to include a variety of data from different sources to meet various user needs. Users will find data layers listed that might suggest some similarities or duplication. How are they different? At a glance:

a)   National Wetlands Inventory vs. Tidal Marsh Inventory: The National Wetlands Inventory (NWI) is drawn from the US Fish and Wildlife's National Wetlands Inventory Database. NWI includes tidal and non-tidal wetlands

delineated from digital orthophotography and published at a scale of 1:24,000. For selected areas, some updates are as recent as 2003. Due to the size of this GIS coverage, the application has clipped the NWI data to the "Coastal Zone" of Virginia. The Tidal Marsh Inventory (TMI) was developed by the Wetlands Advisory Program at VIMS and digitized by the Comprehensive Coastal Inventory Program (CCI). This database includes only tidal marshes, and was generated from field surveys that estimated the distribution of plant communities in each marsh. The TMI uses "marsh" boundaries delineated on topographic maps as its baseline, and is also mapped at 1:24,000.

b) Shoreline vs. Hydrology: The Shoreline layer represents the mean high water shoreline illustrated on USGS Topographic Maps. The scale is 1:24,000. The coverage was generated by the Comprehensive Coastal Inventory Program (CCI). The Hydrology layer comes from the Environmental Protection Agency, and is part of their 1:100,000 stream database. You will notice that the network of streams included in this layer is much denser than the line work provided in the Shoreline. This layer, however, is at a significantly coarser resolution and you may find that a number of the datasets will not over lay properly is you use it as a base layer. Hydrology is provided for those who which to evaluate watershed properties.

c) Shoreline Inventory–1990 vs. Shoreline Structures/Shoreline Access Structures The Shoreline Inventory-1990 was developed from low altitude videography for primary and secondary tributaries in Virginia. This inventory is being replaced by the Shoreline Situation Reports that are now under development in Virginia. Data from available Shoreline Situation Reports are included in SMAK under the layers called "shoreline structures", "shoreline access structures" and "riparian condition". A separate module of this workshop is dedicated to the Shoreline Situation Reports (see below for more details).

Wetlands Mitigation-Restoration Targeting Tool:

Website: http://ccrm.vims.edu/wet_target/index.html

The Wetlands Mitigation-Restoration Targeting Tool was developed to assist with the selection of sites appropriate for the creation of wetlands. Construction of wetlands for environmental enhancement or mitigation poses great challenges in a rapidly developing landscape. Site selection in the Coastal Plain of Virginia is constrained as much by existing development as hydro-geomorphic processes. This is particularly the case in urban areas.

The Wetlands Targeting tool was developed by the Comprehensive Coastal Inventory Program (CCI) to target sites in the landscape suitable for wetland creation. The project first developed and ran a GIS based suitability model that utilizes available GIS data. Second, a series of static maps were produced from the model output. They can be viewed and

downloaded from the Internet. Finally, ArcIMS was used to generate an interactive query system to allow users to customize their site search based on project specific requirements.

The model takes a landscape approach to site selection and is hierarchical. The protocol applied evaluates suitability on the basis of five parameters: presence of hydric soils, presence of hydrology, adjacency to existing wetlands, existing landuse and the opportunity for landscape conversion, and proximity to designated conservation areas. A suitability ranking system assigns descriptive values to polygons that meet designated conditions. The application draws from a variety of data sources including the National Wetlands Inventory Program, and the National Land Cover Dataset (NLCD). The table below shows the rankings.

Level	Conditions Necessary	Rank
Level 1	hydric soils and hydrology	potential
Level 2	Level 1, adjacent to wetland	moderate
Level 3a	Level 2, land cover is forested	good
Level 3b	Level 2, land use is agricultural	high
Level 4a	Level 3a, adjacent to conservation area	high
Level 4b	Level 3b, adjacent to conservation area	excellent

The model output provides a mechanism for scanning a large landscape with many potential sites to find the most suitable. The model does not replace the need for site evaluation or verification. The model also does not consider land ownership, property availability, or real estate costs.

Static maps can be viewed and downloaded from the project homepage by clicking on the "MAPS" button. The index that comes up shows the study area for the project boundaries at this time. The tiles are equivalent to one half a topographic map (north or south)(ex. Bacons Castle)

The interactive query product uses ArcIMS technology. This interface allows a user to define certain parameters important to their mitigation/restoration project. Users can specify acreage requirements, preferred hydrologic unit where the project should occur, and the locality. The user can also define the rank (see table above) at which the search should be made. Queries submitted through this interface will identify polygons that meet these explicit conditions. The application is useful for sorting through a potentially large number of available sites to only a few. Use the "QUERY" link to access this tool.

This project was funded through a Wetlands Development Grant received from the Region III Office of the United States Environmental Protection Agency.

Shoreline Situation Reports

Website: http://www.ccrm.vims.edu/shoreline_situation_rpts.html

The Virginia Shoreline Inventory is comprised of a series of reports known as the Shoreline Situation Reports. Each report documents conditions along the tidal shoreline of each coastal jurisdiction in Virginia. The protocol for this inventory was developed by the Comprehensive Coastal Inventory Program (CCI) at the Virginia Institute of Marine Science in 1999 (Berman and Hershner, 1999). Meetings with anticipated local, state, and federal end users helped insure that regulatory and planning needs for these agencies were being met. The Shoreline Situation Reports compiles information pertaining to riparian land use, bank condition, and shoreline features. The inventory is developed using on the ground GPS surveying techniques combined with GIS for database management and map display. While earlier reports were hardcopy documents, electronic venues are now utilized for data reporting and distribution. This reduces costs and aids in efficiency. Efforts to complete this series are ongoing in Virginia.

The data inventory is based on a three tiered assessment approach. The three tiered shoreline assessment approach divides the shorezone into three regions: 1) the immediate riparian zone, evaluated for land use (Table 1); 2) the bank, evaluated for height, stability and natural buffer protection (Table 2); and 3) the shoreline, describing the presence of shoreline structures for shore protection and recreational purposes (Table 3). Each tier has a detailed set of attributes to describe conditions observed.   See the tables below.

GIS is used to archive, and analyze data. All GIS data are posted to the Comprehensive Coastal Inventories (CCI's) online GIS database web page. A map series was developed for non-GIS users. Data are displayed in a series of plates that can be viewed and downloaded from the web page. You will query these maps in this workshop to arrive at answers to the questions presented.

Table 1. Tier One - Riparian Land Use Classes	
Forest	stands greater than 18 feet / width greater than 30 feet
Scrub-shrub	stands less than 18 feet
Grass	includes grass fields and pasture land
Agriculture	includes cropland
Residential	includes single or multi family dwellings
Commercial	includes small business, recreational facilities
Industrial	includes large facilities
Bare	lot cleared to bare soil
Timbered	clear-cuts
Paved	hard surface: parking lots, roads
Unknown	land use undetectable from the survey vessel

Table 2. Tier 2 - Bank Conditions

Bank Attribute	Range	Description
bank height	0-5 ft	from the toe to the edge of the fastland
	5-10 ft	from the toe to the edge of the fastland
	10-30 ft	from the toe to the edge of the fastland
	> 30 ft	from the toe to the edge of the fastland
bank stability	low erosion	minimal erosion on bank face or toe
	high erosion	includes slumping, scarps, exposed roots
bank cover	total	>75% cover
	partial	25%-75% cover
	bare	<25% cover
marsh and/or beach buffer	no	no marsh or sand at the bank toe
	yes	marsh or sand present at bank toe
Phragmites australis	present	
marsh stability (if present)	stable	no obvious signs of erosion
	unstable	marsh edge is eroding or vegetation loss
beach stability (if present)	stable	accreting beach
	unstable	eroding beach or non emergent at low tide

Table 3. Tier 3 - Shoreline Features

Feature	Feature Type	Comments
Control Structures		
riprap	L	includes marsh sills and bulkhead toe struct.
bulkhead	L	includes seawalls
breakwaters	L	first and last of a series is surveyed
groinfield	L	first and last of a series is surveyed
debris	L	can include tires, rubble, tubes, etc.
unconventional	L	use of unusual materials for stabilization
jetty	P	surveyed the seaward limit
Recreational/Access Structures		
pier/wharf	P	includes private and public
boat ramp	P	includes private and public
boat house	P	all covered structures, assumes a pier
marina	L	includes piers, bulkheads, wharfs

where L= line feature; P=point feature

Chapter 2: Getting to Know the ArcIMS Mapping Tool

This general map tool format is the same for SMAK and the Wetlands Mitigation-Restoration Targeting Tool. As you use these tools, you will become more familiar with the functionality of ArcIMS, and the layout of the interface. This section can be used as a reference, and you should refer to it when negotiating your way through the following chapters.

The Toolbar

The toolbar is located on the left side of the screen. It includes tools to assist you in viewing and analyzing maps you construct in ArcIMS. These are the "default" tools and you will find them in nearly all ArcIMS applications. Place the cursor over the icons, and the function of the button will pop up after a few seconds. Also the function will be displayed at the bottom of the screen. Familiarize yourself with the icons (used to zoom in and out, and move the map)

a. ▣ - Toggle overview map – the overview map is the small inset map in the upper left corner of the screen. It displays the extent of the map coverage and outlines the section of map you are displaying on the screen. When you click on the icon, the inset map will be removed from the screen. An additional click will replace the inset map. This feature is useful if you need to look at features of an area that may be under the overview map.

b. 🔍 - Zoom in – Allows the user to enlarge an area of the map and increase the scale of the map in the viewer. To activate the tool, you click on the tool in the toolbar. There are two ways to use this tool. Click and hold the mouse button, drag the mouse to outline the desired area, and release the mouse button. Another way is to click in the center of the desired area, and the map will enlarge the area surrounding the area where you clicked on the map.

c. 🔍 - Zoom out – Allows the user to increase the scope of area displayed by the viewer. In doing so, the user reduces the scale of the map. To activate, click on the tool in the toolbar. There are two ways to use this tool. Click and hold the mouse button, drag the mouse to outline an area and release the mouse button. The viewer will increase the scope of the area that can be viewed. Also, you can click in the middle of the area you would like to zoom out and it will increase the scope around the area where you clicked.

d. 🔳 - Zoom to full extent (of the layer boundaries) – This tool increases the scope of the viewer to the complete extent of the map. This tool can be used at any time to zoom out completely. To use, click on the tool and it will zoom out.

e. 🔳 - Zoom to the active layer – On the screen, there is a section where you can add data layers (we will discuss this section extensively). If you click in the circle beside a layer, that layer becomes the "active layer", and a message will be displayed indicating such. This tool brings the scope of the map to the size that shows the entirety of the active layer. To use this tool, click on the tool in the toolbar, and the extent of the active layer will be shown. If the active layer extends throughout the full extent of the project area, this zoom will be no different than your results using the zoom to full extent.

f. ![icon] - Zoom to previous extent – If you change the scope of the map in the viewer and you would like to go back to the scope of the map prior to the last change, this tool can do it. This tool un-does the last alteration in scope that you have completed. To use, click on the tool, and it will take you back to the previous view of the map. It is not recommended that you use the back button on your browser.

g. ![icon] - Pan view – The pan tool can move the view on the screen in any direction adjacent to the current view. To use this tool, click on the tool in the toolbar. Click on the map and hold the mouse button. Drag the mouse arrow in the opposite direction of the direction you would like to move the map, and it will expose the desired area. Release the mouse button and it will refresh the map with information about the newly exposed area. You can use this tool many times once it is selected.

h. ![icon] - Identify – This tool takes you to the attribute information in the database for a selected data layer. You must first select a layer and make it active on the right. When you have selected an active layer, make sure the attributes are present on the map. If you would like specific information about a feature of the active layer (e.g you are looking for the size of a certain grass bed), you will use this tool. Using a grassbed as an example, make SAV active on the right. Refresh the map if necessary. Click on the Identify tool in the toolbar to the left, and then click on the SAV polygon on the actual map. The attribute table will appear in a pop-up window. This table will have information about dimensions and characteristics of the features of the active layer.

i. ![icon] - Query – This tool can be used to search certain attributes of the active layer. For instance, if you were looking for grass beds under a certain size, you could search certain parameters using this tool. To use this tool, click on the icon and a pop-up window will appear. You will choose the attribute of interest (Field), the specifications of the
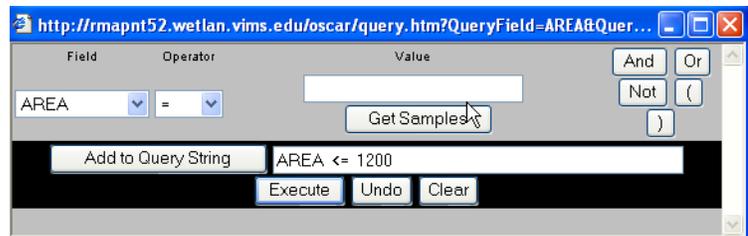
search (Operator – such as greater/less than, equal to), and the limit value (Value). You will enter these specifications into their respective boxes and click the button that says, "Add to Query String." You can add multiple qualifications in one query by using the buttons And, Or, Not, or parentheses. The results (an attribute table of applicable sites) will be displayed in another pop-up window.

j. ![icon] - Measure – This tool measures the distance between two places and can also measure the total distance of many segments linked together. To activate this tool, click the icon on the toolbar. To use, click somewhere on the map to start measuring distance. The top left hand area will show the distance from the starting point in the box marked "Segment." Once you click on the map a second time, the distance between point 1 and point 2 will be displayed in the "Total" box. The distance displayed in "Segment" is the distance from point 2 to the mouse arrow. If you click on the map a third time, the distance between point 2 and point 3 will be added to the total, and "Segment" will show the distance between point 3 and the mouse arrow.

k. ⬚ - Select by Rectangle – For this tool, you will use the active layer. If you would like information about the attributes of the active layer in a certain region, this tool allows you to select an area with features of the active layer in it. To use this tool, click on the tool in the toolbar to make it active. Click and hold the mouse button, drag the mouse to cover the desired region, and release the mouse button. A pop-up window will display attributes of the selected active layer features.

l. ✎ - Clear Selection – This tool is used to un-select something that is selected on the map. To use this tool, select the tool from the toolbar, and it will clear any features you have selected. If you have marked a distance, you can get rid of it using this tool.

m. 🖨 - Print – When you click on this tool, a pop-up box will appear that will ask you what title to display on the map. You can change it from the suggested title. Clicking on "Create Print Page" will open a new browser window with the map image, overview map image, and legend displayed. You can then use the File/Print menu item to send the display to your printer.

Data Layers

The data layers are located on the right side of the screen.

n. By clicking in the square boxes, the chosen layer will be added to the map—these are the visible layers. You can add as many layers as you would like to the map, but additional layers may make features more difficult to distinguish and take longer to load. Click the "refresh map" button whenever you change the layer selection.

o. One layer can be chosen as the active layer. You can activate a layer by clicking in the circle to the left of the dataset. A pop-up window will appear that indicates the layer you selected is now the active layer. If you would like to inquire about a feature of the layer you have chosen, make sure you have selected the active layer as a visible layer as well (select the square box next to the circle). To inquire about a feature, select the ❶ from the toolbar and click on the mapped feature of the active layer you would like information about. A box entitled

Rec	AREA	PERIMETER	BEDS01_	BEDS01_ID	BEDID	DENSITY	CONTIGBED	QUADID	CBPSEG	STATE
1	1432267.281	8021.269	2733	2732	HA	4	F	124	CB7PH	VA

Query/Selection Results - Microsoft Internet Explorer

Underwater grass beds-2001

'Query/Selection Results' will be displayed with the attributes of the feature. The active layer is also important when performing a query, selecting by rectangle, and zooming to the active layer. It is possible that the attribute information is coded. Details pertaining to these codes may only be available by viewing the metadata.

Data Layers
Click on layer names for metadata

Visible Active

Habitat Restoration Sites
Resource Conservation and Recovery Areas
Surface Drinking Water Intake Sites
Sensitive Areas
Fish Passageways
Shoreline Sensitivity
Sensitive Species Project Review Areas
Public Access Sites
Reef Restoration Sites
Populated Places
Facility Response Plan Facilities
Craney Island Staging Areas
Craney Island

How to use the Tools

p. The query tool filters the active data layer and selects features satisfying the query conditions.
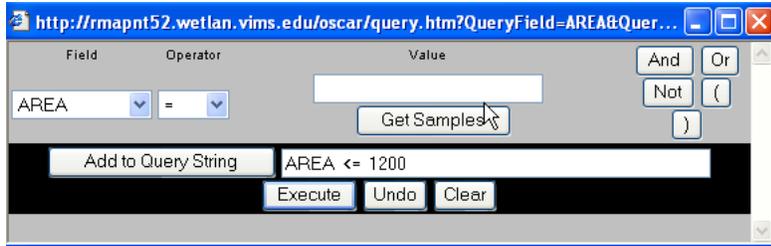
i. Activate the data layer of interest (active layer) by clicking the 'Active' box for the data layer. After clicking this tool, a query box will appear at the top that allows you to specify the query conditions based on the attributes of the data.

ii. Select a field from the field drop-down box. The drop down menu contains the suite of attributes that are available in the active layer to be queried. In this example, AREA.

iii. Choose an operator from the operator drop-down box. The operator is the limitation you would like to place on the data. Available operators include =, <=, >=, <, and >. In this example "<=" was selected.

iv. Type in a limit value in the value field. This is the value your operator will act upon. You can get actual values of that field by clicking on 'Get Samples'. These actual values can help you choose your limit value. This example looks at areas of underwater grasses smaller than 1200 square meters.

v. Click the 'Add to Query String' button to enter the full query in the text box below. Clear the text box by clicking 'Clear'. This button will add the information in the text boxes to the query string.

vi. You can add conditions if desired by clicking the 'And', 'Or', 'Not', and parentheses buttons. In this way you can add more than one qualifier to the search of the active layer. For instance, if you wanted to find an area of underwater grasses where the beds are less than 1200 square meters and located in zone 2 of Virginia, you could design your query to accommodate both qualifiers. (In this case you would input the criteria for your first qualifier, add the query string, use And/Or/Not, input the criteria for your second qualifier, add the query string, and execute.)

vii. Click "Execute" to begin the query. A pop-up window will appear with the attribute table of the applicable grass beds meeting these conditions. The query results will look something like the table below. By clicking on a record number the map will zoom to that polygon.

q. ⬚ Measures a distance in the map area in miles. After clicking this tool, click in the map area. This is the starting position. The distance between the starting position and the present position of the mouse pointer is displayed on the top left corner of the screen in the box marked "Segment." When you click a second time, the distance is recorded in the box marked "Total," and the distance from the second point to the mouse pointer is displayed in the box marked "Segment." You can add as many segments as you want, and they will continue adding in this manner.

r. ⬚ Selects features of the active data layer enclosed within a rectangle drawn in the map area. First, activate the data layer of interest by clicking the 'Active' box for that layer in the data layer section. After clicking this tool, draw a rectangle in the map area by pressing and holding the mouse button, drawing a box around the desired area, and releasing the mouse button. The feature(s) of the active data layer within the rectangle will be selected. The attributes of the selected feature(s) will be displayed in a pop-up box and the selected features will change color.

Query/Selection Results - Microsoft Internet Explorer

Underwater grass beds-2001
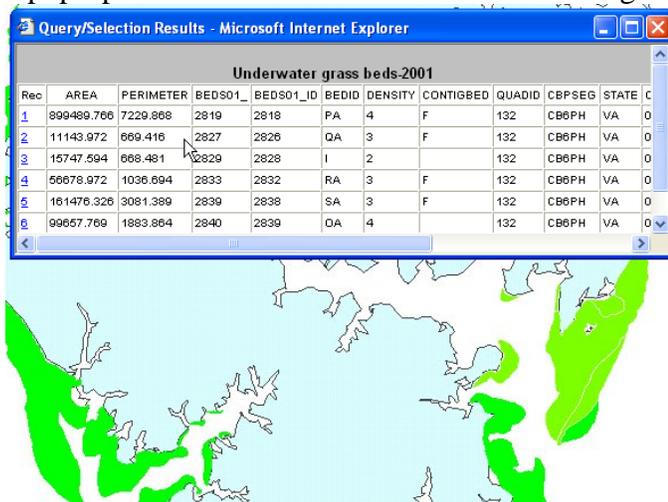
Rec	AREA	PERIMETER	BEDS01_	BEDS01_ID	BEDID	DENSITY	CONTIGBED	QUADID	CBPSEG	STATE	C
1	899489.766	7229.868	2819	2818	PA	4	F	132	CB6PH	VA	0
2	11143.972	669.416	2827	2826	QA	3	F	132	CB6PH	VA	0
3	15747.594	668.481	2829	2828	I	2		132	CB6PH	VA	0
4	56678.972	1036.694	2833	2832	RA	3	F	132	CB6PH	VA	0
5	161476.326	3081.389	2839	2838	SA	3	F	132	CB6PH	VA	0
6	99657.769	1883.864	2840	2839	OA	4		132	CB6PH	VA	0

Chapter 3: <u>Shoreline Managers Assessment Kit (SMAK):</u>

       The Shoreline Managers Assessment Kit requires users to navigate through an introductory screen and a disclaimer before you get to the application. These screens provide important information about data, usage, and limitations. Please take a moment to read these. Entrance to the website is through a link at the bottom of the Disclaimer page.

This online mapping tool integrates a variety of shoreline and landuse features which have been generated and compiled using GIS technology. The tool has been developed to assist with environmental reviews and shoreline management along Virginia's shoreline. To the extent possible, the most recent data sources have been included. In the absence of recent data, historic information is presented if the data are still considered relevant and valuable despite their age.

These data represent efforts from a variety of agencies and programs including the Virginia Institute of Marine Science's Comprehensive Coastal Inventory Program (CCI), Wetlands Advisory Program, and Submerged Aquatic Vegetation (SAV) survey program; and the Virginia Marine Resources Commission (VMRC). When available, metadata records provided by the data developer are included. If metadata records are not available for a particular data theme, a brief description of the data has been prepared.

Contiguous data may not be available throughout the project boundaries. Information is data rich around the tidal shorelines since this is where collection efforts have been strongest. Metadata records will define the geographic limits of datasets.

A "HELP" tool is available to get new users started. This tool gives a general introduction to the interface, including instructions for activating data themes, zooming and panning, getting tabular data, and viewing metadata.

This project was funded in part by a Wetlands Program Development Grant from the U.S. Environmental Protection Agency through grant number CD-983196-01-0.

To use this tool, you must first read and agree to conditions outlined in the disclaimer.

Disclaimer - SMAK

The Comprehensive Coastal Inventory Program (CCI) provides this tool and these data with the understanding that it is not guaranteed to be correct or complete. The interactive mapping tool allows extreme flexibility and freedom in mapping. Conclusions drawn from data sets compiled are the sole responsibility of the user.

Every attempt has been made to ensure that these data and the documentation are reliable and accurate. Neither CCI, the Virginia Institute of Marine Science (VIMS), the Virginia Marine Resources Commission (VMRC), or other contributors not specifically listed, assume liability for any damages caused by inaccuracies in the data or documentation, or as a result of failure of the data to perform in a particular manner. CCI, VIMS, and other contributors make no warranty, expressed or implied, as to the accuracy, completeness, or utility of this information, nor does the fact of distribution constitute a warranty.

Citation for this tool or products derived from this source should be:

Comprehensive Coastal Inventory Program, 2001. Shoreline Manager's Assessment Kit. Virginia Institute of Marine Science, College of William and Mary, Gloucester Point, VA 23062.

1. Use of these data in map publications requires the proper citation above, and inclusion of the CCI logo:

tif logos zipped

Postscript logos zipped.
tif logos gzipped
Postscript logos gzipped.

2. CCI is not responsible for misuse of these data;

3. CCI does not oversee or assume responsibility for alterations to this product by users;

4. CCI may not address specific questions from users who received the data through another party;

5. Distribution of these data is not restricted. **CCI recommends metadata file(s) always remain with the data;**

6. CCI encourages noticeable errors be reported to CCI contact person identified in the metadata files;

7. These data should not be used for the jurisdictional determination of wetland boundaries.

This project was funded in part by a Wetlands Program Development Grant from the U.S. Environmental Protection Agency through grant number CD-983196-01-0.

Go to SMAK website

SMAK Exercises:

1. You are in Surry County and developers are planning to build residences on the Lower James River on the peninsula adjacent to Isle of Wight County.
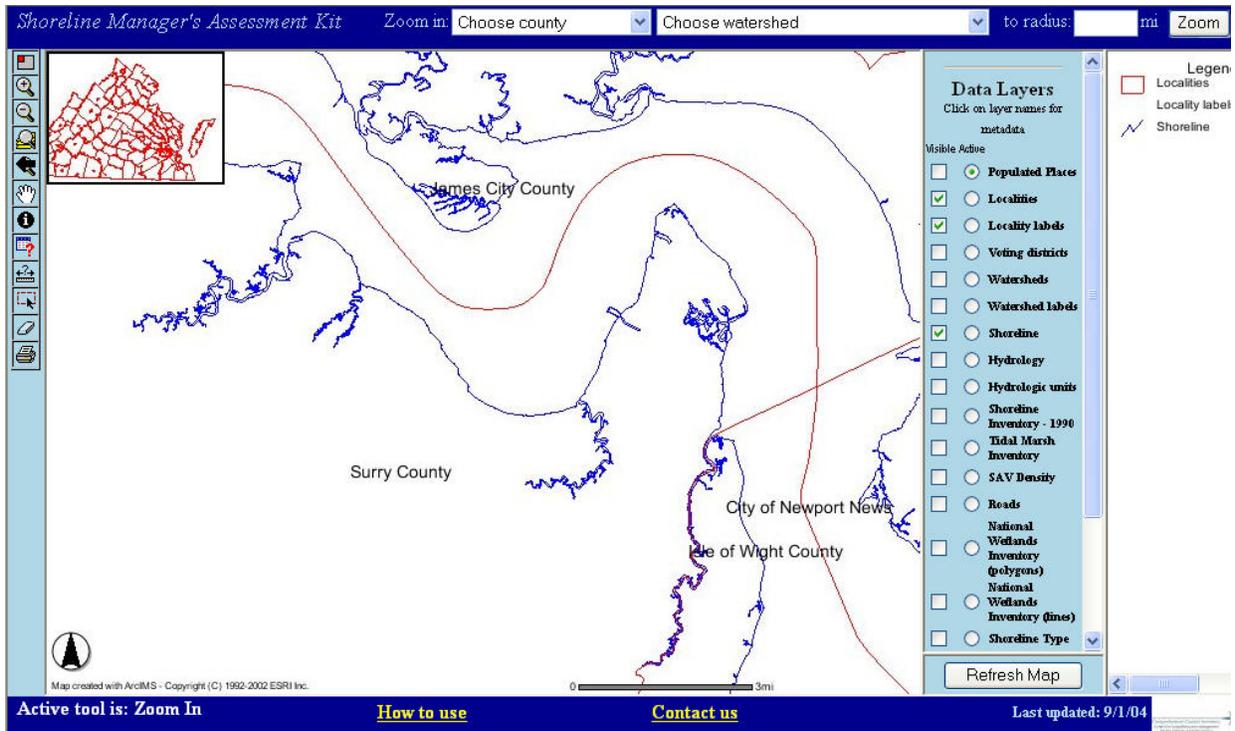
    a. What kind of habitat will be impacted by development along this coastline?
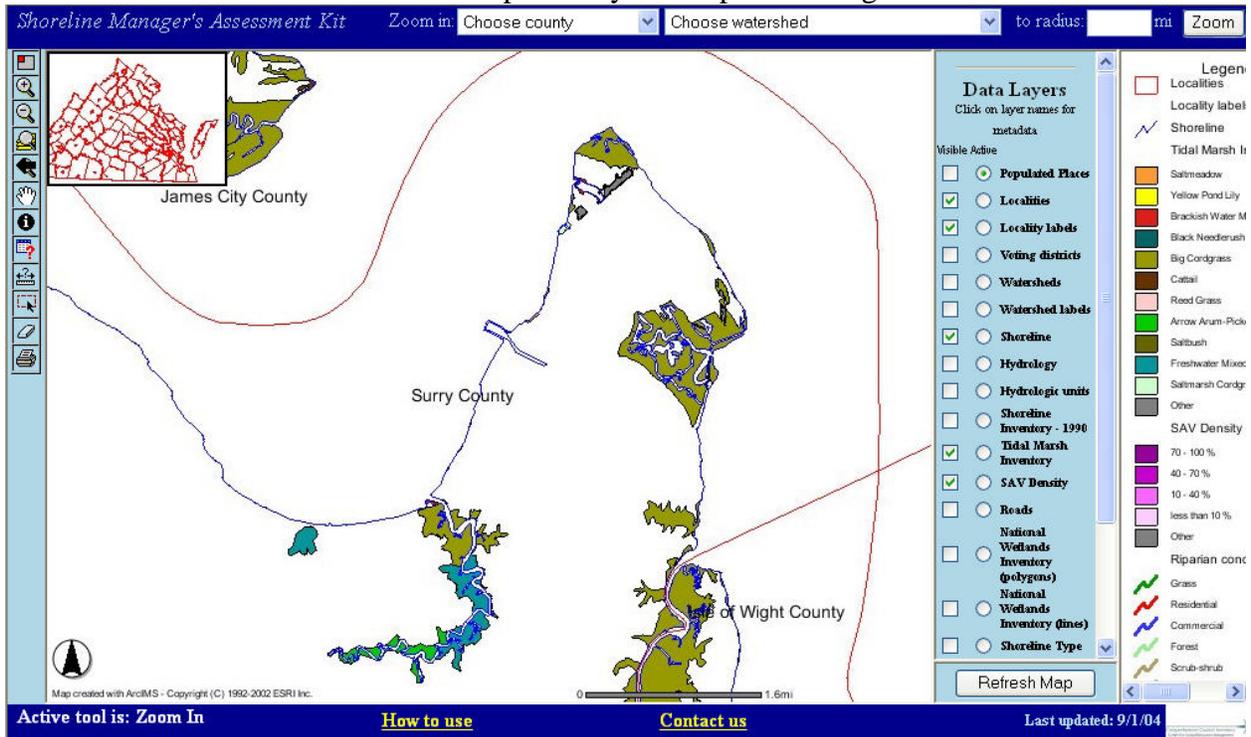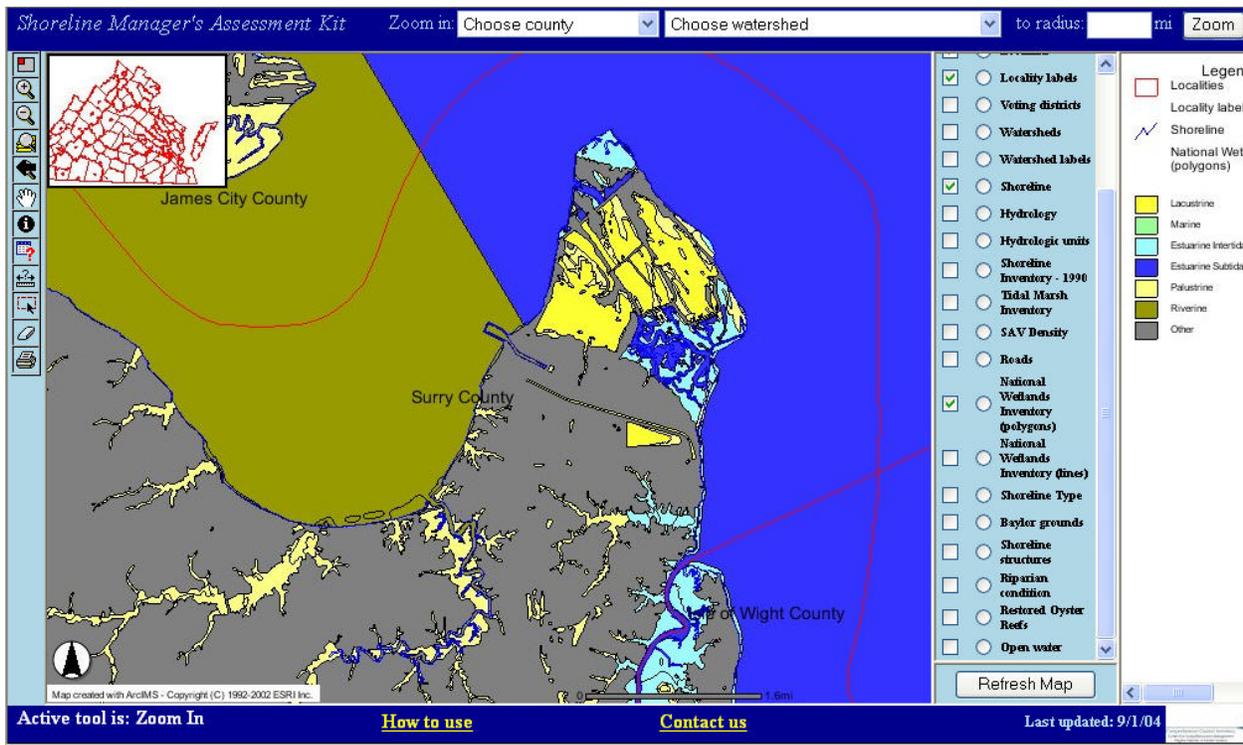
b. Will SAV be a factor in building decisions?
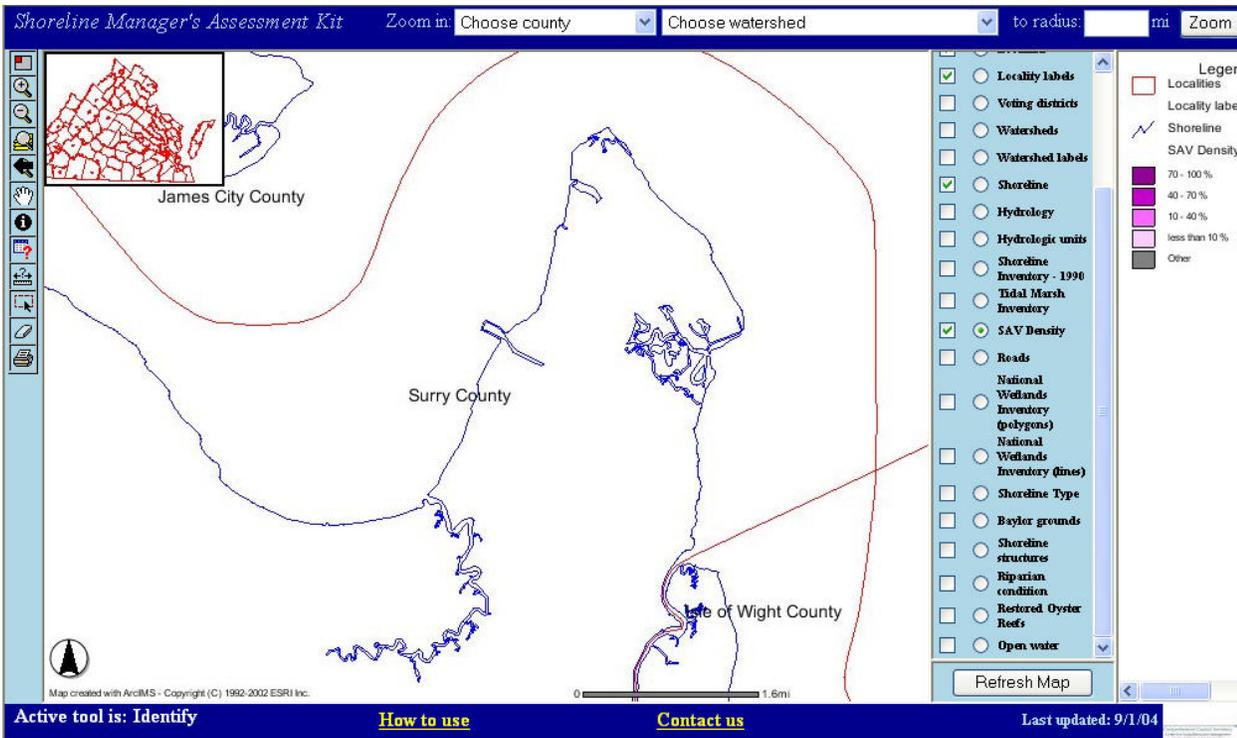
c. There is no Shoreline Situation Report for Surry County. What data layer can give you information regarding shoreline structures in place?
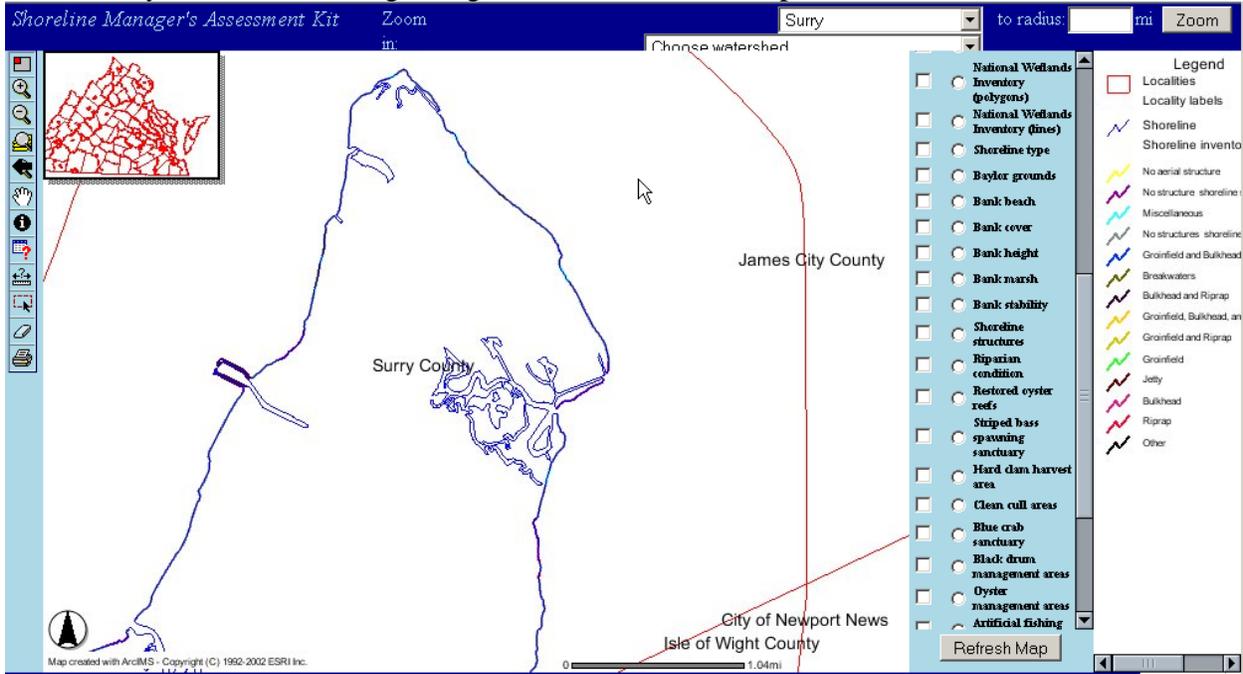
d. Where would a proposed development on this peninsula impact the least amount of habitat?
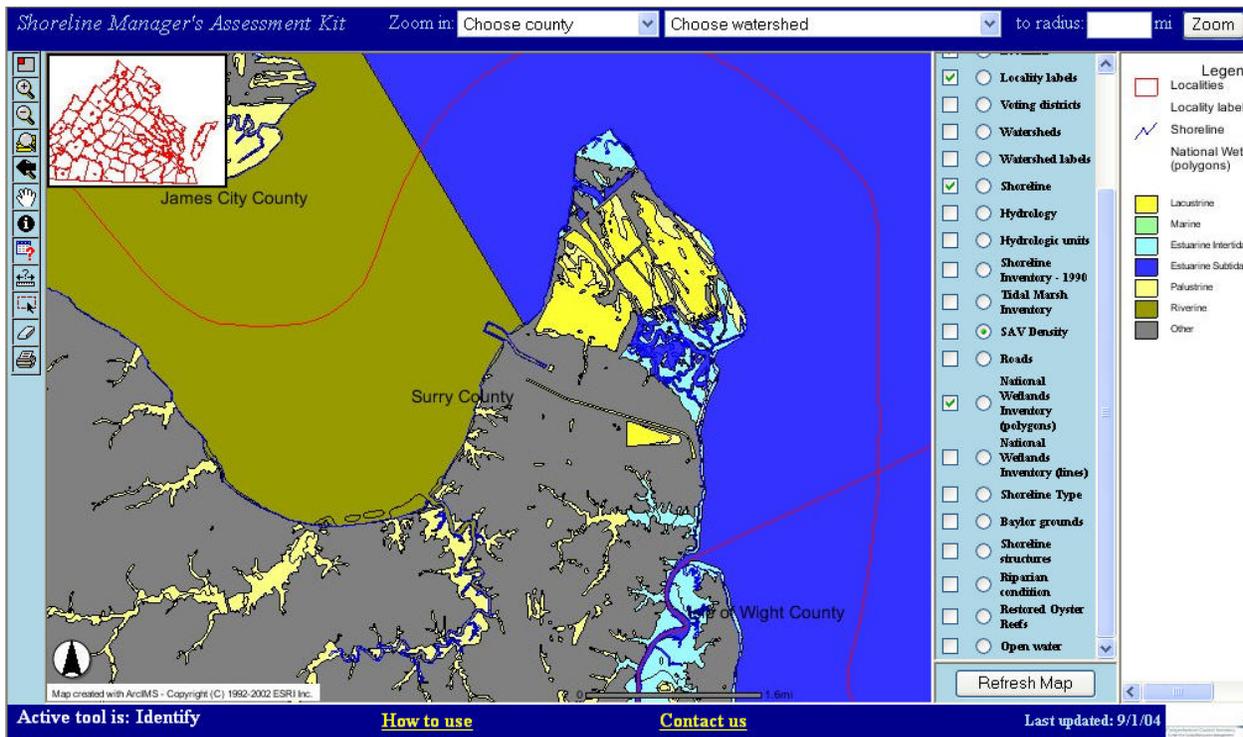
2. Find Sarah's creek, a bifurcated tributary to the York River just below Gloucester Point.
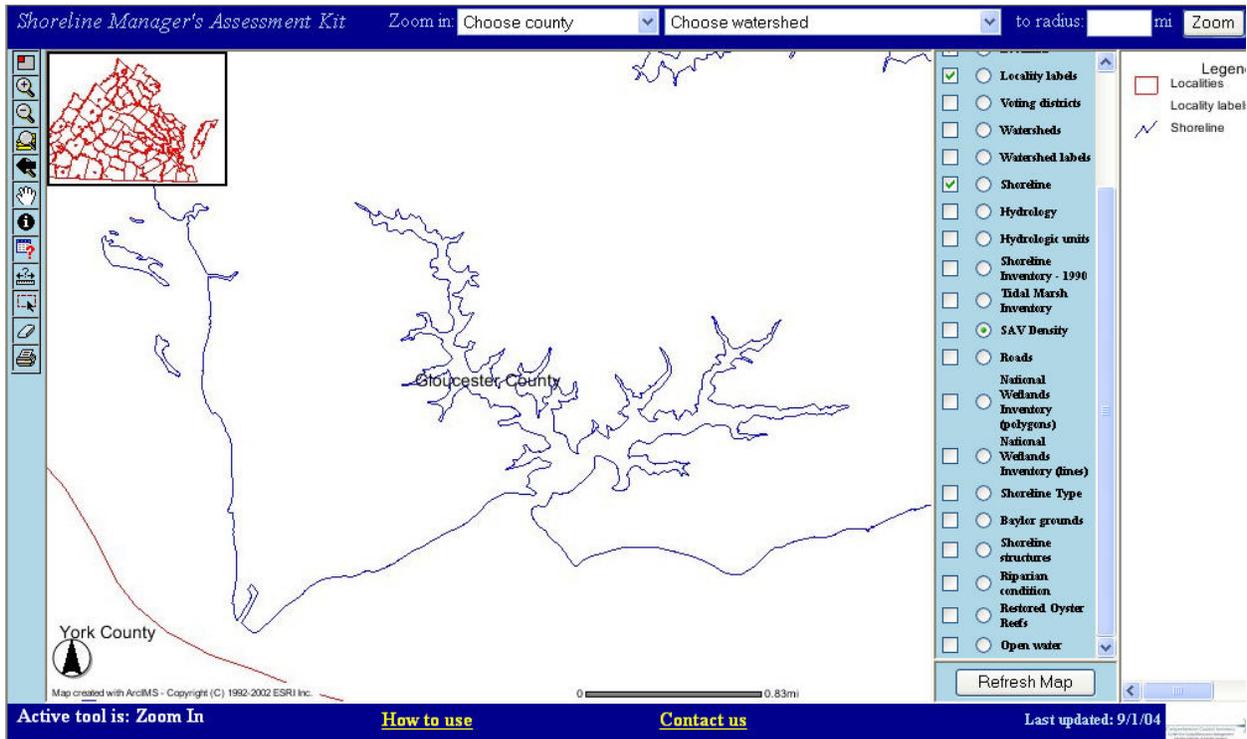
a. What is the distance from the mouth of the creek to the western-most tip of the creek?
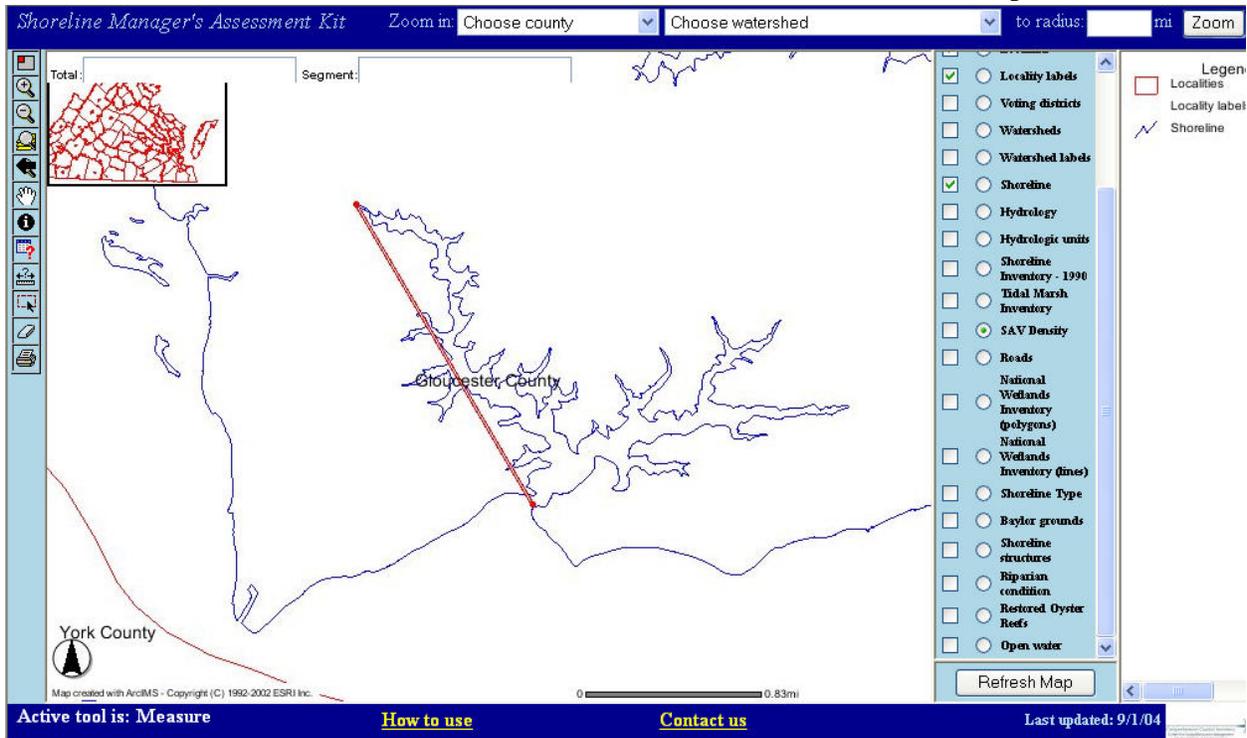
b. With shoreline type as your active layer, observe the variation in shoreline types. Use the identify function to investigate some of the intertidal marsh shoreline.
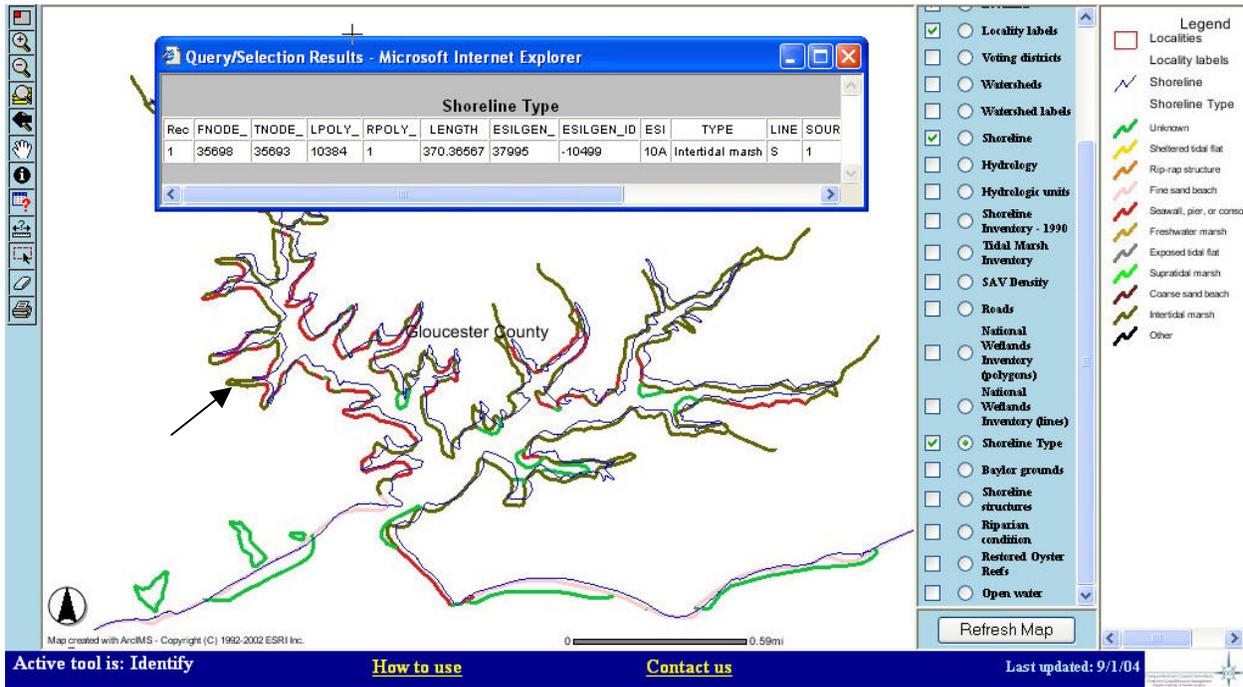
c. Turn on the tidal marsh inventory. Use the query to locate the one marsh that is 29968.91 square meters in area. What type of marsh is this?
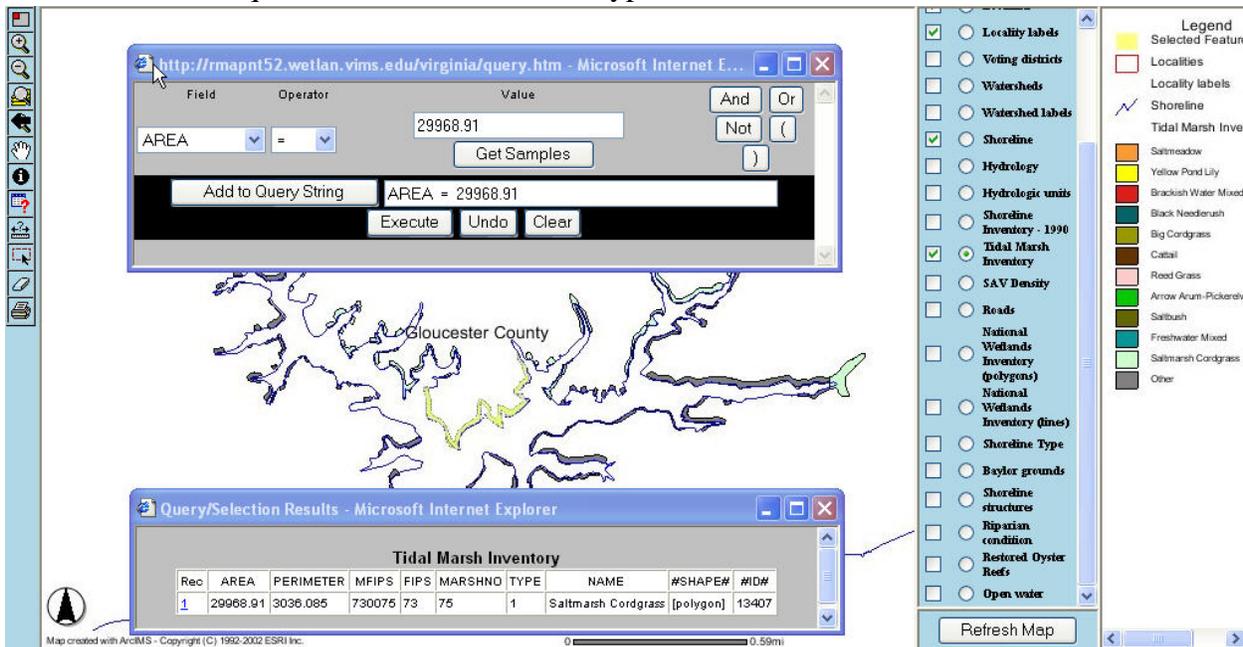
3. You have received a request to evaluate the impacts of a bridge crossing across the
   Rappahannock River within 10 miles of Irvington in Lancaster County on the Northern Neck.
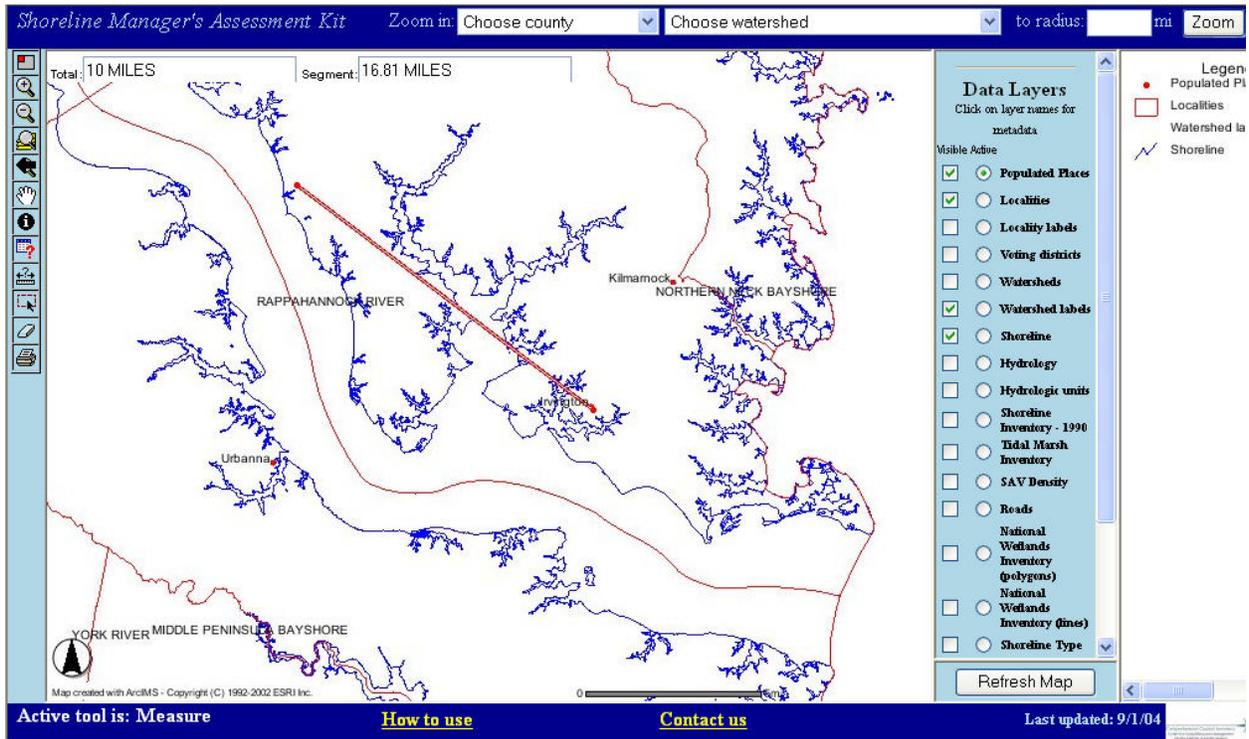
   a. Where would you place the crossing based solely on placement of roads/bridges and the
      distance across the river?
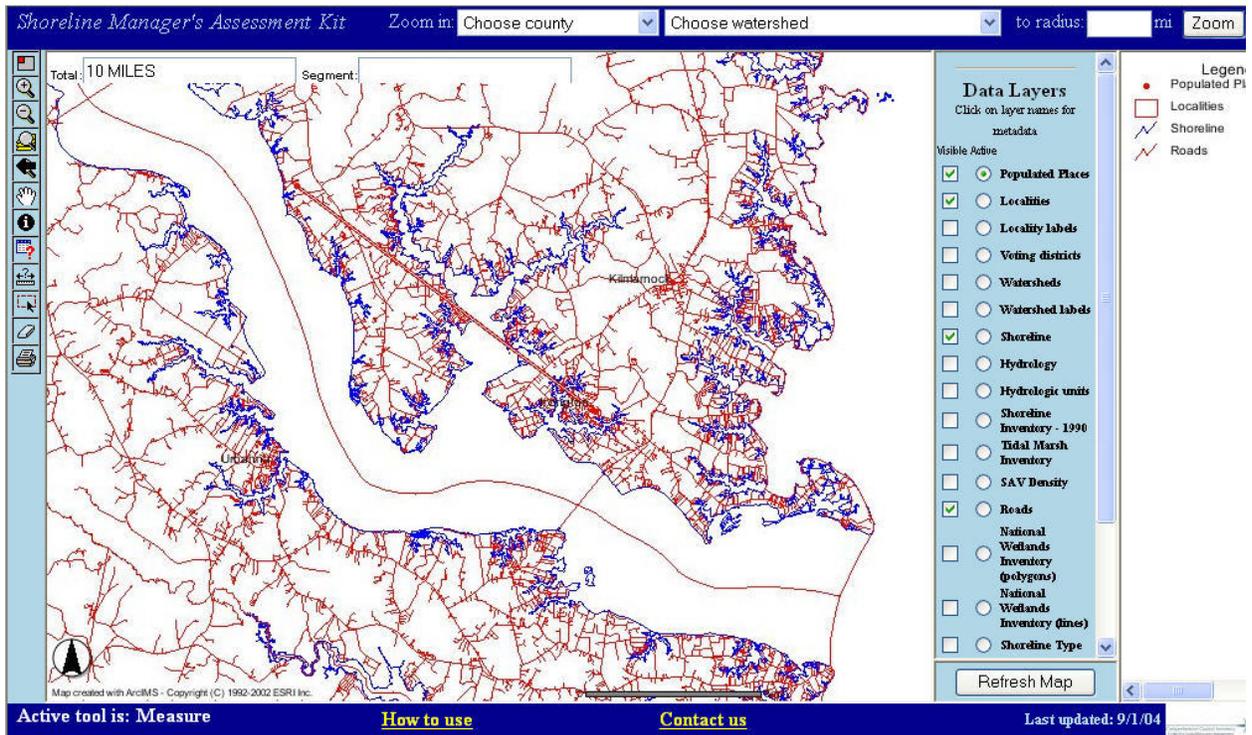
b. What is the distance of the crossing at the point you chose?
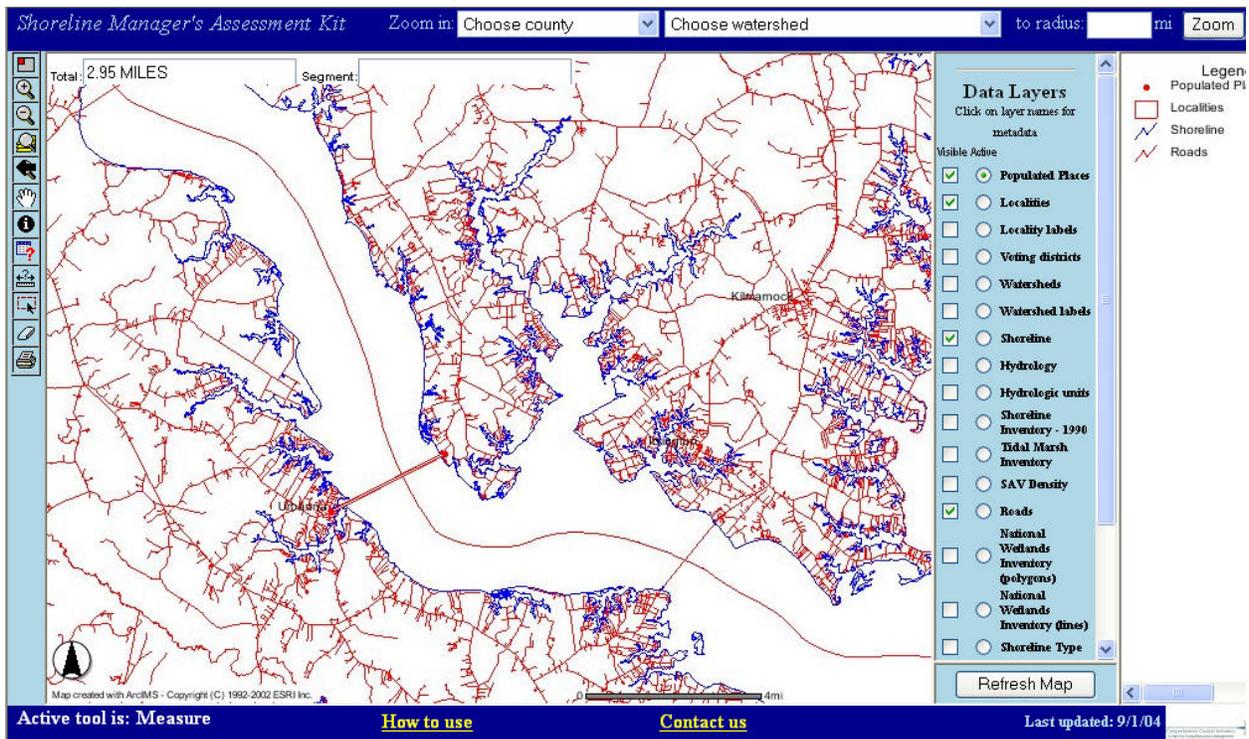
c. Using the Urbanna crossing as an example, what habitat considerations must you be aware of during the evaluation?
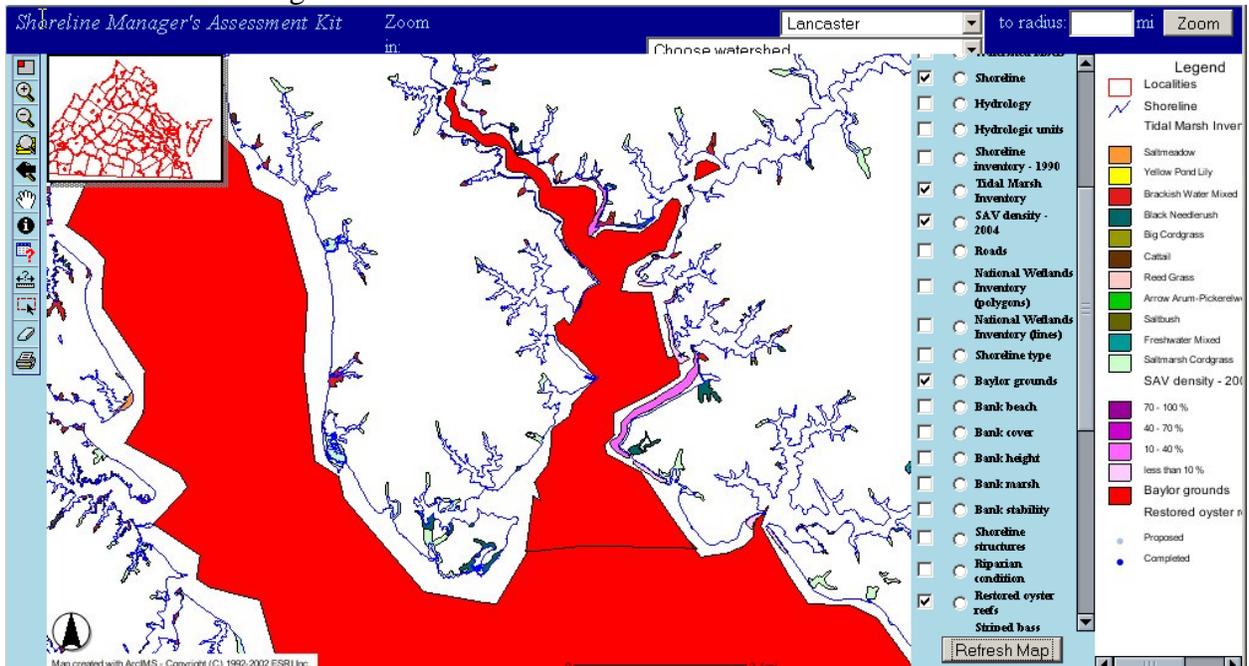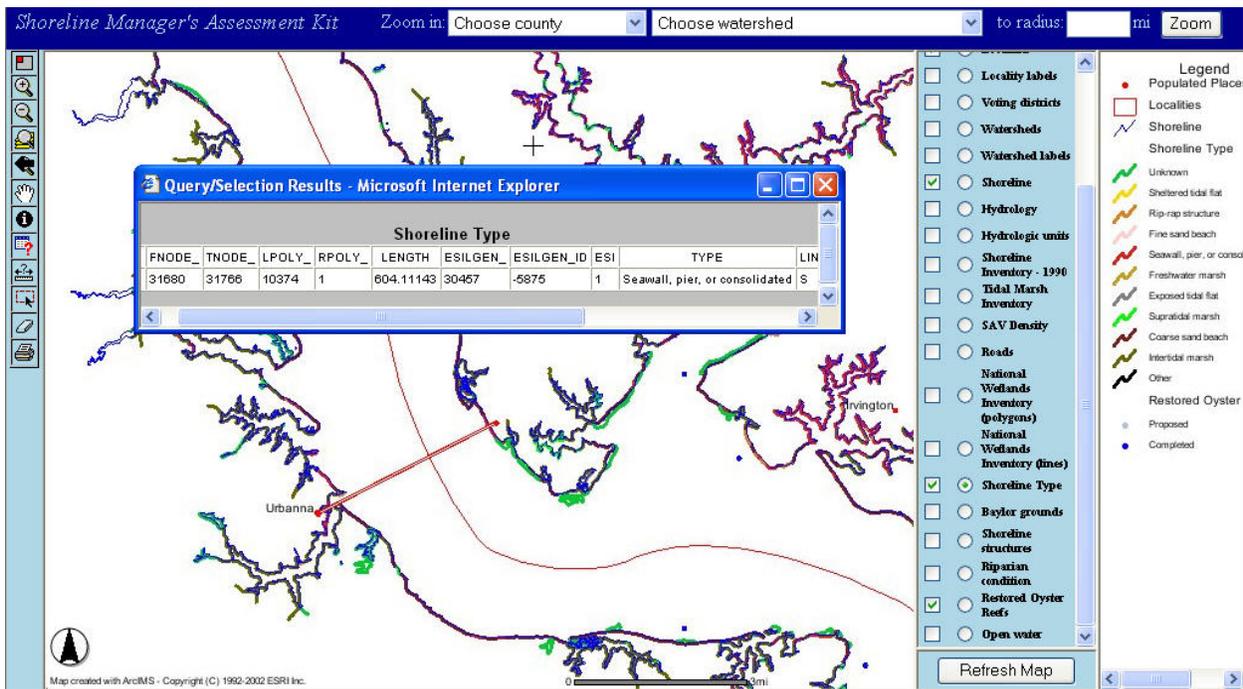
d. In light of these considerations, would you still propose the placement of the bridge in the place you originally proposed? What about this example crossing in Urbanna?
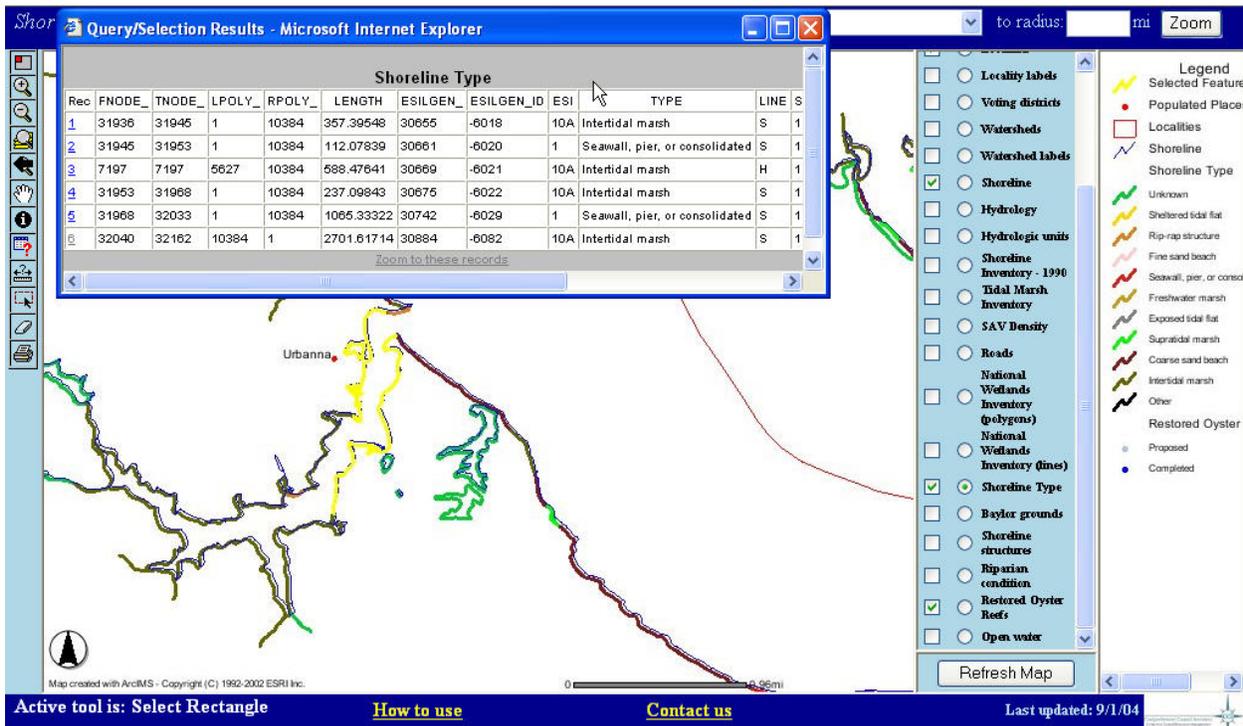
4. The center line of Indian Creek is the boundary between Northumberland and Lancaster counties. a. Find this creek on the map (hint: it's not labeled).

b. Are there any major differences in riparian land use between the two sides?
c. What landuse dominates on the north shore?
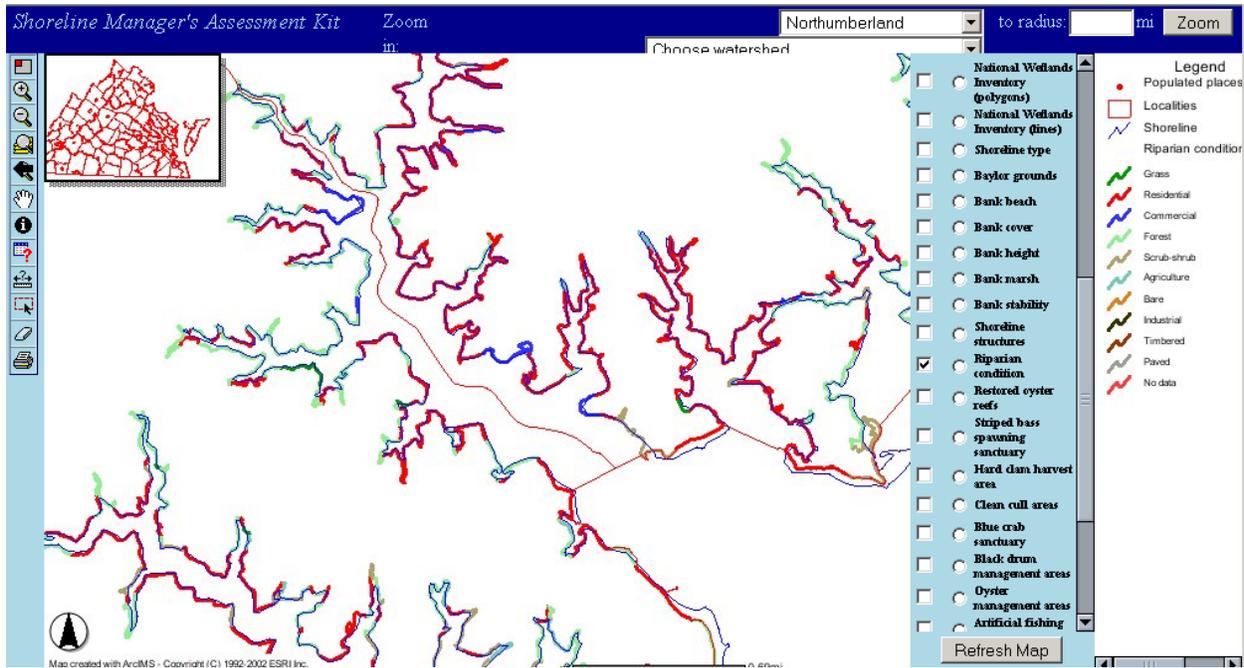
d. Identify the important shallow water habitat found outside the creek entrance.
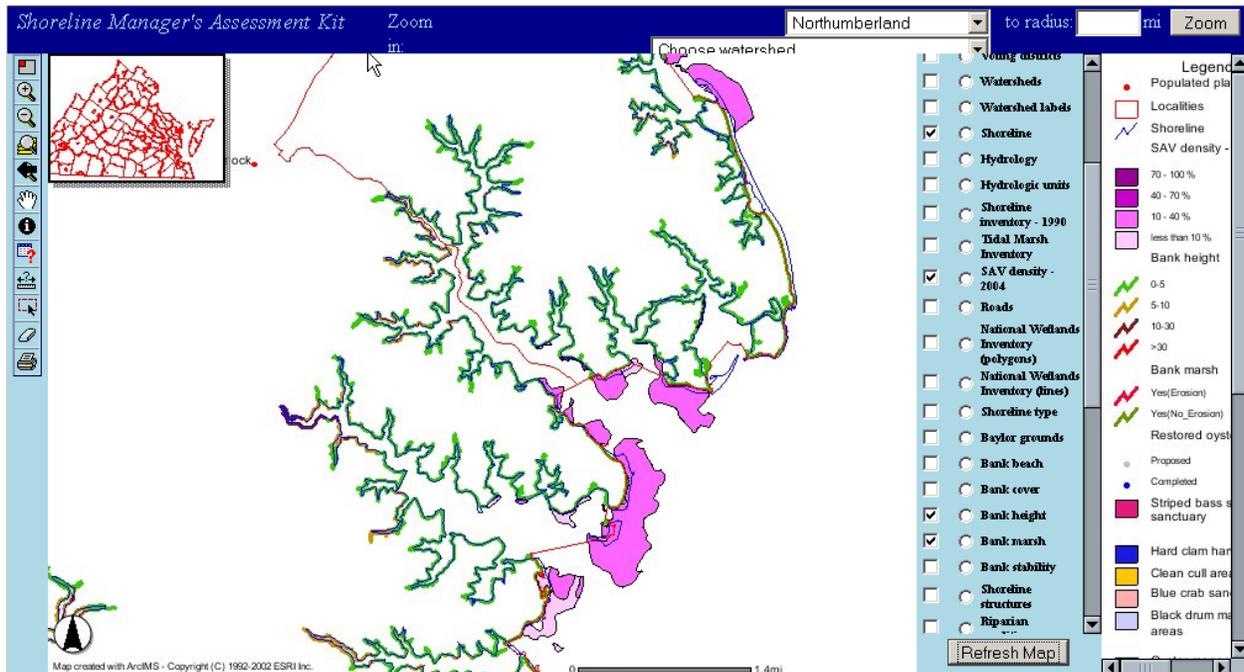
5. At the southernmost tip of Newport News, the land use is highly industrialized.

   a. What is the condition of the shoreline in this area?
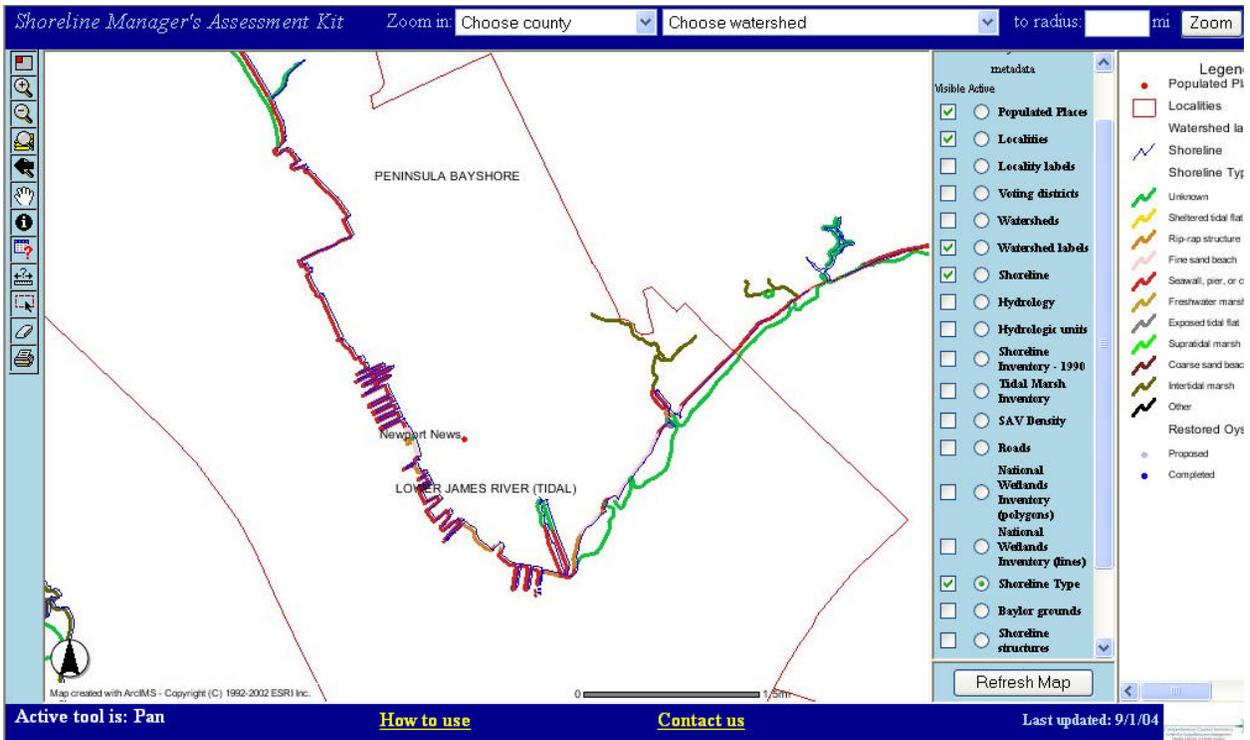
   Would additional structures like docks have any additional environmental impact?

6. Find the creek by the town of Smithfield
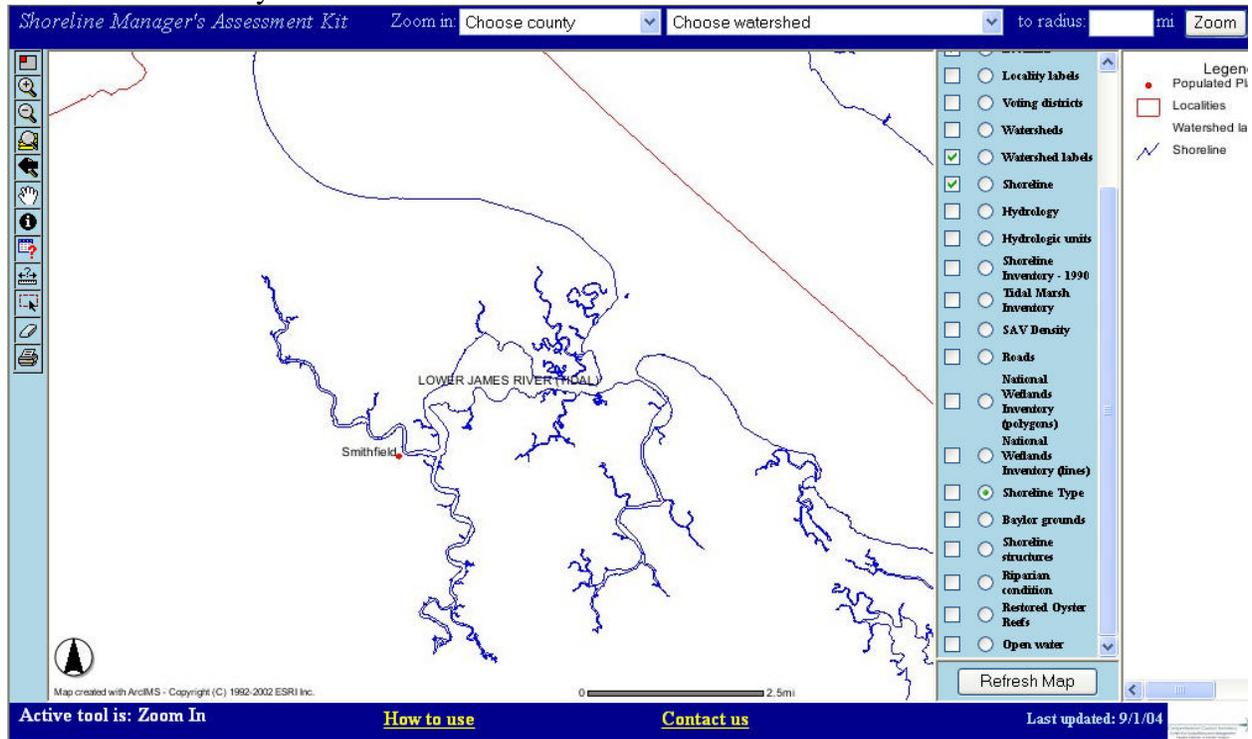
a. What types of tidal marshes are represented in the area?
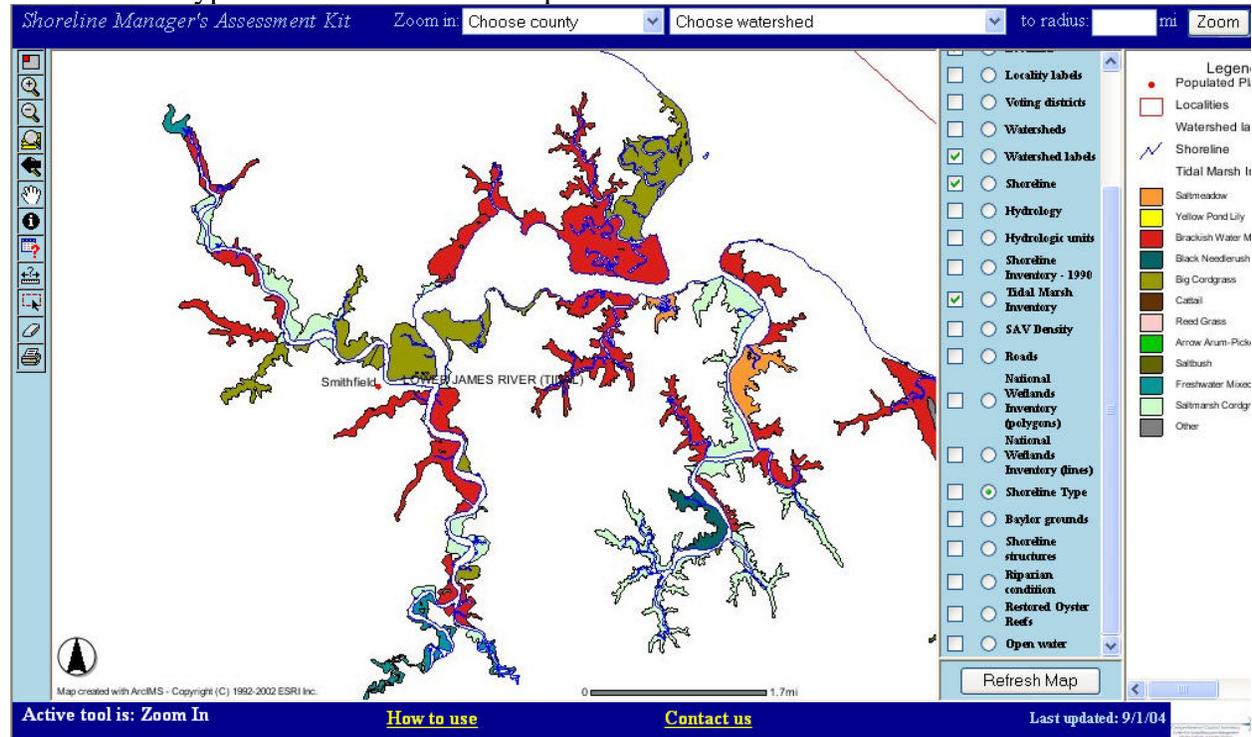
b. What two types of marsh dominate the area?
c. What types of coastal activities associated with the Smithfield ham processing plant can affect these types of marshland?

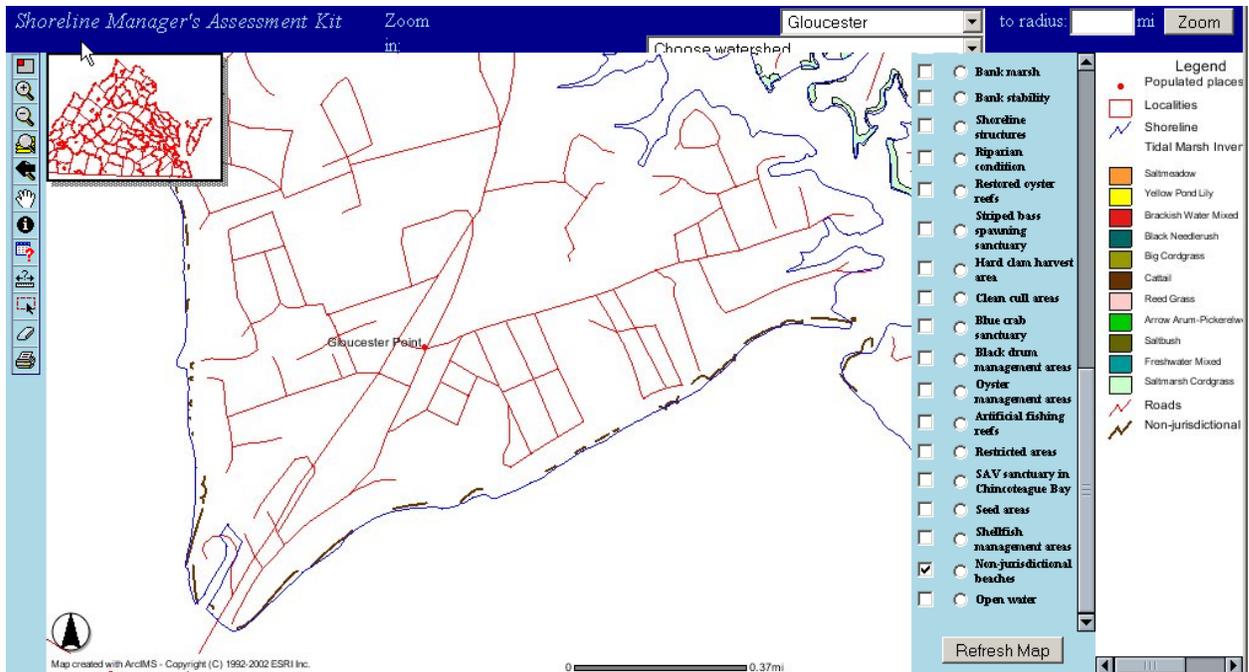7.Gloucester Point is located on the north side of the Coleman Bridge (York River) in Gloucester County?
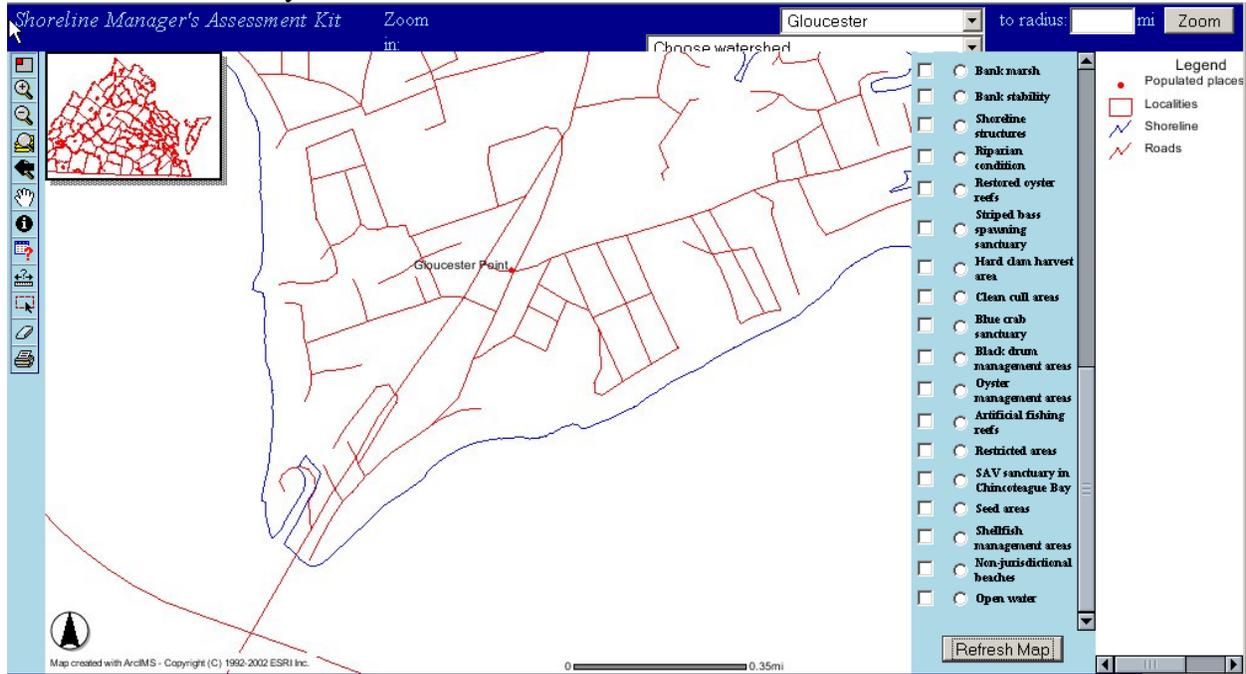
a. What is the density of the SAV beds on the north side of the Coleman Bridge (York River) in Gloucester County?
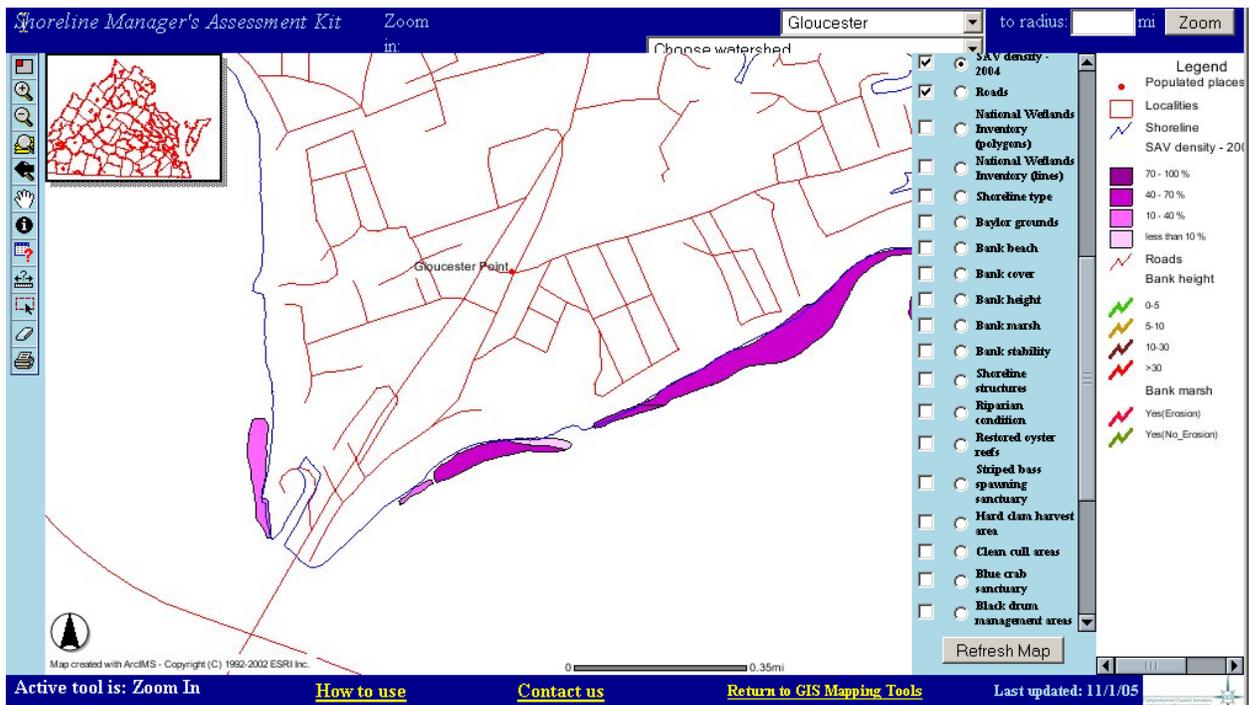
b.Are tidal marshes also present in the area?
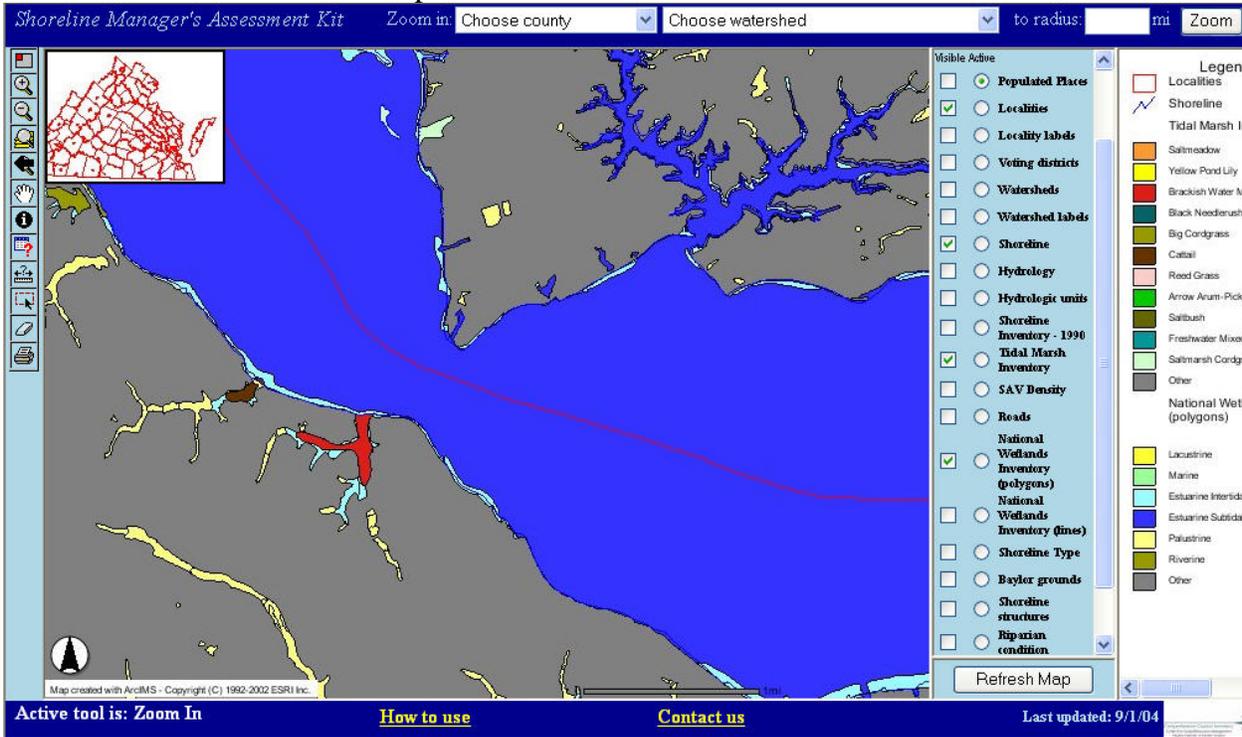
d. What other important managed habitat is present along the Gloucester Point shoreline?

8.The following questions apply to all datasets contained within SMAK.

    a. Are the data presented recent data or historic?
    b.What are the data origin?
    c.What is metadata? Where do you find it in SMAK?
    d.If you use a particular data layer outside of the ArcIMS tools, what should remember about
   the metadata file(s)?

9.South of Virginia Beach is a large area of tidal marshland called the Back Bay National
Wildlife Refuge (BBNWR). A major industrial facility wants to remove water from BBNWR,
pipe it across National Park Service land, and use it for cooling at the plant.
   a.   What types of coastal habitat could this pipe damage?
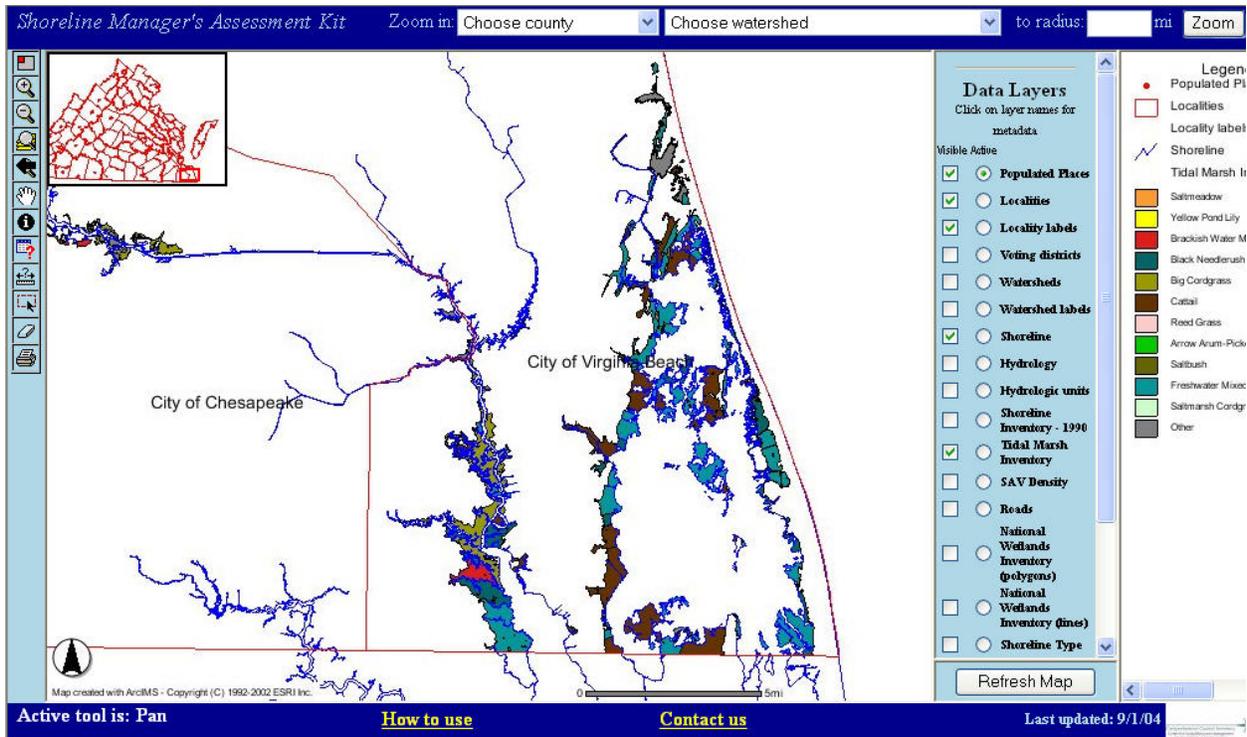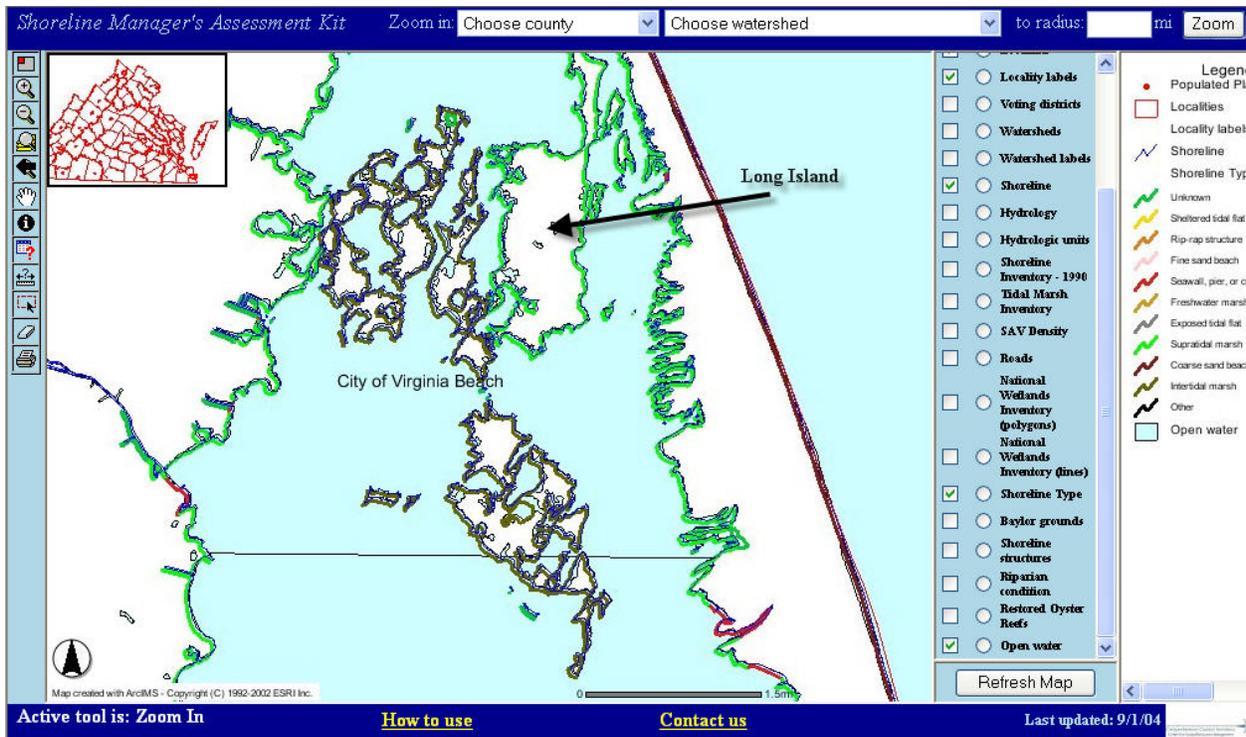
b.The islands next to Long Island are part of the wildlife refuge. How is the shoreline of these islands characterized? What is the shoreline type of Long Island?
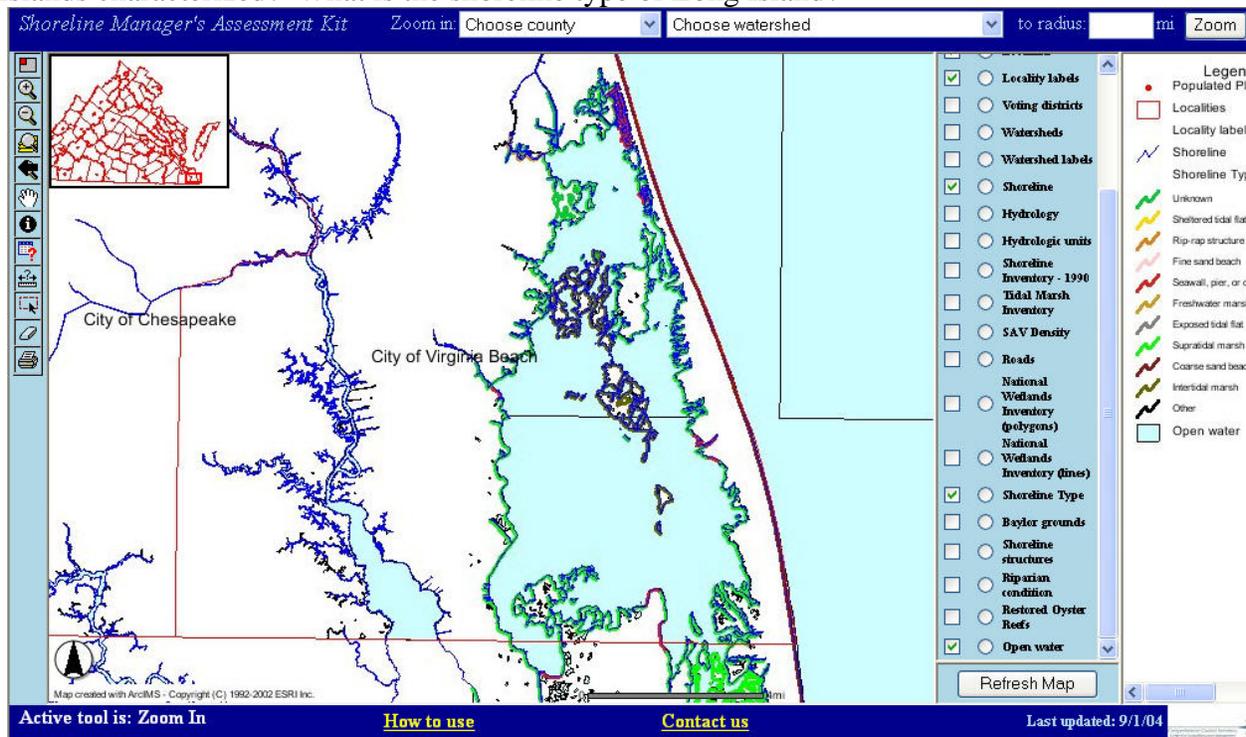
10. For quite some time, people in the Hampton Roads Area have been contemplating the benefits and costs of a third crossing from the peninsula bayshore (Newport News/Hampton) to southern bayshore (Norfolk/Portsmouth/VA Beach). The third crossing would serve the purpose of aiding in emergency evacuation and easing ever-growing traffic concerns, but the project would have a very large price tag.
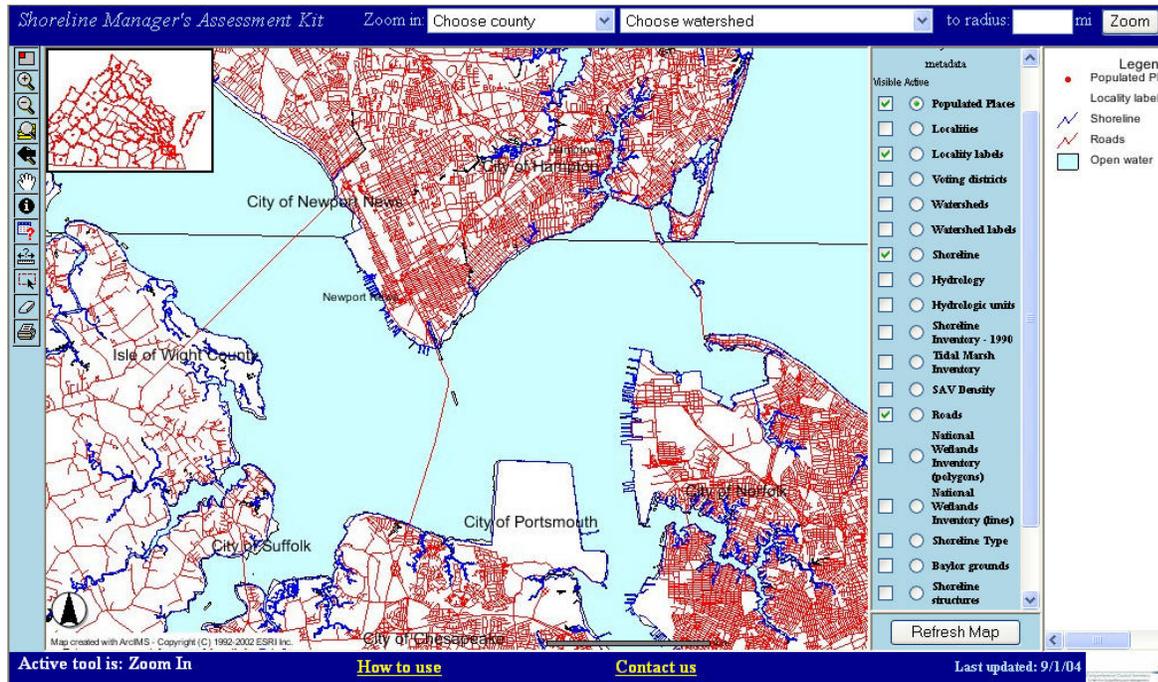
a. Where would you propose the third crossing be built, taking into account impact to the coastline and the need for more effective evacuation routes?
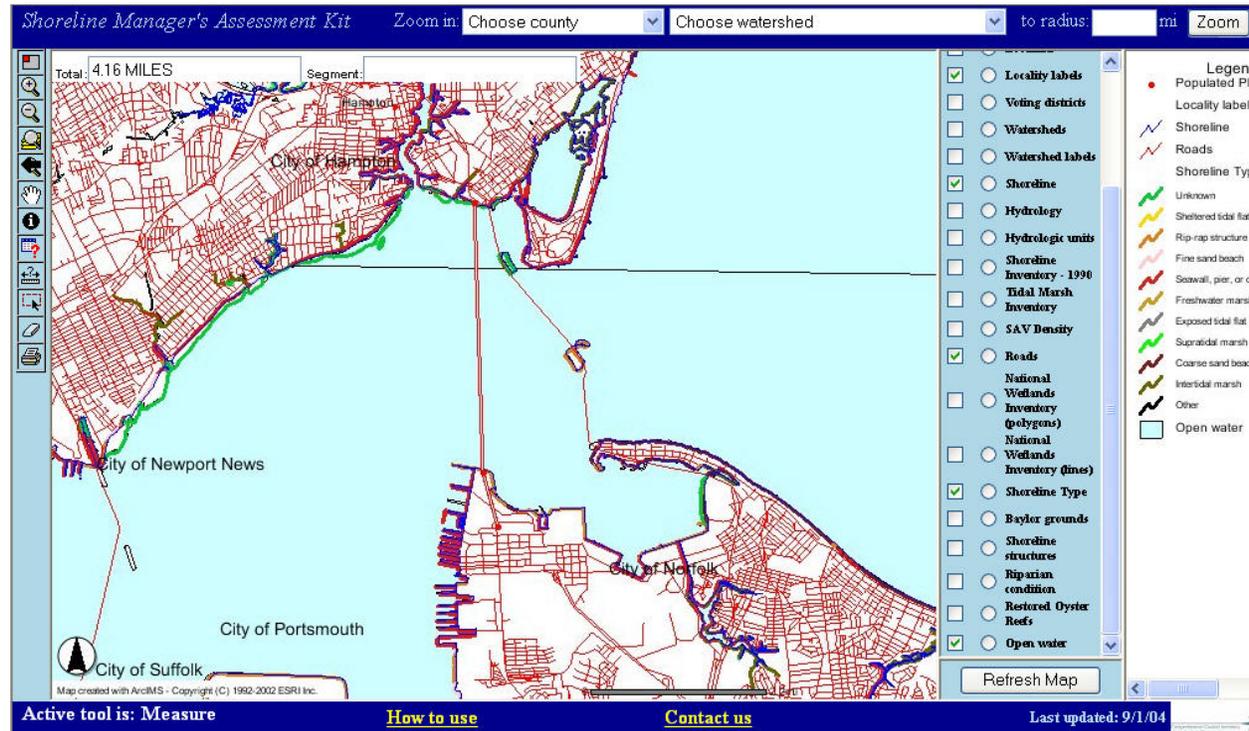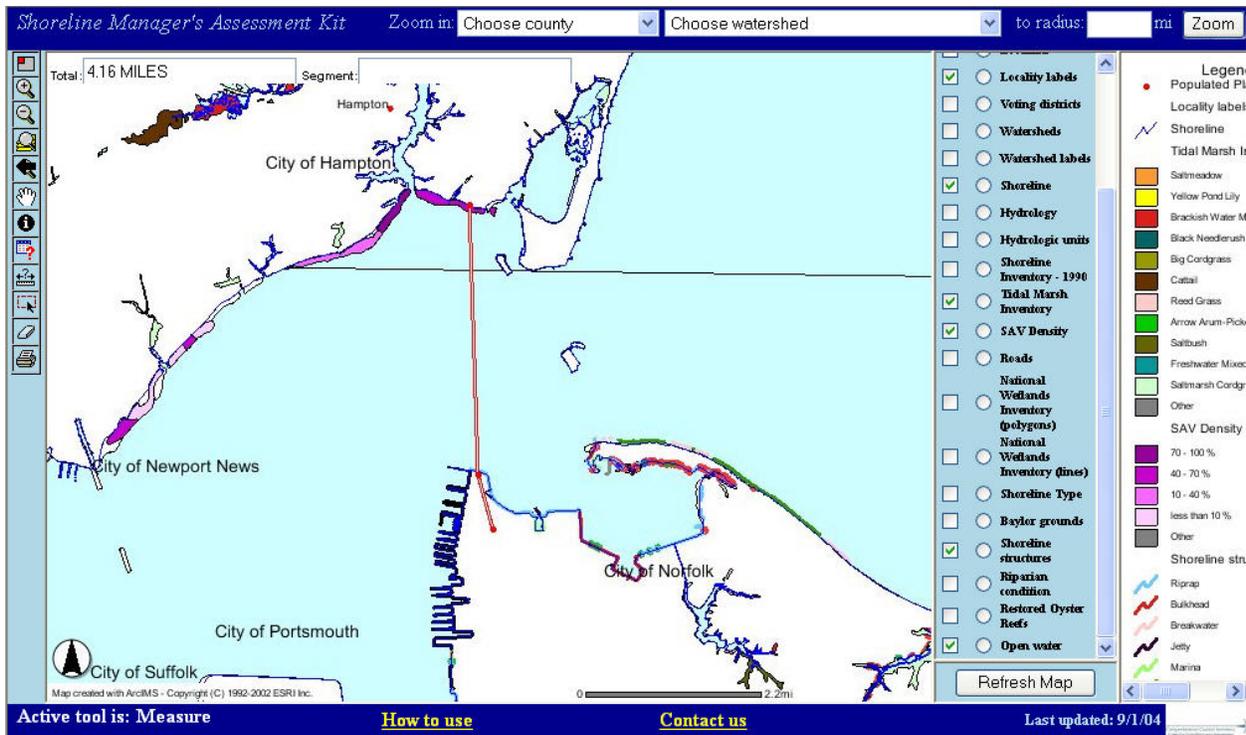
b.How many miles of road/bridge tunnel would have to be created if this plan were implemented?

c.This project would affect the James River. What are some other considerations besides impact to the coastline that would need to be considered?

11. On the Eastern Shore of Virginia, tomato farming is a large industry. A new tomato farmer buys an extremely large tract of land west of Parksley. Runoff from tomato farms is heavily laden with fertilizers and pesticides.
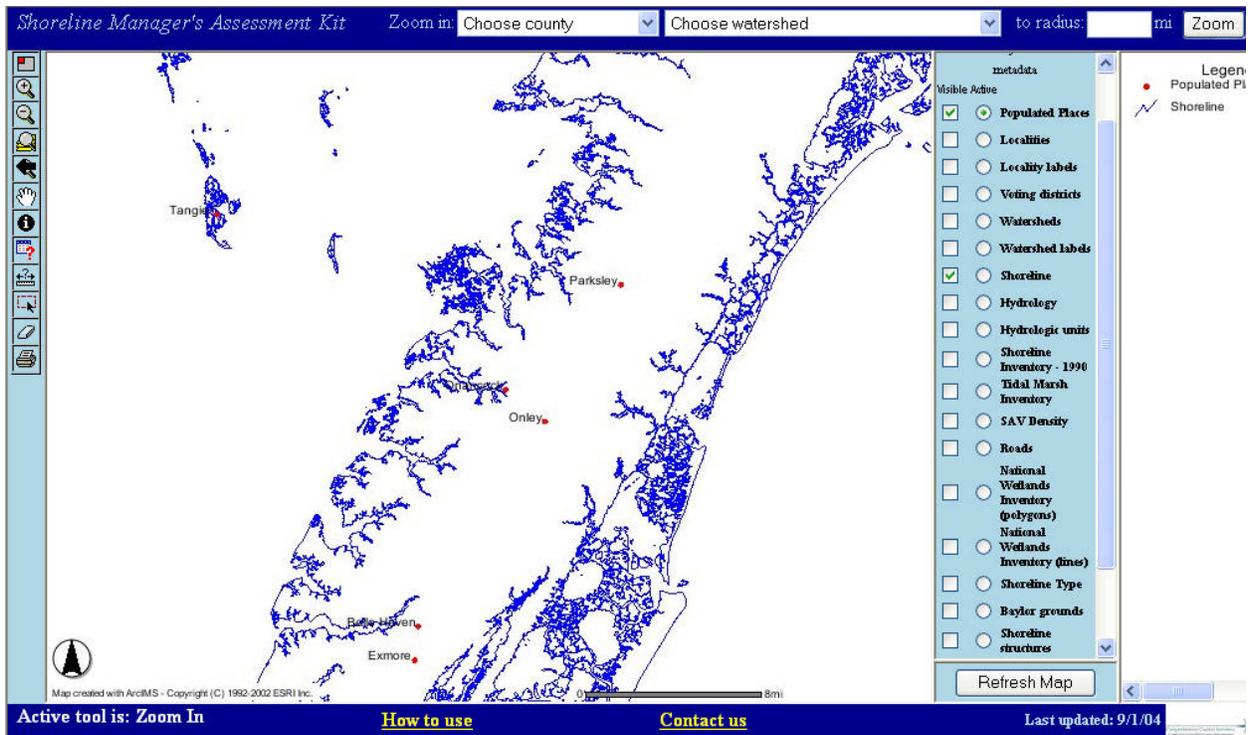
a. Would the runoff from the tomato farm go to the seaside or the bayside?
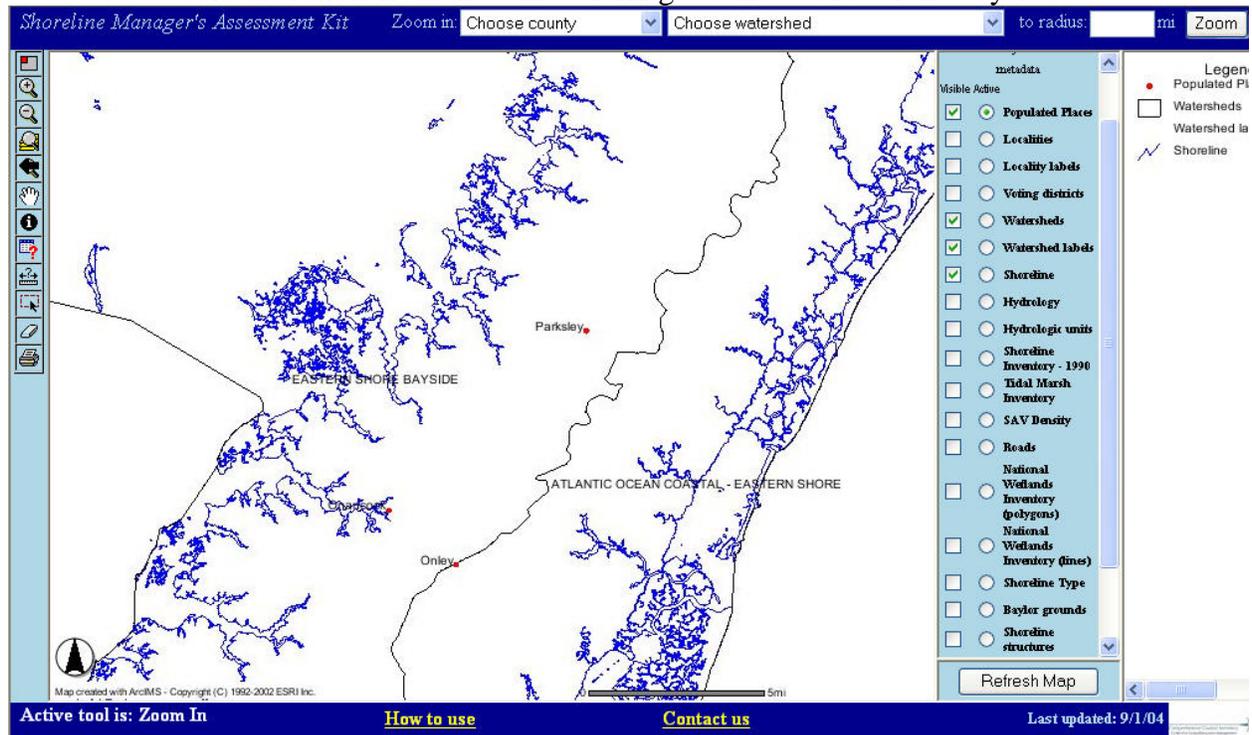
b. What types of habitat might the runoff affect?

Chapter 4: <u>Wetlands Mitigation-Restoration Targeting Tool:</u>

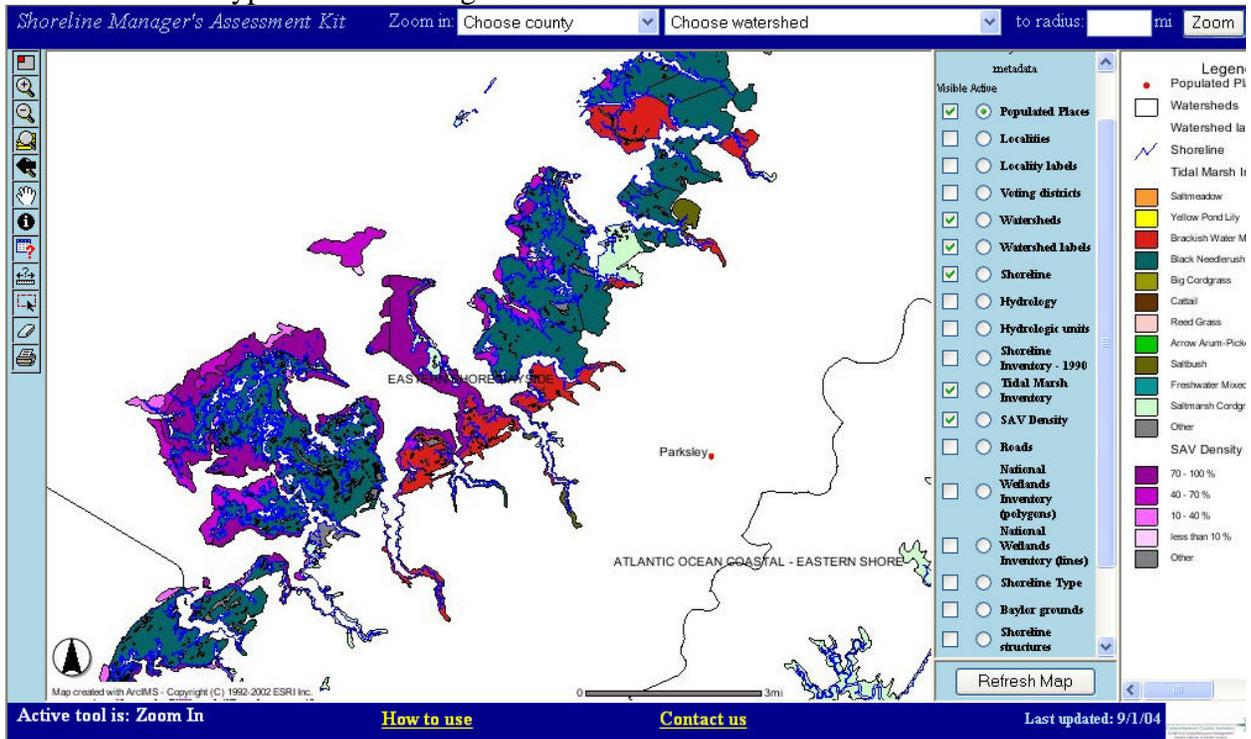Two GIS based tools were developed to assist with the selection of sites appropriate for the creation of wetlands. This tool was designed for both the individuals searching for landscape sites, as well as those who will review and consider proposals for mitigation plans. The project currently encompasses only the pilot area of Hampton Roads. Within a few months, however, this model will be run for the entire coastal zone of Virginia. The website will be updated at that time. Among the caveats for using this tool, the model output clearly states the tool does not replace the need for site evaluations.
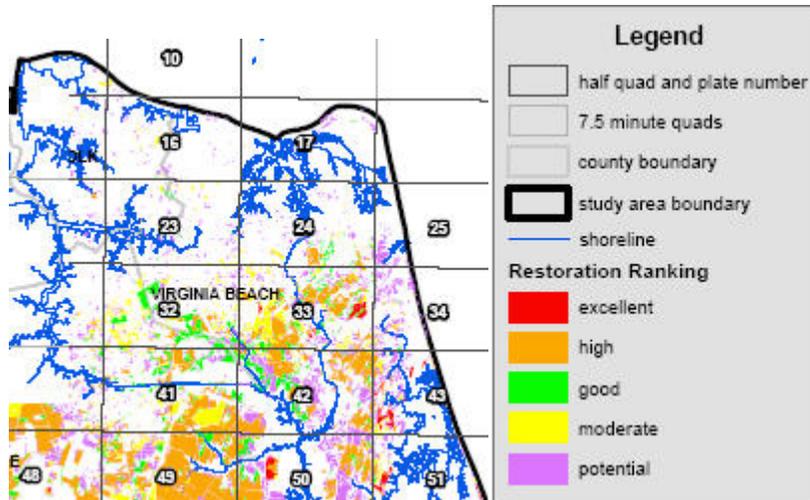
Through the project homepage you can access several products. The final report explains the details of the protocol and the analysis. The metadata is particularly important for understanding the source data and the limitations. The two GIS based products are the static maps, and the query tool. The exercises that follow have you using both.

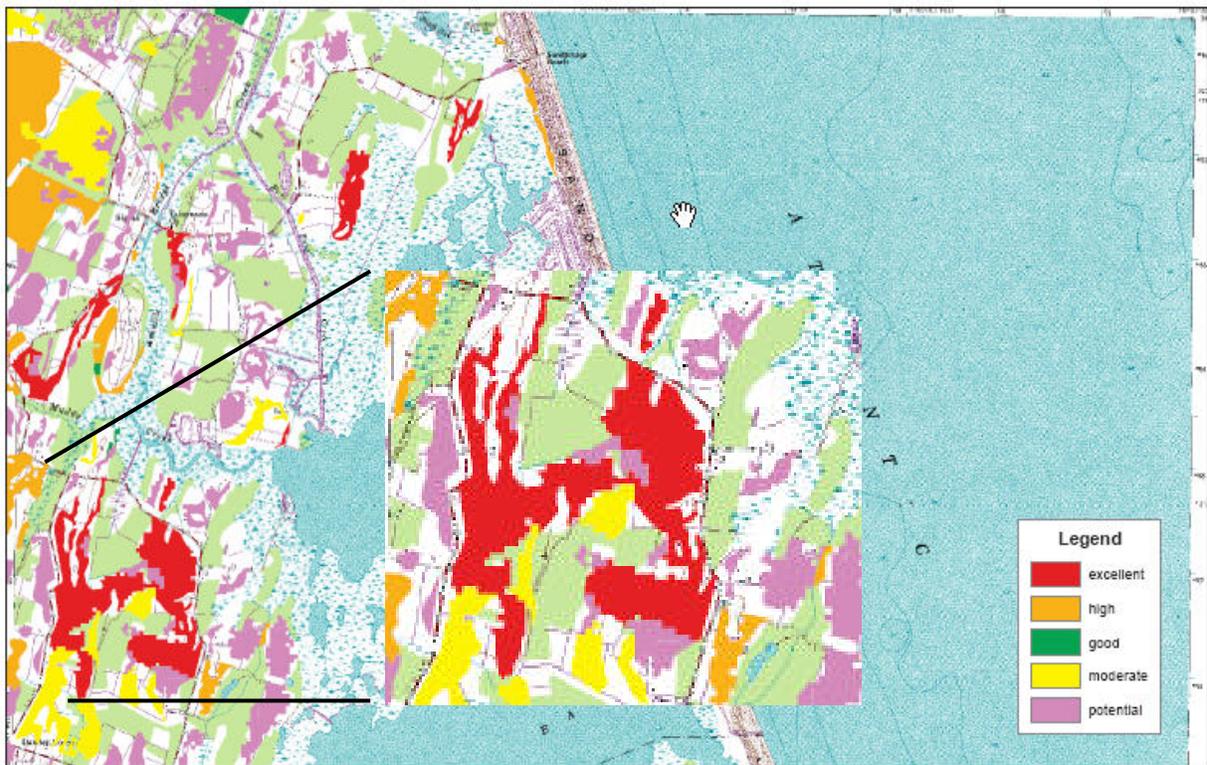**Wetlands Mitigation-Restoration Targeting Tool Exercises:**

1. What distinguishes a site from having a ranking of "good" versus "high"?

2. What unique condition must exist in order for a site to have a suitability ranking of "excellent"?

3. What is the main difference between the "Maps" and "Query" tools?

4. Go to "Maps". From Map 51, determine what feature is most likely responsible for the large available area of "excellent" restoration sites.

5. In the Query Tool, what are the four parameters available to help you narrow your search for a suitable site?

Zoom In	What size wetland do you want (acres)? ⌄	Input locality of interest ⌄	Input hydrologic unit of interest ⌄	What suitability class do you want? ⌄	Submit
How to use	**Hydrologic unit code descriptions**		**Contact us**		Last updated: 12/04/03

6. If you are unfamiliar with hydrologic unit codes, where can you find help on this?

7. In the list of data layers, select "hydrologic units" and "hydrologic unit codes" and use the refresh button to display the boundaries and codes of the hydrologic units on the map. If you click the identify button along the left side of the screen and then any HU code you will can get the area of that watershed and the actual name. What is the name and area (m2) of HU C08?

8. In the "Maps" section of the tool, examine the coastline of Virginia Beach.
   a. Approximately how much of the land has a restoration ranking of "Excellent" or "High"?

Legend

- half quad and plate number
- 7.5 minute quads
- county boundary
- **study area boundary**
- shoreline

Restoration Ranking

- excellent
- high
- good
- moderate
- potential

b. If you were restricted to the area represented by Plate 43 and you were looking for a restoration area with an "excellent" restoration rating and a minimum of a 0.25 kilometer wide section, in which area would you start looking?

Legend

- excellent
- high
- good
- moderate
- potential

Basemap Source: U.S.G.S Digital Raster Graphs

Kilometers
0   0.25 0.5   1   1.5   2

9. The "report" button and the "metadata" buttons will link you to the final report for this project and all of the information about projection, dates, and origin of the data sets. Explore these links.

10. The "query" button will bring up the ArcIMS viewer.

a. Use the drop-down menus at the bottom of the view to zoom in to a 20-30 acre wetland in Isle of Wight County with a high restoration rating in the Hydrologic unit G11. Be sure to fill in all drop-down menus before submitting the request.

b. Use the info button on the browser to find attributes of a particular parcel.

c. Is it adjacent to a wetland?

Restoration ranking

Rec	PERIMETER	ID_NUMBER	ATTRIBUTE	WETLAND	HYDRIC	TRINSIDE	LU	STR_CONN	COINC_A	COINC_P	COINCIDENT	ADJ_WET	CONNECT	COINOUT	STR
1	11224.931053457	14145	U	U	Y	0	ag	Y		Y	Y		cc	Y	Y
2	4742.3118225025	15246	U	U	Y	0	ag				N				

Item descriptions

11. In what color are the selected polygons resulting from the query displayed on the map?

12. In the City of Virginia Beach there is only one site that meets the following conditions: is between 50 and 100 acres in size, and ranks as an excellent site for mitigation. Locate this polygon, and answer the following questions:
    a. What is the actual size of the potential site?
    b. What type of wetlands construction would probably be best at the site?
    c. Can you determine what major protected area is in the vicinity of the site?

13. VDOT is planning a wetland mitigation-banking project in order to replace wetlands they may impact in the future. They are looking at sites adjacent to vegetated wetlands.
    a. Are there places that fit this description? Zoom to the area of the first 20 wetlands by clicking the "zoom to these records" at the bottom of the query window.

    b. Where are the first 20 records located?

14. The study area includes seven jurisdictions: Isle of Wight County, City of Franklin, City of Suffolk, City of Norfolk, City of Portsmouth, City of Chesapeake, and City of Virginia Beach.
    a. Overall which jurisdiction(s) has the most sites available for wetland creation?
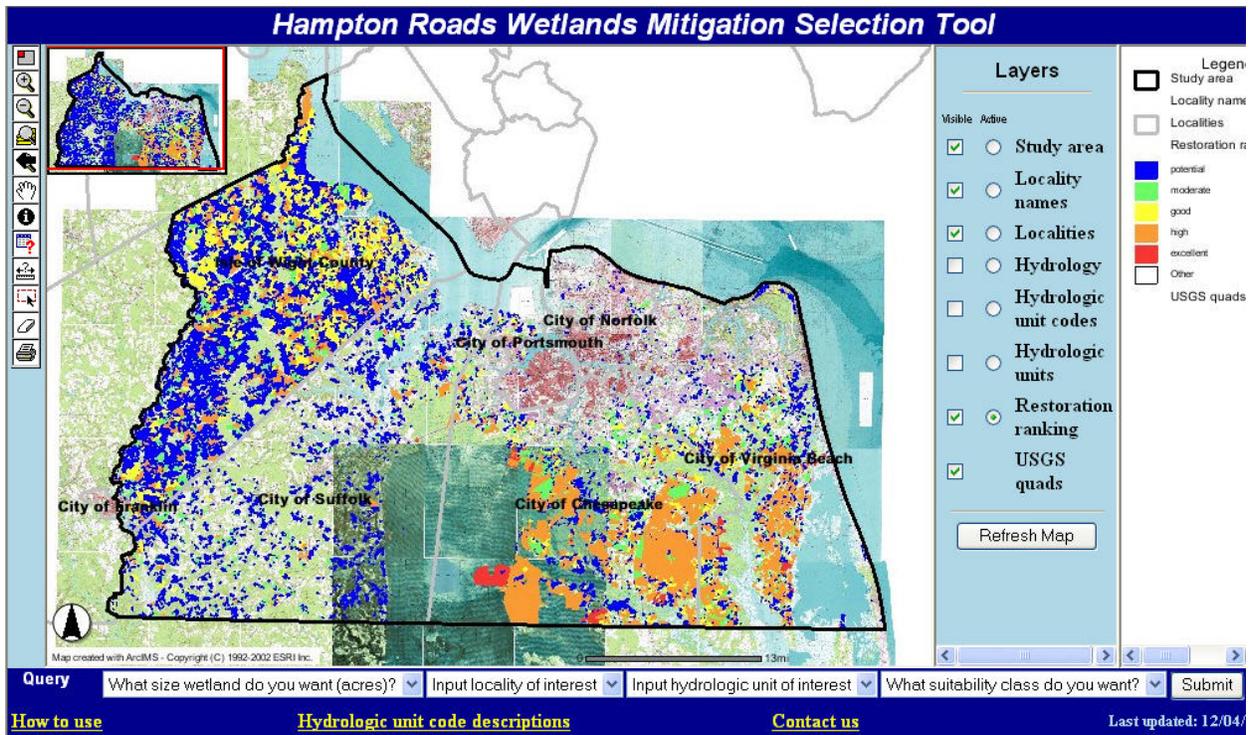
b. Which jurisdiction(s) has the highest ranked potential wetland sites?
c. Which jurisdiction(s) is not likely to conduct many wetland creation activities?

15. What watershed is K41?

16. You may not find any sites that meet your preferred conditional requirements. For example:

    a. How many site are available for wetlands mitigation in HU C08 in Norfolk between 5-10 acres and ranked "good"?
    b. Are there any sites in this location available? (hint: adjust your query)

Chapter 5: Shoreline Situation Report

The Shoreline Situation Reports (SSRs) are not viewed online in an interactive map environment like ArcIMS. They are static map products that can be viewed or downloaded as .pdf files. They are posted to the website and are accessible through two avenues. First, you can access the Shoreline Situation Reports through the CCI Online GIS Databases web page (http://ccrm.vims.edu/gisdatabases.html). You will notice other data can also be downloaded from this page (e.g Tidal Marshes). Currently, SSRs are predominantly organized by locality. It is the intent of the program to continue with this format until all coastal cities and localities are finished.

The SSRs can also be accessed from this link: http://www.ccrm.vims.edu/shoreline_situation_rpts.html. Here the user sees how individual shoreline reports contribute to the overall Chesapeake Bay Shoreline Inventory.   All Maryland localities are now complete. As new Virginia localities are finished their links will become active, and the list will grow.
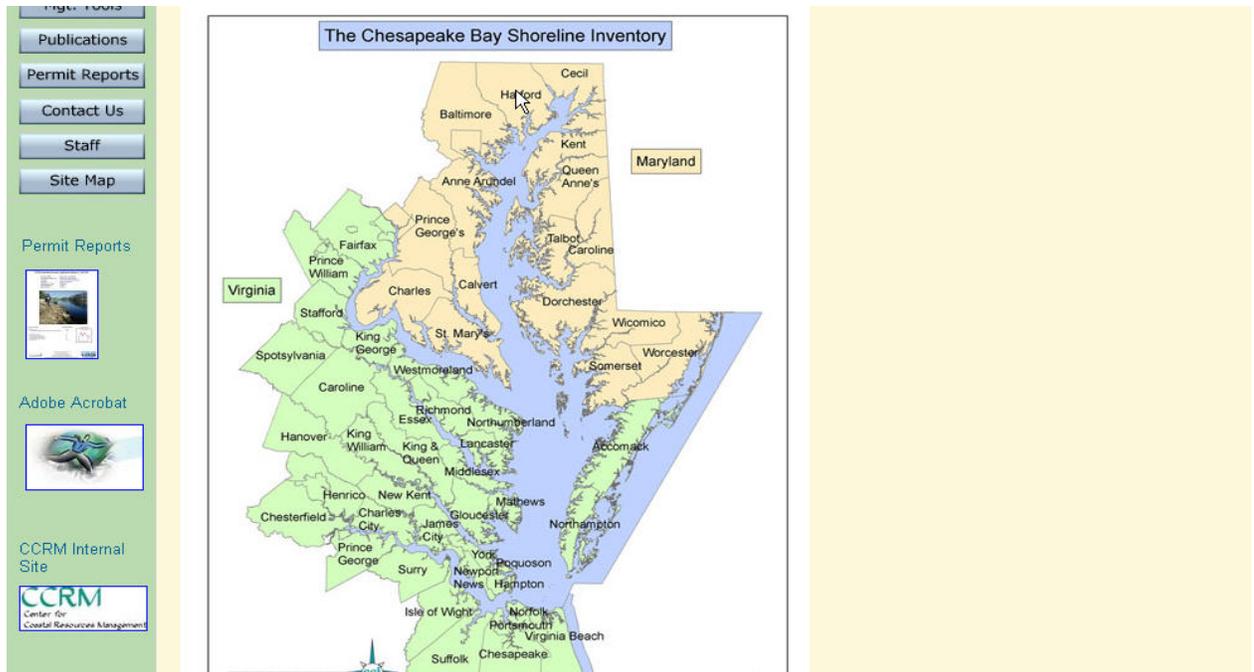
The Shoreline Situation Reports applied a protocol for data collection and reporting developed by Berman and Hershner, 1999. This protocol was reviewed by state and local agency users prior to adoption. The original protocol can be downloaded as a PDF file from this site http://ccrm.vims.edu/gisdatabases.html by clicking on "Development of Guidelines for Generating Shoreline Situation Reports". As better technology and user comments have come about, slight modifications to the original protocol have been made. These modifications are most obvious in the most recent publications.

From the database homepage above, a locality can be selected. This will link you to the home page for that locality's SSR database. A brief description of the project is given. A DISCLAIMER has been prepared that advises users on copyright information, data limitations, and restrictions. Files available for viewing or downloading varies by jurisdiction. For older inventories only maps, tables and GIS data (with metadata inclusive) can be downloaded. Final reports are not available electronically at this time. You can contact the Program Director for hardcopies. The Program has transitioned to electronic versions only, and this format is available for new(er) inventories.

Caroline County, Virginia

Digital Shoreline Situation Report (SSRs) -
Description and Disclaimer

DESCRIPTION

The Comprehensive Coastal Inventory Program (CCI) at the Virginia Institute of Marine Science (VIMS) is generating new Shoreline Situation Reports (SSRs) for coastal localities in the Commonwealth of Virginia and the state of Maryland. SSRs were developed by VIMS in the 1970s and have been the foundation for shoreline management planning in Tidewater Virginia ever since. CCI has developed new protocols for collecting, disseminating, and reporting data relevant to shoreline management issues using state of the art mapping and remote sensing techniques. New SSRs are being generated on a county by county basis for Maryland and Virginia.

The data inventory developed for the Shoreline Situation Reports is based on a three-tiered shoreline assessment approach. In most cases this assessment characterizes conditions that can be observed from a small boat navigating along the shoreline. Hand-held GPS units are used to log features observed. The three tiered shoreline assessment approach divides the shorezone into three regions: 1) the immediate riparian zone, evaluated for land use; 2) the bank, evaluated for height, stability, cover and natural protection; and 3) the shoreline, describing the presence of shoreline structures for shore protection and recreational purposes. Three GIS coverages are generated. The car_lubc coverage are features related to the land use in the riparian zone, and conditions at the bank. The car_sstru coverage includes information

Using Caroline County as an example, the home page for the Caroline County Shoreline Situation Report is shown above. Along the right margin, and again along the bottom of this page are links to the various datasets. Several data products are available online. First the maps that can be customized and printed for publication scale using zoom tools. You will use these maps to answer the questions in this section of the lab. More helpful hints are to follow. The tables can be viewed and printed from the website. For newer inventories there is a text report, which includes methods and summary tables as a downloadable PDF file. The metadata file pertains more to GIS data than to printable maps, however it does give information about data generation and analysis. The web page also provides GIS data for GIS users. These are the raw GIS coverages and/or shape files that can be downloaded and integrated into your programs.

To download and view maps from the website you must click on the "(maps)" link above. For each jurisdiction, an index map will be displayed. As you will learn, the Shoreline Situation Reports display data in a series of three plates. The first displays the riparian land use. The second displays conditions of the bank and natural buffers. The third displays the presence of any shoreline structures. In the series they are numbered (Plate #a, Plate #b, and Plate #c). On the map index page, they are listed below on the left, and are grouped. You must scroll through the list and click on these plates individually. The index map in the window on the right helps you find your location. Each box has a plate number corresponding to the plate list on the left.

Plates 7a, 7b, and 7c are shown below for the City of Norfolk. The legends are complex and should be reviewed. Plate 7a illustrates Riparian Land Use by color coding the shoreline. The legend defines eleven (11) different classes. These classes may not be present on every map in Norfolk. The classification for other jurisdictions may also differ slightly. Color infrared imagery from 1994 is used as the backdrop for these maps. The scale bar is set for 11x17 inch printing. If you print at a different size the scale will be different.
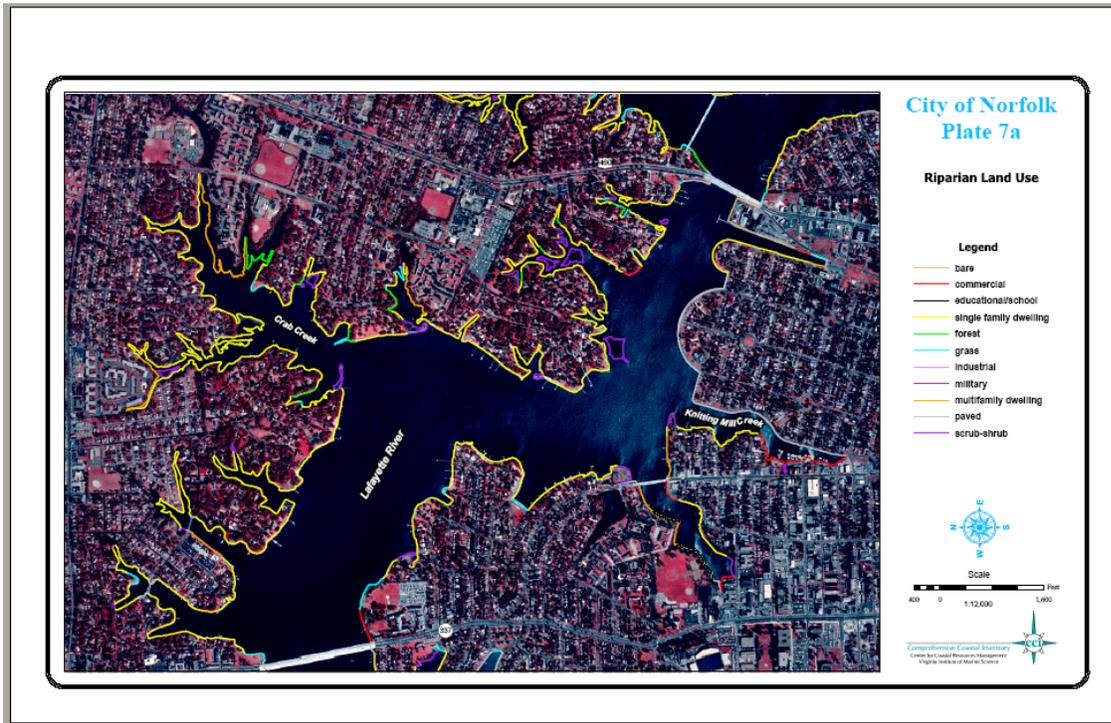
Plate 7b illustrates bank and natural buffer conditions surveyed. The coding systems combines symbols, patterns, lines and colors. Careful review of the document will provide detailed information for interpreting the maps. In general, erosional conditions are illustrated in red. Stable bank conditions are shown in green. Marshes are illustrated by open circles. Beaches are shown as solid circles. The thickness of the bank stability line is a reference for bank height. The thicker the line the higher the bank. Bank cover is a thin solid line landward of the bank height/stability line. This line is color coded to reflect the degree of cover observed on the bank. If *Phragmites australis* is present, it is designated as a thin light blue line seaward of the other designations. *Phragmites* and bank cover were later additions to the data collection effort and are not included in the earlier inventories.

42

City of Norfolk
Plate 7b

Bank and Buffer Conditions
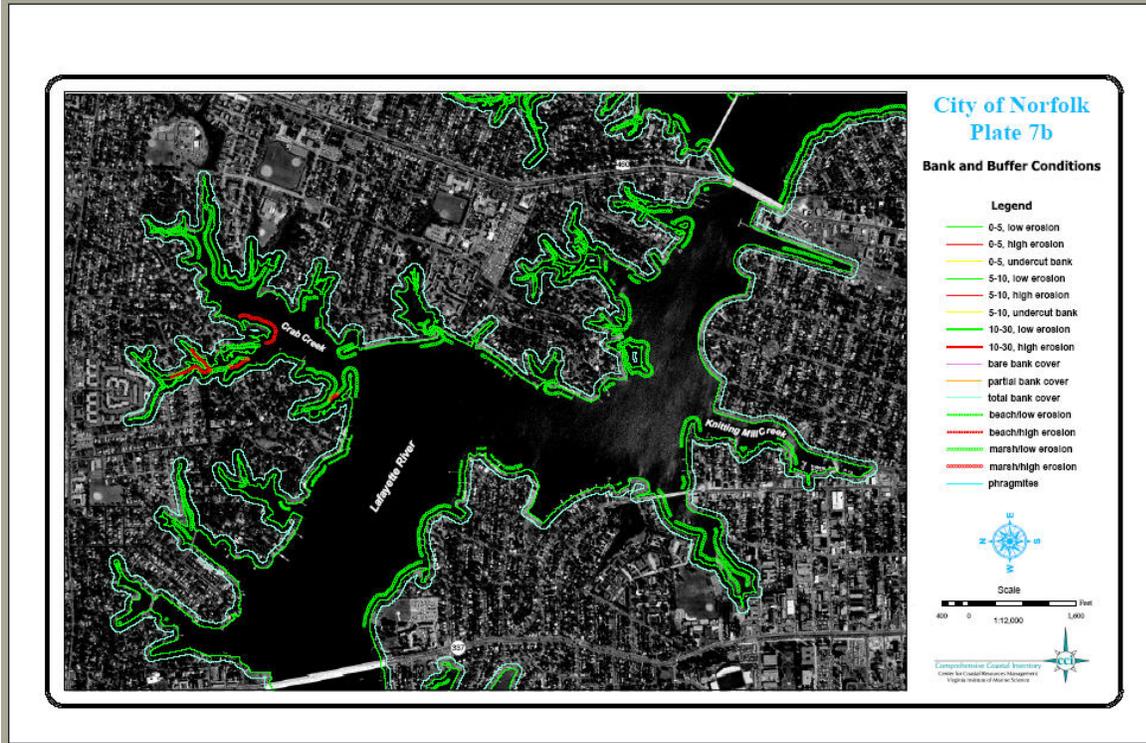
Similarly, for Shoreline Features (Plate 7c), color coded points and lines have been designated to represent the location of shoreline structures.

City of Norfolk
Plate 7c

Shoreline Features
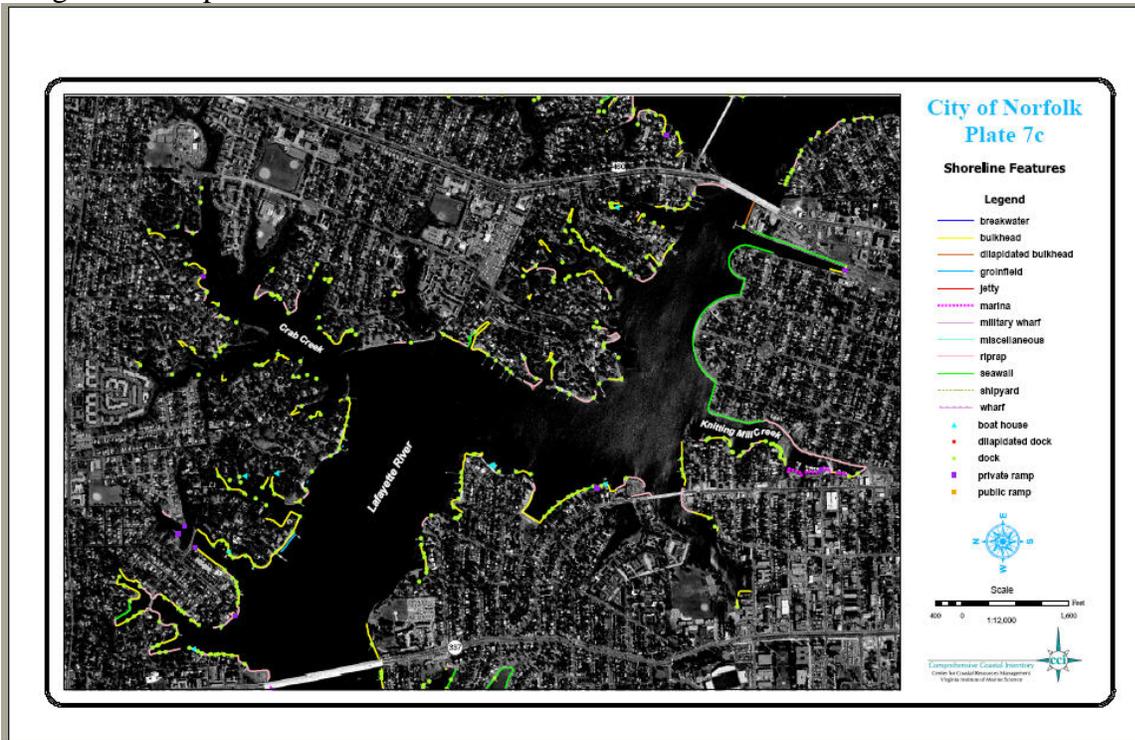
On the web site, you can use the zoom tools available to increase your viewing capacity. Since this is not an ArcIMS application, attribute information, or measuring tools, etc. are not available.

Shoreline Situation Report Exercises:

1. How would you classify land use in the Willoughby area of Norfolk (Plate 3 and 4)?

2. On the Lafayette River in Norfolk (SSR plate 7)
   a) What is the dominant shoreline use/condition?
   b) Is this an area at risk to flooding?
   c) What about existing erosion in this area?
   d) Considering information on Plate 7b alone, can you reason why erosion is low here?
   e) Is this natural bank vegetation?

3. On Plate 7a there is a commercial operation in Knitting Mill Creek.
   a) Can you find out anything more about that operation?
   b) There is a proposal to expand the operation downriver and add a few more slips. Are there sensitive habitat considerations in doing so?
   c) Is there any place where the marina could expand?

4. Just west of the jetty on Plate 1 in Norfolk there are a series of breakwaters.
   a) From the imagery, do they appear to be effective?
   b) What does the thin light blue line along most of the Little Creek shoreline indicate?
   c) From Plate 1c we note that there are relatively few structures along the north shore. What does that tell you about the bank?

5. Mathews County SSR plate 18a – Riparian Land Use
   a) What is the dominant shoreline use/condition?
   b) Just by looking at plate 18a, what would you conclude is the major difference between land use at the shore and landuse within the drainage basin?
   c) Would you expect to see a lot of erosion along the shoreline here?
   d) Do the reported bank conditions agree with this assessment?
   e) There is a permit request for 1,000 linear feet of bulkheading along a section of Put In Creek. Is there any suggestion from the information that this type of hardening is necessary here?

6. City of Poquoson SSR plate 2: A residential property owner at the headwaters of Bennett Creek on the southwest shore has submitted a permit application to construct 500 linear feet of riprap. Currently the only structure on the property is a private pier. What information can you gather from the three plates to assist in your assessment or recommendation regarding this permit? (hint there is only one residential property owner in this specific area, so the lot should be easy to locate on the maps).

7. From Essex County Shoreline Situation Report; Plate 3 on the Rappahannock River:
   a) There is a short groin field on the far north west side of the map (far left). Is there any evidence of active erosion in the area?
   b) Is there a likely local sediment supply for the beach present?
   c) Does the groin field appear to be an effective offensive structure?
   d) Are there other types of structures nearby?

Still in Essex County from the groin fields between Wares Wharf on plate 4 and Browns Point on Plate 3.

    e) Is there evidence of a net drift direction? On/Offshore or alongshore?

8. In Lancaster County (Plate 2) there is a new residential subdivision in place on Dymer Creek. The subdivision is located along the shoreline of Dymer Creek and the east entrance to George's Cove.

    a. In 1994 what was the riparian land use along this shoreline?
    b. A potential buyer inquires about erosion trends, and shoreline protection alternatives at the new waterfront subdivision. What can you tell them about the prevailing conditions? Bank stability? Bank elevation? The need for shoreline armoring?
    c. What other tool(s) presented in this workshop could you use if you wanted to know what type of marsh is present?
    d. The bank is well vegetated. What evidence can we extract from the Shoreline Inventory to lead us to that conclusion? A note of interest – Despite these conditions a rock revetment, groins, and beach fill have since been permitted along this shoreline.

9. Community Pier Siting, Weems, Lancaster County (Plate 11)

The Marina Siting Tool described below suggests that it is undesirable to consider constructing a community pier at a new residential subdivision in Weems.

    a. What additional information can you get from the Shoreline Inventory that supports this conclusion? The cove is actually centered between Corrottoman Point and Orchard Point.
    b. Roughly, how far is the proposed site from deep water?
    c. Are there any marshes or SAV beds that should be avoided between the pier and main channel?
    d. Are water depths sufficient from proposed pier to marked channel to avoid the need for dredging?
    e. In addition to tidal marshes and SAV habitat, what other indicators of natural water depth are available in the absence of bathymetry data?

10. The Lagrange Creek Land Owners Association in Middlesex County (Plate 4) was recently praised by the Rappahannock River Tributary Strategy Team for their efforts in reducing non-point source pollution in an agricultural drainage basin.

    a. Looking at Plate 4 in Middlesex County, can you observe any management strategy that may have precipitated this acknowledgement?

b. On the south side of the creek there are two isolated areas that are exhibiting erosion. What differences do we see here that may contribute to this isolated instability?
c. The environmental setting suggests that planting marsh grass might be a reasonable option to help stabilize the bank here. Would you agree, and why?

11. On Chincoteague Island in Accomack County there is a marina located on Assateague Channel (Plate 41).
a. Is this marina a community based facility or a private enterprise?
b. What can be said about the topography of the Island along the shore?
c. What about island morphology?

Chapter 6. Other Resources in the Toolbox

Blue Infrastructure (http://ccrm.vims.edu/blueinfrastructure/bi_intro.html):

Blue Infrastructure includes ecologically and economically significant aquatic resources (marine and freshwater) found within the coastal zone of Virginia. The intent of the project was to make baseline aquatic resource data available to a target audience who includes local, state, and regional planners and citizen groups.   Blue infrastructure was partially motivated by its terrestrial counterpart "Green Infrastructure" well underway in Virginia.

The project acknowledges community development at the waterfront contributes to the overall condition achievable for the aquatic ecosystem, and that land use choices may conflict with desires to support the highest levels of aquatic health. Blue Infrastructure is not intended as a tool to help mediate use conflicts. It does display locations of important and sensitive aquatic resources.   The hope is that local planners will use this resource as an aid to guiding future growth and development along the waterfront. In doing so, the opportunity to identify sensitive resource zones, aquatic conservation areas, or marine managed areas exists.

 Data has been assembled in GIS and can be displayed from the website using the ArcIMS technology.   The interface presented is similar to SMAK, and has the same functionality and tools. The GIS data is also available for downloading from the project home page.

The project was funded by a grant through the Virginia Coastal Zone Management Program, through the National Oceanic and Atmospheric Administration.

Oil Spill Clean-up and Response Tool (OSCAR)(http://ccrm.vims.edu/OSCAR_intro.html):

OSCAR is an oil spill response tool designed to assist in the identification of sensitive resources for the Chesapeake Bay coastal region. During the last several decades, the Chesapeake Bay has experienced several large spill events threatening our environment. The Bay's resources remain vulnerable as they share the coastal area with several large shipping ports, major interstate commerce routes, extensive underground pipelines, industrial facilities, and other areas that have the potential to cause significant environmental damage through accidental spills. This Internet application allows you to create customized maps, and with a click of the mouse, identify a point of interest and view detailed scientific data associated with that location.

For rapid and effective response to incidents that may occur, vulnerable resources must be identified in advance. OSCAR provides information on protection priorities within the Chesapeake Bay basin. Although data for the entire basin is included, the coastal area was the primary focus for this iteration of OSCAR. There are 28 different layers included in OSCAR. One will notice that some layers are not available baywide. They may only include data for Maryland or Virginia, respectively, depending on origin. By clicking on the name of the data layer in the listing, metadata will appear and give you information on the geographic extent.

OSCAR was created in 2001. Conceptually, the purpose behind OSCAR was modeled after the national effort to provide an Environmental Sensitivity Index Atlas (ESI) to all coastal states. This was initiated in the early 1980s. Virginia was completed in 1983. Data products from the ESI have been converted to digital formats and are included in OSCAR (e.g. "Shoreline Sensitivity"). There is now a Chesapeake Bay wide initiative to update some of the components of the original ESI datasets. As these become available OSCAR will be updated. At this time, there have been few updates to OSCAR, otherwise.

As you use OSCAR, it is important to consider OSCAR as a tool for other resource questions beyond oil spill response. OSCAR represents an extensive collection of data for the Chesapeake Bay and therefore can serve as an important planning or research tool to address environmental issues in the Bay.

The Marina Site Suitability Tool (http://ccrm.vims.edu/wet_target/index.html)

The pressure to develop shorelines in the coastal plain of Virginia continues to increase. Concomitant with shoreline development is increasing demand for more or expanded marina facilities. Additionally, government policies and initiatives promote expanded public access to waters for recreational and commercial purposes. The demand for additional boat storage facilities will continue to increase as more people move to the coastal plain and join the recreational boating community.

As marina developers, or those expanding or purchasing old marinas with the intention to expand, acquire a parcel of land the issues of economic and environmental impacts are paramount to a project moving forward. If the area is environmentally sensitive then a protracted and expensive permitting process may ensue which can be resource intensive for both the applicant and the locality.

All local governments have designated shore land uses through zoning ordinances. These designations reflect the counties desired uses for waterfront property and may conflict with a property owner's desire to develop the land in a particular manner.

The Commonwealth of Virginia, through the Virginia Marine Resources Commission, developed detailed criteria for siting of marina facilities (VMRC, 1993). The Marina Site Suitability Tool was developed at the CCI, by integrating the VMRC siting criteria into a GIS data model.   The project is applied to the tidal shoreline of Virginia, and the analysis is performed at 600 meter increments along the shore.

The siting criteria were divided among three categories: a. criteria mostly related to marina *design*, b. criteria mostly related to *water quality* considerations, and c. criteria mostly related to *habitat considerations*. GIS algorithms were developed to model the VMRC criteria, and an index of suitability was formed. Indices were summed within each category (design, water quality, and habitat) to identify areas as desirable, desirable with limitations, and undesirable for the location of a marina. A summary index combines the index values for all

three categories. More details regarding the protocol are discussed in the final report that can be viewed or downloaded from the web page.

The web page for the Marina Site Suitability Tool has links to static maps that illustrate the model output for each category under "MAPS". When you click on any one of these categories a geographic index appears. Click on the area of your interest and the map will appear. These can be printed, and a color printer is recommended.

For users with GIS capabilities, the GIS data are available as well. For those without GIS capabilities an interactive map application has been recently developed. You access the tool by clicking on the "Interactive Map Tool" link. This tool is particularly useful for those who want more information about why a particularly area had a low suitability designation for one or more of the categories. Using the ArcIMS functions you can access the GIS attribute tables where this information is stored. To do this, first make the layer active in the data layer table on the right. Next, click on the ID tool on the left, and click on the map. The attribute table for that polygon will appear. Within the table you will find each criteria assessed and how it was ranked in the model. Given habitat, for example, in a given area. The attribute table may indicate that the segment you are considering for development is rich in SAV, tidal mudflats, wetlands, and includes a riparian forest. These factors would contribute to reducing the sites suitability for marina development. If the site was habitat for a rare, threatened or endangered species, regardless of any other factors present, the site would be listed as "undesirable".

Experiment with both the static maps and the interactive map tool to decide which you prefer.

Wetlands Data Viewer (http://ccrm.vims.edu//disclaimer_wetlandsdataviewer.html):

The Wetlands Data Viewer is still under development. At this time however, it is possible to review in tabular form the extent of wetlands (tidal and non-tidal) by hydrologic unit in the state. The Data Viewer uses a simple ArcIMS interface, but includes only a very few baseline layers to turn on or off. The default layer illustrated when you go to the site is the boundary layer for the 14-digit hydrologic units. To retrieve information on wetlands for any hydrologic unit you must click the "identify" button first and then click within any hydrologic unit illustrated on the map. A table will be displayed that lists all the National Wetlands Inventory (NWI) wetlands classes present in the unit, the number of polygons for each present, the total acres for each class, and a breakdown by size. CCRM is working on expanding this interface.

APPENDIX.   Answers to Lab Exercises

SMAK Answers

1.
    a. picture 1: big cordgrass, saltmarsh cordgrass, brackish water mixed, freshwater mixed, arrow arum-pickerelweed, picture 2: lacustrine, palustrine, estuarine intertidal, estuarine subtidal, and riverine wetlands
    b. no
    c. Shoreline Inventory -1990
    d. in between the tip and the base of the peninsula

2.
    a. 1.60-1.70 miles
    b. subjective, just investigating the identify function
    c. saltmarsh cordgrass

3.
    a. subjective, example places bridge crossing to Urbanna
    b. subjective, example = 2.95 miles
    c. there are some SAV on the north shore of the river, tidal wetlands are present on both shores, and public Baylor grounds on bottom.
    d. subjective, example = yes

4.
    a. subjective
    b. both sides are mixed land uses. The southern shore has more agriculture than the northern shore.
    c. Residential

5.
    a. hardened nearly 100%
    b. there exist a number of shellfish management areas directly offshore of this location. Some of these may have time of year restrictions regarding activities that can occur within the vicinity. Construction may need to be timed accordingly.

6
    a. saltmeadow, brackish water mixed, black needle rush, big cordgrass, freshwater mixed, and saltmarsh cordgrass
    b. big cordgrass and brackish water mixed
    c. release of effluent from the processing plant (chemicals, treated waters, temperature differences, etc.)

7.
    d. less than 10-40%
    e. unvegetated intertidal habitat only
    f. beaches

8. See SMAK info and disclaimer online or pasted into the workshop information
    a. Both
    b. Virginia Institute of Marine Science's Comprehensive Coastal Inventory Program (CCI), Wetlands Advisory Program, and Submerged Aquatic Vegetation (SAV) survey program; and the Virginia Marine Resources Commission (VMRC)

c. information about the data, including projection, origin, year, and attributes of the data layer. Metadata can be viewed by clicking on the data layer in the data layer column.

d. It should always stay with the data.

9

      a. extensive marshland

      b. intertidal marsh, supratidal marsh

10.

      a. subjective, possibly in between the Hampton Roads Bridge Tunnel and the Monitor-Merrimack Tunnel joining up with I-64, but that would cause more traffic problems on 64.

      b. subjective, example = 4.16 miles

      c. Flow, bottom habitat, sediment dispersal/accumulation, pollution, water column disturbance, etc.

11.

      a. Bayside

      b. SAV and black needle rush wetlands, brackish water mixed

Wetland Mitigation/Restoration Targeting Answers:

1. "Land Use" The answer can be found in the Project Introductory Page at http://ccrm.vims.edu/cci/wet_target/. At level 3 all parameters are equal accept the landuse. Good - forested, High - agriculture. In level 4, conditions meeting level 3a are also high if the polygon is adjacent to a conservation area.

2. Polygon must be adjacent to a conservation area

3. Maps represent static output from the model run in the Hampton Roads study area. The Query is also restricted to the Hampton Roads area but allows for interactive user input for certain parameters.

4. Back Bay National Wildlife Refuge – the large natural area south of Virginia Beach

5. Size Range (acres), Locality, Hydrologic Unit (HUC), Suitability Level

6. Click on "Hydrologic Unit Code Descriptions" for a list of all the 14-digit Hydrologic Units.

7. Lynnhaven River/Little Creek, 246433104 m^2

8.
      a. about half is rated "high" but not much is ranked "excellent"

      b. see map

9. inquiry

10.
      a. inquiry

      b. inquiry

      c. no

11. Fuschia

12.
    c. 55.9 acres
    d. E2EM or PFO
    e. Back Bay National Wildlife Refuge

13.
    a. yes
    b. Isle of Wight County

14.
    a. Isle of Wight or Chesapeake
    b. Chesapeake (more high restoration rating sites)
    c. Norfolk or Portsmouth

15. North Landing River

16.
    a. none
    b. In the same size class, there is one polygon available and that polygon is ranked moderate

Shoreline Situation Report Answers:

1. Mixed land use.
2.
    a. Single family dwelling
    b. Yes, bank conditions on plate 7b indicate most banks are between 0 and 5 feet in height, indicating low lying topography at least along the shoreline.
    c. From Plate 7b, erosion is reported to be low.
    d. Banks are predominately 100% covered. This is illustrated by the light blue line furthest inland.
    e. No. From Plate 7c, with the exception of selected areas, the majority of the shoreline has been stabilized. The erosion is assumed to be zero in areas that are stabilized, unless obvious signs of erosion still exist.
3.
    a. Yes. Plate 7c tells you that the commercial operation is a marina.
    b. Yes. Plate 7b indicates that just down river of the marina is an area of stable marshland.
    c. Yes, upriver of the existing slips there is no indication of fringe marshes. The shoreline has already been hardened. Assuming the property owner also owns this area, the recommendation should be to consider expanding upriver if water depths allow for this.

4.
   a. While waves are breaking in front of the structures, there does not appear to be any accumulation of sediment behind them.
   b. Total bank cover
   c. The bank is vegetated

5.
   a. Residential
   b. Residential housing is concentrated along the shoreline. Agriculture, however prevails as you move away from the shoreline.
   c. No, this is a fetch limited environment.
   d. Yes, from plate 18b, the majority of the shoreline is stable and supports a fringe marsh.
   e. While onsite review will be necessary, from a quick look at Plate 18b we saw most of the shoreline is stable. From Plate 18c we also see that relatively little shoreline has been hardened.

6. From plate 2a we can locate the only residential property owner on the southwest shore of the headwaters of Bennett Creek. From Plate 2b we see the shoreline was classified as stable with marsh. Construction of riprap will impact tidal fringe marsh and possible unvegetated bottom. From Plate 2a, we also note that adjacent property is vegetated scrub shrub. There are no other stabilization structures in this area of the creek (Plate 2c). The initial assessment prior to site visit is not to recommend approval of the permit request.

7.
   a. Yes, SSR (plate 3b) indicates bank is unstable and beach is eroding.
   b. Yes there are high eroding banks by the groin field. However, field verification to evaluate the extent of the potential sediment supply would be necessary.
   c. Yes, there are crenulated beach cusps inshore of the groins.
   d. Only piers & a boat ramp, no other erosion control structures.
   e. Sand stacked on upriver side of groins, suggests net drift is southeast. Seasonal variability is probable.

8.
   a. Scrub-shrub along the shoreline with agriculture.
   b. Despite the low bank elevation (0-5), the bank appears stable and there are intertidal marshes present for protection. A living shoreline approach might be recommended.
   c. You could use SMAK. You could also explore the use of OSCAR (see Ch.6)
   d. With the light blue line, Plate 2b indicates the bank has "total cover". This could mean vegetative cover or structural cover. However, plate 2c indicates there are no structures here. Therefore we can assume that vegetation is present. This clearly helps stabilize this low-lying bank.

9.
   a. The imagery indicates that this area has a lot of sediment and is relatively shallow. Therefore, the natural water depth is probably not sufficient for mooring

boats.   Therefore, construction of the project could require significant dredging which would impact water quality and add additional cost to the project.

b. Using the natural shading illustrated in the imagery, and the scale bar, deep water is just over 500 feet from the shoreline.

c. Yes, both resources are present. You could use another tool like OSCAR or SMAK to determine the current density of the SAV beds and the type of tidal marsh present

d. No, tidal marshes are present across the mouth of cove, SAV beds are present in the nearshore, navigation access is limited, dredging would be needed, secondary impacts due to boat wakes & prop dredging could be expected

e. Visible in aerial photograph in SSR – location & length of existing piers, dark color of deeper waters, lighter color of sand shoals & intertidal flats.

10.

a. A forest riparian buffer is maintained along most of the shoreline.

b. The absence of a fringe marsh.

c. Yes, since marsh grass is present along most of the shoreline and the creek is relatively sheltered.

11.

a. From the land use Plate 41a the area designated as a marina is also designated as commercial.

b. At the shore, the bank heights do not exceed 5 feet anywhere.

c. The island is composed of a series of relic ridges which are still visible in the imagery. These ridges might actually be topographic highs in the interior but one would need to look at topographic maps to verify this.