Appendix J: The Technical GIS details of Each Step of the Analysis

Characterize Coastal Sub-regional Watersheds

Shapefile versions of the land cover were used. The GIS Identity function used land cover as input and sub-regional watersheds as identity features. The Identity function computes a geometric intersection of he input features and identity features. An area column was added to the attribute table and area was calculated in acres. Next, the Frequency function was used with the input being the results of the identity, fields being gridcode (class number) and basin number and summarized by acres. The Frequency function calculated frequency statistics for fields in the input table. The tables were exported and formatted in excel.

Sub-regional Watershed Change

The shapefile version of the change map was used. The change map was created using four dates of land cover and determining which pixels changed land cover in what time period. The same GIS functions that were used to determine land cover area (above) were used to determine change class area except they were performed on change data instead of land cover data. The statistics were calculated in excel.

Characterize Riparian Areas within coastal SRWs

A number of methods were tested and the following represents the best combination of data and methods to create the "to be buffered" file. The data layers used were the following:

- *Stream Segments*: the hydronet data layer from CT DEP was used for the stream lines (all water except water bodies)
- *Tidal Wetlands*: We determined that DEP tidal wetlands layer is most accurate (more so than USGS DLG hydro data). The problem is that the water features don't match the boundaries of the tidal wetlands layer. It is necessary to have these layer coincident so one consistent edge can be buffered.
- *Water Polygons*: The DEP hydro layer was used for waterbodies. Only water and marsh features were kept. All other classes were excluded including Long Island Sound. We were not interested in buffering the sound shoreline.

Both the hydro layer and tidal wetlands layer were clipped with the study area boundary and both were hand edited so they overlapped and didn't leave any holes. The editing was done on top of high resolution, color aerial imagery (ADS40 captured by UConn CLEAR) to ensure the changes were accurate. After completing the manual edits, Merge was used with the edited waterbodies and tidal wetlands then a Dissolve function resulting in one "to be buffered" polygon file.

The polygon areas were removed from the stream segments (hydronet) using the Erase tool. Hydronet is the hydrography network so centerlines exist in waterbodies. These would be duplicative thus necessitating the erase. The lake/tidal wetland polygons were converted to a polyline file and Merged with stream segments. The result was one, continuous file that included stream segments and shorelines. This was the final "to be buffered" layer.

Once the "to be buffered" file was created, it was buffered three times, each with a different distance. The distances were 100 feet, 200 feet and 300 feet. The buffer occurred on both sides of the line. This is desirable for streams but not for waterbodies that have area where the inside is water and should not be buffered. The area of water and wetland polygons was erased from the buffers.

Create Land Cover Within Each Buffer Zone
To assess land cover by basin, the buffer area files needed to be "cut" where they crossed the basin boundaries. The Identity tool was used with buffer file as input features and basins as identify features. This was repeated for each of the 100, 200 and 300 foot buffers.

The nature of the land cover is that the developed class is all connected due to the road network. It is an immensely complex polygon and is too much for the computers. The first step to deal with the complex developed polygon was to create a vector land cover file that covered only the study area. This had to be done in sections. The basins were Split into three sections. The shapefile land cover was Clipped using each of the three sections and the Intersect tool was used with the "cut" buffers and the land cover for each section. The three sections were Merged back together to create a file of land cover within the 100 foot buffer zone for the entire study area. The steps were repeated for the 200 foot buffer zone and the 300 foot buffer zone. All steps were repeated for the 1985 land cover data.

Summarize Land Cover within Each Buffer Zone
The steps to summarizing the land cover within each buffer zone are as follows:

- Add area field in attribute table and calculate acres.
- Frequency command with basin number and class number as frequency fields and acres as the summary field. The output is a table.
- Use Pivotable command with basin number as input field, class number as pivot field and acres as the value field.
- The pivotable shows the summary of each land cover class within each basin.

This was repeated for the 200 foot and 300 foot buffer zones. It was also repeated for all three buffer widths of the 1985 land cover.

High Resolution Classification for Single Watershed
There are two ADS40 datasets. One set is an 8-bit color-balanced mosaic for the entire coastline. The second set is the raw, 16-bit data that has not been changed. The analyst experimented with both datasets and determined that the 8-bit had experienced too much radiometric degradation and that the 16-bit had a better result. The trade-off was the very large file size and that four tiles were necessary to cover the Niantic bay watershed.

Four eCognition projects were created, one for each quadrant. Each eCognition project contains the four ADS40 bands, NDVI and LIDAR elevation data. Rules were created for each class and the same rules were used in each of the four projects. The segments and their classes were exported as polygon shapefiles. A geodatabase was used to bring the four quadrants together and avoid overlap. Dissolve within each quadrant. In hindsight, I would omit this step. Union quadrants. Clip by original quadrant and Merge.

Because the shoreline and stream lines were not perfectly matched to the high resolution imagery, the "to be buffered" file need to be edited to better match the high resolution data. A modified 300 ft buffer zone was created. Instead of editing the water and wetland polygons so the erase command works properly, do a different set of steps when it was time to erase: union, select, delete inside of buffer area.

A significant amount of time was spent editing and cleaning up classification. The 300ft buffer classification was then Clipped by both the 200 foot buffer zone and 100 foot buffer zone so the land cover class areas could be analyzed.