

Project name:
R-2553 Kinston Bypass Flood Analysis

Project ref:
R-2553 Kinston Bypass

From:
Kory Wilmot, AECOM

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To:
John W. Twisdale, Jr., PE, CPM
Assistant State Hydraulics Engineer
Hydraulics Unit
North Carolina Department of Transportation

919 707 6754 office
jtwisdale@ncdot.gov

1020 Birch Ridge Drive
1590 Mail Service Center
Raleigh, NC 27699-1590

CC:
Stephen Morgan, NCDOT; Leigh Lane, Louis
Berger; Greg Rucker, AECOM; Ed Edens, AECOM;
Bill Kincannon, NCDOT; Heather Lane, NCDOT

Memo

Purpose:

The purpose of this analysis was to evaluate eleven new location route options for the proposed Kinston Bypass Project, for US 70 in Lenoir County, NC near Kinston and determine areas along the different alternatives which may experience flooding during an extreme event. Comparisons were made between the road surface and the water surface elevations for the 1 percent annual chance (1pct), 4 percent annual chance (4pct), and Hurricane Matthew events. Note that the upgrade existing build alternative was not evaluated in this analysis, as the existing vertical elevation of the road would not change.

Methodology:

The 1pct and 4pct water surface elevation (WSEL) raster datasets developed for the North Carolina Floodplain Mapping Program were acquired for the subject area. The Hurricane Matthew raster dataset provided to AECOM by NCDOT contained a flood boundary and several integer rasters, but did not contain a raster dataset that reflected the Hurricane Matthew WSEL. For Hurricane Matthew the WSEL developed for the Neuse Mitigation Strategies study completed in May 2018 by AECOM for NC Emergency Management was used. This dataset only contains elevations along the Neuse River and for backwater to the Neuse River.

For each of the alternatives, a dataset consisting of x, y, and z coordinates of the road surface was converted into a point shapefile in GIS. This shapefile was used to develop a triangulated irregular network (TIN) which was then converted to an elevation raster dataset with 10' by 10' cells. Raster subtraction calculations were performed in which each of the three WSELs being evaluated were subtracted from each of the road surface rasters. This resulted in three raster datasets for each of the alternatives with each consisting of 10' by 10' raster cells whose values show the difference between the road surface and the water surface.

Of the three water surfaces evaluated, the 1pct WSEL was the highest. Maps were developed to show the difference in elevation between the roadway and the 1pct WSEL for all areas where the potential

path of the road intersected the Neuse River floodplain. The roadway path was color coded such that areas below the WSEL are shown in red, areas that are between zero and three feet above the WSEL are shown in yellow, and areas that are greater than three feet above the WSEL are shown in green. Maps were also produced to show areas for any routes that crossed the 1pct floodplain on tributaries to the Neuse with a freeboard of three feet or less.

According to this analysis, none of the potential routes are inundated by the 1pct annual chance flooding event (i.e. areas shown in red). The other two events evaluated have lower water surface elevations than the 1pct and will therefore not overtop any of the potential routes either, therefore mapping was not developed for the 4pct and Matthew events at this time. The analysis did show some areas (proposed sag locations) that are between zero and three feet above the 1pct (100 year) WSEL (i.e. areas shown in yellow) for each of the alternatives. During the final design phase of the preferred alternative, the vertical alignment of the mainline will be revised in these areas shown in yellow to achieve a minimum of a 1.5 foot freeboard at the proposed shoulder point during a 1pct (100 year) annual chance flooding event.

Deliverables and Recommendations:

A total of 13 maps were produced showing eleven of the twelve alternatives (upgrade of existing US 70 was not included in the analysis) in comparison to the 1pct WSEL. Four raster products for each of the eleven scenarios are provided in eleven separate databases. These are all clipped to the option corridor and show the following:

- Roadway elevation
- Difference between roadway elevation and 1pct water surface elevation (what is provided in pdfs)
- Difference between roadway elevation and 4pct water surface
- Difference between roadway elevation and Matthew water surface

The three WSEL raster datasets used in the analysis are included in a separate database.

It is recommended that a 2D hydraulic analysis be performed for this reach of the Neuse River due to the amount overland flow occurring during low frequency flooding events. A 2D model would likely be a better tool to more accurately reflect this complex overland flow than the 1D analysis, particularly with the difficulties of laying out 1D hydraulic cross sections through reaches with a large bend and a significant number of hydraulic crossings like what is seen in Kinston.

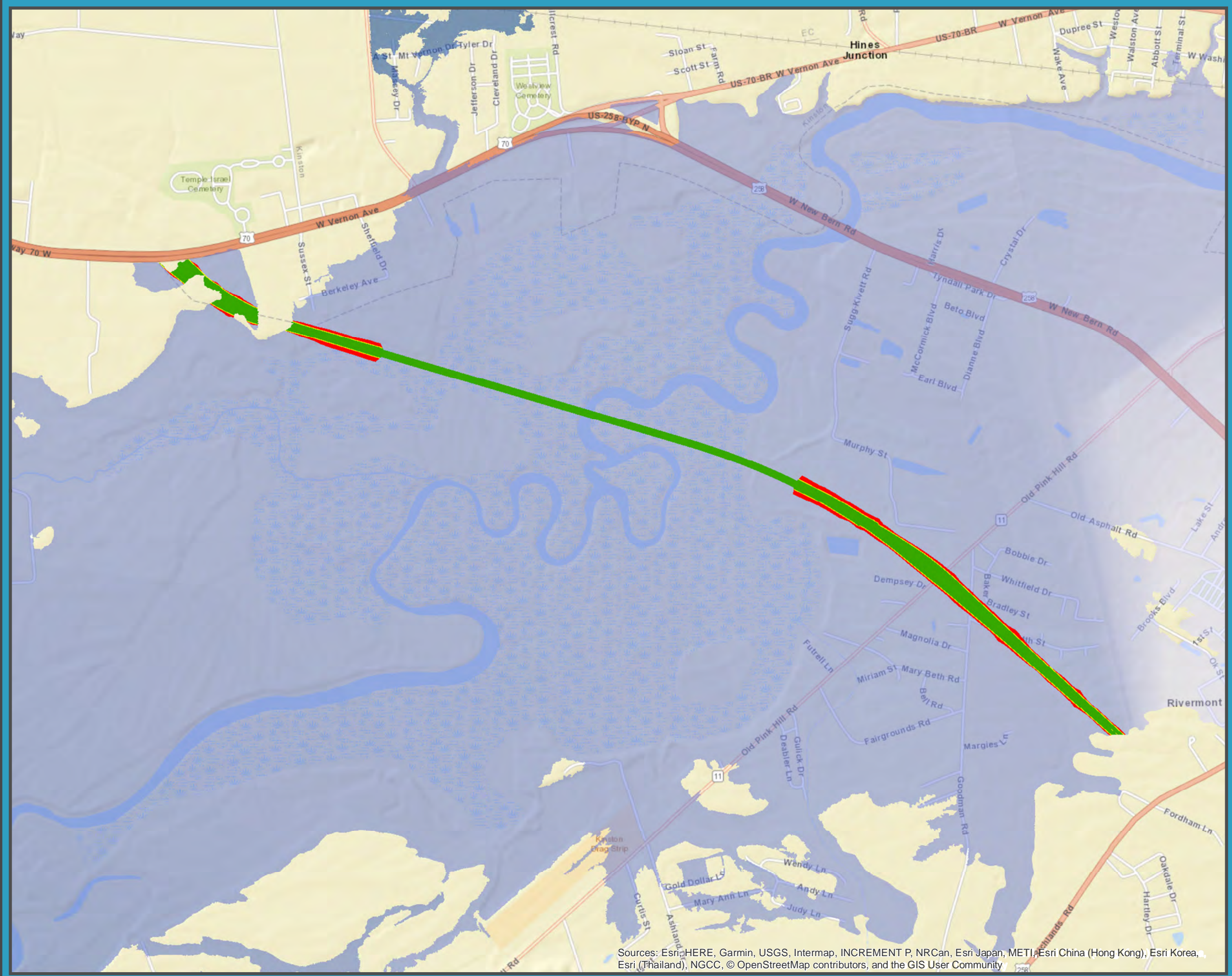


Figure AUESB
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 17.9 - 0
- 0 - 3
- 3.01 - 29.8

**100Y Floodplain
Value**

- High : 49.774
- Low : 37.6561

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, © OpenStreetMap contributors, and the GIS User Community

Figure A11
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 8.3 - 0
- 0 - 3
- 3.01 - 33

**100Y Floodplain
Elevation**

- High : 44.7
- Low : 41.7

1 inch = 1,500 feet



This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

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Figure A12
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 8.7 - 0
- 0 - 3
- 3.01 - 32.9

**100Y Floodplain
Value**

- High : 44.7
- Low : 41.7

1 inch = 1,500 feet




This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

Figure A31
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

 -8.7 - 0

 0 - 3

 3.01 - 33

**100Y Floodplain
Value**

 - High : 44.7

 - Low : 41.7

1 inch = 1,500 feet



This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

Figure A32
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 8.7- 0
- 0 - 3
- 3.01 - 32.9

**100Y Floodplain
Value**

- High : 44.7
- Low : 41.7

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.



Figure A35
Elevation Above 1 pct
Water Surface Elevation



**Elevation Above
1pct Water Surface**

- 13.3 - 0
- 0 - 3
- 3.01 - 25.1

**100Y Floodplain
Value**

- High : 49.5
- Low : 43.8

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

Figure A36
Elevation Above 1 pct
Water Surface Elevation



**Elevation Above
1pct Water Surface**

- 13.3 - 0
- 0 - 3
- 3.01 - 25.1

**100Y Floodplain
Value**

- High : 49.2
- Low : 43

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

Figure A51-1
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 10.3 - 0
- 0 - 3
- 3.000000001 - 27.1

**100Y Floodplain
Value**

- High : 48
- Low : 42

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.



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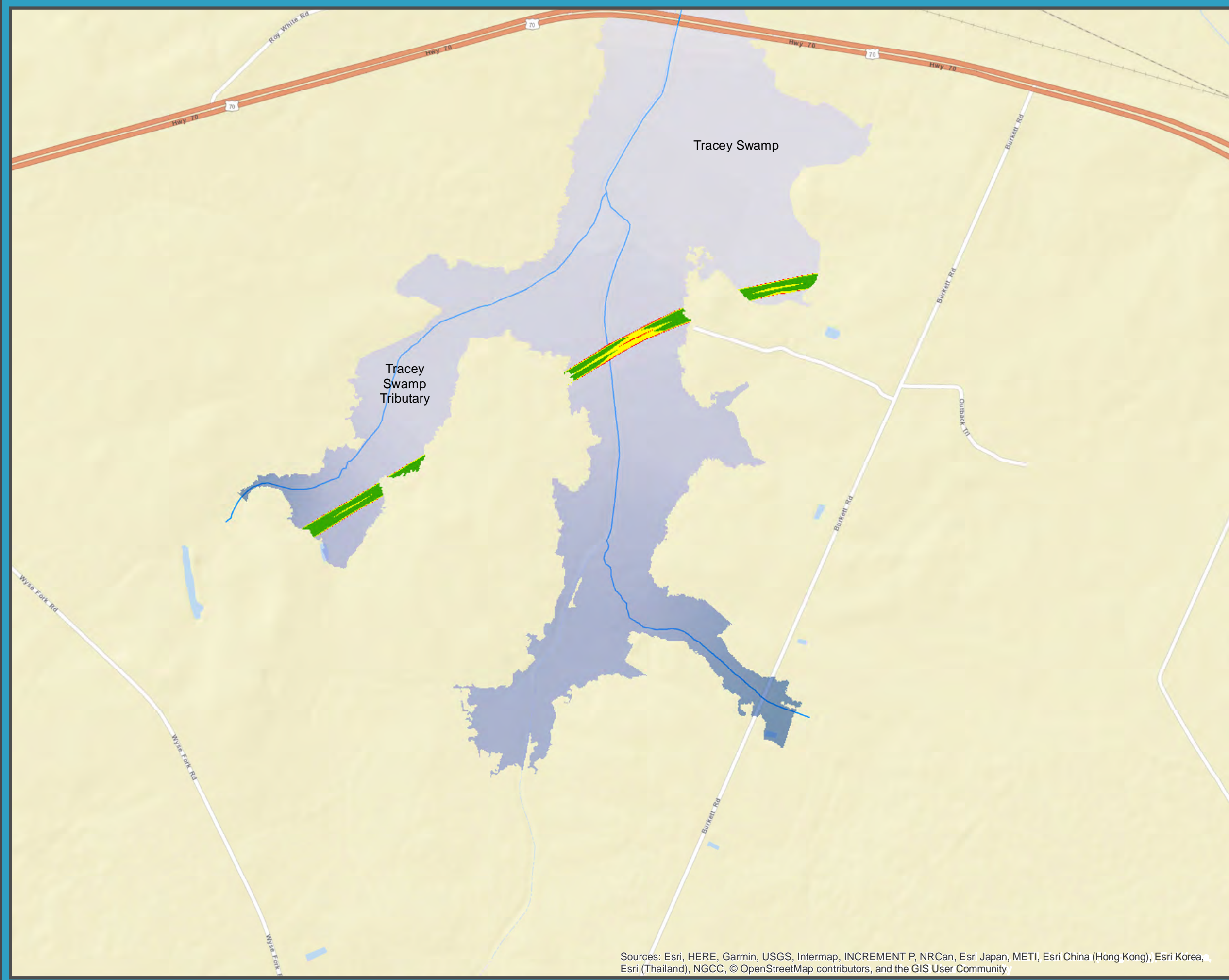


Figure A51-2
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 10.3 - 0
- 0 - 3
- 3.01 - 27.1

100Y Floodplain

- Value**
- High : 53.9
 - Low : 45.6

1 inch = 1,000 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

Figure A52
Elevation Above 1 pct
Water Surface Elevation



**Elevation Above
1pct Water Surface**

- 10.3 - 0
- 0 - 3
- 3.01 - 27.1

**100Y Floodplain
Value**

- High : 48.3
- Low : 42.0639

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

Figure A63
Elevation Above 1 pct
Water Surface Elevation



**Elevation Above
1pct Water Surface**

- 20.8 - 0
- 0 - 3
- 3.01 - 35.7

**100Y Floodplain
Value**

- High : 46.4
- Low : 42

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

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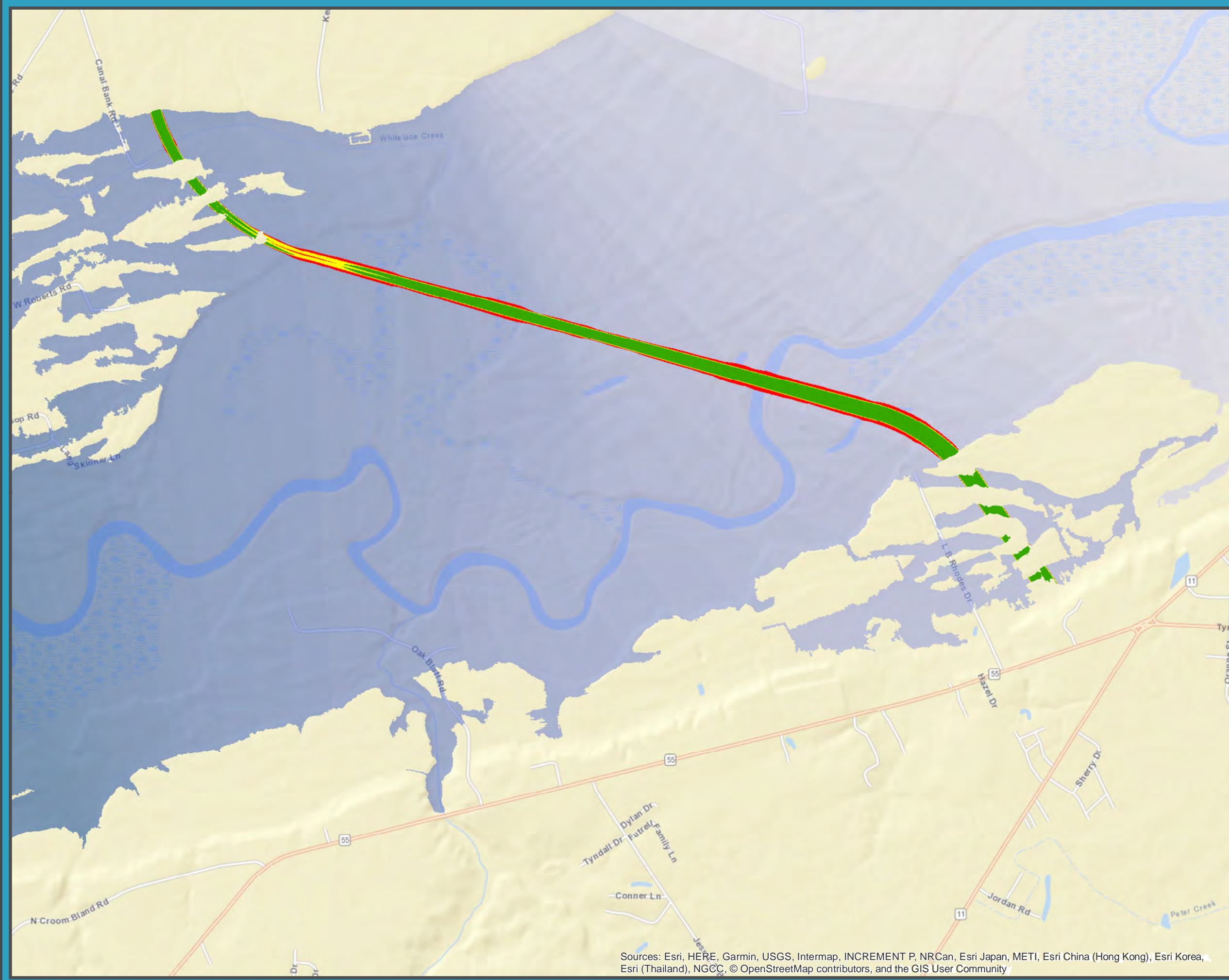


Figure A65-1
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 20.9 - 0
- 0 - 3
- 3.01 - 35.8

**100Y Floodplain
Value**

- High : 46.1
- Low : 41.981

1 inch = 1,500 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
NCOneMap, NCWRC, NCSHPO, EPA, USFWS,
USDA, NRCS, DWR, ESRI and AECOM.

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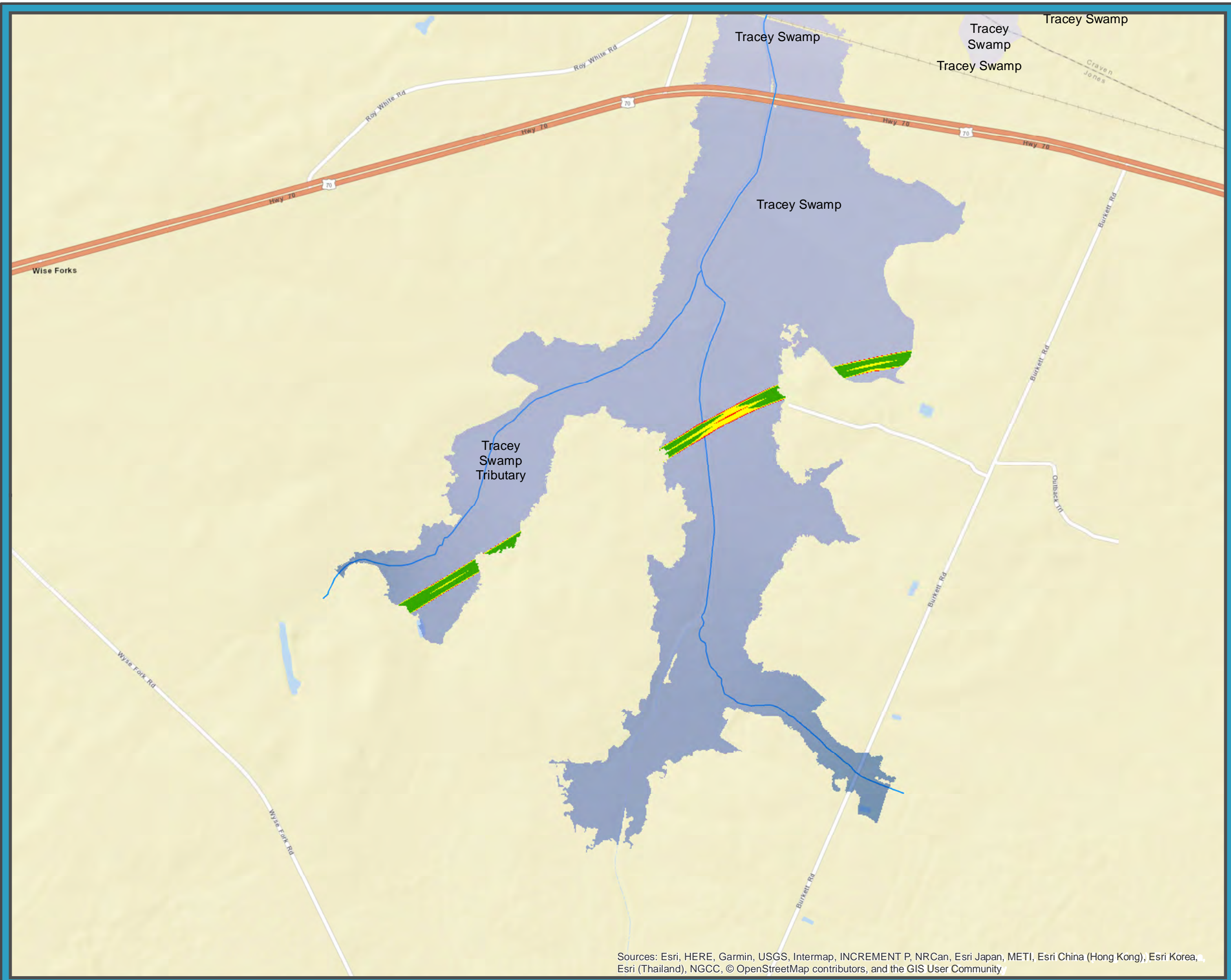


Figure A65-2
Elevation Above 1 pct
Water Surface Elevation

**Elevation Above
1pct Water Surface**

- 20.9 - 0
- 0 - 3
- 3.01 - 35.8

**100Y Floodplain
Value**

- High : 53.9
- Low : 42.4

1 inch = 1,000 feet

This map is for reference only.
Sources: CGIA, NCDOT, NCDEQ, NCDCM,
Craven County, NCEM, Lenoir County,
Jones County, City of Kinston,
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